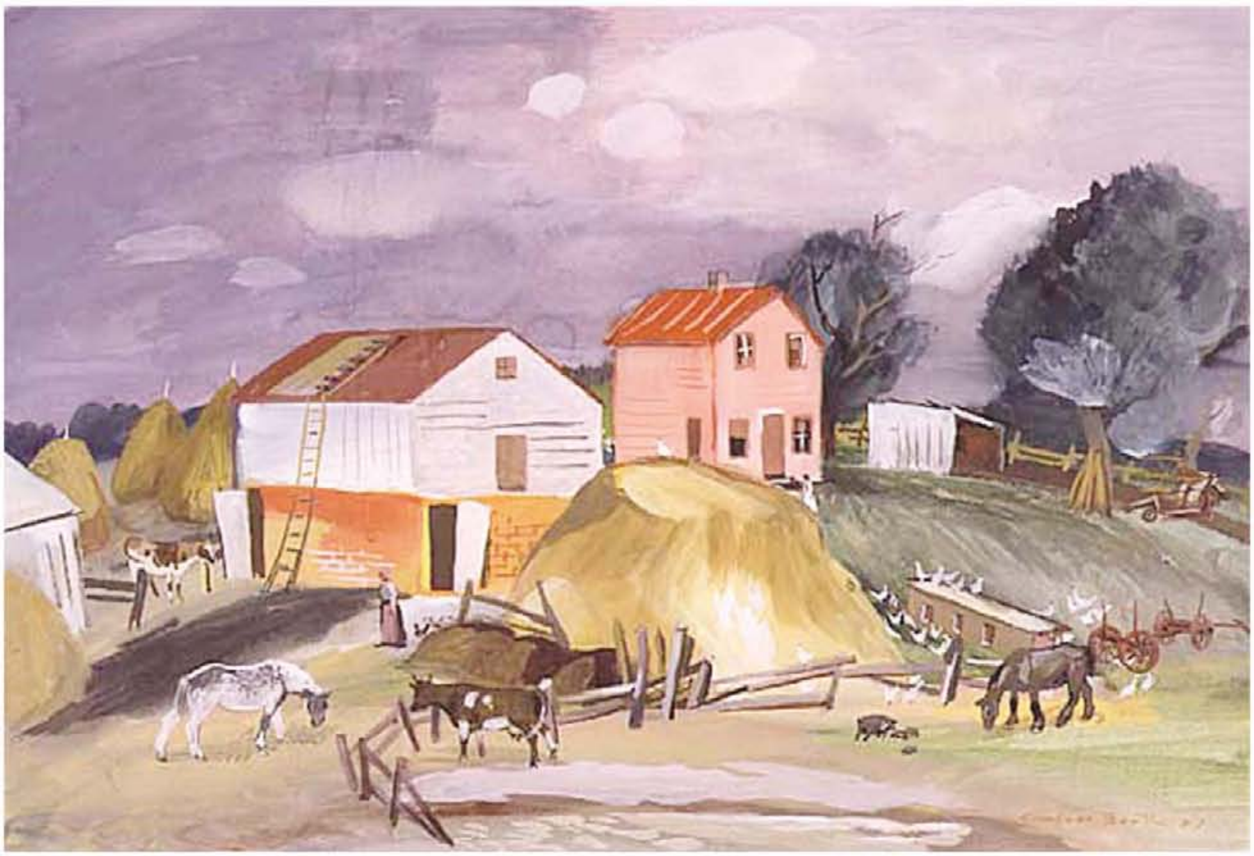
HISTORIC CONTEXT STUDY OF MINNESOTA FARMS, 1820-1960

Vol 1



prepared for the
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Susan Granger and Scott Kelly
Gemini Research June 2005

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HISTORIC CONTEXT STUDY OF MINNESOTA FARMS, 1820-1960

VOLUME 1

Prepared for the
Minnesota Department of Transportation

June 2005

Prepared by Susan Granger and Scott Kelly
Gemini Research, Morris, Minnesota

Additional research and writing by Chris Butler, Arden Granger, Kay Grossman, John Lauber, Virginia L. Martin, Liz Morrison, Annie Olson, and Tami K. Plank

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ABSTRACT

A cultural resources investigation of pre-1960 farms in Minnesota was conducted in 2003-2005 by Gemini Research for the Minnesota Department of Transportation (Mn/DOT). A primary goal was to create a tool that will help Mn/DOT evaluate the significance of historic farm resources as it carries out its responsibilities to take significant cultural resources into consideration during project planning. Another user of the document will be the Minnesota State Historic Preservation Office, which often works with Mn/DOT and other state and federal agencies to help identify and evaluate significant cultural resources, and to develop ways to avoid and reduce potential effects to them. This study resulted in a new statewide historic context entitled "Euro-American Farms in Minnesota, 1820-1960." In addition to providing background information on farms and farm structures throughout the state, the historic context includes evaluative guidelines to help streamline the process by which farm resources are evaluated for their eligibility to the National Register of Historic Places.

On the cover: *Juke's Farm* by Cameron Booth, gouache, 1937 (MHS art collection)

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A Minnesota milk house. Location unknown, circa 1940. (MHS photo)

INTRODUCTION

This study of historic farm resources in Minnesota was conducted in 2003-2005 by the Minnesota Department of Transportation (Mn/DOT) through its consultant Gemini Research.

A separate study of historical archaeological resources on Minnesota farms comprises Volume 4 of this study. The historical archaeological volume was prepared by Michelle Terrell of Two Pines Resource Group, LLC.

Mn/DOT has responsibility under state and federal law to take significant cultural resources – including historic farms – into consideration during project planning, and frequently develops plans for roadway improvements that potentially affect farm properties.

Mn/DOT prepared this historic context study as a way to help streamline the environmental review process that accompanies highway project planning.

The study will help Mn/DOT determine which historic farm resources meet the eligibility criteria of the National Register of Historic Places, a benchmark of significance for federal agencies and their funding recipients. This study will also help Mn/DOT make better-informed decisions as it seeks ways to avoid, reduce, and mitigate potential adverse effects to significant historic properties.

Jackie Sluss and Liz Abel of Mn/DOT's Cultural Resources Unit and Susan Roth and Dennis Gimmestad of the State Historic Preservation Office (SHPO) served as technical advisors for the context study. The project continued work begun several years ago by BRW, Inc., Mississippi Valley Archaeology Center, and Rivercrest Associates, all under contract with Mn/DOT.

This study was conducted by Susan Granger and Scott Kelly of Gemini Research. Special thanks are extended to Les Lindor, agricultural engineer, and Harley Hanke, animal specialist, both retired from the West Central School of Agriculture and Experiment Station in Morris, and to Dr. Gene Anderson, longtime Morris veterinarian. Many thanks also to Chris Butler, Arden Granger, Kay Grossman, John Lauber, Virginia L. Martin, Liz Morrison, Annie Olson, and Tami K. Plank, all researchers and writers who worked on this project.

Storing hay in a dairy barn. Location unknown, ca. 1910. (MHS photo by Harry Darius Ayer)

OBJECTIVES AND METHODS

■ OBJECTIVES

The principal goal of this study was to produce a tool that would help the Minnesota Department of Transportation (Mn/DOT) to more efficiently assess the significance of historic farm resources in Minnesota. It is Mn/DOT's responsibility under federal and state law to take significant cultural resources into consideration during project planning. Determining which resources are significant is an important step in this environmental review, and this project was designed to help streamline that process. Another important user of this tool is the State Historic Preservation Office (SHPO), which works with Mn/DOT and other public and private parties to help identify Minnesota's significant cultural resources and assist in their preservation. Like Mn/DOT, the SHPO frequently encounters farm resources in its work and needs tools to help understand and evaluate them.

■ PROJECT SCOPE

GEOGRAPHIC AND TEMPORAL LIMITS

This historic context study included the entire state of Minnesota within its scope.

The beginning date of the study was set at 1820, the year after the first soldiers arrived at Fort Snelling and the likely start of intensive Euro-American agriculture in present-day Minnesota. The ending date was set somewhat arbitrarily at 1960. Using 1960 as an ending date allowed the study to include resources built in the 1950s that are associated with far-reaching, post-World War II changes in farming. This ending date also allowed the study to include resources that will reach 50 years of age during the first few years the study is in use. (One of the requirements of National Register eligibility is that a resource be at least 50 years old.)

TYPE OF PROPERTIES

The study was designed to focus on the most common kind of Minnesota farm: a farm developed and operated by a small group of people, usually a single family. The project did not study other types of farms such as communal farms or farms operated to serve companies or institutions. While these uncommon farm types are not directly addressed in the study, much of the contextual information contained in this report will also apply to them.

The study focused only on resources located on farms. Agricultural resources located off of farms (e.g., mills and creameries located at rural "crossroads," or grain elevators located in towns) were not included. Rural resources not directly related to farming (e.g., township schools, meeting halls, and rural churches) were also excluded.

This study focused on Euro-American farms. Special farming practices or resources associated with Native American agriculture, for example, were not included.

The bulk of this study focuses on standing structures. Historical archaeological resources are considered separately in Volume 4.

■ PREVIOUS RESEARCH

The development of Minnesota's agriculture in all of its economic, technological, and political complexity has been the subject of considerable research and writing. However, there are relatively few sources that specifically focus on cultural resources on Minnesota farms. There have also been many typological studies of farm structures in various parts of the U.S., but few that specifically consider Minnesota resources.

Fairly recent works that discuss historic farm resources in Minnesota include:

Amato, Anthony J., Janet Timmerman, and Joseph A. Amato, ed. *Draining the Great Oasis: An Environmental History of Murray County.* Marshall, MN: Crossings Press, 2001.

Brinkman, Marilyn Salzl. *Bringing Home the Cows: Family Dairy Farming in Stearns County, 1853-1986*. St. Cloud: Stearns County Historical Society, 1988.

Brinkman, Marilyn Salzl, and William Towner Morgan. *Light from the Hearth: Central Minnesota Pioneers and Early Architecture*. St. Cloud: North Star Press, 1982.

Gudmundson, Wayne, with text by Suzanne Winckler. *Testaments in Wood: Finnish Log Structures at Embarrass, Minnesota*. St. Paul: Minnesota Historical Society, 1991.

Hart, John Fraser, and Lisa M. Rainey. "Redundant Farmsteads in Minnesota." *CURA [Center for Urban and Regional Affairs, University of Minnesota] Reporter* 28 (1998): 1-6.

Henning, Barbara J., Dale R. Henning, and Timothy E. Roberts. *Mn/DOT Farmstead Study: The Cutover Region of Northeast Minnesota.* Prepared for Mn/DOT by Rivercrest Assoc., Inc., 1999.

Kooiman, Barbara M, Charles Moffat, Wendy K. Holtz, and Vicki L. Twinde. "Minnesota Statewide Farmstead Study: Focal/Cash Crop Region, Southwestern and Western Minnesota. Draft." Prepared for Mn/DOT by Mississippi Valley Archaeology Center, 2000.

Martens, Steven Cleo. *Ethnic Tradition and Innovation as Influences on a Rural Midwestern Building Vernacular.* Master's Thesis. University of Minnesota, 1988.

Mead and Hunt. "Minnesota's Historic Agricultural Landscapes Phase I Report." 1997.

Mead and Hunt. "Minnesota's Historic Agricultural Landscapes Phase II Report." 1998.

Noble, Allen G., and Hubert G. H. Wilhelm, ed. *Barns of the Midwest.* Athens, OH: Ohio University, 1995.

106 Group Ltd. and SRF Consulting Group. *Preserving Historic Farms in Blue Earth County: A Case Study of the Arnold Family Farm.* Prepared for the Blue Earth County Highway Department, 1996.

Peterson, Fred W. *Building Community, Keeping the Faith: German Catholic Vernacular Architecture in a Rural Minnesota Parish*. St. Paul: Minnesota Historical Society, 1998.

Peterson, Fred W. *Homes in the Heartland: Balloon Frame Farmhouses of the Upper Midwest, 1850-1920*. Lawrence, KS: University of Kansas, 1992.

Peterson, Garneth O., and Bruce R. Penner. "Minnesota Farmstead Study: Southeastern and Central Region." Prepared for Mn/DOT by BRW, Inc., 2000.

Slattery, Christina, Kathryn Franks, and Amy Squitieri. "Nansen Agricultural Historic District." National Register of Historic Places Registration Form. 1999.

Sluss, Jackie, Suzanne Rhees, and Christine Carlson. *Managing a Working Landscape: A Protection Strategy for the Nansen Agricultural Historic District, Goodhue County, Minnesota.* Prepared for the State Historic Preservation Office by BRW, Inc., 1999.

Sluss, Jackie, Suzanne Rhees, and Christine Carlson. *Preserving Minnesota: Inventorying, Managing and Preserving Agricultural Historic Landscapes in Minnesota.* Prepared for the State Historic Preservation Office by BRW, Inc., 1999.

▪ METHODS

PERSONNEL AND PROJECT SCHEDULE

The study was conducted by Gemini Research of Morris, Minnesota, with Susan Granger serving as principal investigator and Scott Kelly as investigator. Other researchers and writers were Chris Butler, Arden Granger, Kay Grossman, John Lauber, Virginia L. Martin, Liz Morrison, Annie Olson, and Tami K. Plank.

The project was conducted over a 20-month period from November 2003 through June 2005.

RESEARCH

This was primarily an endeavor of research and writing, without a field survey component. Gemini Research conducted only limited fieldwork to learn about specific farm resources, to test theories developed during the course of the research, and to help develop and refine evaluative criteria.

Developing comprehensive criteria to help evaluate the National Register eligibility of farm resources would have been greatly helped by a statewide survey of extant farm resources. Unfortunately, such a survey would be costly to conduct and was beyond the reach of this project. Because of this limitation, some of the conclusions reached by this project are provisional and should be modified in the future as new information is learned.

RESEARCH QUESTIONS

The topic of the history of Minnesota agriculture is daunting in its breadth and complexity. Gemini Research tried to focus its efforts on those aspects of agricultural history that most directly affected the design and construction of the built resources on Minnesota farms. Some emphasis was placed on topics that had not been covered by previous studies.

Some of Gemini's research questions are listed in the original research design that appears as an appendix to this report.

RESEARCH SOURCES

Research was conducted using a range of sources. Most are listed in the Bibliography in this report's appendices. Among the most important sources were the following:

Previous Cultural Resource Studies. Gemini Research examined previous cultural resource studies prepared in Minnesota and other states. This helped Gemini learn from other authors' approaches and identify parameters and sources of information.

Specialized Literature. Gemini examined several types of specialized literature to help understand the physical evolution of farm structures and to identify and understand the factors that influenced the construction of farm resources. These materials included 1) farm periodicals and technical bulletins geared toward farmers (including those issued by the Minnesota Agricultural Experiment Station and the Minnesota Extension Service); 2) technical literature written by and for agricultural engineers; 3) farm building plan books; and 4) advertising from the manufacturers of farm equipment, building materials, and buildings.

Historic Photographs. Numerous historic photos at the Minnesota Historical Society were examined.

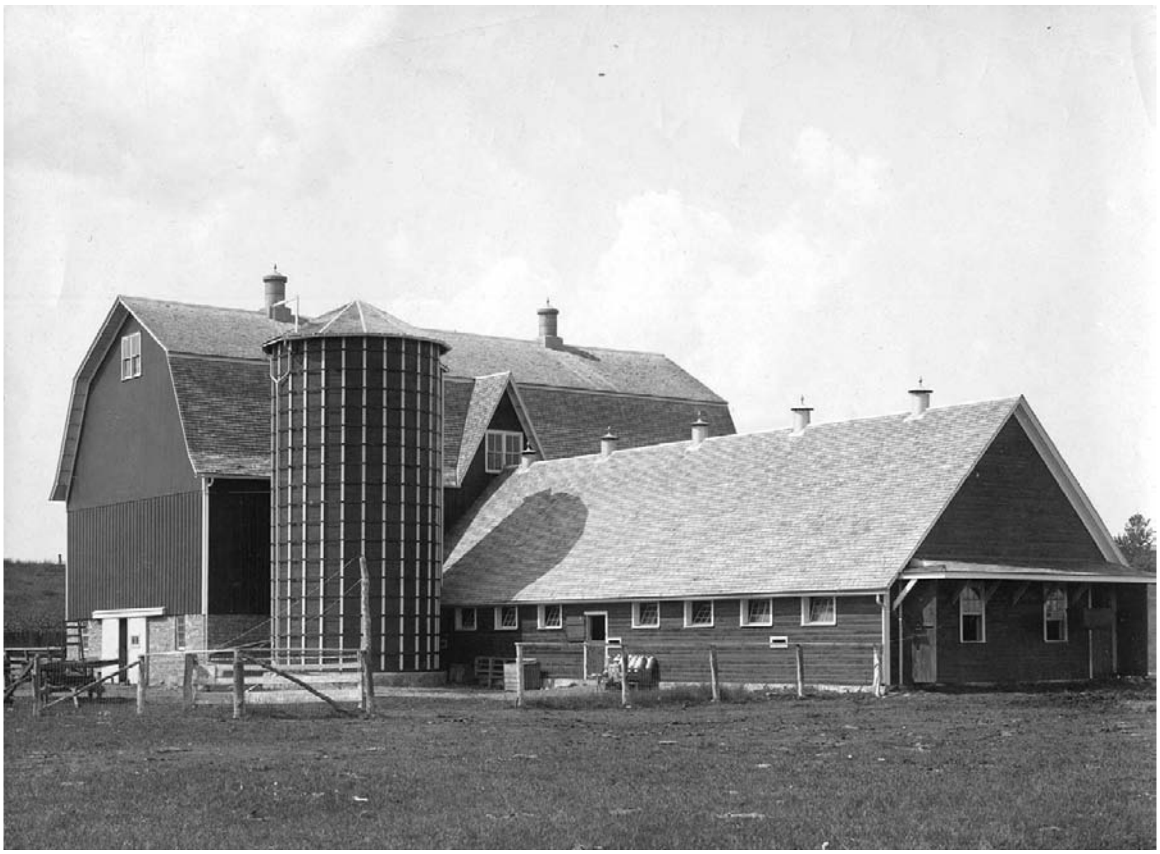
Nominations for National Register-Listed Properties. The nomination forms for all Minnesota farm resources currently listed on the National Register of Historic Places were reviewed.

Inventory Forms for National Register-Eligible Properties. Gemini reviewed inventory forms for all Minnesota farm resources recently determined eligible for the National Register through the SHPO review and compliance process.

Expert Interviews. Gemini consulted with several experts familiar with the development of Minnesota farm resources including agricultural school and experiment station faculty and staff (most retired) in agricultural engineering, animal husbandry, and agronomy.

■ RESULTS

This project resulted in the creation of a new statewide historic context entitled "Euro-American Farms in Minnesota, 1820-1960." This four-volume report is the principal final product of the study. The report's organization is based on precedents such as the National Register Multiple Property Documentation Form, and identifies developmental farming periods, individual farm elements or property types, and National Register eligibility requirements.



Schilling Farm, near Northfield, probably Rice County, circa 1910. (MHS photo by Harry Darius Ayer)

Poultry house. Rose Farm, location unknown, 1929. (MHS photo)

DEVELOPMENTAL PERIODS IN THE HISTORIC CONTEXT "EURO-AMERICAN FARMS IN MINNESOTA, 1820-1960"

To begin to identify and understand the major historical forces that have shaped Minnesota farms, the historic context "Euro-American Farms in Minnesota, 1820-1960" has been divided into eight developmental periods, listed below:

Period 1: Early Settlement, 1820-1870
Period 2: Development of a Wheat Monoculture, 1860-1885
Period 3: Diversification and the Rise of Dairying, 1875-1900
Period 4: Industrialization and Prosperity, 1900-1920
Period 5: Developing the Cutover, 1900-1940
Period 6: Development of Livestock Industries, 1900-1940
Period 7: Depression and the Interwar Period, 1920-1940
Period 8: World War II and the Postwar Period, 1940-1960

Each period is briefly described on the following pages.

Summary information on the number and size of farms in Minnesota and how this changed through time can be found in the individual farm elements section entitled "Farms".

Hewn log building near the Minnesota River southwest of Blakely, probably LeSueur County, 1940. (MHS photo by Paul Klammer)

PERIOD 1: EARLY SETTLEMENT, 1820-1870

During the early settlement period, millions of acres of land west of the Mississippi River were acquired by the United States government through land cession treaties with Native Americans. European-American pioneers moved onto the undeveloped land, many attracted by federal government incentives. The establishment of farms was limited, however, by a river-only transportation system, lack of goods and services, and rudimentary technology.

Milestones of this Period

1819	–	Fort Snelling established with gardens and fields
1821	–	Farms established along the Red River south of Canada's Selkirk Colony
1837	–	Land cession treaties signed with Dakota and Ojibwe for Indian lands between Mississippi, St. Croix, and Crow Wing rivers
1841	–	Preemption Act allowed squatters with established claims on surveyed public lands to legalize ownership by paying official price
1847	–	Treaty with Ojibwe opened two large tracts near St. Cloud to settlement by the Winnebago
1848	–	One of Minnesota's first federal land offices opened in St. Croix Falls
1849	–	Minnesota Territory established
1850	–	Minnesota census reported a total of 157 farms and about 6,000 residents
1850	–	Farmers made up 64% of U.S. labor force
1851	–	Treaties of Traverse des Sioux (July) and Mendota (August) opened to Euro-American settlement lands east of the Red, south of the Mississippi
1854	–	Treaty of La Pointe opened Ojibwe lands in Minnesota's arrowhead to Euro-American settlement
1854	–	Preemption privilege extended to unsurveyed public lands
1854	–	Minnesota Territorial Agricultural Society established
1855	–	Land cession treaty negotiated with Ojibwe for lands in the Iron Range region
1856	–	Grasshopper plagues over two seasons
1857	–	Congress authorized land grants to railroads for four lines in Minnesota
1857	–	Panic of 1857 – land values fell, immigration slowed, railroad construction stopped
1858	–	Minnesota became the 32nd state
1861-65	–	U.S. Civil War
1862	–	Congress approved new land grants for Minnesota railroads after lines planned earlier were not built
1862	–	Homestead Act became law
1862	–	U.S. Government-Dakota Conflict
1864	–	Grasshopper plagues over three seasons
1865	–	Most evacuees back in southwest Minnesota after U.S. Govt.-Dakota Conflict

See also

Farms
Boundary Markers
Woodlots
Fields and Pastures

Appendix: Focus on Gov Land Programs

EURO-AMERICAN AGRICULTURE AT FORT SNELLING AND THE RED RIVER VALLEY

Euro-American farming in present-day Minnesota began on a small scale around the region's first trading posts, missions, and military posts. (Euro-Americans were not the only people farming during the early settlement period, however. Native Americans grew crops including corn, potatoes, turnips, and pumpkins.)

Most historians name the fields near Fort Snelling, established in 1819, and farms along the Red River, established in 1821, as the two earliest centers of Euro-American farming. The farms at the Red River in northwestern Minnesota were established by a small group of Scottish settlers and Metis people in an unofficial southern extension of the Selkirk Colony near present-day Winnipeg. According to historian Stanley N. Murray, by the mid-1830s the Red River farmers "were able to provide the fur trade with flour, potatoes, dairy products, and fresh meat. The market for these foodstuffs was never large, but after twenty difficult years, the Selkirk colonists had established an oasis of semi-commercial agriculture in the middle of a vast wilderness" (Murray 1967: 17, 47-48; Balmer 1926: 210).

The Selkirk farms generated American interest in the fertility of the Red River Valley and were visited and watched throughout the 1850s and 1860s. Among the observers were James J. Hill and other transportation and land developers who came to believe in the agricultural potential of the Red River Valley and investors' ability to make steamboats, railroads, farms, and other ventures profitable in that region (Murray 1967: 47-48).

LOSS OF NATIVE AMERICAN OWNERSHIP OF THE LAND

The first Europeans who came to present-day Minnesota found the region already settled by Native Americans. According to one study of land use in Minnesota, Native Americans were recognized as "having a right of occupancy but not of ownership" (Dana et al 1960: 63). This semantic sleight-of-hand set a precedent for Euro-American use of the 820,000 square miles of land acquired in the Louisiana Purchase of 1803. "By 1804 . . . the United States was in full control of all of Minnesota and in a position to dispose of the land as Congress saw fit. Before clear title to the land could be conveyed, however, it was necessary to liquidate the Indian right of occupancy. For many years the method followed in obtaining cession by the Indians of their possessory rights was through treaties" (Dana et al 1960: 63, 67).

Major cession treaties for Minnesota lands were negotiated with the Dakota, Objibwe, and other groups, primarily in the 1830s-1850s. They opened the door to agricultural development as well as intensive logging. Writing about the 1830s, historians Eileen McMahon and Theodore Karamanski explained that Native Americans "reluctantly accepted the [1837] treaties because of the growing environmental degradation of their embattled homelands. . . . The Dakota no longer had the broad sweep of territory over which they had traditionally ranged during their annual subsistence cycle. . . . The Chippewa [Objibwe] who were accustomed to operating within a smaller territorial range than the Dakota suffered less than their rivals. Even so adjustments were forced on them" (McMahon and Karamanski 2002: chpt. 1).

Historian William Folwell wrote of the 1851 treaties:

> No sooner was the signing of the treaties with the Sioux in 1851 noised abroad than enterprising white men began to cross the Mississippi and invade the 'Suland.' They made their claims, opened roads, cut timber, and built houses and even mills. They naturally followed up the valleys of the streams flowing into the Mississippi, that of the St. Peter's [the Minnesota River] being best known through traders and missionaries. There is a tradition that some impatient immigrants actually staked out their claims to cover the garden patches of the Indians. The Indian agent exerted himself in vain to prevent this unlawful occupancy of the Indian country (Folwell 1921/ rpt. 1956: 352-353).

Historian Hiram Drache wrote, "Cheap, fertile land was the chief reason for the great settler's rush to Minnesota between 1854 and 1857 when 5,250,119 acres of public land were sold. . . . Land, the great exploitable commodity of Minnesota, attracted the pioneers who were also encouraged by the availability of water and trees" (Drache 1964: 17).

The timing of the "early" or "pioneer" settlement phase varied throughout the state, with southeastern Minnesota moving through its frontier phase and into a commercial wheat monoculture sooner than most of the rest of the state.

FEDERAL GOVERNMENT ENCOURAGEMENT TO SETTLEMENT

The federal government provided strong incentives for settlement in the 1840s-1870s. Not only did Congress hope to raise revenues through the sale of public domain land, but encouraging pioneers to settle on the "frontier" helped advance other government interests including federal Indian policy, the development of intercontinental transportation (e.g., railroad-building), and the harvest of natural resources including timber.

The U.S. government surveyed present-day Minnesota between 1847 and 1903 to facilitate its sale. The survey divided the land into a regular grid of townships and sections, and the public land was offered at $1.25 per acre, the standard federal minimum. By 1855 Minnesota had six federal land offices to handle the paperwork, and eventually land offices were located as far afield as Crookston.

Even before public domain land was officially surveyed, however, settlers or "squatters" poured into Minnesota Territory. Dana and others explain:

> 'Squatting' . . . was an inevitable result of the slowness of the government to survey the public lands and to offer them for sale. . . . Congress recognized squatting, or preemption, as an inescapable fact of frontier life by passing numerous acts legalizing the practice in specific situations and for specific periods. Finally it approved of preemption as a basic policy in the 'Log Cabin Bill' of September 4, 1841. That act authorized every head of a family, widow, or single man over twenty-one years of age, who was a citizen of the United States or who had declared his intention to become a citizen, to settle upon and purchase at $1.25 per acre not more than 160 acres of surveyed, unoccupied, unreserved, nonmineral public lands, subject to certain restrictions (Dana et al 1960: 100-101).

Preemption at first only applied to surveyed lands. After considerable lobbying by Minnesota territorial officials and others, preemption was extended to unsurveyed lands in Minnesota and four other states in 1854. Beginning in 1862, unsurveyed lands in all states could be preempted.

THE 1850s

Immigrants poured into Minnesota in the 1850s, particularly after the 1854 preemption act and after the creation in the mid-1850s of a combined river-rail transportation route between Minnesota and the East Coast via Chicago.

While many of the territory's new residents were farmers and loggers, there was also a flood of land speculators. Folwell wrote of the new Minnesotans, "The whole urban population was more or less infected with the virus of speculation. . . . Every man who had credit or could obtain it invested in property which ever continued to rise in value" (Folwell 1921/ rpt. 1956: 363). As the state's population grew, agriculture was so minimal that Minnesota was not raising enough to feed itself, and nearly all food except garden produce and wild game had to be shipped up the Mississippi from regions farther south.

The speculative bubble burst in August of 1857 when a large New York finance company failed. According to Folwell, "The panic struck Minnesota with extreme violence. The eastern banks and other creditors called their loans. . . . Everybody was in debt and the territory was literally emptied of money" (Folwell 1921/ rpt. 1956: 363-364). Railroad-building halted, immigration abruptly stopped, and land speculators living here "were forced to become farmers" (Larson 1926: 18).

Those who were farming suffered rough times. Wheat prices had been depressed before the crash, and the state's farmers found themselves with little income. According to one account, farmers in the New Ulm area, after planting their seed potatoes, "had to dig them back up to feed their staving children" (Rippley and Paulson 1995: 91).

THE 1860s

Drama in the 1860s also shaped early farming. The first major event was the Civil War, which began in 1861. Wartime demand led some Minnesota farmers to raise tobacco, sorghum, and sheep when the Union army needed wool for uniforms and blankets, and as Southern production of cane sugar, tobacco, and cotton was curtailed. While the war also caused some labor shortages, most of this disruption occurred east of Minnesota and, according to historian Merrill Jarchow, "all in all, large numbers of Minnesota farmers lived through the years from 1861 to 1865 rather undisturbed by events of the war" (Jarchow 1949: 15). During this period Minnesota wheat production nearly doubled between 1861 and 1865, despite severe drought in 1862 and 1863 (Jarchow 1949: 12).

More influential in Minnesota was the U.S. Government-Dakota Conflict in which hundreds of Euro-American settlers and Native Americans were killed. Many parts of south central and western Minnesota were virtually depopulated for several years, despite new military posts established to encourage white settlement. According to Drache, the outbreak of the conflict in August 1862 "was so terrifying that in less than one week a majority of the [Euro-American] inhabitants of twenty-three counties had vacated their homes. The scare was so intense that in nineteen counties none of the refugees had returned to their homes prior to November, 1863. And it was not until 1865 that the settlers could return with complete safety" (Drache 1964: 19).

In the political arena, the Civil War period brought three ground-breaking laws that advanced Minnesota agriculture. In 1861 when Southern states seceded from the Union, the balance of power tipped in Congress, allowing passage of key agrarian reforms long-blocked by Southern senators. In 1862 – almost simultaneously – Congress established the United States Department of Agriculture (USDA), gave free farmland to settlers via the Homestead Act, and granted land for the creation of agricultural colleges through the Morrill Land Grant College Act. All three measures were supported by state- and county-level agricultural societies, including those formed in Minnesota in the 1850s.

The 1860s also saw some very low crop yields. The 1861 growing season was so poor, for example, that the fall crop in central Minnesota was an almost complete failure.

The Homestead Act of 1862 was greeted with enthusiasm in Minnesota and its full text published in newspapers throughout the state. The law gave 160 acres of land (valued at $1.25 per acre) or 80 acres of land (valued at $2.50 an acre) to adults or heads of families who were citizens (or citizen applicants), provided the land had been surveyed and the homesteader lived on the land for five years.

Like the 1841 Preemption Act, the Homestead Act initially applied only to public acreage that had been surveyed, but in 1880 unsurveyed public land was also included. After 1874, settlers on the treeless prairie could receive another 160 acres by planting and maintaining 10 acres of trees (Hart 1998: 155-157; Jarchow 1949: 41, 66, 69-70).

ETHNIC ENCLAVES

Historians estimate that roughly 1 million immigrants moved to Minnesota between 1820 and 1975 ("Introduction" 1981: 3). European immigrants began to arrive during the state's early settlement period and continued to come in large numbers through 1920. Many became farmers, acquiring land where they found suitable topography, adequate transportation, low-cost acreage offered through federal programs, and/or fellow immigrants who had gathered via informal networks or through the efforts of a formal settlement program. While some immigrants tended to disperse geographically and assimilate culturally, others lived in concentrations or enclaves that persisted for several generations.

One group of German immigrants, for example, settled in the Minnesota River Valley between Fort Snelling (near St. Paul) and Fort Ridgely (near the western Nicollet County line). These families were part of a much larger group of German immigrants that settled in the center of the state. According to scholar Hildegaard Binder Johnson, central Minnesota – including the Minnesota River Valley and adjacent counties to the north such as McLeod, Meeker, Wright, and Stearns – became the largest region in Minnesota to be occupied predominantly by a single ethnic group (Johnson 1981: 164).

Most German immigrant farm families came to the Minnesota River Valley in a pattern of "chain migration," whereby the newcomers joined family and friends already established in the area (Rippley and Paulson 1995: 2, 103). Chain migrants tended to create, and remain living within, tightly-knit cultural communities. Communities of chain migrants – like the greater New Ulm area in the Minnesota River Valley – tended to retain Old World cultural characteristics – including farming practices and building construction techniques – longer than comparable communities. Historians Rippley and Paulson have written, "Chain migrants were less apt to seek acculturation. They were less likely to marry outside their 'cocoon' and were less inclined toward assimilation with American society." The authors compared German-Bohemian immigrants in the New Ulm area with Minnesota's Danish immigrants, who they say did not follow chain migration patterns. The Danes tended to "disperse" more readily than Germans and to assimilate sooner, including being relatively quick to abandon Danish as their primary language (Rippley and Paulson 1995: 2-4).

German immigrants in and around the New Ulm area created a cultural community that was almost homogeneous in its ethnicity. In 1860, for example, Courtland and Lafayette townships in Nicollet County were 80 to 99 percent German, according to census data (Johnson 1981: 163). According to Rippley and Paulson, in 1870 only 8.7 percent of "New Ulm area Germans" were marrying outside of their ethnic background. In large numbers, these German immigrant families continued to speak German. As late as 1970, 41 percent of New Ulm residents still claimed German as their principal language, compared to 8 percent statewide (Rippley and Paulson 1995: 4, 148).

TECHNOLOGY

While pioneers were enthusiastic and political events encouraging, Minnesota agriculture developed slowly, only able to advance as fast as technology would allow. With virtually no improved roads in much of the state, settlement followed navigable rivers, which were blocked with ice during the winter. Historian Arthur J. Larsen wrote, "Since the lands along the rivers were the most accessible, they usually were the first to be taken up, although, from the agricultural standpoint, they often were inferior to those farther removed from navigable streams. The settlers were eager to get at the lands in the interior, but the absence of roads was a formidable obstacle" (Larsen 1940: 226-227).

Connections between Minnesota and outside markets were also limited. According to Larsen:

> Before 1867 Minnesota had no rail connections with exterior points. The [Mississippi] river carried its products to St. Louis and to the Mississippi railheads of roads leading to Milwaukee and Chicago. Transportation, both by river and by rail, was slow, unreliable, and expensive. The river was in some respects an unsatisfactory highway. Since it was closed a large part of the year, certain problems in the storage, sale and shipment of grain arose, but irregularities in the navigation of the river due to low water in the open season were even more serious (Larson 1926: 39-40).

Limited transportation prevented the dissemination of goods and services that made farming easier. A scattering of entrepreneurs established grist mills, saw mills, lime kilns, post offices, and stagecoach stops – usually on their own farms – which often became the nuclei of small commercial centers. If nearby farmers had excess grain or produce to sell, it was usually collected and traded there.

Farming itself was constrained by limited technology. Fields had to be painstakingly created by hand-cutting trees and grubbing stumps, or by breaking thick prairie sod with oxen and walking plows drawn by mules. Planting and harvesting implements were crude, inefficient, and dependent on much hand labor. (In 1860 there were 10,000 more oxen than horses in Minnesota, according to Jarchow. Ten years later, horses outnumbered oxen by 50,000 (Jarchow 1949: 147).)

According to Merrill Jarchow, "The Minnesota commissioner of statistics, J. W. McClung, in 1860 estimated that it cost $795 [roughly $17,500 in 2003 dollars] to open a farm, including the price of implements, provisions, oxen, cows, a team and wagon, breaking about twenty acres, and building a house and fence."

Jarchow explained:

> One of the first tasks confronting the settler was to build a cabin, and during its construction, the family often lived with a kind neighbor. Another was to break a little land for a crop. Many settlers did not know how to break land and many had the wrong kind of plow. Others had no horses nor oxen, and they had to hire the job done. . . . Potatoes, corn or rutabagas were the usual crops sown on newly broken land, corn often being inserted in an opening made with an ax in the sod. By the following spring the land would be ready for a wheat crop. After building a cabin, breaking some land, and planting a few crops, the pioneer frequently had to turn his attention to the problem of fencing, since until the late 1870s livestock was allowed to run at large (Jarchow 1949: 6-7).

While pioneers in wooded areas constructed buildings of logs, those in treeless areas used another available material – sod. Jarchow wrote:

> Beyond the wooded areas materials for log cabins and frame shanties were not easy to obtain, and, after the vanguard of settlement had pushed into the treeless areas, a different type of shelter was needed there until the railroads came and until the farmers could afford to import lumber. Once again, the pioneer exercised his ingenuity and utilized the materials at hand. He found an answer to his need in the thick prairie sod everywhere available, which he cut into bricks suitable for building. In the 1860s, 1870s, 1880s and even later, western Minnesota was dotted with sod houses of various types and sizes. . . . [In Brown county] a Danish family built a sod house large enough to accommodate not only themselves, but their cows and oxen as well. . . . Some houses were built completely of sod while others had sod bricks laid on the outside of frame shacks. The walls of sod barns frequently were three or four feet thick; yet rain, sun, wind, mice, and rotting grass reduced them to piles of dirt in a few years (Jarchow 1949: 83).

By the end of the early settlement period, much of the state was agriculturally undeveloped. According to Jarchow:

> As late as 1870, four-fifths of the population in Minnesota was [still] concentrated in the southeastern part of the state, accessible to the Minnesota, St. Croix, and Mississippi rivers. This area, in general, was wooded, the kind of area congenial to the pioneers, for it furnished them with materials for fuel, fences, and houses. Only with reluctance did they venture out on the open prairie, where tradition maintained that the soil was less fertile, and where winds, blizzards, fires, insect pests, Indians, and lack of transportation facilities seemed to doom the settler to failure or death (Jarchow 1949: 80).

CHARACTERISTICS OF FARMS FROM THE EARLY SETTLEMENT PERIOD, 1820-1870

- new farms
- farms concentrated in southeastern Minnesota and near rivers

- farms with subsistence-level, diversified farming systems
- farms with a small but growing number of improved acres
- farms using horse-, oxen-, and human-power
- "traditional" or ethnically-based farming methods
- "traditional" or ethnically-based building design and construction
- few barns (most kept animals outside or housed in very simple or temporary shelters)
- small buildings built with native materials
- dugouts, log houses, sod houses
- timber frame buildings
- pole and straw buildings
- worm fences
- well-preserved resources from this period expected to be rare

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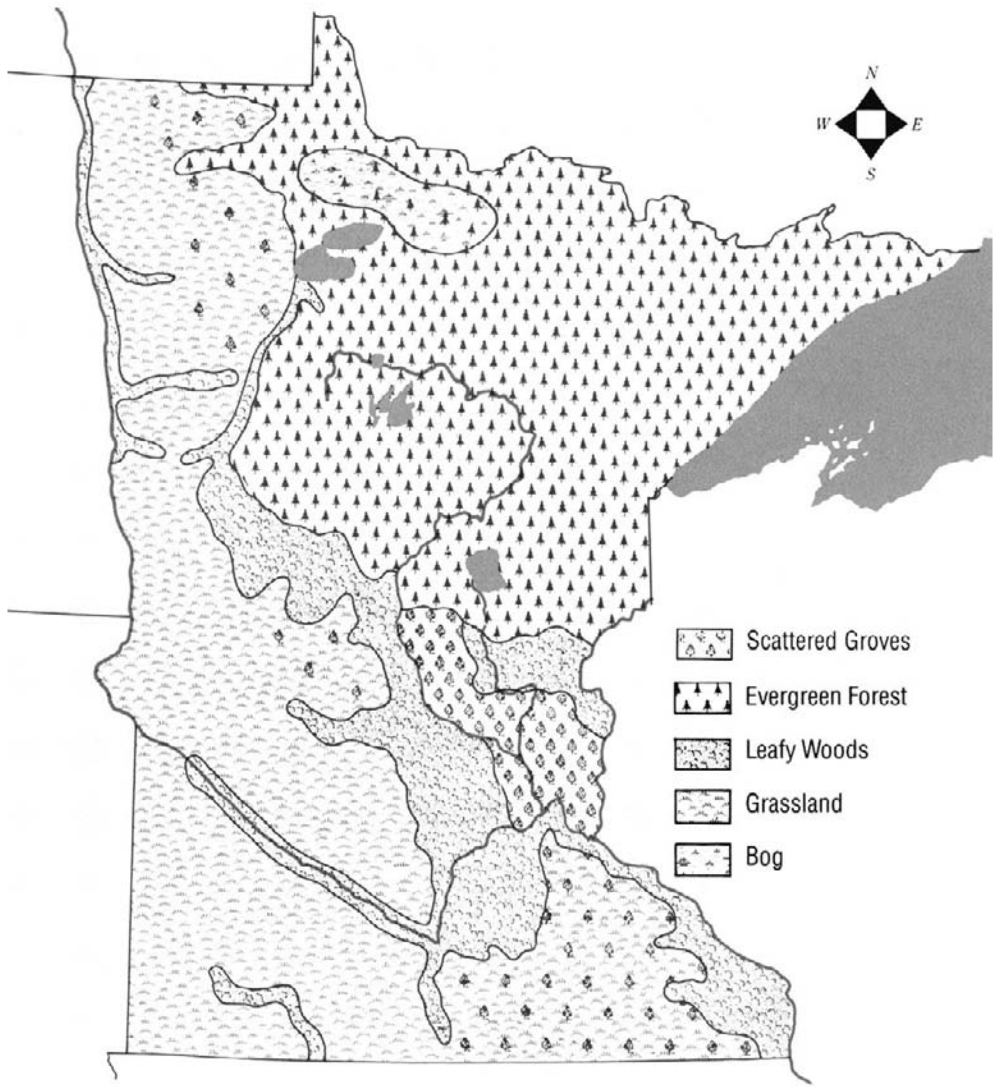
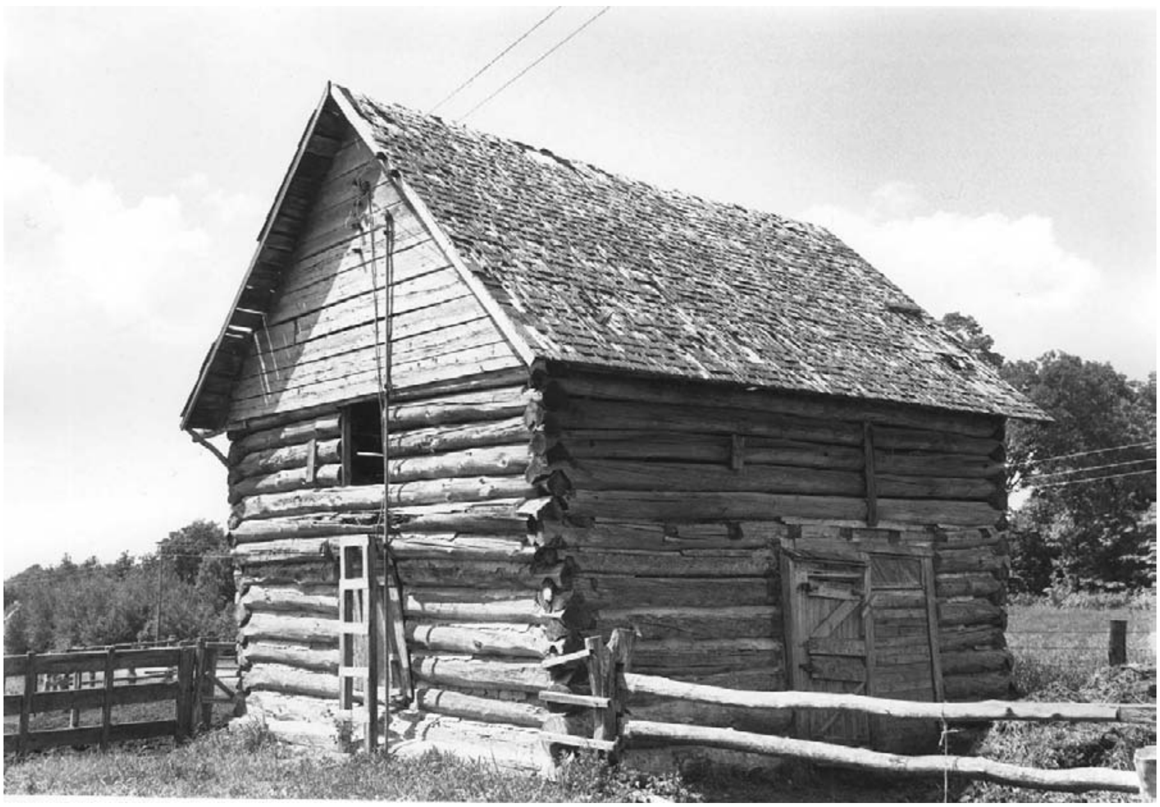


Minnesota's vegetation at the advent of Euro-American settlement. The "scattered groves" and "leafy woods" in the southeastern quarter of the state were called the Big Woods. Much of western Minnesota was prairie grasslands, and the northern half of the state was dominated by coniferous forest. From Rhoda Gilman's *The Story of Minnesota's Past* (1989).



A settlement-era barn in Belle River Township, Douglas County. Photo taken in 1983. (MHS photo)

A settlement-era barn, still looking sturdy at the turn of the century. Location unknown, circa 1900. (MHS photo by Louis Enstrom)

According to historian Merrill Jarchow, there were 10,000 more oxen than horses in Minnesota in 1860. By 1870 horses outnumbered oxen by 50,000 (Jarchow 1949:147). Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

PERIOD 2: DEVELOPMENT OF A WHEAT MONOCULTURE, 1860-1885

As Minnesota farmers moved out of the subsistence phase and into commercial agriculture, the majority grew wheat as their exclusive cash crop. Wheat farming developed first in southeastern Minnesota where the grain was shipped to market on river boats. Around 1870, yields began to decline at the same time that land prices were rising with population growth in southeastern counties. As southeastern farmers began to diversify to maintain profitability, the wheat monoculture shifted to the state's new frontier – the vast western territories now accessible on the new network of rail lines. Minnesota led the nation in wheat production, Duluth became the country's premiere grain shipping port, and Minneapolis became the international leader in flour milling.

Milestones of this Period

1858	–	First flour was exported from Minnesota; until then flour had been imported
1862	–	Minnesota's first rail line, the St. Paul and Pacific, began to operate between St. Paul and St. Anthony
1862	–	Federal Homestead Act became law
1862	–	USDA established
1862	–	Congress passed Morrill Land Grant College Act to further agricultural education
1865	–	U.S. wheat exports began a rise that lasted to 1880
1869	–	University of Minnesota College of Agriculture established
1870	–	Population of Minnesota rose to 439,616, up 255% in ten years
1871	–	Northern Pacific finished a line between Duluth and Moorhead opening the Red River Valley to agricultural development and Great Lakes shipping
1871	–	Duluth Ship Canal constructed
1871	–	First middlings purifier installed in Minneapolis' Washburn B Mill; market for northern spring wheat created
1873	–	First carload of wheat was shipped from Moorhead to Duluth
1873	–	Failure of Jay Cooke organization sparked Panic of 1873 and halted construction of Northern Pacific and St. Paul and Pacific railroads
1873	–	After the Cooke collapse, railroad investors developed bonanza farms on land that had been collateral for railroad bonds
1873	–	Grasshopper plagues through 1877
1873	–	Federal Timber Culture Act passed, State Tree Bounty Law passed
1878	–	Wheat grown on almost 70 percent of Minnesota farmland
1878	–	Congress authorized dredging a 4 1/2'-deep Mississippi River shipping channel
1878	–	James J. Hill and partners acquired the Northern Pacific and St. Paul and Pacific and renewed construction
1879	–	Robust boom period in western and northwestern counties; lasted until late 1880s

See also

Farms
Threshing Barns
Granaries, Elevators, Bins, Dryers
Appendix: Focus on Minnesota Crops
Appendix: Focus on Mechan Techno

Wheat, which was the first crop grown commercially on a large scale in Minnesota, was a frontier crop, dependent on abundant and inexpensive land. It had arrived in Minnesota after moving westward along with the U.S. frontier. Wheat was "the premier lazy man's crop, taking relatively little labor [and little expertise] to produce," according to historian David Danbom (Danbom 1995: 147).

In 1839 little wheat was grown west of Indiana and 20 years later, by 1859, wheat fields were covering southeastern Minnesota and, for the first time, "the value of the wheat shipped from the state exceeded that of furs, which had been the most important commercial product since trading began," wrote historian Henrietta Larson (Larson 1926: 17-18). In the 1870s wheat fields appeared in Minnesota's new frontier – the Red River Valley. Nationwide, the center of U.S. wheat production in 1839 was in West Virginia, and by 1909 it had shifted west to the Iowa-Nebraska border (Olmstead and Rhode 2002: 6).

Farmers were encouraged by a strong market for Minnesota wheat that was created by rising U.S. population as millions of Europeans immigrated to America. Demand for food also increased in western Europe, especially England. Larson wrote:

> Wheat was an important element in the diet of the people of those [European] regions. And it was also easily stored, transported and graded so as to become an article of trade earlier and for longer distances than more bulky and more perishable products. Its value was high compared with its weight, so that transportation to a distant market was economically possible. Furthermore, the fertile, clean, virgin soil of the frontier could produce a better grade of grain with the use of less capital and labor than was possible in the older sections [of the U.S. and Europe] where land had been cultivated longer. Therefore, the demand for food in those far-away regions was expressed in Minnesota as a demand for wheat, and no product brought so regularly a good price throughout the early years of Minnesota's history as did wheat (Larson 1926: 25-26).

Market demand, technological innovations, population growth, and transportation improvements created an overall pattern of intense agricultural expansion in Minnesota and nationwide, according to Danbom. By several measures U.S. agriculture doubled from 1870 to 1900. And while "the [U.S.] farm population was doubling between 1870 and 1900, the urban population was tripling" (Danbom 1995: 133).

Minnesota's success in wheat growing was also made possible by advances in technology. Important mechanical developments of the 1840s-1870s included new reapers, threshers, self-binders, and countless other devices and techniques, many developed by ingenious farmers and shared with others. On the biotechnology front, plant breeders had produced 'Red Fife,' North America's first hard spring wheat, which was introduced to the U.S. in the mid-1850s. 'Red Fife' allowed wheat to thrive in northern latitudes and, as a consequence, it was successfully grown across Minnesota, Wisconsin, the Dakotas, and southern Canada. 'Red Fife' was also a precursor for later varieties including 'Marquis,' which, after it was introduced in 1912, became the leading spring wheat in the northern plains (Olmstead and Rhode 2002: 9, 12, 15).

By 1890 Minnesota became the national leader in wheat production, and Minneapolis and Duluth had become the nation's largest wheat markets.

PHASE I OF THE WHEAT ERA: SOUTHEASTERN MINNESOTA, 1860-1875

Wheat farming in Minnesota passed through two distinct phases. The first began during the early statehood period of the late 1850s and was linked to river transportation. During this phase, most wheat was grown in fields laboriously cleared from the hardwood forests of southeastern Minnesota. Most of the grain was threshed by hand, and the wheat was transported down rivers or hauled in slow wagons to Mississippi River ports. It eventually reached railheads from which it was shipped to terminal markets like Chicago and Milwaukee.

Farmers who had wheat to sell brought it to local merchants and millers. For the best prices, farmers hauled their wheat to towns that were located on or near major rivers. Larson wrote:

> The larger towns within a day's hauling of the river became fairly satisfactory markets for farm products. . . . The first cash wheat market in the interior [the portion of Minnesota west of the Mississippi] seems to have been at Chatfield, a prominent trading town, where a federal land office was located. Milo White, a general merchant, began to buy wheat for cash in 1859. He built a warehouse for storing the grain, and shipped by team to LaCrosse in winter [where there was a rail connection to the east] (Larson 1926: 21-22).

Between 1860 and 1875, wheat production nearly doubled every five years (Folwell 1926/ rpt. 1969: 66). Much of the wheat was planted by farmers taking advantage of incentives like the Homestead Act of 1862. According to historian Theodore Blegen, "Even in the Civil War years, up to 1865, a million and a quarter acres of public lands were entered by more than nine thousand claimants; and the rush for homesteads went steadily forward through the next decades" (Blegen 1975: 344).

In 1870 the principal wheat-growing counties in Minnesota were Olmsted, Goodhue, Fillmore, Wabasha, Dakota, and Winona – all in southeastern Minnesota (Jarchow 1948: 12-13).

PHASE II OF THE WHEAT ERA: SETTLEMENT OF THE WESTERN COUNTIES, 1875-1885

The second phase of Minnesota wheat growing began around 1875. It was characterized by several interrelated patterns and events: the depletion of soils and the rise of land prices in southeastern Minnesota, the construction of railroads throughout the state, the establishment of farms on Minnesota's prairies, the phenomenon of bonanza farming, the rise of Minneapolis milling, and the development of organized colonies and settlement movements.

By the mid-1870s, farmers in southeastern Minnesota who had been planting wheat for 15 years were seeing decreasing yields from depleted soils, crop diseases, and pests. Planting more acres was not an option as the region's land values had risen along with its population. Some southeastern farmers moved to the undeveloped prairies of western and northwestern Minnesota, joining tens of thousands of European immigrants who were also migrating there. Others decided to stay in southeastern counties, invest in new equipment and livestock, and diversify (Nass 1989: 131).

Larson explained, "Supremacy both in the amount and quality of wheat raised was passing to the region bordering on the Red River. The rich virgin soil of that section proved to produce excellent wheat in large yields, and the cultivated area of the northwestern part of the state was extended considerably" (Larson 1926: 118-119). According to Larson, "The [state's] tilled area increased almost fourfold in the decade following the [Civil] war. The growth in wheat production was even greater" (Larson 1926: 55-56). By 1900, Minnesota's four largest wheat-growing counties were Polk, Clay, Marshall, and Otter Tail – all in and near the Red River Valley (Drache 1964: 13).

Construction of Railroads. The second phase in wheat growing was linked to the building of railroads that opened the northern plains to Euro-American settlement. In the 1860s, Minnesota's earliest (and long-awaited) railroads were concentrated in the southern and southeastern parts of the state, areas that were already "settled." In 1867 a critical connection to eastern markets was made when the Minnesota Central completed the first direct rail link to Milwaukee. Around 1870, tracks in Minnesota pushed beyond the frontier, moving rapidly into vast unbroken areas in advance of Euro-American settlement. Major lines were built between St. Paul and Duluth in 1870, between St. Paul and Breckenridge in 1871, and between Duluth and Moorhead in 1871. These tracks tied west central Minnesota and the Red River Valley – which became the state's richest wheat-producing region – with Great Lakes shipping and with Minneapolis flour mills. They also opened much of the state to Euro-American settlement (Larson 1926: 59-60).

In the fall of 1873, just as the first wheat was being shipped eastward from the Red River Valley, Jay Cooke and Company – the Northern Pacific's major investor – collapsed. The catastrophe sparked the financial panic of 1873 and the ensuing five-year depression, halted railroad construction, and slowed settlement. (The halt in railroad building encouraged Red River steamboating, however. Wheat was shipped from northwestern counties on barges (towed by wood-burning steamboats) to the Northern Pacific railhead at Fargo-Moorhead, and from there was shipped eastward to Duluth and Minneapolis.)

Transportation improved and farm development accelerated again in 1878 when James J. Hill's St. Paul, Minneapolis and Manitoba railroad laid the first tracks up the Minnesota side of the Red River. Until this point, the eastern bank had been bypassed by farmers in favor of the Dakota side where the soils were better drained. Completion of Hill's so-called "St. Vincent Extension" opened the Minnesota side to farming. According to historian Howard Dickman, "The completion of Hill's railway lines in late 1878 loosed a flood of settlers into this area and beyond into eastern North Dakota. Even after the high tide of this 'Dakota Boom' receded in the late 1880s and hard times came in the early 1890s, Minnesota continued to grow. Agricultural settlement did not appreciably slacken until the turn of the century, by which time most desirable prairie lands . . . were either occupied or in private hands" (Dickman 1977: 50, 52).

Bonanza Farming. With the failure of Jay Cooke's company in 1873, railroad investors acquired vast amounts of land in the Red River Valley that had been used as collateral for the railroad construction bonds. More than 1.7 million acres of railroad land entered private ownership between 1873 and 1878. More than half of the land went to a small group of about 60 investors whose acquisitions averaged more than 14,000 acres each (Murray 1957: 60). Around 1874 these men began to develop "bonanza" farms in the Red River Valley to demonstrate the viability of farming there, to generate traffic for the railroads, and to attract new settlers.

Most bonanza farms were located on the western bank of the Red River since the Minnesota side was more prone to flooding. However, large-scale farms began to appear in Minnesota after Hill's St. Vincent Extension was built in 1878. One group of four farms near Kennedy in Kittson County, for example, totaled 65,000 acres.

Bonanza farms – like most wheat farms – suffered from the droughts in 1887-1889 that "hit the Red River Valley with exceptional severity" (Briggs 1932: 36). A few years later, the Panic of 1893 devastated many bonanza farmers who had over-expanded on borrowed capital. By the mid-1890s, most bonanza farms were being divided into smaller, more conventional operations.

While many of the bonanza farms were short-lived (ca. 1875-1893), Blegen explains "these huge farms contributed to the fame of the Red River Valley, on both the Minnesota and the Dakota sides, as an incredibly rich wheat-producing area. The bonanza farm was wheat growing on a grand scale, taking advantage of machinery in large quantities, cheap land, and virgin soil" (Blegen 1975: 345). In fact, with their large-scale mechanization and economies of scale, bonanza farms were Minnesota's first "factory" farms, preceding by nearly a century the large specialized farms that developed in Minnesota after World War II.

Minneapolis Milling. The second (post-1875) phase of Minnesota's wheat boom was encouraged by technological breakthroughs in the flour milling process. Machines and techniques, such as the middlings purifier, enabled the Minnesota "patent" flour milling process. They were introduced in Minneapolis mills in the early 1870s and made Minnesota hard spring wheat just as viable for bread flour as high-quality winter wheat grown elsewhere. Minneapolis rose to become an international leader in flour milling, just as Duluth became a world-class grain shipping port. Both markets were supplied with grain grown by soaring numbers of northern wheat farmers and purchased by a new class of professional wheat buyers or middlemen. The grain was shipped on Minnesota's growing network of rail lines after being collected and stored in a new system of "line" elevators built in small towns along the tracks (Larson 1926: 118-119).

Colonization and Settlement Activities. Railroads played a much stronger role in agricultural development than merely shipping the products of Minnesota farms, and much of this activity began during the wheat-growing era. To encourage investors to construct rail lines, Congress granted rail companies 10 million acres of free public land in Minnesota – about 20 percent of the state's total land area – in a set of transfers that constituted "by far the largest grant made by the government for any single purpose," according to one source (Dana et al 1960: 98).

Railroad companies sold parcels of their land to prospective farmers and encouraged them to settle along the tracks, to trade in railroad-platted townsites, and to patronize grain elevators and lumberyards that the railroad or an associate owned. In a 1926 article, historian James B. Hedges explained the impetus behind the settlement activities of western railroads like the Northern Pacific:

> The railroads east of the [Mississippi] river were, for the most part constructed through territory already well settled and in a relatively high state of productivity. . . . The railroads, first built to fill in gaps between important waterways, naturally found developed trade awaiting them. . . . [The eastern railroads were] thus practically assured in advance of a profitable business.
>
> West of the Mississippi the railroads were built in comparatively new and unsettled country, and frequently anticipated by a generation the needs of the region tributary to them. . . . To overcome the timidity which such a situation created in the mind of the investing public, the railroad land-grant . . . was developed. By this method large bounties of the public domain were offered in promotion of railway construction. Despite this . . . aid, however, railroad companies often found themselves with their lines completed,

> looking in vain for the traffic which could come only as the prairies were converted into homesteads. It came about, then, that the first great problem of these railroads was one of colonization (Hedges 1926: 311-312).

In essence, wrote Hedges, railroads west of the Mississippi were "forced . . . to adopt definite colonization programs in order to make their existence on a profitable basis possible." As these programs were instituted in Minnesota and elsewhere, the railroads became "the most important single factor in the development of the Trans-Mississippi country" (Hedges 1926: 311-312).

The Northern Pacific established a land department in 1871, the same year it completed its Duluth to Moorhead line. The company then launched an aggressive campaign to advertise and sell land, distribute seed and seedings for fields and shelterbelts, extend credit on favorable terms, build hotels and reception houses (also called immigrant houses) near depots, and sell pre-built homes to settlers who could afford them. The Northern Pacific and other lines recruited settlers from "every corner of Europe and Eastern America," provided discounted and free transportation, carried on agricultural experiments, established demonstration farms, and disseminated technical agricultural information (Drache 1964: 25-26). Logging companies engaged in similar efforts to sell excess their land, and both railroad and lumber companies worked in concert with church groups and through land developers and other intermediaries. Prospective farmers were also recruited to Minnesota by state and federal agencies, and other organizations.

Farming on the Prairie. Until 1870, most Minnesotans farmed in the hardwood forests. Historian Hiram Drache wrote, "The railroads changed the picture by luring farmers to the prairies. This was especially true after the farmers learned that they could improve as much prairie land in three years as they could woodland in twenty years. Wheat, the most transportable farm commodity, quickly took over as the major crop" (Drache 1964: 22).

According to Blegen, "Lands patented under the Homestead Act reached 255,648 acres in 1873 and a peak of more than 367,000 in 1885. Generally through the 1870s and 1880s the totals never fell below 200,000 acres a year" (Blegen 1975: 344). In recognition that "the 160 acres available under the Homestead Act might not be enough to support a family in much of the [prairie] region, Congress sought to make more land available for settlers. The Timber Culture Act, passed in 1873, allowed farmers to claim 160 acres in addition to what they held if they planted 40 acres with a specified number of trees" (Danbom 1995: 144-145). The Act was amended in 1878 to reduce the required amount of trees to 10 acres. The Minnesota legislature passed its own version of the timber culture incentive in 1873, offering a cash bounty to farmers who planted and maintained trees on prairie lands or along public highways.

Farming on the plains offered challenges different from those in the woods. There were fears that the soil wasn't fertile, and prairie areas lacked timber for firewood, lumber, and shelter from the wind.

Fortunately, railroads carried some manufactured goods to prairie farmers, including those using local sod as a primary building material. Folwell wrote:

> It was not necessary for the thrifty prairie farmer to live long in his shack or sod house. The managers of sash and blind factories in the principal river towns early developed a plan for furnishing all the timber, boards, shingles, and finishings for houses, as well as the

> doors and windows and their frames, and shipping them out [along railroads] in carload lots. On a ready foundation the balloon frame of light timbers, nailed together without mortise or tenon, was soon run up, and the roof boards and shingles were nailed on. The rough sheathing of the walls next went on, often reinforced by a layer of heavy tarred paper. Outside of these was put the siding, which had been planed smooth at the factory. The frames for doors and windows were next put into their places and the moldings were run around the openings. When the floors were laid, the stairs built, and the doors and windows adjusted, the house was habitable for summer weather. . . . With air-tight wood stoves or base-burning coal stoves the family was comfortable even when the fiercest of cold waves swept over the prairie (Folwell 1926/ rpt. 1969: 63-64).

KING WHEAT

According to historian Everett E. Edwards, "During the eighties [1880s] Minnesota forged ahead from fifth to first rank among the leading wheat-producing states of the Union. In the following decade, it not only retained this pre-eminent position, but nearly doubled its output" (Edwards 1938: 148). Another source wrote, "In the space of forty years, from 1850 to 1890, Minnesota had become the leading wheat producing state of the nation. Peak wheat crop was harvested in 1899, when Minnesota again led all states with over 95 million bushels, 14.5% of the nation's total" (Minnesota Institute 1939: 8-9). In 1890 about half of all Minnesota crop land was planted to wheat.

Years of exclusive wheat culture eventually caught up with Minnesota farmers. Deteriorating soil quality, repeated outbreaks of the fungal disease called "rust," and invasive weeds like Russian thistle, which moved into Minnesota around 1890, depressed yields and farm income. By the late 19th century, experts were urging farmers to diversify and Minnesota agriculture entered a new era.

CHARACTERISTICS OF FARMS FROM THE PERIOD OF WHEAT MONOCULTURE, 1860-1885

- farms using horse-, oxen-, and human-power
- farms with growing number of improved acres
- relatively few buildings to house animals
- buildings used to store grain
- timber frame buildings
- three-bay (also known as English) barns, primarily in the southeast
- in the southeast, early buildings of framing and native materials like log and stone
- in the west, early buildings of sod and materials bought from early trackside lumberyards
- new farms, especially near railroads
- windbreaks, woodlots, and shelterbelts planted in prairie areas
- structures associated with bonanza farms
- designs influenced by local carpenters
- designs influenced by Eastern agricultural publications and early agricultural societies

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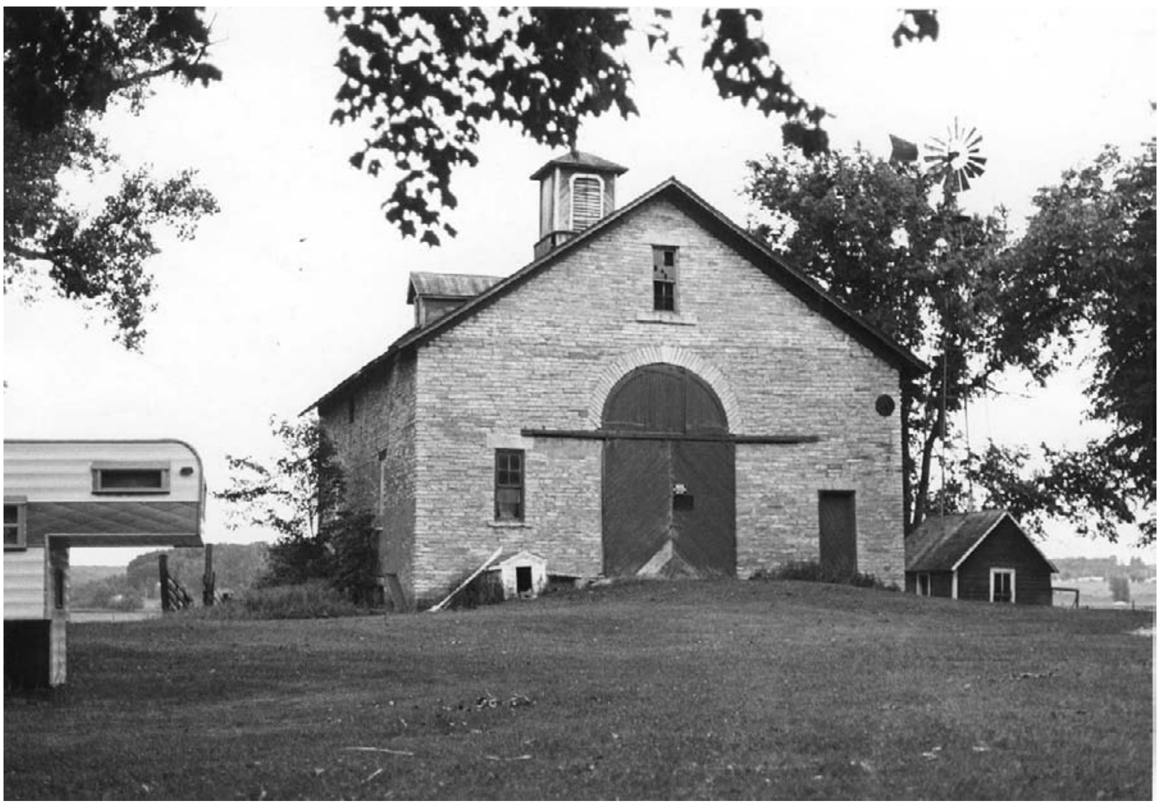

A limestone barn in southeastern Minnesota. Fellows Farm, near Rochester, Olmsted County, 1973. (MHS photo by Thomas J. Lutz)

A woodframe farmhouse in western Minnesota likely built in the 1880s. Norman Farm, Mandt Township, Chippewa County, circa 1920. (MHS photo)

This farmhouse, which is larger and fancier than most in west central Minnesota, represents the period when farmers in prairie areas were growing wheat almost exclusively. Quaal Farm, Hantho Township, Lac qui Parle County, circa 1920. (MHS photo by Chalmers and Son)

After grain was cut, it was tied into bundles or sheaves. Several sheaves were stacked together to form the shocks shown here, which remained in the field for a short time to dry. The back-breaking work of cutting, tying, and stacking was eased by mechanical reapers, which became prevalent in the 1850s, and by reaper-binders, developed in 1875. Mosscrip Farm, Washington County, 1947. (MHS photo by Norton and Peel)

PERIOD 3: DIVERSIFICATION AND THE RISE OF DAIRYING, 1875-1900

To maintain profitability, most Minnesota farmers were compelled to move from pioneer wheat farming to a more diverse set of crops and livestock. The change began in the 1870s. Dairying became an important part of this diversification, but grew gradually because it required a large capital investment and new farming skills. The growth of Minnesota's dairy industry was stimulated by increasing population and technical advances such as winter-hardy alfalfa, the Babcock butterfat test, the centrifugal cream separator, and the silo. In the 1890s, Minnesota farmers began forming cooperative creameries, which helped spread dairy farming and soon dominated dairy marketing and processing.

Milestones of this Period

1858	–	First Grimm alfalfa planted; grown only in Carver County for several decades
1867	–	State Agricultural Society made early call for farm diversification
1870	–	Minnesota's first cheese plants established in the late 1860s
1871	–	Louis Pasteur invented pasteurization
1878	–	Minnesota Dairyman's Association formed
1880	–	Minnesota's first butter plants (creameries) established in the late 1870s
1882	–	Minnesota Butter and Cheese Association founded
1884	–	Hand-cranked, centrifugal cream separator introduced
1885	–	Minnesota State Dairy Commission established (became Minn. Dept. of Agriculture)
1886	–	Minnesota Farmers' Institutes began
1887	–	Hatch Act created federally-funded agricultural experiment stations
1889	–	*Minnesota Farmers' Institutes Annual* published an early article on silos
1889	–	USDA became a cabinet-level department
1890	–	Clark's Grove Cooperative Creamery established; became the model for other creameries
1890	–	S. M. Babcock developed a test for butterfat in milk
1891	–	University of Minnesota established a dairy school with T. L. Haecker as instructor
1891-93	–	Widespread bankruptcies and financial depression
1895	–	USDA established a dairy division
1895	–	Agricultural engineering course formally established at the University of Minnesota
1896	–	Power machinery first taught at the University of Minnesota
1897	–	Minnesota's first four free rural mail delivery routes established at Farmington
1898	–	Minnesota had 664 creameries
1900	–	Grimm alfalfa came to the attention of Univ. of Minn.; dissemination soon began
1902	–	Steel stanchions for dairy cows introduced
1905	–	Milking machine marketed
1913	–	Haecker's *Feeding the Dairy Herd* published; used for the next 60 years

See also

Farms
Dairy Barns
Combination or General Purpose Barns
Silos
Springhouses and Springboxes
Milk Houses

DIVERSIFICATION

In the 1870s, economic forces compelled Minnesota farmers to move from wheat farming into higher-grossing enterprises such as horticulture, sheep or poultry raising, corn and hog or beef production, and dairying. Regions east of Minnesota had followed a similar pattern in the mid-1800s, as historian Hiram Drache explained:

> Wheat production was deemed best adapted to the conditions of frontier agriculture. As land became more valuable, it had to be used for livestock production and dairying rather than wheat raising. This accounted for the shift from wheat to diversified agriculture in the states east of Ohio in mid-century. Where land was still cheap, as on the frontier, the rent charge was low and the farmer used as much land as possible in relation to labor and capital. Wheat best answered these conditions. But later when land prices rose, the farmer shifted to greater gross income crops (Drache 1964: 12).

By the 1870s, the soil in Minnesota's earliest-settled region was exhausted from 20 years of raising only wheat. The area's population was increasing and land values were rising, making it hard for farmers to increase their earnings by adding acreage. Grasshoppers and other pests, crop diseases, declining yields, and low wheat prices all encouraged diversification (Edwards 1938: 148-149). Wheat farming shifted to Minnesota's western and northwestern frontier where land was less expensive while, "the older southern and eastern sections of the state turned to other types of agriculture, especially from 1878 onward," according to historian Merrill Jarchow (Jarchow 1949: 185).

In 1867 the Minnesota State Agricultural Society issued an early call for diversification when it adopted a resolution stating that "the continual cropping of wheat, year after year, in the same field, without even a change of seed, is bad farming, and ought to be discouraged," explained Jarchow (Jarchow 1949: 253). Farm diversification was also promoted by the agricultural press and by the nation's young agricultural colleges, Farmers' Institutes, and experiment stations.

Diversification was also advanced by corporate interests such as railroad companies that were rapidly building lines across central and western Minnesota. Howard Dickman, biographer of James J. Hill, explained:

> Most of the farmers who poured into western Minnesota and eastern North Dakota in the 1880s raised only wheat. But Hill knew that these farmers' reliance on the 'one crop system' was not in their, nor his, long run interest. Experience demonstrated that unless agriculturalists practiced crop rotation and adopted diversified farming systems, even the most fertile land would eventually 'give out.' In the long run, these farmers, or more likely their sons and grandsons, might move on if the land lost its fertility and ceased to afford them a living. But the railroad had an enormous capital investment in its roadbed and its other physical plant; it was here to stay. Hill could not afford to have the soil 'give out' (Dickman 1977: 68).

James J. Hill and others encouraged farmers to use "dual-purpose" beef-dairy cows; add poultry, beef cattle, sheep, and hogs to their farms; and plant alternative crops like potatoes and sugar beets. Land developers, agricultural processors, and other agribusinesses also pressed for diversification to help maintain and increase the farm productivity on which their industries depended.

Diversification protected farmers from being completely wiped out by the failure of a single crop, and in fact, market prices for meat and grain tended to move in opposite directions so that farmers who produced both had some risk protection (Danbom 1995: 256). Minnesota farmers who had diversified found they were better able to weather times of economic depression.

Diversification also had other advantages. Bringing in regular "egg money" and a "milk check" improved cash flow which, under a wheat-only regimen, was dependent on a single payment for the grain harvest in the fall. Livestock and poultry feeding made better use of the family's total labor pool, including children. Diverse operations spread farm labor more evenly throughout the year: corn required work in spring and fall, alfalfa needed labor in the summer, wheat in summer and fall, and milking and stock-fattening used winter labor (Roberts et al 1956: 510). With a mixed crop and livestock system, the farm could also make good use of farm by-products. Livestock could be let into the fields to eat crop residue missed during harvest, for example, animals could be fed crops like culled potatoes or corn that had failed to ripen, and excess skim milk could be fed to young pigs and calves. Manure could be spread on the fields to increase fertility, and land too steep or rocky for tilling could be used for pasture. Even the process of grazing (e.g., the trampling of hooves, dropping of manure, and shearing of plants) could have a beneficial effect on pastureland if well managed. Rotating crops, important to diversification, improved soil texture and fertility. Good rotation could also ensure that a feed crop, a cash crop, and a soil-building crop were always being grown.

Steady mechanization, which had begun with the adoption of many new horse-drawn implements in the mid-19th century, helped farmers diversify. By 1900 Minnesota farmers used horse-drawn riding plows, disc plows, harrows, two-row corn planters, one- and two-row cultivators, grain drills, mowing machines, hay rakes, mechanical hay stackers, and grain binders. Yet many farm jobs were not yet mechanized. Corn was picked by hand, and silos were generally filled by the backbreaking method of loading in bundles of green cornstalks one-by-one. Cows were milked by hand, the cream separator was cranked by hand, manure was loaded and spread with a pitch fork, and most of the hay crop was loaded and unloaded with hand forks. Farm products were still transported by horse-drawn wagon.

By the mid-1890s diversification was well underway, and between 1900 and 1910 wheat's share of the total value of Minnesota farm products dropped from 31 percent to 20 percent. (In some areas, such as the Red River Valley, wheat was still dominant in the 1930s.) The drop in wheat production came along with corresponding rises in the value of other crops and in dairy products and livestock (Robinson 1915: 210).

According to Jarchow, "Diversification did not come all at once, nor did it affect all parts of the state equally. Some farmers carried on mixed agriculture in the midst of specialized wheat areas, and some clung to wheat almost solely in areas of diversification" (Jarchow 1949: 185).

The effect of diversification on Minnesota's built environment was profound. Livestock farming, and especially dairying, required farmers to make significant capital investments for new buildings and equipment. Two-story barns (usually housing animals below and feed such as hay above), silos, corncribs, and fenced fields became a significant part of Minnesota's rural landscape, as did a whole array of other structures related to animal husbandry. Diversified farming dominated Minnesota agriculture until the late 1950s.

DAIRYING

As most Minnesota farmers strove to diversify, dairying "proved to be the ultimate substitute for wheat" (Edwards 1938: 148-149). During the early settlement period, most Minnesota farms kept a milk cow or two for home use. The cows were pastured during the growing season, turned out into the stubble fields after harvest, and in the winter fed wild hay, corn fodder, turnips, bran, oats, and distillers' grain from local breweries. The family cow would go dry in the fall because of poor quality rations, but with spring and the first flush of nutritious grass, she usually delivered a calf and started her flow of milk again. The homesteader's milk room was a dugout, cellar, or springhouse. The milk was poured into shallow pans or crocks to cool and separate. After the cream floated to the surface, it was skimmed off and churned into butter. The milk was consumed by the family, or fed to the pigs and calves. Any extra butter was traded at the local store for necessities (Jarchow 1949: 207-210; Wayne 1977: 28, 32).

Pioneer cows were generally hardy "blizzard" cows that could withstand outdoor living and harsh weather but did not produce much milk or butterfat (Jarchow 1949: 219). They were bred indiscriminately, milked for a few years, and then slaughtered for meat. Likewise, early settlers' bulls were simply "cow fresheners" chosen with little attention paid to breeding. Still, these animals helped open up the Minnesota frontier. According to Minnesota dairy historian Ralph Wayne, "They provided milk and butter for the family. . . . They were also the main source of farm work, power and transportation in the early days" (Wayne 1977: 28).

In the 1870s, Minnesota dairy farming began to grow beyond subsistence levels. It became well-established over the next three decades.

Dairy farming was a natural choice for Minnesota farmers, many of whom had come from places like Scandinavia where dairying was important. Minnesota's climate was good for growing grass and hay, and hilly regions that could not be cultivated made good pasture. Just as important, "the [national] butter market had not yet been captured by another region," unlike the cheese market which Wisconsin already led (Keillor 2000: 101-102). These factors led many Minnesota farmers to move to dairy products as their main cash crop. From 1870 to 1910, dairying developed in a region that stretched from southeastern to central and west central Minnesota. Dairying was especially prominent during this period in Houston, Fillmore, Winona, Faribault, Freeborn, Mower, Carver, Otter Tail, Douglas, and Stearns counties. Because pigs could be fed the excess skim milk, hog raising was strongly associated with dairy farming except in areas near large cities where there was a consumer market for the fluid milk (Jarchow 1949: 185-215; Wayne 1977: 27; Tweton 1989: 270).

Dairy farming was labor intensive and a family enterprise. Everybody, even young children, helped milk twice a day and do other chores. Women often led the milking, separated cream, made butter and cheese, and cleaned all equipment. Men and older boys traditionally cleaned the barn. Wayne explained, "The size of the herd was often determined by the number of people available to milk cows by hand – the bigger the family the larger the herd" (Wayne 1977: 11).

As dairying advanced, farmers formed the State Dairyman's Association in 1878 and the Minnesota Butter and Cheese Association in 1882. Milk cow numbers stood at about 275,500 in 1880, a fivefold increase since 1860 (Jarchow 1949: 207). Still, the shift to dairy farming was gradual because a milking operation required large investments in livestock, buildings, fences, equipment, and labor. Dairy cows, unlike scrubby native cows, were expensive and delicate. To return a profit, they needed good shelter and nutrition, comfort, and careful handling. Grain farmers had to learn new skills – raising wheat was fairly simple compared with dairy husbandry (Jarchow 1949: 185). "Much time and capital are necessary to convert the grain into a livestock farm," observed a Rochester dairyman in 1882. "The change must be made slowly" (quoted in Jarchow 1949: 215; Grout 1910: 2; Scott 1960: 20; Keillor 2000: 103).

One of the first Minnesotans to promote diversification through dairying was Oren C. Gregg, a progressive farmer from Lyon County and the first superintendent of the Minnesota Farmers' Institutes operated by the University of Minnesota. Gregg, who came to Minnesota from Vermont in 1865, rejected the custom of having cows go dry in the fall and freshen in the spring. After experimenting with feeds, breeds of cattle, and husbandry methods in the 1870s, he induced his cows to calve in the fall after the busy harvest season, and produce a steady flow of milk all winter (Scott 1960: 21-22; Blegen 1975: 393-394). Gregg became a champion of winter dairying and invited other farmers to see the results. Railroad companies, "recognizing that diversified agriculture would produce heavier and more certain traffic than wheat growing," sent agents to study his methods, according to historian Roy V. Scott. In the 1880s, the Winona and St. Peter Railway paid Gregg's expenses so he could travel around the state sharing his ideas at dairy conventions and county fairs (Scott 1960: 21-22).

Minnesota dairying was stimulated by other innovations as well. In the 1850s and 1860s, a Carver County farmer, Wendelin Grimm, developed "everlasting clover," a vigorous strain of alfalfa that could survive Minnesota winters. Grimm alfalfa was a nutritious feed for beef cattle and dairy cows, yielding three or four cuttings a year. It also enriched the soil with nitrogen. By 1910 the crop was promoted by the University of Minnesota and the Minnesota Extension Service, and being widely adopted by state livestock farmers. Grimm seed was initially in short supply, but by 1920 Minnesota dairymen were advocating "an acre of alfalfa for every cow" (Nass 1989: 131). By the late 1930s Minnesotans were planting more than 1.3 million acres of Grimm alfalfa (Blegen 1975: 396; Wayne 1977: 31).

Silos – air tight structures that preserved green fodder for the winter months – transformed the profitability of dairy farming and helped spread dairying throughout Minnesota. The state's first silos were built in the late 1880s and by World War I they were becoming standard. Silos transformed dairy farming by allowing farms to feed dairy cows nutritious green material year-round, which encouraged them to remain fresh through the winter. A silo could increase the livestock-carrying capacity of a farm by more than one-fourth (Wayne 1977: 30-37). Silos were coupled with new field machinery that allowed farmers to cultivate more land and raise enough quality feed to sustain winter milking.

Other mechanical advances fostered dairying. The centrifugal cream separator became available in Minnesota about 1885, eliminating inefficient passive separation. According to historian Marilyn Brinkman, "Cream separators gave farmers a reliable means of separating cream and skim milk at home and eliminated the backbreaking task of hauling whole milk to creameries. The only drawback of cream separators was their need to be washed after each use – a painstaking chore" (Brinkman 1988: 17). (By 1910, most Minnesota creameries or butter plants were receiving only cream.)

In 1890 the University of Wisconsin's S. M. Babcock developed the first practical test for measuring butterfat in milk. Before that, there had been no reliable way to determine butterfat amounts, leading to frequent price disputes between farmers and creamery operators (Jarchow 1949: 217-218; Blegen 1975: 394). The butterfat tester also helped farmers identify and cull less-productive cows, resulting in herd improvements. And it allowed farmers to accurately determine which feeds, shelter, and husbandry methods produced the highest butterfat yields (Schlebecker 1975: 184).

Milking machines first appeared in Minnesota about 1905. The earliest machines were "some interesting contraptions," as Wayne has remarked (Wayne 1977: 36). One type, for example, was made of two hinged boards that opened and closed, squeezing the teat, and another used a series of revolving rollers. The first vacuum milking machines used plunger-type kitchen sink pumps. All had serious drawbacks, but gradually improvements were made. By 1910, effective milking units such as the DeLaval, Sharples, Empire, and Hinman were available, and in 1922 the very popular Surge Bucket Milker was invented. The earliest milkers were powered by portable gas engines or batteries. Some Minnesota farms started using milking machines during World War I when labor became scarce and expensive. However, hand milking was still common on small and medium-sized Minnesota farms until World War II. When a farm got high-line electricity, a milking machine was often one of the first pieces of electric equipment purchased (Wayne 1977: 6; Brinkman 1988: 17).

Farmers' earliest source of information on dairying was probably the agricultural press. Regional magazines such as *The Farmer*, *Farm, Stock, and Home*, and national magazines such as *Farm Journal* and *Hoard's Dairyman* published extensively on dairy topics beginning in the 1880s. Breed magazines were another source of information, as were farmers' clubs and agricultural societies. At an 1869 meeting of the Glencoe Farmers' Club, for example, a member described his dairy operation, and reported that his profit from cheese, butter, and whey was averaging $35 per cow (about $470 per cow in 2003 dollars) (Jarchow 1949: 210).

The University of Minnesota's College of Agriculture established a formal dairy school in 1891. T. L. Haecker, its first director, taught at the University for the next 27 years and became known as the "Father of Minnesota Dairying." Haecker promoted winter dairying, developed the first scientific dairy cow feeding regimen, and encouraged farmers to use improved cattle breeds. To his students he liked to say, "Treat the cow kindly, boys. Remember she is a lady – and a mother" (quoted in Blegen 1975: 398). In the late 1880s and 1890s, the University's Minnesota Farmers' Institutes spread advanced dairying methods including those developed by Haecker (Wayne 1977: 47-49; Brinkman 1988: 26).

As dairying expanded, Minnesota farmers improved their stock. In the Red River Valley, cows tended to be "dual-purpose" breeds raised for both meat and milk. Elsewhere farmers began specializing in either beef or dairy cattle. Common dairy breeds in Minnesota were Holstein, Guernsey, Jersey, Brown Swiss, and Ayrshire. By 1880, the state had a few purebred or registered dairy cattle. Farmers with common cattle bought bulls from these herds to introduce higher milk production in their own herds. Experienced dairymen suggested that a profitable cow needed to give at least 5,000 pounds of milk a year (Jarchow 1949: 219; Brinkman 1988: 16). "However, it took a long time to get real improvement in the herds of common red cows and they made up the majority of many herds until after World War I," explains Wayne (Wayne 1977: 28). (Because building a herd was a slow and painstaking process, it was devastating for many Minnesota farmers to be forced to sell their cows during the financial hardships of the Depression (Brinkman 1988: 21).)

A breakthrough in livestock nutrition came in 1913, when the University of Minnesota published T. L. Haecker's *Feeding the Dairy Herd*, which became the standard for more than 60 years (Wayne 1977: 51). Haecker's dairy feeding tables were the first scientific approach to milk cow nutrition, specifying the optimum amount of energy and protein to feed a cow based on her weight, milk production, and the milk's butterfat content. Haecker emphasized the importance of protein in the dairy ration, "a fact that most dairymen at that time had never heard of" (Wayne 1977: 31-32). The Minnesota Extension Service helped disseminate Haecker's findings to farmers around the state through special dairy clinics and county extension work (Wayne 1977: 32).

Cow testing associations and dairy herd improvement associations began in Minnesota about 1910. Through these services, technicians visited member farms once a month to test milk for butterfat content, and consult on ways to improve animal health, reproduction, and feed rations. As a result of better feeding and management, Minnesota's average annual milk production increased 400 percent from about 2,500 pounds per cow in 1890 to 10,120 pounds per cow in 1975 (Wayne 1977: 29, 33; Brinkman 1988: 30-31).

Early Dairy Processing. Minnesota's dairy farming industry could not develop without a processing and marketing system. During the early settlement period, butter- and cheese-making were home enterprises. The quality of farm butter varied greatly but was generally low. Barn sanitation was often poor and facilities to store milk and cream were primitive.

Markets for butter and milk were local. Although some butter was being exported from the state in the 1860s, "the lack of a dairy market held back the industry until after 1870, or even later, and the local store remained the main market for any surplus a farmer might have," according to Jarchow (Jarchow 1949: 208, 211).

As dairy farming was getting established, a few entrepreneurs started cheese and butter factories. Minnesota's first two cheese plants began in the late 1860s, and by 1880, the state had 49 cheese factories – most privately-owned and all in the eastern part of the state (Jarchow 1949: 214; Blegen 1975: 393; Wayne 1977: 38).

In the late 1870s, the state's first butter factories – also called creameries – were established. Most early creameries were privately owned. Farmers brought milk to the creamery once or twice a day in cans, which were emptied and then refilled with sour milk. The sour or skim milk was taken back to the farm where it was mixed with grain and usually fed to hogs or calves. In some territories where the journey to the creamery was far, skimming or collecting stations were established at intermediate locations. In the 1880s, some plants started pick-up routes, sending teams around to farms to collect the cream (Jarchow 1949: 211-221).

The need to efficiently haul milk to the local creamery every day was one of the factors that led Minnesota farmers to become advocates of the "good roads" movement at the turn of the century. Transportation historian Arthur J. Larsen explained, "The influence of the creamery as a factor in bringing about good roads can scarcely be overestimated. Many a farmer, after he arrived at the creamery and found his cream churned to butter by the bumpy, rutty roads, learned to curse such roads fluently. . . . there can be no staying at home until the road dries" (Larsen 1966: 367).

By 1885, dairying was becoming a significant Minnesota industry, and the state had 63 creameries and 46 cheese factories (Jarchow 1949: 221). Commercial cheese production led butter until about

1885, when butter processing became more important. Historians cite several reasons for this: New York and Wisconsin were by this time already well-established in the cheese market but the butter market was still open. Minnesota farmers were enlarging their livestock herds, and they wanted the skim milk – a by-product of butter-making – for calf and hog feed. Early leaders at the University of Minnesota also promoted butter over cheese, in part to foster livestock production. The mechanical cream separator, which farmers began using in the late 1880s, also favored butter-making (Jarchow 1949: 211-214, 220-221; Wayne 1977: 38; Tweton 1989: 272).

State government began regulating dairy processing and marketing in the 1880s, in part to protect farmers from competition from vegetable-based oleomargarine – "the bugbear of the dairyman" (Jarchow 1949: 220). In 1881, the legislature passed a law requiring that all packages of "counterfeit butter" be marked with the word "oleomargarine." The law proved ineffective, so in 1885 the legislature banned the sale of oleomargarine altogether, prohibited the sale of diluted or otherwise adulterated milk, and established the Minnesota State Dairy Commission to oversee the rules. Eventually the Dairy Commission's mission was expanded to the regulation of all processed foods. Soon individual Minnesota cities were also passing their own milk laws to protect milk quality, and eventually state and local dairy laws regulated the design and operation of milk houses and other dairy facilities on Minnesota farms. (Minnesota was one of seven states to ban the manufacture and sale of oleomargarine and, after the ban was lifted, Minnesota one of more than 30 states to mandate that margarine be sold without color so that it couldn't be mistaken for butter. Colored oleomargarine was illegal in Minnesota until 1963.)

As dairying moved forward in the 1890s, it became a consequential force in the Minnesota economy. By 1900, Minnesota farmers owned about 754,000 dairy cows and produced milk and butter valued at over $16 million. Ten years later, the state's dairy output had increased to $30 million, and only wheat and oats brought in more cash. By 1910, according to Tweton, "Minnesota had joined Wisconsin, New York, and California as a premier dairy state" (Tweton 1989: 270-271; Blegen 1975: 393).

Cooperative Creameries. Cooperative creameries created the essential marketing infrastructure for Minnesota's dairy industry by spreading out the financial risk of bringing expensive butter processing equipment into a local area. The movement began in 1889 and 1890 when farmers in Dodge, Olmsted, McLeod, and Freeborn counties organized cooperative creameries along the lines of successful operations in Denmark and Iowa. In most cooperative operations, member farmers delivered their cream or milk to the plant and then shared in the profits based on how much butterfat they contributed.

The Clark's Grove Cooperative in Freeborn County, formed in 1890 by Danish immigrant farmers, became the prototype of a successful cooperative creamery. In 1894, Professor Haecker wrote an influential Extension bulletin about organizing a cooperative creamery using Clark's Grove as a model. Haecker was a tireless promoter of cooperatives and trained more than 2,000 butter-makers and creamery operators. Minnesota butter-makers were soon winning top honors at national buttermaking contests, further promoting the state's dairy industry (Edwards 1938: 149, 155; Blegen 1975: 398; Wayne 1977: 38, 51; Flaten 1898: 29).

Cooperative creameries played a significant role in the development of the industry. Neighbors took turns hauling milk or cream to the cooperative, so each farmer visited his creamery several times a month, monitored operations, and conferred with fellow farmers. Professional and social activities were organized at the local creamery level, and statewide dairy marketing and supply cooperatives were organized by coalitions of creameries. According Wayne, "The members of a cooperative creamery took great interest and pride in their organization. . . . They knew that their cooperative provided a real service to them" (Wayne 1977: 19). By 1898, Minnesota had 664 creameries – 84 percent of them cooperatives. Twenty years later, Minnesota had 671 cooperative creameries. This total was just under half of all cooperative creameries in the nation (Blegen 1975: 398; Tweton 1989: 272; Wayne 1977: 18-19, 41).

Until the 1920s, Minnesota cooperative creameries sold milk and butter mainly in their local area, although some butter was shipped out of state. Federal antitrust laws prevented groups of independent creameries from marketing collectively, and individual creameries had little bargaining power because of their low volume. In 1921, the Minnesota Cooperative Creameries Association formed and began to establish and implement butter quality standards for member creameries. In 1922 Congress passed the Capper-Volstead Act, the cornerstone law which allowed farmers' cooperatives to price and sell their products. The following year the Minnesota Cooperative Creameries Association began formulating a national sales strategy. In 1924, the Land O' Lakes brand was launched, and soon after, the association changed its name to Land O' Lakes Creameries (Wayne 1977: 19; Brinkman 1988: 27; Tweton 1989: 272).

Other state marketing cooperatives formed including North Star Dairies, the Rochester Dairy Cooperative, and the Twin Cities Milk Producers Association. Land O' Lakes was the best known of these and soon became the largest butter marketing company in the world. By 1929 it was handling more than 91 million pounds of butter (Blegen 1975: 398; Wayne 1977: 41; Tweton 1989: 272-273).

MINNESOTA DAIRY PIONEERS

The National Dairy Shrine was founded in 1949 to recognize important developments in the U.S. dairy industry. Among approximately 260 individuals who have been honored with the Shrine's "Pioneer Award" are 14 Minnesotans, listed below:

- Appleman, Robert D. (1931-1991), Extension Service educator and researcher
- Astroth, Frank B. (1893-1956), Jersey breeder, dairy association leader
- Brandt, John (1885-1953), organizer of Land 'O Lakes Creameries
- Eckles, Clarence H. (1875-1933), professor of dairying at University of Minnesota
- Fitch, James B. (1888-1962), professor of dairying at University of Minnesota
- Graham, Christopher (1856-1952), Holstein breeder, co-founder of Mayo Clinic
- Haecker, Theophilus L. (1846-1931), professor of dairying at University of Minnesota
- Hansen, Axel (1887-1964), Holstein breeder, agriculture director at Femco Farms
- Lilly, A.A. (1862-1937), Brown Swiss breeder, founder of Lilly Swiss Farm
- McGuire, A.J. (1874-1933), cooperative creameries organizer
- Moscrip, W.S. (1878-1959), Holstein breeder, dairy assoc. president (1942-1947)
- Munn, Marcus D. (1858-1946), Jersey breeder, Dairy Council leader
- Wayne, Ralph W. (1907-1995), Extension dairy specialist (1945-1972), program director, author of dairy industry history
- Wilson, Leslie V. (1893-1977), manager of Boulder Bridge Farm (National Dairy 2003).

CHARACTERISTICS OF FARMS FROM DIVERSIFICATION AND THE RISE OF DAIRYING, 1875-1900

- new farms, especially in western Minnesota
- farms using horses for power, fewer oxen
- farms with more improved acres
- farms with lots of fencing
- beginning to see evenly-sized fields for crop rotation
- early drainage systems
- windbreaks, woodlots, and shelterbelts planted in prairie areas
- early model or demonstration farms
- farms associated with colonization
- stock breeding farms
- stockyards
- pastures
- poultry houses
- early hog barns
- early silos
- corncribs
- granaries
- springhouses
- icehouses
- general purpose or combination barns
- early dairy barns
- barns with hay mows
- raised three-bay barns, other basement barns
- early nonorthogonal barns
- timber frame buildings
- buildings of dimensional lumber and other materials from trackside lumberyards
- early gambrel roofs
- designs influenced by local carpenters
- designs influenced by technical bulletins
- designs influenced by agricultural publications and agricultural societies

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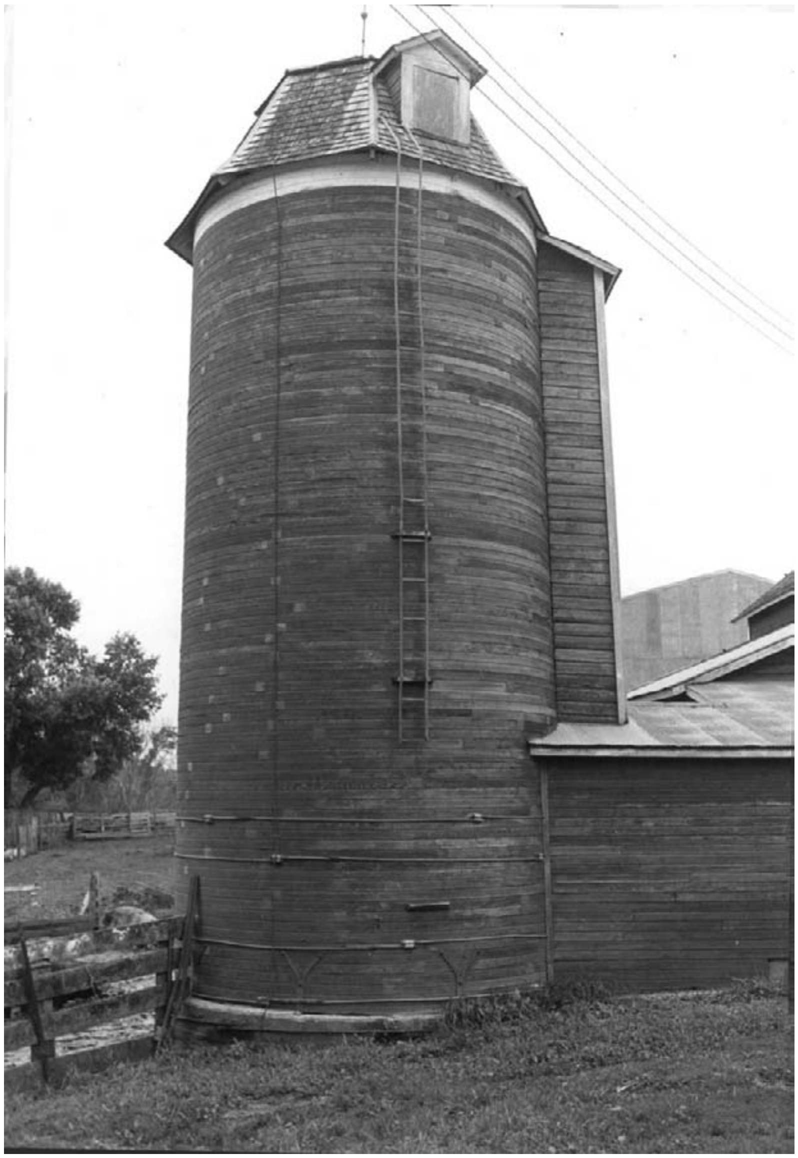
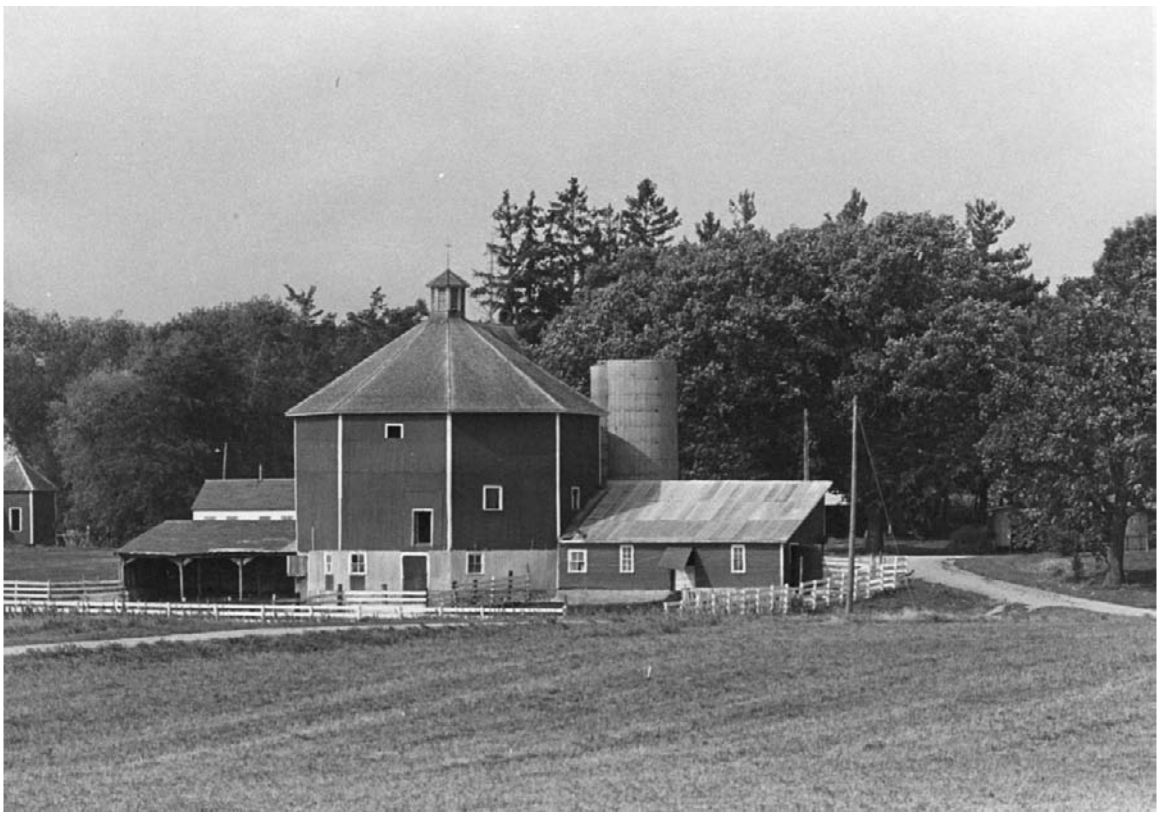
Outside the barn in this 1903 photo are more than two dozen lambs and ewes, about eight cows and calves, two horses, and at least two pigs. Crippens Farm, location unknown, 1903. (MHS photo by Frank T. Wilson)

Raising livestock provided valuable manure that was absorbed in a barn's straw bedding. The straw-manure mixture was removed from the barn and spread on the fields to improve soil texture and fertility. Location unknown, circa 1920. (MHS photo by Harry Darius Ayer)



Silos made dairy farming more profitable. Introduced to Minnesota around 1890, they became common around 1910. Wooden tower silos like this one were often made of horizontal boards. Robert Farmstead, Judson Township, Blue Earth County, 1979. (MHS photo)



Minnesota's dairy industry grew gradually, in part because it required a large capital investment in buildings and livestock. Warner Farm, Rockford Township, Wright County, circa 1973. (MHS photo)

Most farms that milked cows also raised pigs which were fed the skim milk, crop residue, and table scraps. This farm had several fenced pastures and yards close to the buildings. Note the rail fence. Obscured by the trees are a log barn, a house, and another barn or granary. Location unknown, circa 1910. (MHS photo by Charles J. Hibbard)

PERIOD 4: INDUSTRIALIZATION AND PROSPERITY, 1900-1920

The years from 1897 to 1919 were a period of farm prosperity. Farmers adopted new technology, machinery, and science-based methods to raise farm productivity, just as a similar process of industrialization was going on in other sectors of society. Scientists at the experiment stations and agricultural schools, working in cooperation with private industry, developed and disseminated improvements in plant and livestock breeding, mechanical technology, building designs and materials, and farm methods and management. At the same time, farmers were diversifying from wheat into new crops and livestock. Gravel roads, automobiles, and Rural Free Delivery helped relieve farm isolation. The Country Life Movement called attention to lagging rural living standards and the social and economic problems that were contributing to a farm exodus. In 1920, the bubble of prosperity burst and farmers entered a 20-year period of economic depression.

Milestones of this Period

1903	–	Minnesota Valley Canning Co. (makers of Green Giant brand) founded in Le Sueur
1904	–	Cokato Canning Co., the state's second canning factory, started
1905	–	Minnesota Highway Commission organized
1905	–	Cement staves introduced; soon very popular for silos
1907	–	Rural mail routes in Minnesota reached 1500, up from 134 in 1901
1907	–	American Society of Agricultural Engineers (ASAE) established
1907	–	Butler Manufacturing sold its first steel grain bins
1907	–	Minnesota Sugar (later American Crystal Sugar) began recruiting Mexican farm laborers to tend Minnesota beet fields
1908	–	Model-T Ford automobile introduced
1908	–	First structural clay tile silo built
1909	–	President Roosevelt's Country Life Commission issued its report
1909	–	Legislature created what became known as the Minnesota Extension Service in the University's department of agriculture
1909	–	The University's Division of Agricultural Engineering formed
1910	–	Minnesota's first dairy herd testing association formed in Albert Lea
1910s	–	Peak of public drainage ditch construction in Minnesota
1910-14	–	Apogee of farm prices compared to the cost of living; provided the benchmark for later farm subsidy programs
1911	–	J. J. Hill's Great Northern RR established an Agricultural Extension Department
1912	–	State ag experiment stations founded 1910-1912 in Morris, Waseca, and Duluth
1913	–	"Farm Motors" class added to the University of Minnesota curriculum
1913	–	Concrete demonstration barn built in Illinois
1914	–	World War I began
1914	–	Smith-Lever Act established Cooperative Extension Service between USDA and land grant colleges

See also

Farms
Farmsteads
Poultry Houses
Implement or Machine Sheds
Appendix: Focus on Mechan Techno
Appendix: Focus on U of M Programs

1914 – Stoney Run Light and Power Co., one of the nation's first electric cooperatives, established in Granite Falls
1915 – Grimm alfalfa acreage doubled over the previous year
1916 – Federal Land Banks created to offer farmers long-term credit with land as security
1916 – Minnesota Country Life Conference held at the College of Agriculture in St. Paul
1916 – Rural Road Post Act began regular federal funding of rural road building
1917 – Food Production Act provided federal funds to place county extension agents in counties where agents were not operating
1917 – U.S. entered World War I; serious farm labor shortage
1917 – Smith-Hughes Act enabled federally-funded high school ag and vocational classes
1917 – Ford Motor Co. introduced the Fordson tractor, the first mass-produced tractor
1918 – World War I ended
1918 – Minnesota Extension Service issued a bulletin entitled *Shall I Buy a Tractor?*
1919 – The USDA began a national campaign to increase milk consumption
1920 – More than 30% of American farmers owned at least one auto
1920 – Agricultural prices collapsed
1920 – Census showed for the first time most Americans lived in urban, not rural areas
1920 – Babcock Amendment created Minnesota's trunk highway system
1920 – Radio began broadcasting in the U.S., with farm programming as the mainstay
1920 – Almost 40 percent of American farms had a telephone
1924 – The Farmall tractor introduced; widespread tractor use began

As the 20th century dawned, Minnesota farmers entered "the Golden Age of Agriculture," as the period from 1900 to 1919 is often known. Farming increasingly became a business, rather than a self-sufficient enterprise. By 1929, for example, 86 percent of the value of Minnesota farm products was being sold on the market and only 14 percent was being used directly by the farm family (Engene and Pond 1940: 13).

Farm income rose during the period as high crop yields accompanied high commodity prices, as land values increased, and as mortgage indebtedness fell. In 1910-1914 farmers achieved a position of economic parity, in which the prices they received for their products were favorable compared to the prices they had to pay for manufactured goods. This 1910-1914 parity level became the benchmark goal for later farm subsidy programs.

As immigration swelled the cities, demand for food surged. Farmers bought modern machinery and tractors, and began using scientific farming methods to increase their output. They diversified, planting more productive crops and expanding into dairy and livestock. Cars, trucks, and rural mail delivery eased their isolation. According to economist and historian Willard Cochrane, "Farm people came to believe that the good life could be achieved on the farm" through "hard work, thrift, savings, and investment" (Cochrane 1993: 99).

During World War I, Minnesota farmers continued to thrive. Worldwide demand for food soared and market prices shot up in 1916. After the U.S. entered the war in 1917, the government urged farmers to plant "fence to fence" to produce more food. They responded by planting 30 million additional acres. In 1918, Minnesota farmers increased the wheat crop by 70 percent, harvested the state's largest-ever corn crop, and bumped up hog production 15 percent. Foreign demand for American farm products stayed strong through 1919, fueled by postwar reconstruction. By 1919, farm prices had skyrocketed to double the prewar levels (Cochrane 1993: 100-111; Wilson 1918: 221; Tweton 1988: 21, 262; Saloutos 1982: 3).

But in the summer of 1920, the bubble of prosperity burst. Food exports and farm prices fell sharply, and a 20-year agricultural depression began that would not end until World War II.

Some historians see the first two decades of the 20th century as a watershed in agricultural development (Cochrane 1993: 371; Danbom 1979: 137-142). It was during this period that Minnesota farmers began to shift to intensive production, employing technology and scientific methods to increase the output of their land and labor – a process some call industrialization. Like other maturing industries, intensive farming required capital, modern efficient equipment and buildings, innovation and best practices, and a high level of management skill.

Historian David Danbom explained:

> Often beginning his career as an average man with few special talents, the farmer was increasingly 'forced to make adjustments to the demands of the new industrial order, involving progressive mechanization, scientific technique, adequate capital, available credit and dependable markets.' . . . Perhaps most important, the increasing business demands of successful farming effectively closed it as an occupation readily open to the average man. When the century opened farming was the only major occupation in which the citizen without special skills or large capital could achieve the status of an independent businessman. By 1930 farming had been industrialized to the point where the man entering it without expertise or capital faced a marginal existence at best (Danbom 1979: 142).

This period marked a social watershed, too. In the words of dairy historian Ralph Wayne, Minnesota farmers of 1900-1920 were "the last to know the isolated frontier." The decade preceding 1920 was a "turning point in farm family living and in most farm operations. . . . The outside world was brought closer. It was a new dawn in rural family living" (Wayne 1977: 23).

DIVERSIFICATION

Between 1900 and 1920, Minnesota farmers steadily diversified. They switched from wheat – the frontier cash crop – to a broader mix including oats, corn, potatoes, barley, flax, rye, vegetables, fruits, dairying, and livestock. The shift was gradual, beginning about 1875 in the southeastern sections of the state where rising population and land values pushed farmers to alternative farming methods. During the next 50 years, diversification spread across the state as farmers determined which crops and animals were most profitable in their circumstances. Agricultural statistics show both the extent of diversification and the tremendous increase in overall productivity. For example,

- Oats jumped from 23 million bushels in 1880, to 74 million in 1900, to 126 million in 1930.
- Corn increased from 14 million bushels in 1880, to 47 million in 1900, to 104 million in 1930.
- Barley jumped from 2 million bushels in 1880, to 47 million in 1930.
- Potatoes went from 5 million bushels to 25 million in the same period.
- State butter production went from 19 million pounds in 1880, to 82 million in 1900, to 272 million in 1936.

- Wheat totaled 35 million bushels in 1880, rose to 95 million bushels in 1900, and then dropped to 19 million in 1930.
- A new crop, alfalfa, went from only 2,000 tons in 1900 to more than 1 million in 1930 (Blegen 1975: 391, 396).

Grain. Wheat was preeminent until 1900, accounting for about half the state's crop acreage. By 1910, wheat's share had shrunk to 25 percent of cropland, and in 1930 it was 10 percent. Economist Edward Robinson wrote, "King Wheat, after a reign of more than forty years in Minnesota, had finally been dethroned" (Robinson 1915: 174). The largest decrease in wheat acreage was in southwestern Minnesota, where by 1910 oats equaled wheat. However, wheat continued to be the mainstay crop in northwestern Minnesota and the Red River Valley. New varieties including the hard spring wheat called 'Haynes Bluestem' boosted yields after the turn of the century. (Also called Minnesota 169, 'Haynes Bluestem' was released in 1898 and was one of many important introductions by the Minnesota Agricultural Experiment Station.) Despite acreage declines, wheat from Minnesota and elsewhere continued to support an extensive flour milling industry in the state. Nearly 400 flour mills produced 30 million hundredweight of flour in 1900, led by two Minneapolis giants – Pillsbury-Washburn Flour Mills (later Pillsbury) and Washburn-Crosby Company (later General Mills). Both companies survived the depression of the 1930s and went on to become billion-dollar international corporations (Nass 1989: 131; Tweton 1989: 265-267).

Corn. In southern Minnesota, corn – the favored feed for cattle and hogs – became the most important crop after 1900. Farmers typically grew corn in a three-year rotation with cultivated hay and barley or oats. As faster-maturing varieties were developed in the 1930s, corn growing migrated northward from the southern edge of the state. In the 1940s, as tractors replaced horses on Minnesota farms, the need for oats declined and many farmers planted oil-seed and feed crops such as corn and soybeans instead.

Hay. Acres planted in cultivated hay increased rapidly after 1900. With the help of county extension agents, over 6,000 farmers seeded 12,000 acres of Grimm alfalfa in 1914, and some 25,000 acres in 1915. Grimm alfalfa seed producers' associations formed in North Dakota in 1916 and in Minnesota in 1924 to carry out seed testing and promote the use of certified alfalfa seed. Minnesota alfalfa production soared from a tiny amount to more than 1 million tons in 1930. The increased production of hay and corn reflected strong growth in dairy and livestock farming. Cattle numbers rose more than a quarter from 1900 to 1910. Hog and poultry production also increased significantly. The value of livestock on Minnesota farms jumped 81 percent during the decade (Robinson 1915: 214, 226; Nass 1989: 131).

Dairy. Dairy grew steadily after 1900, and by 1910 was the principal farm revenue source in southeastern Minnesota and counties west of the Twin Cities. Dairy cow numbers grew 44 percent in 1900-1910, while the value of dairy products jumped 84 percent to $30.6 million. Dairy farming became increasingly sophisticated with improvements in dairy housing, feeding, herd testing, and disease control. Commercial dairy processing kept pace. In 1909, the Minnesota Department of Agriculture reported 797 creameries (butter plants) in the state, plus 46 skimming stations and 69 cheese factories. Cheese-making became concentrated in three regions: Dodge and Goodhue counties, Otter Tail and Wadena counties, and Red Lake and Polk counties (Robinson 1915: 179, 216, 230-231).

Poultry. Minnesota's poultry industry in the 1900s and 1910s was still widely distributed on farms all around the state and, according Robinson in 1915, "only a few crops gave larger returns." Poultry saw big increases during this period. Bird numbers grew 31 percent during the decade of the 1900s, while the value of poultry products jumped 80 percent to $13.5 million. Egg production rose from 43 million dozen in 1900 to 107 million dozen in 1930 – a 150 percent increase. Poultry care and egg marketing continued to be dominated by women (Robinson 1915: 180, 231-232; Blegen 1975: 391).

Specialty Crops. Minnesota farmers began raising more specialty crops around 1900. In southeastern Minnesota, orchard products and small fruits like berries became important. The developing fruit industry was advanced by the University of Minnesota's fruit breeding research farm at Excelsior, established in 1907 (Blegen 1975: 403). The production of ornamental plants and cut flowers increased after the turn of the century. Ranges of greenhouses and small fields were located around the Twin Cities, in southern Minnesota, and even on the Iron Range.

Potatoes became a major cash crop in the northern half of Minnesota and on the sandy plains north of the Twin Cities. In the Red River Valley, farmers began raising potatoes as a cash alternative to wheat, and potato acreage there jumped from a few thousand acres in 1900 to 55,000 acres by World War I. Between 1915 and the early 1920s, Clay County was the second-largest producer of potatoes in the U.S., behind a county in Maine. Potato washing and processing plants were built in potato growing areas (Kenney 1995: 83; Tweton 1989: 284).

In 1900-1920 sugar beet production expanded southwest of the Twin Cities and then spread to the Red River Valley. Eastern European immigrants and, after about 1907, Mexican and Mexican-American workers helped thin and harvest this high-labor crop. In the early 20th century, farmers in south central Minnesota began growing canning vegetables including peas, beans, cucumbers, beets, sweet corn, asparagus, and pumpkins. There were 16 canneries operating in Minnesota in 1910. That number grew to 37 in 1947, and included companies with regional and national sales such as Green Giant and Gedney (Robinson 1915: 174-178, 210-211, 226; Baerwald 1989: 27-28; Tweton 1989: 282-288). Minnesota farmers also grew flax for fiber and linseed oil, and processing plants and paint factories were established. Minnesota and North Dakota led the nation in flaxseed production until the 1950s, when demand for linseed oil declined (Tweton 1989: 279-280).

FARM NUMBERS AND SIZE

In 1910, Minnesota farms ranged from an average of 57 acres in Ramsey County to 305 acres in Wilkin County. The statewide average size was 177 acres – four percent larger than in 1900 (Robinson 1915: 180, 216-218).

During this period, there was a statewide decline in the numbers of both small and large farms – those between 20 and 175 acres, and those over 1,000 acres (Robinson 1915: 219).

On average, Minnesota farms got slightly larger between 1900 and 1920, although there was considerable regional variation. In the northwestern and western parts of the state where grain farms predominated, the average farm size increased and the number of farms decreased after 1900. Minnesota's dairy farms also enlarged as advances like the silo, the Babcock butterfat test, the mechanical cream separator, and the use of factory methods became more widespread.

Farms adjacent to the Twin Cities were smaller and more numerous than those elsewhere. This was in part due to an increase in vegetable and fruit growing operations that supplied city markets. The number of small truck farms under 20 acres increased by 17 percent from 1900 to 1910 (Robinson 1915).

Between 1900 and 1920 farm numbers increased in northeastern Minnesota where additional land was coming under cultivation after being logged.

SCIENTIFIC AGRICULTURE

The turn of the century marked a new phase of agriculture, one based not on tradition but on proven scientific methods. "From the beginning, agriculture has been almost an art," wrote the superintendent of the West Central School of Agriculture in 1914. "Its practice has been handed down from father to son, and he is the best farmer who is the most proficient in carrying on the physical labor and manipulation. . . . Now the new phase of agricultural development may be called the scientific phase, for it involves the application of scientific principles to the practice of farming" (Higbie 1914: 9).

Science-based agriculture developed slowly during the first three decades of the 20th century and flowered after World War II. Progress was built on discoveries made during this period in plant and animal biology, disease and pest control, livestock nutrition, soil fertility, and a host of other topics. New scientific and academic fields such as agronomy, agricultural engineering, and farm management emerged, and industrial production and business accounting principles were applied to farming. New information and techniques were passed on to farmers through the extension service, other educational agencies, farm journalists, and private industry (Cochrane 1993: 101).

The United States Department of Agriculture led agricultural research in the late 19th and early 20th centuries. Around 1910, however, the bulk of research shifted to state experiment stations and land-grant colleges. The University of Minnesota's framework for a statewide system of six regional experiment stations and five associated agricultural high schools was developed during this period.

In 1909 the Minnesota Agricultural Extension Service was established, and in 1914 the agency became a federal-state cooperative effort with the introduction of federal money to help place an extension agent in each county seat. These agents became a primary channel for transferring scientific knowledge to working farmers. The food shortages of World War I intensified the push to make agriculture more productive and, with a wartime boost in funding, extension agents were working in nearly every Minnesota county by 1918. Extension agents taught farmers about new crops such as alfalfa, helped them combat livestock diseases and improve their herds, promoted the construction of silos, and eased the labor shortage by recruiting townspeople to help with the harvest. The extension service also educated farm boys and girls through the popular 4-H Club program, and supported initiatives passed in 1909 and 1914 to add agricultural instruction to Minnesota public schools (McNelly 1960: 47-50; Blegen 1975: 400; Nass 1989: 141-142; Cochrane 1993: 104-107).

Private industry also supported science-based agriculture. Land developers, equipment manufacturers, railroad companies, food processors, and the makers of building materials generated new ideas and disseminated information. In 1911, for example, James J. Hill established an agricultural extension department within the Great Northern Railway. Hill encouraged farmers to diversify crops, raise livestock, use fertilizer, and install drainage. The Great Northern extension department, which operated until 1956, conducted research on soil fertility, tillage, and crop rotation. It performed soil testing, helped organize fertilizer buying cooperatives, set up demonstration plots on private farms, and "deployed a cadre of traveling agriculturalists and 'instruction trains' to help farmers with crop production, livestock breeding and marketing," according to historian Howard Dickman (Dickman 1977: 68).

Implement companies like International Harvester Company, John Deere, and J. I. Case established rural improvement programs. International Harvester began doing extension work in 1910. The company created a service bureau that answered farmers' questions, distributed literature through banks and seed merchants, and presented motion-picture and lantern-slide lectures. The service was so popular that International Harvester expanded it in 1912 and pledged to spend a million dollars on farm education. By 1913 the company had established five demonstration farms in the U.S. to show the benefits of diversified farming and livestock production. The company also carried out alfalfa growing campaigns that, in the words of historian Roy V. Scott, were "without doubt the most concentrated rural education programs ever undertaken by businessmen" (Scott 1970: 193). Anticipating later county extension methods, International Harvester educators traveled the countryside in automobiles doing alfalfa demonstrations in fields and holding meetings in farmers' homes. In 1913, the company put on 2,000 meetings in 16 states, speaking to thousands of farmers and distributing more than 1 million pieces of literature (Scott 1970: 190-199).

Salesmen for farm supply and equipment companies, and representatives of farmers' cooperatives, also became important sources of relevant technical information for farmers.

TECHNOLOGY

Mechanical technology improved steadily during the period, and the labor shortages of World War I encouraged farm mechanization. According to a 1939 estimate, Minnesota farmers increased their machinery use by 40 percent between 1910 and 1925. With the help of tractors and other machinery, farmers were able to plant and harvest larger fields and raise more livestock with less labor. As a result, farm output rose about nine percent between 1910 and 1920, even as farm labor decreased slightly (Robinson 1915: 208-209; Minnesota Institute 1939: 26; Schlebecker 1975: 211-212; Cochrane 1993: 110, 362, 377).

In 1900, the machinery on most Minnesota farms included walking or riding plows, harrows, a grain seeder, corn planter, mower, rake, grain binder, and a couple of wagons with racks for hay and livestock. After 1910, farmers added mechanical manure spreaders, corn binders, and hay loaders. Wide four-bottom plows pulled by a hitch of eight horses became common in grain-producing regions such as the Red River Valley. Steam-powered threshing machines came into use, operated by groups of cooperating farmers. Dairy farmers began using mechanical cream separators, hay loaders, feed carriers, litter carriers, and gas or battery-powered milking machines (Wayne 1977: 30-37).

About 1910, gas-engine tractors began replacing horses for pulling implements and for powering stationary equipment. The number of farm horses peaked nationwide around 1913, then slowly declined. The first tractors were heavy and inefficient, but the technology quickly improved. In 1917, the first mass-produced tractor, the Fordson, was introduced, and soon became a leading seller. U.S. tractor use grew from about 25,000 in 1915 to 246,000 in 1920. The tractor age truly began in 1924 when International Harvester introduced the lightweight, maneuverable Farmall tractor. The nimble 13-horsepower Farmall was the first small, low-priced tractor built especially for row crops, and each of its 40"-tall rear wheels had its own brake, allowing sharp turns in small fields. Midwestern farmers lined up to buy them. By the late 1920s tractors had become common on Minnesota farms (Fite 1989: 280; Engene and Pond 1944: 28; Nass 1989: 140-141; Baerwald 1989: 29; Cochrane 1993: 377; Barlow 2003: 122).

Silos of wood, poured concrete, and masonry units were becoming common in Minnesota around 1910. During World War I, the Minnesota state committee on food production urged farmers in all corn areas to build silos "as one means of meeting the world's food shortage and of helping to win the war" ("Build" 1917).

Scientific agriculture promoted farm buildings that were more carefully designed to encourage efficiency and support new production methods. In the late 1890s, milk houses began appearing on Minnesota dairy farms, and by 1914, the Minnesota extension service urged any farmer with ten or more cows to install a milk house in order to improve the value of his product (Washburn 1914: 181). New materials such as poured concrete, cement block, cement staves, clay tiles, and sheet metal were employed. Dairy barns were built with factory-made stanchions and mangers, King ventilation systems, and manure gutters of optimal shape. Poultry and hog raisers began using "colonies" of individual housing units to reduce the spread of disease. New models of corncribs and grain bins were introduced, and expansive sheds were built to store the new tractors and other machines. Windmills, acetylene plants, gasoline generators, piped cistern water, and septic systems improved farm infrastructure. Even the layout of farms and the location of buildings, roads, fields, and pastures were reworked based on science. During World War I, silos and other modern farm buildings were considered so important to the war effort that they were exempted from a general U.S. ban on new building construction ("Building" 1918).

COMMUNICATION AND TRANSPORTATION

Isolation had always been a feature of rural Minnesota life, especially for women, who were often "largely confined to the farm" (Wayne 1977: 12). Farmers' clubs and other social groups sought to relieve this isolation, but the establishment of Rural Free Delivery (RFD) in 1896 was the first big step toward opening communication with the outside world. Before RFD, farmers went to the nearest town about once a week for mail, supplies, and news. When RFD started, farmers could receive and send mail every day by walking to the mailbox at the end of the driveway. Correspondence, newspaper, and periodical circulation rose, bringing the farm "within the daily range of the intellectual and commercial activities of the world," wrote historian David Nass, and giving farmers access to technical information and market reports (Nass 1989: 136). In 1899, Minnesota had just four experimental RFD routes, all near Farmington. Two years later there were 134 routes serving 67,000 people. By 1925, the state's 1,720 RFD routes covered 49,160 miles. In addition, by 1920 nearly 40 percent of American farms had a telephone. In 1921 the first farm radio broadcast was heard in Minnesota (Wayne 1977: 16; Nass 1989: 136).

Automobiles also helped relieve rural isolation. The Model T Ford was introduced in 1908 and by 1910 auto advertisements were appearing in farm magazines. Farmers eagerly embraced cars: in 1913 about half of the state's more than 40,000 automobiles were registered in rural areas. (Farm trucks came a bit later, with many purchased in the 1920s.) Farmers could buy kits to allow their Model T to pull a plow or, using a belt from the rear wheel, run a pump, churn, feed mill, saw, washing machine, or electric generator. By 1939, 87 percent of Minnesota farms had an automobile (Nass 1989: 139; Barlow 2003: 122).

Most rural roads before 1920 were muddy, rutted, seasonal affairs built and maintained by townships. They were smoothed with a log or scraper pulled by horses. Many of these dirt roads were not much higher than the adjacent lands, so they drained poorly and flooded frequently. In wooded areas, roads were crowded by close-growing trees and brush. In winter, they blew full of snow. In open areas, repeated drifting caused the sleigh tracks to build up. Come spring, the thick, packed ice ridges melted slowly, turning the road into a muddy gumbo. In dairy farming areas, farm roads tended to be a little better because milk had to be delivered to the creamery daily. Dairy farmers, in fact, helped lobby for state road improvements. In other areas, farm-to-market roads were barely more than rutted tracks (Tweton 1988: 165; Vogeler 1995: 129; Wayne 1977: 22; Baerwald 1989: 20).

As public pressure for good roads coalesced, the Minnesota Highway Commission was organized in 1905 to work on road improvements. In 1906 a constitutional amendment allowed the state to levy taxes for road and bridge construction. In June 1913, Minnesota Good Roads Day was launched to help "pull Minnesota out of the mud." The road levy tax was increased in 1913, and in 1916 the federal government began providing regular funds for road construction (Borchert 1989: 61; Blegen 1975: 465).

In 1920 Minnesota voters approved the Babcock Amendment, allowing the state to issue bonds to finance road building and establishing a modern trunk highway system. Better roads made district-wide public schools and school bus service feasible. Farm families gained better access to manufactured goods and services, medical care, churches, and community activities.

DRAINAGE

By the 1890s most of the desirable agricultural lands in Minnesota had been cultivated. One way to increase farm productivity was to drain wet land, and farmers began to install ditches and tiles that drained into a new system of public ditches built over several decades. In northwestern Minnesota, James J. Hill took the lead in drainage projects, sponsoring a topographical survey of the Red River Valley and helping found the Red River Board of Audit to oversee drainage in the region (Dickman 1977: 24-25).

Drainage projects were especially prevalent in the early 20th century and peaked in Minnesota in the 1910s and early 1920s. Between 1907 and 1913, the construction of state and county ditches enabled the drainage of six million acres of land. By the 1960s, drainage improvements had been made on about one-third of the state's cropland, and on about one-half of the land in the Minnesota and Red River valleys. Widespread drainage increased the size of fields and farms and contributed to increased profits. Drainage also became increasingly controversial in the mid-to-late 20th century for its effects on the ecosystem and on animal and plant habitat (Nass 1989: 130; Baerwald 1989: 30).

COUNTRY LIFE

Before World War I, living conditions on Minnesota farms were still quite difficult. Ordinary farms didn't have running water, central heat, indoor plumbing, electricity, or refrigeration. Although mechanization was under way, much hard physical labor was still needed to raise crops and livestock and care for the family.

In 1908, President Theodore Roosevelt appointed the Country Life Commission to study farm living conditions. The Commission's report suggested that farm life failed to satisfy the social and intellectual aspirations of rural people – a significant segment of the U.S. population. Further, economic opportunities in agriculture lagged behind business opportunities in urban areas. These failures were contributing to the migration of rural people to cities (Nass 1989: 133). In Minnesota, this population shift became evident in the census of 1890 and again in 1900. According to Robinson, the trend "reappeared in 1910 on a greatly enlarged scale. In fact, a considerable number of counties, mostly in the southern part of the state, decreased in total population; a still larger number, extending in an almost continuous zone from southeast to northwest, declined in total rural [farm] population. . . . Only in the region of cut-over lands was there any considerable increase" (Robinson 1915: 180).

The Country Life movement aimed to counter the rural exodus by making farm life more appealing. In meetings across the country, reformers promoted modern housing and household appliances, electrification, and farmstead beautification. Farmers were urged to fix up their homes and install running water to ease the burdens of women who, in the opinion of many, were the most overworked people on the farm. Farm magazines, builders' journals, and government bulletins published plans for improved farm buildings. In 1913, the Minnesota State Art Society held a contest for model farmhouse designs (Nass 1989: 134-135; Beecher 1999: 257).

There were efforts to bring electricity to Minnesota farms. As early as 1914, for example, a group of farmers from Stony Run Township in Yellow Medicine County organized a company to distribute power from the Granite Falls municipal plant to 26 farms. In 1924, a five-year demonstration project to electrify a small group of farms near Red Wing began. In 1926, a group in Dawson built its own power lines and purchased electricity from Otter Tail Power Company in Fergus Falls. Most farmers, however, had to wait to get electricity until the New Deal's Rural Electrification Administration began in 1935, and many farms weren't electrified until the 1950s (Nass 1989: 137).

The Country Life movement's goals went beyond the farmstead. Reformers promoted rural social activities, literary clubs, extension education, and the revitalization of country schools and churches. In 1916, a Country Life Conference was held at the University's College of Agriculture in St. Paul. The event attracted political leaders, teachers, rural school administrators, clergy, journalists, and others interested in social reforms. "*The Farmer,* Minnesota's oldest and most influential farm magazine, praised the work of the conference but regretted that only a few farmers attended the meetings," according to Nass (Nass 1989: 133-135).

CREDIT AND MARKETING

In the economic realm, the Country Life Commission called national attention to farmers' credit problems, citing "a lack of any adequate system of agricultural credit whereby the farmer may readily receive loans on fair terms," according to economist and historian Willard Cochrane (Cochrane 1993: 112). Congress struggled to devise a remedy, and in 1916 passed the Farm Loan Act. The law authorized a cooperative system of 12 federal land banks, capitalized mainly by the government, which provided long-term agricultural credit at regulated interest rates. Farmland could be used as collateral. As farm labor became scarce and expensive during World War I, many farmers borrowed money to buy labor-saving machinery. They also bought land, taking advantage of lenient, long-term credit offered by the new Federal Land Banks. Strong demand pushed up farmland prices by 70 percent between 1913 and 1920. In the best farming areas, land prices doubled. When the farm economy crashed in 1920, many farmers were unable to repay their loans and lost their farms (Tweton 1988: 21; Cochrane 1993: 100-101, 112).

Another economic problem that plagued farmers was the lack of market power, including unpredictable access to markets and little influence over marketing costs (Cochrane 1993: 111). Farmers in the 1870s had tried to organize politically and to form cooperatives, often sponsored by the Grange chapter or another farm group. But these early marketing attempts usually failed. According to Cochrane, "Lack of capital, inability to work together, farmers' lack of business experience, and the competition provided by private businesses, some fair and some unfair, drove most of these cooperative ventures out of business by 1880" (Cochrane 1993: 113).

The first successful farm marketing cooperatives began forming around 1890, when Minnesota's cooperative creamery movement began, and continued through the 1920s. These were local associations organized to ship and sell grain and livestock, and to manufacture and sell dairy products, especially butter. Nearly 10,000 farmers' cooperatives were organized between 1900 and 1920, most of them in Iowa, Wisconsin, and Minnesota, and Minnesota became a leader in the cooperative movement nationwide. By 1920 Minnesota had about 670 cooperative creameries, or just under half of all cooperative creameries in the U.S. Some Minnesota cooperatives became very large. On the grain front, Equity Cooperative Exchange entered the grain marketing business in 1908, competing with giants Cargill and Peavey, which controlled the lion's share of the Minnesota grain trade in the two decades before World War I. By 1921, the Exchange had more than 17,000 farmer-members and 417 elevators. The cooperative ran into financial trouble in the 1920s and fell into receivership. In 1926, its grain terminal operations were taken over by another cooperative, the Farmers' Union (Blegen 1975: 398; Tweton 1989: 267-269; Nass 1989: 143; Cochrane 1993: 114).

CHARACTERISTICS OF FARMS FROM THE ERA OF INDUSTRIALIZATION AND PROSPERITY, 1900-1920

- farms supplementing horse power with gasoline engines
- model or demonstration farms
- farms associated with colonization
- improved infrastructure (e.g., water systems, electricity generators)
- farms with lots of fencing
- improved farm layout
- field drainage structures
- evenly-sized fields for crop rotation
- windbreaks, woodlots, and shelterbelts planted in prairie areas
- ornamental plantings
- pastures
- dairy barns
- silos
- milk houses
- general purpose or combination barns
- dairy barns including "Wisconsin" style

- barns with hay mows
- basement barns
- barns with windows; structures oriented or sunlight and wind
- barns with gravity ventilation systems
- nonorthogonal barns
- hog barns
- corncribs
- poultry houses
- beef barns
- stockyards
- automobile garages
- implement sheds
- springhouses
- icehouses
- farmhouse improvements
- structures of poured concrete, concrete block, cement staves, sheet steel, sheet iron
- buildings of dimensional lumber and other purchased materials
- plank and balloon frames
- fewer new timber frame buildings
- gambrel roofs
- pre-cut "kit" or mail-order buildings
- designs influenced by science, engineering, management principles
- designs influenced by materials manufacturers, agricultural engineers
- designs influenced by technical bulletins

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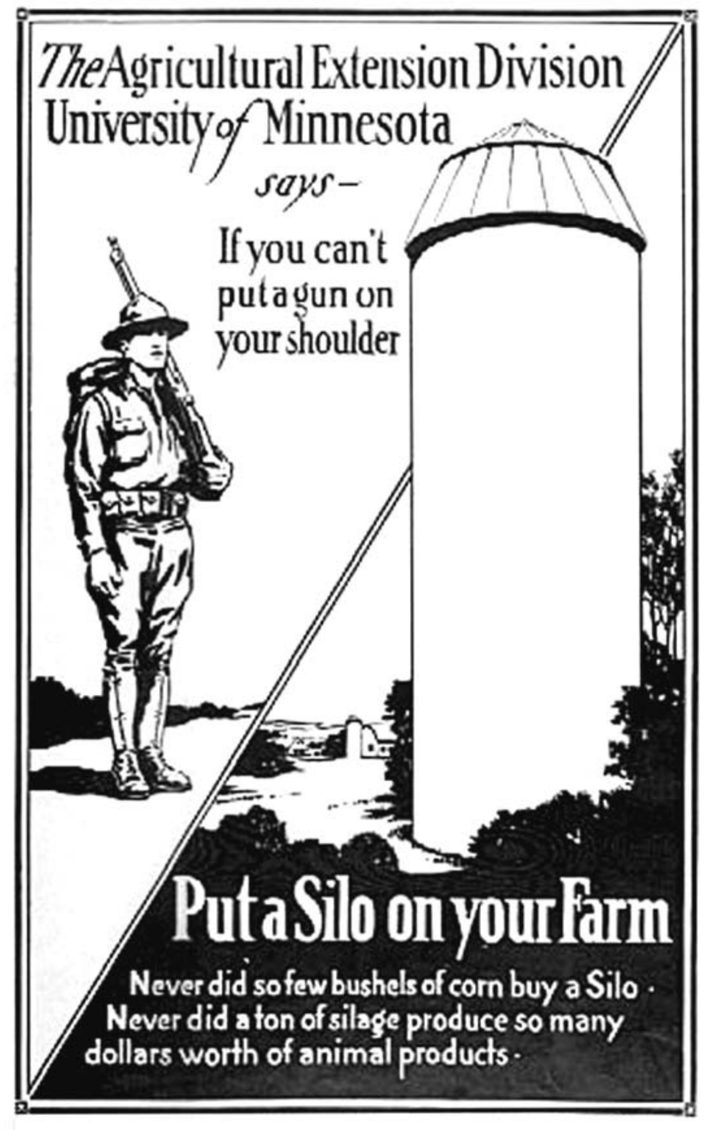
A diversified farm in Minnesota during the "Golden Age" of agriculture (1900-1919). The house was brick, the barns had vertical siding, and the fence rails were made of both logs and boards. Location unknown, circa 1905. (MHS photo)

This farm invested in a large barn and hay loading equipment. Bradley Farm near Marietta, Lac qui Parle County, circa 1909. (MHS photo by Carl Graff)

A western Minnesota farmhouse built in 1908. Farm incomes were relatively high from 1897-1919. Tryggeseth Farm near Dawson, Lac qui Parle County, circa 1910. (MHS photo)

This farm's windmill likely furnished power for pumping water, sawing wood, and grinding feed. There are dairy cows, pigs, and horses in the stockyard, and stacks of firewood and hay nearby. In the background is an early car, possibly a Model T. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)



During World War I, the state committee on food production urged farmers in all corn areas to build silos as a means of meeting the world's food shortage and helping win the war. Silos and other farm buildings were considered so important to the war effort that they were exempted from a general wartime ban on new building construction. University of Minnesota poster, circa 1917. (MHS photo collection)

PERIOD 5: DEVELOPING THE CUTOVER, 1900-1940

Most of the farms on northern Minnesota's logged "cutover" land were established between 1900 and 1940 amid difficult environmental, economic, and social conditions. The number of farms in the cutover reached its peak in 1925, a time when the logging industry was winding down and agriculture nationwide had just completed two decades of relative prosperity. Cutover farming is associated with significant organized recruiting and resettlement efforts by corporate interests and government agencies.

Milestones of this Period

1900	–	There were 9,300 farms in 16 logged or "cutover" counties
1905	–	Peak of logging in the cutover
1909	–	Meadowlands colony established by the Duluth and Iron Range Railroad; Meadowlands demonstration farm created by the railroad and the University of Minnesota
1910	–	Decade of widespread farmland drainage began
1919	–	Nationwide farm economic depression began
1921	–	Minnesota's first radio station started broadcasting
1925	–	Number of farms in 16 cutover counties peaked at 32,700
1926	–	Minnesota Extension Service distributed 7.7 million pounds of tree stump explosives to farmers over previous five years
1929	–	Stock market crashed
1932	–	Committee on Land Utilization convened by Minnesota Governor Floyd B. Olson to study cutover conditions
1934	–	New Deal's Beltrami Island resettlement project began; most settlers moved away by 1936
1934	–	Lands in part of the cutover were withdrawn from homestead entry to discourage settlement on submarginal land
1936	–	First settlers moved to New Deal's farming settlement at Hermantown

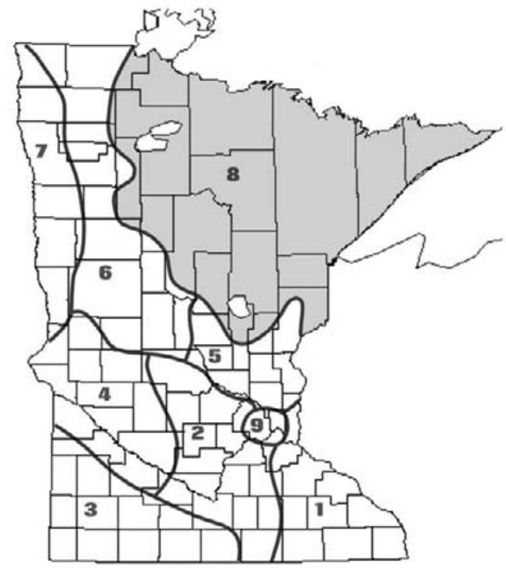
Northeastern Minnesota's cutover, a region that encompassed about 16 counties, was a difficult landscape to farm. The cutover's soils were thin, rocky, and sandy with low fertility; the growing season was short; and the land was covered by dense second-growth trees and brush, impenetrable bogs and "muck" lands, and millions of acres of stumps left from logging. There was the constant threat of fire, roads were few, and markets far away. Many settlers had little farming experience and capital, few neighbors, and a heavy property tax burden. On the other hand, the cutover was a compelling landscape of great beauty. The timber could be harvested for building materials, fence posts, firewood, and logs to sell, and the forests and lakes were rich with wild game, fish, berries, and sap for maple syrup. Many families survived on very small farms, albeit at a nearly subsistence level.

See also

Farms
Root Cellars
Woodlots
Hay Barns or Sheds
Sugarhouses
Field Rock Piles

One source wrote in 1924, "To the uninitiated, the job of creating a farm in the cutover country seems a hopeless task" (Thompson and Schwantes 1924). Another wrote, "After the buildings are up and well sunk, the settler in the cutover country is ready to start clearing land, and that is when he is most likely to lose courage" (Ashby 1924: 28). Clearing the land of stumps, brush, and stones was a major obstacle to agricultural development, and experts in Minnesota and other Great Lakes states devoted considerable attention to overcoming it. In 1918 the University of Minnesota reported that cutover farmers were only able to clear an average of 3.8 acres per year. Because of the difficulty of clearing, fields were small and irregularly shaped and the ratio of tillable land to total farm size was low. By 1930, many cutover farmers were trying to make a living on 20 to 50 acres of tillable land (Peck 1918: 6; Cavert and Pond 1931). (See also Henning et al 1999 on cutover land clearing.)

Much of the cutover's landscape was also wet: "It is said before the ditches were dug the farmers cut their hay in hip boots and spread it on the stumps to cure" (Ashby 1924: 28). Farmers worked with government agencies to plan and construct public ditches and farm drainage systems that would turn soggy land into productive fields and pastures. Most land was drained in the 1910s, a decade of widespread farm drainage elsewhere in the state. Most cutover drainage projects were funded with local property tax assessments, a burden that many local farmers couldn't repay.



Minnesota's cutover region as defined by the University of Minnesota's Engene and Pond in 1940.

Cutover farmers had difficulty competing with farms elsewhere in the state where the growing season was longer and where there were fewer land clearing problems, better soil, and transportation systems suited to hauling farm products to market. For many cutover farmers, marketing their farm products required driving slow wagons or trucks over unimproved, often impassible, back roads or paying high rail shipping costs to a declining network of logging railroads.

In 1933 the University of Minnesota's Pond and Crickman explained the region's major markets:

> Practically all the surplus livestock from the [cutover] area is marketed at South St. Paul. Private or cooperative creameries are located wherever the dairy production within a community is sufficiently heavy to provide enough butterfat for their successful operation. Otherwise, dairy products are marketed as cream to centralized creameries in Duluth. Potatoes are shipped to the Twin City markets. Rutabagas find a market principally in the southern states. . . . In most parts of the northeast cutover area there is a market in local cities for dairy products, eggs, vegetables and fruits. However, there are comparatively

> few large cities or towns in the area – Duluth and the iron range towns are the best local markets. In the past, lumber companies have furnished an outlet for hay and vegetables but with the decline in lumbering operations this has largely disappeared. The summer tourist trade affords a market for whole milk, eggs, fruits, and vegetables that as yet has not been supplied locally to its fullest possibilities (Pond and Crickman 1933: 18-19).

FIRST PHASE OF CUTOVER FARMING, CIRCA 1890-CIRCA 1905

The first phase of cutover farming occurred in a roughly 15-year period from about 1890-1905. This was a time of small, subsistence-level farms, many operated by laborers in logging camps or iron ore mines who also farmed to make ends meet and earn income during the off-season. Some early settlers were drawn to the area by advertisements from railroad or logging companies trying to sell their excess land. As early as 1894, for example, the St. Paul and Duluth Railroad was advertising its cutover lands to prospective settlers.

Timber and mining companies also operated farms during this period to supply food for their workers and feed for draft animals. Such farms began to disappear as logging camps closed in the 1910s, although a few "company" farms were still operating in 1930 (Henning et al 1999: 6).

In 1880 there were only about 545 farms in 16 cutover counties. By 1890 the number was increasing but still small at 2,200 farms. In 1904 cutover farmers were producing potatoes, vegetables, small fruits, butter, poultry, oats, and hay, some of which was marketed to the growing towns in the region (Committee 1934: 10-11; Maguire 1904: 57).

The first phase of cutover farming ended around 1905 when northern Minnesota logging reached its peak and began to move toward decline.

SECOND PHASE OF CUTOVER FARMING, CIRCA 1905-CIRCA 1930

The second phase of cutover farming lasted from circa 1900 through the 1920s as the region's primary land use shifted from logging to agriculture. The phase ended around 1930, which was also the end of the logging boom in northeastern Minnesota. As lumber camp jobs disappeared, some former woodsmen became farmers so they could remain living in the area. Timber companies abandoned logged property, leaving thousands of acres available for new uses.

During this period the number of farms in 16 cutover counties grew from 9,300 in 1900, to 16,500 in 1910, and then to 25,800 in 1920. Southerly cutover counties such as Aitkin, Carlton, Crow Wing, Kanebec, Mille Lacs, and Pine were developed first, followed by those near Lake Superior including Cook, Lake, and St. Louis (Pond and Crickman 1933: 19).

During much of this phase of cutover farming, agriculture nationwide was in a period of relative prosperity which encouraged new would-be farmers to look for opportunities. Productivity was high and commodity prices and farm incomes were strong. Most of the best land in the state had been developed, however. Farmers in prairie areas could find little land to buy or rent and were instead draining wetlands to increase acreage. Some farmers were pushing west into the Dakotas where land was still available. Others were looking at the cutover's abundant, inexpensive acreage. Cutover farms were also established by industrial workers trying to escape from the high cost of living in urban areas (Pond and Crickman 1933: 19; Robinson 1915: 208). A 1924 Extension bulletin noted that, because land was cheap, those who might “otherwise be renters or laborers through life” could become the owners of small farms in the cutover (Thompson and Schwantes 1924).

Prospective settlers were actively recruited by timber companies trying to dispense of logged-over land, and railroads trying to sell their excess acreage and increase traffic along their lines. Both timber and rail companies often worked through land developers or real estate agents. In many cases the sellers were unscrupulous, exaggerating the assets of the area, selling land not fit for farming, and enticing would-be farmers who had little experience and even less capital (Committee 1934: 58-59; Alanen 2000: 2.15; Henning et al 1999: 8-15).

Corporate interests often allied with churches or other organizations to find groups of prospective settlers. In Mille Lacs County, for example, the Foley-Bean Lumber Company worked through its agent, the Johnston Land Company, to collaborate with a Dutch Catholic monastic order called the Crosier Fathers. The partners formed the Minnesota Catholic Colonization Society and in 1909-1911 successfully recruited Catholic families from Holland to immigrate to land near Onamia. Similar arrangements occurred throughout the cutover. (For more information on colonization and the immigrant farmers who settled the cutover, see Henning et al 1999.)

Government agencies also recruited immigrants, veterans, and other settlers to the cutover, spurred in part by the goal of improve statewide agricultural productivity by increasing total farm acreage. Government also worked to reduce the challenges of cutover farming. The Minnesota Agricultural Experiment Station, the University of Minnesota’s Department of Agricultural Engineering, and the Federal-State Cooperative Extension Service (also called the Minnesota Extension Service) all operated programs in the cutover.

The number of farms in the cutover peaked in 1925 when there were about 32,700 farms in 16 counties. After that point, farm depression in the 1920s began to erode some of the gains of the previous decades. By 1930 the number of cutover farms had dropped to 29,500 (Schantz-Hansen 1934: 5-6; Committee 1934: 10-11).

A State of Minnesota report from 1934 described events of the period:

> [There] was the attempt by the state, the lumber companies, the railroads, and various land speculators to induce settlers to take up the cut-over lands and turn them into farms. Extensive advertising and sales campaigns were conducted, but there was no serious or systematic effort to classify the lands and to get settlers only upon the most suitable tracts. Public encouragement was given to drainage and land-clearing projects and to the building of roads and schools throughout the region. For a time the drive for settlers was fairly successful. High war-time prices for farm products, and for the [utility] poles and [railroad] ties that could be cut upon much of the land, helped to maintain the movement until about 1920 or a little later (Committee 1934: 10-11).

Between 1900 and 1930 University experts and others studied the difficulties of cutover farming, assisted with programs to construct drainage ditches and build roads, distributed seed and purebred breeding stock, and helped establish demonstration farms. Experts wrote technical bulletins to predict costs and potential income; describe methods, labor requirements, and marketing; and help farmers choose crops, livestock, and buildings. A 1922 Extension bulletin, for example, was aimed at cutover farms of 40 acres or less and based much of its advice on the experiences of 395 farmers in Beltrami and Itasca counties (Cavert 1922). One bulletin recommended, "A large family is frequently the best asset a settler possesses" and "The first buildings should be small but serviceable" (Worsham 1920: 16-18). Another recommended, "Sheep are better than cattle for subduing brush," but cautioned that the sheep should be enclosed near the house each night because the woods harbored dogs and wolves (Cavert 1920: 115). It was recommended that all farms raise dairy cows and feed the skim milk to calves and a few pigs. Octagonal silos of rough-sawn native timber, built with cribbed construction, were advised (Smith 1923). Because the farms were small, the ratio of building costs to the number of tillable acres was higher than elsewhere in the state. Experts suggested that building small structures and sharing or renting machinery could minimize costs. Cutover farmers were advised to farm with horses, which were more cost-effective than tractors for very small farms, and to keep the horses for longer periods in the pasture (rather than in the barn) to reduce the need to cut and store hay (Cavert and Pond 1931).

County extension agents and others also taught land clearing methods, especially ways to remove trees, stumps, and large rocks. After World War I, county extension agents and others distributed large quantities of surplus explosives made available by the military for land clearing (McNelly 1960: 92; Nass 1989: 130).

Off-farm Work. According to St. Croix Valley historians Eileen McMahon and Theodore Karamanski, "It was rare for a cutover farmer, American born or immigrant, not to resort to work as a lumberjack at some point in the process of establishing a homestead" (McMahon and Karamanski 2002: chpt. 2). Many cutover farmers augmented their income by working in iron mines or for timber companies or by selling forest products from their farm. Many catered to tourists as hunting or fishing guides, by selling roadside produce, or by building small rental cabins or resorts on their farm property. According to a 1920 study, cutover farmers were moonlighting as road workers, harvest hands, loggers, blacksmiths, section hands, miners, carpenters, bricklayers, assessors, postmasters, butter makers, lumber camp cooks, school bus drivers, barbers, saw mill operators, janitors, and paper mill workers (Worsham 1920: 24). One pitfall of having a second job, some experts explained, was that it delayed land clearing and kept farmers from giving their crops and livestock sufficient attention.

Meadowlands Settlement and Demonstration Farm. One of the period's most well-known settlement colonies was Meadowlands, located in St. Louis County on railroad-owned land about 40 miles northwest of Duluth. It was started in 1909 by the Duluth and Iron Range Railroad (D&IR) to convince settlers to buy D&IR land and establish farms. As part of the work, in 1909 the railroad's land office joined forces with the University of Minnesota's Northeast Experiment Station in Grand Rapids to develop a 280-acre demonstration farm at Meadowlands. The project had two goals: to experiment with cutover farming methods and to assist cutover settlers "by furnishing them with purebred seed, stock, and poultry, and by keeping them in touch with the farm's operations that they may avoid serious mistakes in handling their farms" (Dickinson 1913: 198).

Within a few years, the duties of the D&IR land staff at Meadowlands had "broadened to include all sorts of work with the settlers, until now we are operating almost as a regular colonization organization," according to staff member Wallace Ashby writing in 1924. The railroad carved 40-acre farms from the woods in advance of settlement, built roads and drainage structures, provided loans, distributed explosives, advised on crops, etc. When settlers arrived, the company furnished each family with "a movable bunk house that they can live in until their house is built" (Ashby 1924: 27-29).

Meadowlands organizers provided settlers with building plans for houses and outbuildings. Ashby described one house design as being a three-room, 20′ x 24′ structure "built of shiplap covered with heavy composition roofing on sides and roof." Materials for the house cost about $450 (about $4,800 in 2003 dollars). For barns, Ashby explained, "We recommend a shed type of barn 18 feet wide and as long as may be needed, to which a hay barn is added later on. It is important to keep building costs as low as possible because the average settler is not a rich man" (Ashby 1924: 27-29). The nearby town of Meadowlands, established in 1907, had stores, banks, and, by 1940, a cheese factory (Alanen 2000: 2.15-2.38).

Additional demonstration farms in the cutover were created by land developers and others interested in promoting settlement. Among the model farms were those located in St. Louis, Beltrami, and Itasca counties (Henning et al 1999: 11-13).

Veterans' Settlements. In 1918, a policy of encouraging farming in the cutover was suggested as a method of easing the country back into peacetime status after the upheaval of World War I. It was suggested that millions of returning soldiers and laid-off urban industrial workers would need peacetime employment and could become cutover farmers. One proponent wrote in 1918, "The vacant lands of the United States must and will be developed. There has never been a better opportunity for bringing about this development than by giving the returning soldier and the industrial worker who is out of a job at the end of the war the chance to acquire land. The more people we can place on the land in the next two years, the better off this country will be" (Wallace 1918: 213-214). Minnesota and five other states formed individual Committees on Land Settlement for Returning Soldiers and Industrial Workers, and participated in federal-state partnerships to provide farm training and settlement programs for veterans in the 1920s (Reid 1965: 241-242).

Part of this effort was aimed at disabled veterans. According to historian Bill Reid, agricultural rehabilitation of wounded veterans occurred in all parts of the country, but District 10 – encompassing Minnesota, North and South Dakota, and Montana – "had by far the largest number of farm trainees," with Minnesota leading the group (Reid 1965: 243). In 1922 colonies of wounded veterans were established in Aitkin, Mille Lacs, and Carlton counties in the cutover and in one location south of Minneapolis. The veterans were settled on small farms, given some equipment and training, and extended credit so they could make payments on their land over many years. Overall the program was a disaster. By 1930 the rigors of cutover farming, the veterans' poor health, and a widespread lack of farming experience, cash flow, and technical support contributed to financial failure and abandonment of the farms (Reid 1965: 243-250).

THE THIRD PHASE OF CUTOVER FARMING, THE 1930s

Another phase of cutover farming occurred during the Depression of the 1930s. It was encouraged by large-scale government programs and by the movement of unemployed Minnesotans to cheap land to escape urban poverty. It happened during a period of overall stress in the farm economy.

During the 1930s the population of the cutover region was dwindling as timber plants continued to close. Farming was proving to be marginal at best, and farmers were staggering under increasing tax burdens. During the 1910s and 1920s the settlers had lobbied for roads, schools, and large-scale drainage projects – all financed with local property taxes. As the bills for this public infrastructure came due, however, the tax base was shrinking as logging companies closed local operations, abandoned their cutover land, and refused to pay their property taxes.

A State of Minnesota report from 1934 explained:

> Agriculture, recreational industries, and small-scale lumbering operations, the principal sources of income, proved to be quite inadequate to support the burden of local taxation. Much property fell into tax delinquency [in the 1920s]. As logging companies, settlers, and other property owners stopped paying taxes, the burden that was placed upon those who continued to pay steadily increased. . . . More and more of the non-delinquent lands were sucked into the vortex and forced into delinquency. At the present time taxes are paid on less than half the land in the 16 cutover counties (Committee 1934: 58-59).

A "back to the land" movement that had emerged during earlier decades continued during the Depression as city dwellers who had lost their jobs moved onto self-sufficient farms in the cutover. The farms were very small, however, and their operators often inexperienced. In 1940 the University reported that on most of these farms people lived "on a subsistence basis with a very low standard of living" (Engene and Pond 1940: 68). By one estimate a farm needed at least 40 acres of improved land to support a family. But according to the 1935 census, farms in cutover counties averaged less than 36 cleared acres per farm. In some counties, the average was as low as 16.5 improved acres (Schwantes and Thompson 1940).

University staff and other experts assisted cutover farmers as they could, suggesting operational strategies to help farms survive. In 1931, for example, Cavert wrote:

> . . . careful calculations might show that a new barn, by saving labor and producing some extra returns from the livestock, would pay a small profit, but possibly the same money would be better used either in clearing additional land or adding to the machinery. . . . In general, one should be very cautious about borrowing money with which to construct new buildings. . . . The usual experience is that dairy cows, if they are kept reasonably comfortable, give about the same quantity of milk in a cheap barn as in an expensive one. . . . A bull will do well in a paddock that has an open shed at one end. Yearling cattle do well in sheds that are open to the south and are protected by timber. Sheep will winter fully as well in a good shed, open to the south, as in the most expensive barn, if the lambs do not come until warm weather. An important item in considering investments in buildings is the fact that it is usually impossible to sell a small farm for sufficient [cash] to recover anything beyond a very modest investment in buildings (Cavert 1931: 13).

By the early 1930s it was increasingly clear that agriculture had a dim future in the cutover and that many farmers were in serious trouble. A group of Finnish farms near the town of Finland on the North Shore of Lake Superior, for example, was in high tax delinquency in 1932 with taxes overdue on 62 percent of the land. Between 1905 and 1934, many of the 48 farms in the Finland area ceased active cultivation, 8 were abandoned entirely, and most residents lived in poverty and isolation. One University of Minnesota observer noted, "The poverty of existence in the Finland Community is evident even in . . . the cemetery on the Little Marais Road. Its unkempt condition suggests that life is much too hard to give much thought or time to the dead" (Davis 1935: 393).

In 1932, Governor Floyd B. Olson convened a state Committee on Land Utilization to study the problems of the cutover and recommend solutions. The Committee concluded that agriculture in the cutover was generally a failed experiment, and suggested that farming was viable in only a few small portions of the region. The Committee recommended that further settlement efforts avoid placing settlers on poor land and "that conditions be made as favorable as possible to the success of the enterprise" (Committee 1934: 110).

Settlement and Resettlement Projects. During the New Deal of the 1930s, the Roosevelt administration worked to alleviate the poverty faced by the nation's cutover farmers. To discourage further settlement in submarginal areas, for example, in 1934 the government withdrew many cutover parcels from the pool of land available to potential homesteaders. Federal programs also converted submarginal farmland to other uses such as parks and wildlife preserves, moved farmers from failing farms to better land, and settled the urban poor onto small cutover farms (Murchie and Wasson 1937: 6).

Minnesota's Beltrami Island Project, a program that began in 1934, was created by the New Deal's Agricultural Adjustment Administration (AAA). Located south of Lake of the Woods, the Beltrami Island project was designed to serve as a model for similar AAA work in other cutover states. It was also the first submarginal resettlement project of its type nationwide to actually move settlers. From 1934-1936, about 1,000 people living on 300 farms in Lake of the Woods and Roseau counties were physically moved to better farmland nearby. In many cases, houses, barns and other outbuildings were literally moved along with the families. Some participants worked with project officials to design and build new farm structures. Schools and houses for retirees were also built, and settlers were given loans and technical assistance (Murchie and Wasson 1937: 4; Henning et al 1999: 33).

Another New Deal program settled poor families from cities onto farms in rural and suburban areas. Nationwide, the program operated at about 100 sites. Two were located in Minnesota – one near Hermantown (close to Duluth) and the other near Austin in southern Minnesota. The Hermantown project, also known as the Jackson Project, was launched by the federal Division of Subsistence Homesteads and, in 1935, was assumed by the newly-established federal Resettlement Administration. It sought to place settlers on subsistence farms located close enough to the city of Duluth so that participants could work at seasonal or part-time jobs while they farmed. (Placing settlers on the edges of cities was one of the national program's strategies.) Land clearing and well-digging at Hermantown began in 1935, and in 1936 the first settlers moved onto small plots of land. By 1938 about 84 homesteads were occupied. The government-built houses had electricity and indoor plumbing. About half of the homesteads also had a government-built barn. The community formed a homestead association and organized cooperative projects and social activities. Many families succeeded in moving out of poverty and, decades later in 1976, 22 of the original settlers were still living in their homes. The Duluth project was "among the most enduring and successful" of the New Deal experiments of its type nationwide (Garvey 1978: 2-16; Henning et al 1999: 29-33).

CUTOVER FARM CHARACTERISTICS

In 1939 farms in the cutover averaged 103 acres – considerably smaller than the 1939 state average of 165 acres. Acreage actually cleared was even smaller, with cutover farms averaging less than 36 cleared acres in 1935. Most fields were small, irregularly shaped, and surrounded by woods and bogs. Rocky and forested areas were often used as permanent pasture (Engene and Pond 1944: 24; Schwantes and Thompson 1940).

Around 1930, more than half of all tillable land was used solely for hay and forage crops, a situation unique to the cutover. While this cropping system supported dairy cows, it meant that concentrated feed like corn and small grains had to be imported if hogs or other livestock were raised. In 1930 the principal crops were oats (the state's leading small grain crop at the time), barley, some corn, and potatoes. In 1929 the proportion of tillable land devoted to potatoes was third-highest in the state (Engene and Pond 1940: 65-66).

In 1930 only 14 percent of cutover farmers raised pigs. Eighty percent of cutover farmers milked cows (an average of five cows per farm) and some also raised sheep. In 1939, chicken flocks averaged 43 chickens per farm, which was the smallest average flock size in the state (Engene and Pond 1944: 18, 65, 67).

In 1935 the University of Minnesota's Darrell H. Davis described farmsteads and buildings near Finland on the North Shore where farmers were producing small amounts of oats, potatoes, barley, wild hay, and cream. Davis wrote, "Occupied farms and clearings are concentrated on or near the main roads, particularly the east-west highway. Of clearings more than a quarter of a mile off such roads, nearly half are now abandoned" (Davis 1935: 389). He also wrote:

> Some of the houses are of frame construction, but many are of logs, squared on four sides, with corners dovetailed and without projections. Barns and other outbuildings are also frequently of logs. Houses are without basements, storage being provided by root cellars. Although stone is abundant, it has not up to very recently been used in building construction, not even for chimneys. There is a multiplicity of sheds and other outbuildings, including the ubiquitous Finnish bathhouse, all widely separated [to prevent the spread of fire]. In peripheral portions of the community, where Scandinavian elements of the population predominate, the characteristic buildings of the Finnish farmsteads disappear, to be replaced by frame buildings or log houses of more conventional construction (Davis 1935: 390-391).

Davis noted, "Barns and other outbuildings are also frequently of logs" and "The ever present fire hazard is suggested by the ladders often attached to the roofs of the farmhouses and barns as an aid in fire fighting" (Davis 1935: 385). He also reported, "Modern conveniences are few. There are no telephones except in the stores; there are few lighting systems; and labor-saving household devices are also lacking to a large extent. . . . On the upland farms, and even on others, [the] shallow wells go dry during prolonged droughts" (Davis 1935: 391).

A 1999 study of cutover farming by Henning, Henning, and Roberts described the cutover's modest farmhouses, usually built of logs or boards sawn locally. Farmers also saved costs by using inexpensive sheathing materials like tarpaper and rolled asphalt roofing. Both the Henning group and landscape historian Arnold Alanen (who wrote a 2000 study) described the cutover's ethnically-influenced farm buildings. Both sources indicated that dairy barns on cutover farms tended to be smaller than those in other parts of the state. Henning reported that – among ancillary structures such as privies, icehouses, and granaries – "the root cellar was by far the most common in the cutover region" (Henning et al 1999: 54; Alanen 2000).

CHARACTERISTICS OF FARMS FROM DEVELOPING THE CUTOVER, 1900-1940

- new farms
- farms with stony, thin soil
- farms with small number of cleared acres
- small irregularly-shaped fields surrounded by woods and wetlands
- subsistence-level farms of 40 acres or less
- farms with lots of fencing
- drainage structures
- pastures
- small buildings
- general purpose barns or combination with mows
- small hog barns
- potato warehouses
- hay sheds
- poultry houses
- small implement sheds
- low-cost silos such as crib silos or half-buried silos
- sugarhouses
- on-farm sawmills
- on-farm rental or resort cabins
- structures widely-spaced to avoid spreading fire
- structures displaying ethnic influences
- buildings sided with tarpaper or asphalt roofing
- structures built of home-cut logs or boards
- plank and balloon frames
- gambrel, gothic arch, and rounded arch roofs
- farms supplementing horse power with gasoline engines
- model or demonstration farms
- farms associated with colonization or resettlement
- farms associated with the "back to the land" movement
- designs influenced by science, engineering, management principles
- designs influenced by materials manufacturers, agricultural engineers
- designs influenced by technical bulletins

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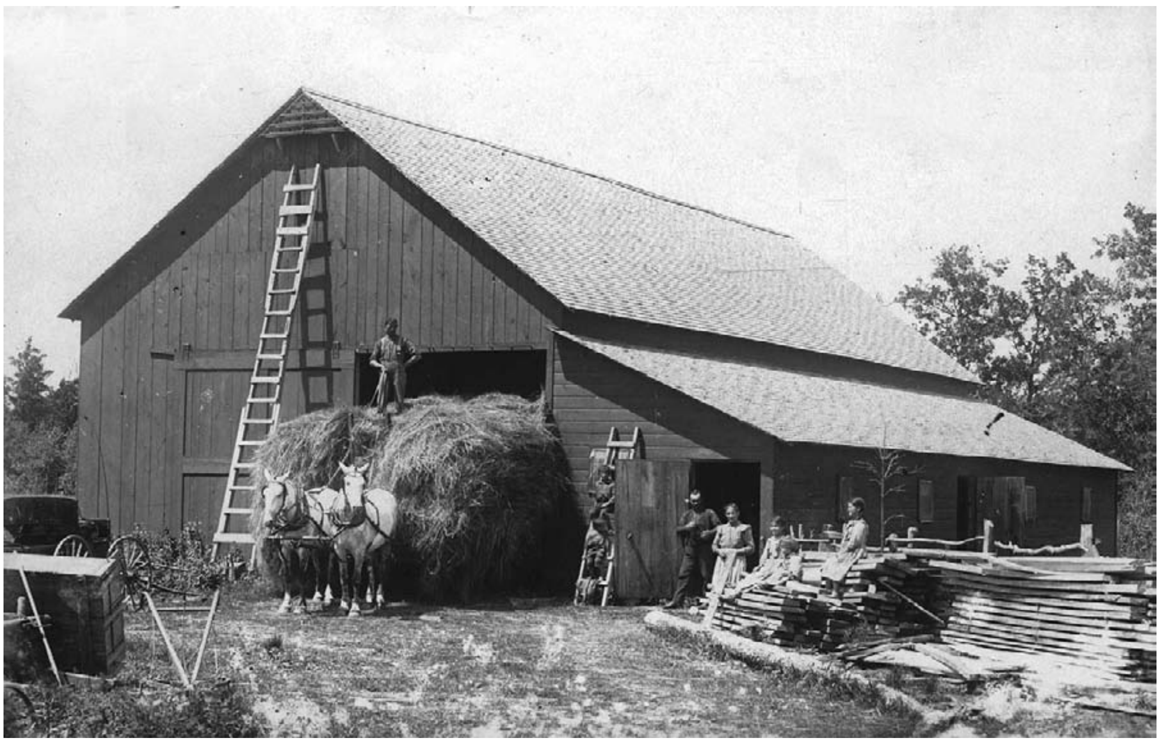
This long, one-story hay barn was apparently located near Aitkin in Crow Wing County. Judging by the size of the barn and the number of workers and horse-drawn hay wagons loading it, this was likely a farm operated by a timber company to supply logging camps with feed for draft horses and perhaps food for workers. The barn had plank siding and corrugated metal roofing. The hay was being moved in bundles, with no hay-moving equipment evident. Probably located near Aitkin, circa 1915. (MHS photo by *Aitkin Independent Age*)

A log barn on the Juneau Farm near Rollins, St. Louis County, circa 1900. (MHS photo)



This barn in a cutover region is faced with vertical boards that were probably cut on or near the farm. (The shed-roof addition is faced with shiplap, likely purchased.) At right, the three girls are sitting on a large stack of thick, newly-cut boards. Morrison County, circa 1900. (MHS photo by Brooks)

A farmhouse and outbuilding covered with tar paper, a common sheathing material that was inexpensive and readily available. The paper easily came loose with conventional nails, so it was secured with wide-headed tacks or strips of lath. It lasted longer in wooded areas where the trees offered some protection from the wind. Asphalt roofing material, available in shingles or rolls, was a more durable alternative. Cass County, circa 1910. (MHS photo)

PERIOD 6: DEVELOPMENT OF LIVESTOCK INDUSTRIES, 1900-1940

During the 40-year period from 1900-1940, livestock farming moved from mostly a small-scale enterprise to become a rising star in the state's farm economy. Among the contributing factors were the creation of the South St. Paul Stockyards and the Minnesota meatpacking industry, increased food demand from rising urban populations, the introduction of new feed crops such as Grimm alfalfa, hybrid corn, and soybeans, and other technological advances like truck refrigeration. The patterns of this period formed the basis for the tremendous growth in livestock farming that occurred several years later in the post-World War II era.

Milestones of this Period

1886	–	St. Paul Union Stockyards established in South St. Paul
1887	–	Fowler Brothers of Chicago built First Minnesota Provision and Packing Co. in South St. Paul
1897	–	Swift and Co. opened in South St. Paul
1906	–	Congress passed Meat Inspection Act
1908	–	Minnesota's first livestock shipping association formed in Litchfield
1915	–	Minnesota ranked fifth nationwide in beef cattle
1919	–	Armour and Co. built in South St. Paul
1920	–	Hormel and Co. in Austin emerged as the state's leading meatpacker
1921	–	Central Cooperative Commission Association founded in South St. Paul
1925	–	Chicago's Cudahy bought Farmers Terminal Packing Co. in South St. Paul
1931	–	University of Minnesota released its first corn hybrids
1932	–	Poultry raising doubled in Minnesota between about 1932 and 1948
1935	–	F. M. Jones of Minneapolis created the world's first mechanical refrigeration system for trucks
1940s	–	Meatpacking became Minnesota's largest employer
1949	–	Soybeans were Minnesota's third-largest cash crop, rising from only a few acres in 1930

LIVESTOCK PRODUCTION BEFORE 1900

During the early settlement period, most farm animals were raised for home consumption. Extra livestock that was sold was usually marketed locally: eggs and butter were sold or exchanged at a neighborhood store, and cattle and hogs were sold to the local butcher. In the 1860s and 1870s, a few wealthy farmers began raising sheep and hogs on a larger scale, as well as raising and breeding cattle. Most of these stockmen made use of open grazing land and abundant wild hay – both low-cost resources that diminished as new settlers established farms across the state. From this beginning, livestock gradually increased but still remained a comparatively small part of Minnesota's farm economy through most of the period.

See also

Farms	Appendix: Focus on Minn Livestock
Beef Barns	Appendix: Focus on Biotech and Agrichem
Hog Barns and Hog Cots	
Sheep Barns	

Beef Cattle. Cattlemen formed a Minnesota stockbreeders' association in 1877. Beef cattle numbers rose from about 1,400 in 1850 to about 383,000 in 1880. The most common breed in those years was the Shorthorn, also called the Durham. Raising cattle on local grasslands and wild hay was inexpensive but, as a University bulletin explained, "With the rapid increase in settlement of the prairies during the late eighties and the nineties . . . the possibilities of raising cattle on cheap prairie grass . . . came to an end in Minnesota" (Crickman et al 1934: 6-7). Feeding grain to cattle was rare, and it took three or four years to raise a market-weight steer.

During the early period some Minnesota cattle were exported to Chicago and Eastern cities. According to historian Jerome Tweton, "Large-scale cattle raisers might drive a herd to St. Paul or other railroad centers for shipment to Chicago's Union Stockyards, the terminal market that served the major packinghouses" (Tweton 1989: 275-276).

Hogs. Pig numbers rose from 734 in 1850 to about 381,000 in 1880. Popular swine breeds at the turn of the century included Chester White and Berkshire. Some slaughtered hogs were shipped, frozen, to Chicago in the winter.

Sheep. Sheep numbers spiked in Minnesota in the 1860s. This early interest was encouraged by strong demand for wool during the Civil War, a time when the Union army needed woolen uniforms, and when Southern cotton was in short supply. From a mere 80 sheep in all of Minnesota Territory in 1850, numbers jumped to 193,000 in 1866, but then declined after the war. The sheep population rose slowly again in the 1870s, reaching 268,000 in 1880. Popular breeds included Leicester, Southdown, Sussex, Silesian, Saxon, and Merino. Minnesota wool was marketed in New York and Boston.

Poultry and Eggs. Poultry numbers rose from a few thousand in the 1840s to 2.26 million in 1880. Poultry was raised on nearly all Minnesota farms. Popular breeds were Brahmas and White and Spanish Leghorns. The Minnesota State Poultry Association was organized in 1874 (Crickman et al 1934: 6-9; Jarchow 1949; Tweton 1989: 271).

EARLY 20TH CENTURY DEVELOPMENT

Livestock raising in Minnesota increased considerably in the early 20th century and hogs, beef cattle, sheep, poultry, eggs, milk, and butter became major farm products. Farm diversification was a leading reason for the increase: in an effort to vary their sources of income, farmers began raising a broader range of crops such as corn, oats, and alfalfa (in addition to wheat) and adding livestock to their farms which could be fed the homegrown crops. (The new livestock were often called "feeder-" lambs, pigs, or calves since they were bought young, fed (or "fattened"), and then sold at market weight for slaughter.) The creation of major marketing outlets for livestock, and innovations like the refrigerated railcar (invented in the 1890s) encouraged this production.

Minnesotans began growing better feed crops after 1900. One of the first was Grimm alfalfa, the first alfalfa that was hardy in Minnesota. It was widely grown throughout the state beginning around 1910, and by 1930 more than 1 million acres were planted. Concentrate feed crops – especially corn and soybeans – also became important. Minnesota's corn crop was at first limited to the southern edge of the state where summers were longest, but when improved hybrids were introduced beginning in 1926, corn culture spread northward. Soybeans were almost unheard-of in Minnesota before 1930, but by 1949 were Minnesota's third-largest cash crop.

As the livestock industry grew, production became concentrated in distinct regions of the state. Southwestern Minnesota, which had the highest yields of corn and soybeans, became a chief area for cattle and hogs. Southeastern Minnesota also developed strong beef cattle and hog industries, as well as dairy, egg, and poultry operations. Central Minnesota north of the Minnesota River became a strong turkey-growing region. The prairie region of central and west central Minnesota developed diverse livestock enterprises including dairy, poultry, eggs, and hogs (Blegen 1975: 565-568).

The Red River Valley also saw increased livestock as farmers sought to diversify from wheat. Historian Howard Dickman explained:

> The [Great Northern] railroad also promoted the feeder lamb, sheep, and cattle business in the Red River Valley counties of Minnesota and North Dakota. The feeder business was a dividend of the increased planting of alfalfa and sweet clover, and of sugar beets (lambs feed off the waste by-product beet tops). Very little feeding or finishing was done in these two states prior to the 1920s. Around 1925 or 1926 railroad agricultural development agents achieved success in arranging for large livestock dealers in Montana to park their stock with farmers in northern Minnesota and North Dakota in transit on the way to the terminal markets, for feeding and finishing. The numbers of sheep and cattle on feed grew very large after 1929, and even the drouth of the 1930s did not demolish this business (Dickman 1977: 225).

Scientific research, changing technology, and new methods of animal husbandry also encouraged the state's livestock industry. Silos, for example, provided a way to preserve corn fodder for winter feeding. Around World War I, the fight against hog cholera made great strides, allowing farmers to expand their swine herds with less risk of being wiped out by disease. Bovine tuberculosis eventually came under control, as did troublesome poultry diseases. Livestock breeders introduced superior stock that gained weight faster and were more fertile. Improved housing for beef, hogs, and poultry boosted efficiency. Mechanization, improved feeding rations, and sophisticated record keeping also spurred productivity (Cochrane 1993: 109, 128-129, 158).

Rising U.S. population and changes in food consumption were also factors in livestock development. Between 1900 and 1950, Minnesota's population rose from 1.8 million to 3.2 million, creating a growing, urban market for food. Consumer preferences also changed: in the 1920s, for example, Hormel Company, a Minnesota pork processor, introduced canned ham which, explains Tweton, "took the market by storm" and spurred pork sales. By 1940 the company's revolutionary canned ham called "Spam" was being consumed by 70 percent of the urban American public (Tweton 1989: 277).

Beef Cattle. In the early 20th century, the market for younger, grain-fattened yearling or baby-beef steers increased, allowing Minnesota farmers to market their cattle after one year instead of three. This change brought about "the establishment of an increasing number of small herds on medium-sized farms," according to University experts (Crickman et al 1934: 8-9). Dual-purpose cattle, raised for both milk and meat, dwindled in number as producers focused instead on beef breeds. Cattle were fed pasturage, high quality fodder such as alfalfa, roughage such as cornstalks, and grain, including corn (Crickman et al 1934: 8-9).

By 1915, Minnesota ranked fifth nationwide in the number of beef cattle. In 1940 beef cattle were being raised in nearly every county, although production was concentrated in the southwest, the southeast, and in west central Minnesota and the Red River Valley (Crickman et al 1934: 9). Some farmers raised cattle from calves to market weight, but others specialized in one of four specific beef cattle operations:

- Cow-calf farms raised large crops of calves that were sold to other farmers who fattened them to market weight.
- Pasture feeding operations fed cattle on range or pasture. As land values increased, pasture operations became less common in Minnesota.
- Feedlot operations, which fed cattle in confinement, were common in the Corn Belt counties of southern Minnesota. Often cattle were first raised on pasture, then hauled to feedlots for a final few months of grain feeding, which produced the marbled meat that consumers wanted.
- Breeding stock production. The farms raised specialized breeds for herd improvement. The most common Minnesota cattle breeds were Angus (black), Hereford (red and white), and Polled Hereford (without horns).

Specialization in beef production continued to increase after 1940 (Blegen 1975: 395-396; Britton 1983: 18-20; Tweton 1989: 270-271).

Hogs. Minnesota hog production developed even faster than beef. Between 1880 and 1900, pig numbers rose almost 400 percent to 1.4 million. At first most hogs were raised on dairy farms where they were fed the skim milk. After 1900, however, hog production was linked with increasing corn yields, and southern Minnesota farmers began to raise more hogs than those in any other part of the state. The experience of Fillmore County demonstrates the trend: "Fillmore County, which for many years had led Minnesota in wheat, became the leading corn county. . . . Used almost entirely as hog feed, corn soared from 14.8 million bushels produced in 1880 to 67.9 in 1910" (Tweton 1989: 271).

With hybrid improvements in the 1930s and the 1960s, corn production moved northward as did hog raising. By the 1980s, Minnesota swine numbers reached 5 million, and the state ranked third nationally in hog production.

Like beef cattle producers, hog farmers made rapid gains in productivity thanks in part to improved technology. Litter sizes increased, more hogs survived the piglet stage, and feeder pigs gained weight faster as farmers employed selective breeding, better housing including portable cots (small, movable houses for a sow and litter), sophisticated feed mixes, and improved veterinary techniques.

Sheep. In 1910, Minnesota farmers raised about 600,000 sheep and produced 3 million pounds of wool. Beginning about 1925, feeder lambs became important in the Red River Valley, where they were fed the tops of sugar beets, a new crop in the area. In the 1930s South St. Paul was the country's seventh-largest sheep marketing center, with Denver and Chicago ranking first and second (Anderson 1943: 511-514).

After World War II, sheep, lambs, and wool declined in importance in Minnesota. Falling lamb consumption and competition from western growers (who had the advantage of low-cost grasslands) pushed Minnesota sheep numbers down to 275,000 by the 1980s. Production shifted from northern to southwestern Minnesota, although small flocks could be found throughout the state (Tweton 1989: 272).

Poultry and Eggs. Between 1900 and the 1940s, poultry raising remained widely distributed across Minnesota. Nearly all farms raised poultry on a small scale and some larger egg producers were concentrated around the Twin Cities. Eggs were the most salable product; the market for poultry meat remained limited by traditional consumption patterns, with many Americans eating chicken only on Sunday and turkey only at Thanksgiving (Tweton 1989: 277).

Poultry raising fit well into diversified family farm operations, and poultry raising increased steadily during the first decades of the 20th century. The University of Minnesota reported that between the early 1930s and 1948 there was "a virtual doubling of egg production per [Minnesota] farm" due to increased flock size and improvements in breeding and technology. Compared to other types of livestock, egg production gained faster than either hog production or the production of butterfat during the years those years (Hady and Nodland 1951: 3).

LIVESTOCK MARKETING

In 1935 Minneapolis engineer Frederick M. Jones developed the world's first refrigeration unit for a truck, an invention that revolutionized the transport of meat, poultry, and other farm products. In 1938 Jones and partner Joseph Numero formed the U.S. Thermo Control Company, later known as Thermo King. The company is still in existence.

By the 1940s, Midwestern farmers were using several methods to market livestock. Among them:

- shipping livestock to a central market where a commission company sold the animals on behalf of the farmer
- selling at smaller, usually seasonal, regional auction barns
- selling for slaughter on consignment
- selling directly to meatpackers
- selling in local markets to other farmers, local butchers, or local livestock buyers
- directly marketing meat to consumers (Anderson 1943: 53).

Terminal Markets and Meatpacking. The establishment of Minnesota stockyards and meatpacking plants created more demand for livestock, and the Twin Cities' importance as a railroad center helped it become one of the nation's leading livestock markets competing with Chicago, Omaha, and others. The centerpiece, the St. Paul Union Stockyards, opened in South St. Paul in 1886. Stockyard investors hoped to attract cattle and hogs from Minnesota and states farther west, and also lure the big Chicago meatpacking companies to town. The yards created a venue for commission sellers to meet livestock buyers, while the Stockyards supplied the infrastructure and services necessary to facilitate the exchange. The Stockyards were immediately successful, and by the 1940s, they were among the world's largest (Jeffrey 1989: 252).

The success of the South St. Paul Stockyards was directly tied to the development of meatpacking in the state. Within a year of the Stockyards' opening, Fowler Brothers of Chicago built a meatpacking plant in South St. Paul, and in 1897 Swift and Company of Chicago built another. Armour and Company, also of Chicago, built a $14 million plant in 1919, and in 1925, another Chicago meat giant, Cudahy, arrived to take over the failed Farmers Terminal Packing Company.

Meanwhile, George A. Hormel and Company, which originated in 1887 as a small butcher shop in Austin, was building a successful meatpacking business, still in that city. By 1917, Hormel was slaughtering over 450,000 hogs per year and had opened distribution centers in Minneapolis, Duluth, Chicago, and other cities nationwide. Hormel's innovative pork products – including canned hams and the famous Spam – gained a national following (Tweton 1989: 276).

Meat processing grew faster than any other Minnesota manufacturing sector in the first two decades of the 20th century. In 1900, meatpacking was Minnesota's fourth-ranking industry by value of products, and by 1919, it ranked second, behind milling. After the decline of the flour industry in the 1940s, meatpacking became the state's largest employer (Jeffrey 1989: 225; Tweton 1989: 276).

After decades of success, volume at the St. Paul Union Stockyards declined in the 1960s. Meat processors began to buy livestock directly from feedlot farmers, and smaller, regional auction barns appeared. The Chicago giants closed their outmoded Twin Cities plants and left town. Other packers built smaller, highly automated plants in rural areas, closer to the supply of animals and to cheaper labor. But Minnesota's homegrown meatpacking giants, Hormel and Jennie-O Foods, a turkey processor established in 1949 in Willmar, invested heavily in advertising, new products, and distribution, becoming two of Minnesota's leading food companies (Jeffrey 1989: 224-225, 232; Tweton 1989: 275-278).

Cooperative Shipping and Marketing. The stockyards and meatpacking industries created strong demand for Minnesota cattle and hogs. Still, most small Minnesota farmers weren't in a position to sell their animals in South St. Paul – mainly because they didn't have enough animals to secure competitive railroad shipping rates to the terminal market. Consequently, "their main market remained the local buyer who dealt with them individually, leaving the sellers little bargaining power," explains Tweton (Tweton 1989: 276).

Like dairy farmers before them, livestock farmers formed cooperatives to gain market power. In 1908, farmers around Litchfield organized Minnesota's first cooperative livestock shipping association, and within a few years, nearly 600 similar associations were sending cattle, hogs, and sheep to the South St. Paul stockyards. Cooperative marketing associations were successful at allowing farmers to pool their animals and thereby reduce rail costs. The associations flourished in the 1910s and 1920s, and then started to decline in the 1930s, when gasoline trucks (which had no minimum car lots) began to replace railcars as the main method of shipment (Dowell and Warrington 1938; Tweton 1989: 276).

In a related marketing venture, Minnesota farmers in 1921 organized a cooperative livestock commission sales service, the Central Cooperative Commission Association, to increase farmers' bargaining power by handling large volumes of animals. Based in South St. Paul and now called the Central Livestock Association, the cooperative is still one of the nation's highest-volume livestock commission sellers (Tweton 1989: 276).

CHARACTERISTICS OF FARMS FROM DEVELOPMENT OF LIVESTOCK INDUSTRIES, 1900-1940

- farms mixing horse power with gasoline engines
- improved infrastructure (e.g., water systems, electricity generators)
- farms with lots of fencing
- improved farm layout
- drainage structures
- windbreaks, woodlots, and shelterbelts planted in prairie areas
- stockyards
- stock chutes, hog wallows, stock tanks
- pastures
- silos
- general purpose or combination barns
- barns with hay mows
- dairy barns
- barns with windows; structures oriented or sunlight and wind
- milk houses
- pole-framed beef barns
- bull barns
- hog barns with concrete floors and yards
- colonies of hog cots
- corncribs
- grain bins
- sheep barns
- automobile garages
- implement sheds
- farmhouse improvements
- structures of poured concrete, concrete block, cement staves, sheet steel, sheet iron
- buildings of dimensional lumber and other purchased materials
- plank and balloon frames
- automated equipment for feeding and barn cleaning
- gambrel, gothic arch, and rounded arch roofs
- pre-cut "kit" or mail-order buildings
- designs influenced by science, engineering, management principles
- designs influenced by materials manufacturers, agricultural engineers
- designs influenced by technical bulletins

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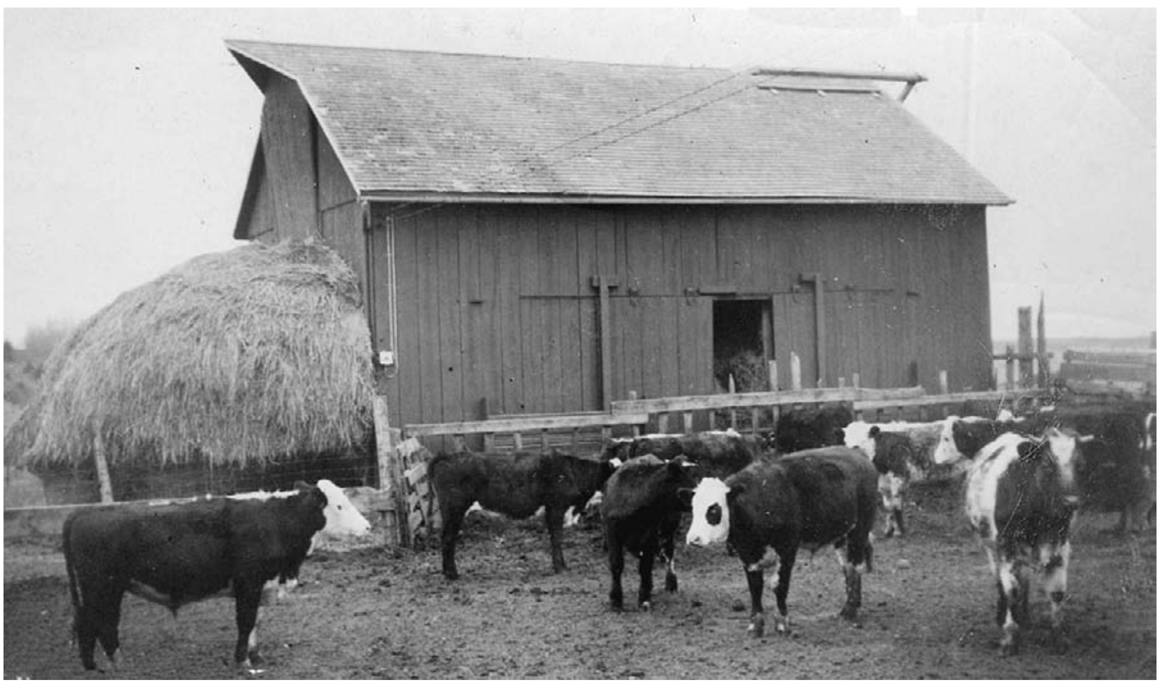
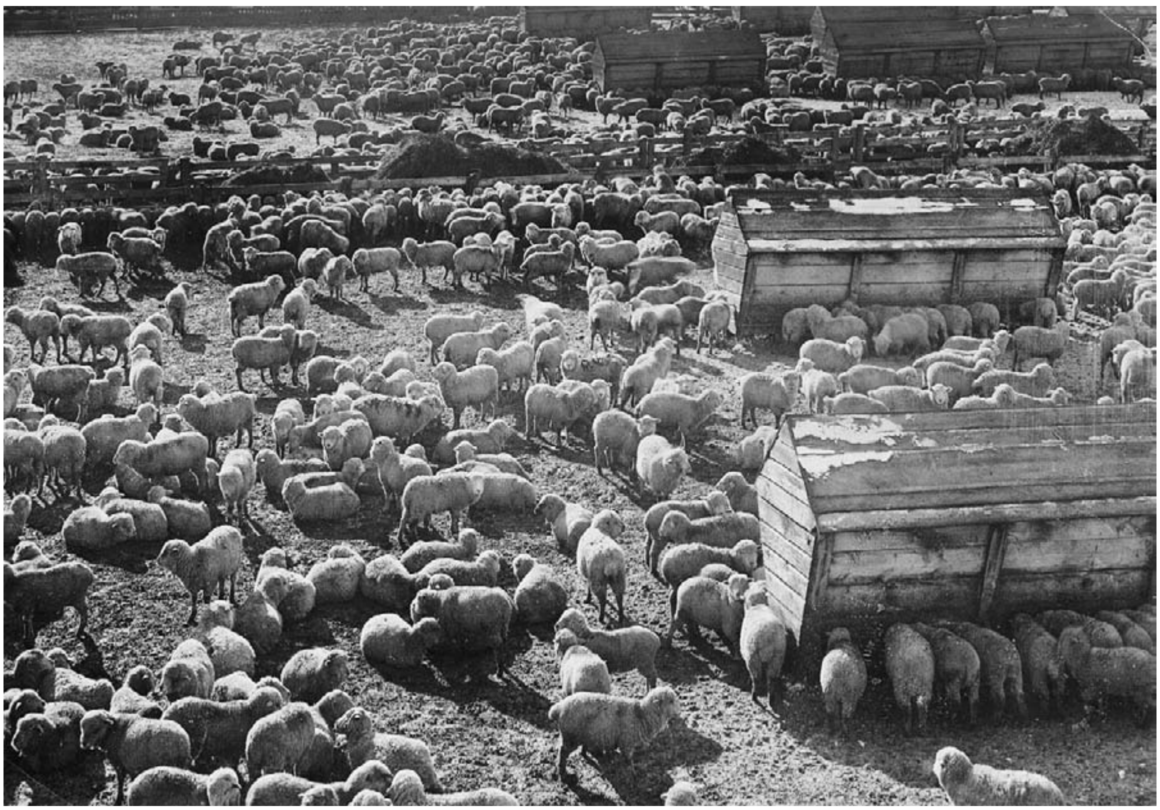
The diversification of Minnesota farms in the late 19th and early 20th centuries created the basis for later growth in livestock. Many farms raised pigs which were fed farm byproducts like skim milk, as well as some grain. Ear corn was stored in wooden corncribs like this one. They were generally filled and emptied with a shovel. Graff Farm near Marietta, circa 1910. (MHS photo by Carl Graff)



Feeder cattle. Dakota County, circa 1930. (MHS photo)

This pig barn had windows in the side walls and in the monitor to light two rows of stalls. The pigs ate at low, wooden troughs. The yard was surrounded by steel woven wire fencing (also called "hog wire" fencing). The brick structure with a stovepipe (at left edge) was probably a feed cooker. Farm possibly near Stillwater, 1940. (MHS photo by *Minneapolis Star Journal*)



A sheep farm. The wooden feeding structures, sometimes called "grain self-feeders," display a typical keystone shape. Location unknown, circa 1930. (MHS photo by Harry Darius Ayer)

PERIOD 7: DEPRESSION AND THE INTERWAR PERIOD, 1920-1940

An agricultural depression began in 1920 after two decades of farm prosperity. Then, in 1929, the Great Depression hit, bringing sharp drops in already-depressed agricultural exports and crop and livestock prices. Many government farm support programs that exist today originated as Depression-recovery efforts. Despite farmers' hardships, innovation and agricultural productivity continued.

Milestones of this Period

1920-21	–	Sharp postwar recession
1922	–	Capper-Volstead Act gave cooperatives legal standing
1923	–	Minnesota Agricultural Experiment Station and several partners erected the nation's first experimental rural electrical line near Red Wing; this farm electrification project ran 1923-1928
1923	–	Meeker County became first in state to test all cows for tuberculosis
1924	–	Great Northern Railroad helped establish the Agriculture Credit Corporation to help offset a crisis in agricultural credit
1926	–	Hybrid seed corn introduced commercially
1929	–	University of Minnesota established a master's degree in Agricultural Engineering; PhD added in 1947
1929	–	Stock market crashed
1930	–	Minnesota had 23,342 farmhouses using electricity, ranking 29th among states
1930	–	Congress authorized a 9'-deep Mississippi River channel with locks and dams
1930	–	Statewide dairy testing and record keeping service established; housed at the University
1932	–	Low pressure pneumatic tires introduced
1932	–	Farm prices and income reached Depression low point
1932-33	–	Farmers' Holiday movement fought farm mortgage foreclosures
1933	–	First New Deal farm programs established in March; first Agricultural Adjustment Act passed
1935	–	Number of Minnesota farms peaked in the mid-1930s
1935	–	Rural Electrification Administration established; the first REA pole was erected in Minnesota the same year
1935	–	Farm tenancy was 33%, up from 25% in 1920
1938	–	Second Agricultural Adjustment Act passed
1940	–	35% of Minnesota's population lived on farms
1941	–	35% of U.S. farms had electricity compared to 10% in 1936

See also

Farms
Corncribs
Granaries, Elevators, Bins, Dryers
Erosion Control Structures
Shelterbelts
Appendix: Focus on Farm Electrification

AGRICULTURE IN THE 1920s

For much of America, the middle and late 1920s were years of prosperity, technological innovation, and business expansion. But for farmers, the "Roaring Twenties" were a time of economic hardship and financial setback (Blegen 1975: 480; Plank 2003: 6).

The farm depression that began in 1920 had been preceded by two decades of sustained economic growth in American agriculture. From 1897 to 1910, crop prices rose steadily, outpacing non-farm prices. These 13 years of prosperity were followed by "the parity era" – the period of 1910-1914, when farm prices reached their apogee compared to the cost of living. (Parity goals for later farm subsidy programs used this era as a benchmark level.) Farm prices were high and stable, trade terms were favorable, and per capita farm income rose.

The good times for farmers had continued through World War I. Worldwide demand for food shot up, triggering a sharp rise in farm prices in 1916. The government urged farmers to produce more food to supply soaring need. Historian Jerome Tweton explains, "To the slogans, 'Food Will Win the War' and 'Plow to the Fence for Defense,' farmers planted 30 million additional acres and took whatever measures were necessary to increase output" (Tweton 1988: 21). Foreign demand for American farm products stayed strong through 1919, fueled by the war and reconstruction. In 1918 and 1919, farm prices reached new heights, double the pre-war levels (Cochrane 1993: 100-111).

High commodity prices led to strong demand for good cropland. Farmers bid against each other for land, taking advantage of lenient, long-term credit offered by the Federal Land Banks, which had been established in 1916. Land prices rose 70 percent between 1913 and 1920 and, in the best farming areas, doubled. Farmers borrowed money to buy labor-saving machinery during the labor shortages caused by the war. In 1925, farmers were using roughly 40 percent more machinery than in 1910 (Cochrane 1993: 100-111; Minnesota Institute 1939: 26; Tweton 1988: 21).

In late 1918, World War I ended. As postwar relief efforts tapered off in the summer of 1920 and long-dormant European agriculture resumed, foreign demand for American farm goods slackened. Food exports fell by more than half, from a high of $4 billion in 1919 to $1.8 billion in 1922. In addition, according to one source, "The nations of the world entered a period of nationalistic policy in which self-sufficiency was the goal. Tariffs, quota restrictions and other forms of trade barriers were adopted both here and abroad to encourage home production and to stifle importation of competitive products" (Minnesota Institute 1939: 24). Consequently, American farmers lost much of their foreign market. Even at home, markets were soft as average Americans, used to wartime restrictions and seeking fashionably slim 1920s figures, were not buying grain, beef, eggs, poultry, and other foods at high levels. While demand decreased, production remained high. Tweton explains that farmers "could not adjust to the smaller market. Armed with new technology and scientific advances in breeding and seed development, farmers easily maintained or increased production" (Tweton 1988: 21-22).

The overproduction, unfavorable tariffs, and soft markets caused big crop surpluses, which drove down prices. In July 1920, for example, wheat sold in Minneapolis for $2.96 a bushel. A year and a half later, it was 92 cents. In the three years after the war, 1919-1922, wheat prices fell 57 percent, corn tumbled 52 percent, hog prices dropped 58 percent, beef cattle 43 percent, milk 36 percent, and chickens 22 percent. Although prices rebounded slightly between 1923 and 1930, they never approached the highs of 1918-1919 (Tweton 1981: 9; Tweton 1988: 22).

National farm income plunged. From almost $17 billion in 1919, it was less than $12 billion in 1929. In Minnesota, where the value of crops dropped more than one-third, farm income fell from $506 million in 1919 to $310 million in 1929, despite big increases in acreage under production (Tweton 1988: 22; Blegen 1975: 480-481).

Meanwhile, the prices that farmers had to pay for goods did not decline as much as crop prices. This severely eroded farmers' purchasing power. Few farmers could afford the comforts that city folk were getting in the 1920s like running water, indoor plumbing, lights, and electricity. In the Midwest, three-fourths of farm homes had no modern household equipment whatsoever during the 1920s (Nass 1989: 144-146; Jellison 1993: 39, 55). One observer wrote, "Through the decade from 1920 to 1930 farmers in general let their buildings go, making only minor repairs and hoping against hope that times would become better" (Ekblaw 1935: 268). Adding to farmers' burdens, rural property taxes nearly doubled during the decade.

Low income and skidding land values made it hard for farmers to repay their loans. Many Minnesotans mortgaged or remortgaged their farms and lost them to foreclosure. Banks that had overextended their farm loan portfolios during the prosperous war years went bust. Nearly 400 Minnesota banks closed in the 1920s, and Minnesota became "one of seven western grain states that suffered nearly half of all the bank failures in the United States from 1921 to 1929," according to historian Theodore Blegen (Blegen 1975: 481). To help alleviate the crisis, the Great Northern Railroad in 1924 set up the Agriculture Credit Corporation, which loaned money to farmers to buy foundation livestock such as dairy or dual-purpose cows and purebred bulls, or breeding ewes and purebred rams (Dickman 1977: 220; Tweton 1988: 22).

In spite of hard times, there were positive developments in Minnesota agriculture. Milk production increased and diversification continued, partly blunting the effects of the farm depression. Farm cooperatives won legal status in 1922 with the federal Capper-Volstead Act, cosponsored by Minnesota Congressman Andrew Volstead. As the Minnesota cooperative movement gained strength, farmers formed mutual associations to cooperatively purchase insurance, telephone service, farm supplies, and fuel. The Minnesota Farmers' Union entered the grain terminal and wholesale farm supply markets, doing business as the Farmers' Union Grain Terminal Association (GTA) and the Farmers' Union Central Exchange (Cenex), which became two of the country's leading cooperatives.

Technological advances continued. In 1924 International Harvester introduced the first lightweight gas-powered tractor, the Farmall. In 1929 one farm expert wrote of the gasoline tractor, "A one-man machine that takes the place of eight men and sixteen mules at plowing, ten men and twenty mules at cultivation, and cuts a harvest and threshing job from $5 to 50 cents an acre, creates nothing short of a revolution" (Doane 1929: 27). In 1932 low pressure pneumatic tires were introduced, soon proving to be a big improvement over plain steel tractor wheels. However, the adoption of tractors and other new implements was slowed by hard times and most farms still relied on draft animals. According to a 1929 University study, 100 percent of the Minnesota farms sampled were using work horses, 17 percent were using tractors, 10 percent were using trucks, and only 4 percent were using electricity (Cavert 1930).

Combine harvesters were first used in Minnesota in 1927, and by 1931, about 250 tractor-drawn combines had been sold in the state. Owners usually did custom work for other farmers to help offset the expense of the new equipment. In 1935, a smaller, lighter, one-man combine powered by a smaller tractor became available. These "baby" combines cut a 5′ to 8′ swath, making them practical for average Minnesota farmers (Anderson 2002: 672, 686).

Transportation also improved. Heavy freight traffic on the Mississippi River had declined during previous decades, losing ground to railroads and thereby offering farmers no alternative to paying railroad freight rates. In 1930 the federal government began a ten-year, multi-state project to revive river shipping by building a consistent 9′-deep channel with 23 locks and dams between Red Wing and Alton, Illinois. Rural road building – also critical for getting farm crops to market – increased considerably in the 1920s and 1930s after the creation of the state trunk highway system in 1920 and a large infusion of state and federal money (Blegen 1975: 481-485).

The Minnesota Agricultural Experiment Station continued its research and outreach in the 1920s, helping to stimulate productivity gains. The federal-state Cooperative Extension Service, which had been created in 1914 and placed agents in every Minnesota county during World War I, brought the fruits of the research to farmers. In the 1920s, Minnesota county agents:

- encouraged farm diversification
- promoted new crops like alfalfa, soybeans, and hybrid corn which spurred growth of the state's livestock and dairy industries
- promoted efficient land clearing methods
- taught new methods to control devastating poultry and livestock diseases such as bovine tuberculosis and brucellosis
- helped organize cooperatives and farm bureaus
- advanced programs for women and farm youth

But in the late 1920s, as the farm depression continued, about one-third of Minnesota counties had to drop their extension agents because they could no longer afford to pay them. "During these years the counties that had dropped county agent work made little progress in organization or technical development," an extension historian wrote (McNelly 1960: 87-88).

AGRICULTURE IN THE 1930s

The economic depression that began for farmers in 1920 spread to the rest of the nation in October 1929, with the collapse of the stock market. A four-year plunge in industrial production followed, accompanied by crushing unemployment. Between 1929 and 1932, industrial production declined by 80 percent and the unemployment rate was nearly 25 percent (Cochrane 1993: 101, 120). Blegen wrote:

> Minnesota had experienced bank failures and acute agricultural distress in the 1920s, but these bore little comparison with the slump after 1929. The 'great depression' affected not banks and farmers alone, but the gamut of the economy of state and nation. The country was paying the price for the vast and swift expansion of its industry and agriculture, the spread of credit, the inflation of capital surpluses, the very efficiency of new machines. . . . Troubles were deepened by tariff policies that impinged upon America's foreign trade (Blegen 1975: 522).

U.S. agricultural exports dropped by two-thirds from 1929 to 1932. Farm prices fell even more sharply than they had after World War I – corn dropped from 80 cents to 32 cents, wheat from

$1.04 to 38 cents, beef cattle from $9.47 to $4.25, and eggs from 30 to 14 cents per dozen. Farm income dropped 60 percent between 1929 and 1932 (Tweton 1981: 9; Tweton 1988: 22-23).

In Minnesota, dairy farmers' income fell by three-fourths in 1931 alone. Farmers sold pigs for three cents a pound and milk for two cents a quart. Droughts and grasshopper plagues added to their miseries. Severe feed shortages forced many farmers to sell the livestock herds they had painstakingly built. By 1932, farm mortgage foreclosures were common in Minnesota. In 1933 – the depth of the Depression – 60 of every 1,000 farmers went bankrupt or lost their farms through foreclosures (Blegen 1975: 524-526; Tweton 1981: 9; Brinkman 1988: 21; Tweton 1988: 119).

Minnesota prices hit bottom in 1932. Between 1933 and 1937 they inched upward, but then slipped again in 1938 and 1939. Net farm income averaged just $454 a year from 1930 to 1934, and didn't climb to $1,000 a year until 1941.

Capital investments in new buildings and equipment were down during the Depression. Between 1930 to 1935, for example, there was significant negative investment in U.S. agriculture as depreciation of farm buildings and equipment exceeded new investments by over $300 million a year.

Although most farmers were in serious financial trouble during the Great Depression, some regions of the state suffered more than others. Farmers in the southern counties and the Red River Valley generally fared better than those in other parts of Minnesota. Faribault, Houston, Mower, Nicollet, Jackson, Scott, Wabasha, and Goodhue counties in southern Minnesota got enough moisture to grow crops and hay for the livestock. Many farms in this region – which was the first in the state to be settled – had low debt and were well diversified, producing hogs, poultry, cattle, dairy herds, corn, hay, and mixed grains. According to Tweton, "The southern Minnesota farmer had long ago abandoned his dependence upon one crop. . . . This diversification played an instrumental role in the economic condition of the area" (Tweton 1981: 13).

The Red River Valley, still largely dependent on wheat in the 1930s, was more distressed than southern Minnesota. Still, counties "north from Wilkin salvaged reasonable crops due to rainfalls which were less than normal but adequate," writes Tweton (Tweton 1981: 13). But counties south of Wilkin in west central Minnesota were ravaged by drought and grasshoppers, and hundreds of farmers in Big Stone, Stevens, Pope, and Swift counties were wiped out. In Big Stone, the hardest hit of Minnesota's counties, "60 percent of its residents struggled to survive on relief" (Tweton 1981: 13). Farmers in central Minnesota, including Stearns, Kandiyohi, and Meeker counties, did a little better because they were more diversified than those in west central Minnesota (Tweton 1981: 13).

As the Depression deepened, the Farm Holiday movement (one of a series of agrarian reform movements) gained strength in Minnesota. Minnesota farmers launched a 30-day strike in September 1932 to demand farm mortgage moratoriums, congressional action to lower the cost of farm credit, and a state guarantee of minimum prices for farm products. The Minnesota Legislature offered some relief in 1933 by passing a farm mortgage moratorium law. Minnesota's Farmer-Labor coalition of 1918-1944, considered to be the most successful third-party movement in U.S. history, succeeded in winning several major political offices including the governorship (Blegen 1975: 524-526; Tweton 1988: 31; Jellison 1993: 69).

Despite low commodity prices, farm incomes, and levels of capital investment, agricultural productivity increased in the 1930s, just as it had in the previous decade. Farmers continued to adopt new technology, increasing their total output by 11 percent in the 1930s. This came on the heels of a 15 percent increase in productivity in the 1920s (Cochrane 1993: 108-110, 137). The benefits of labor-saving machines were considerable and "The Great Depression seems not to have slowed down the innovation and adoption of new devices very much," observed historian John T. Schlebecker (Schlebecker 1975: 254). Tractors were a prime example. Tractor use quadrupled between 1920 and 1930 to nearly 1 million, or about one out of every six farms nationally. In Minnesota, 25 percent of farmers had a tractor by 1930 and by 1940, half did (Minnesota Institute 1939; Engene and Pond 1944: 28; Jellison 1993: 54; Cochrane 1993: 108-110, 137, 198).

Although thousands of farmers lost their farms every year during the 1930s, the number of farms did not decrease. Bankrupt farm families often remained on the land as renters, or other tenant families moved in. Farm tenancy in Minnesota increased from 25 percent in 1920 to 33 percent in 1935, in line with national trends (Minnesota Institute 1939: 23).

The number of U.S. farms held fairly steady during the Great Depression at about 6.5 million. The total number of Americans living on farms also remained even, averaging about 31 million for the decade. This happened despite a sharp decline in the number of man-hours employed in farming (Cochrane 1993: 122). Economist and historian Willard Cochrane explained that most farmers and their families,

> . . . did not leave the land, or at least did not leave the rural areas. They did not because they could not. Unemployment and lack of economic opportunities in urban areas kept them dammed up as underemployed farm labor in rural areas. What we had then in the 1930s was a large, redundant, or underemployed labor force in the farm sector which did not appear unemployed because the individuals involved shared the forced leisure and the low returns from farming with other members of the immediate families with which they lived. This is the way that farm people survived in the 1930s. A large but underemployed labor force in combination with limited capital . . . produced to the maximum year after year during the depression years, shared the meager returns in accordance with family modes of living, and waited for an economic miracle to happen (Cochrane 1993: 123-124).

In 1935 there were 928,487 Minnesotans living on farms. Minnesota farms were being operated by 317,401 family member-workers and 38,846 hired workers.

Minnesota farm population had risen about four percent between 1930 and 1935, with fewer young people leaving the farm in these years and an influx of unemployed city people moving to rural areas. There were also active resettlement efforts in the northeastern cutover regions. As a result of this migration, the number of Minnesota farms rose almost ten percent, from 185,000 in 1930 to 203,000 in 1935 – the all-time high. But about a quarter of the additional farms were less than 20 acres. Many were worked by former urban residents who had left the city for small subsistence-level farms after they became unemployed (Minnesota Institute 1939: 28, 30; Engene and Pond 1940).

GOVERNMENT FARM PROGRAMS OF THE 1930s

The long slump of the 1920s, the hardships of the early 1930s, and the drama of rural protests focused the nation's attention on the farm problem and the need to take remedial action. In 1929, the Hoover administration passed the Agricultural Marketing Act, which encouraged farmers to form national marketing cooperatives. A Federal Farm Board was established to bolster sagging prices by making crop loans. But the program was overwhelmed by the scope of the nationwide depression, and in 1931, after accumulating huge stocks of surplus commodities, it ran out of money (Tweton 1988: 114).

In 1932, Franklin D. Roosevelt was elected president, promising a "New Deal" for farmers and the American people. In June 1933, Congress passed the Agricultural Adjustment Act – one of the first pieces of New Deal legislation. The AAA tried to raise farm prices by reducing the supply of commodities. The program used "acreage allotments" to restrict the number of acres of cropland under cultivation. In return for voluntarily cutting their production, farmers received a "benefit check," which was funded by an excise tax on millers and meatpackers. Under the AAA, the government paid out more than one billion dollars to farmers in 1934 and 1935. But crop surpluses and low prices persisted, despite acreage controls and droughts in 1934 and 1936, because farmers steadily increased their yields with new seeds, fertilizers, and machinery (Cochrane 1993: 141; Minnesota Institute 1939: 17).

In 1936, the Supreme Court ruled the AAA unconstitutional because of its method of funding (the tax on millers and meatpackers) and the program abruptly ended. Congress immediately passed the Soil Conservation and Domestic Allotment Act, which paid farmers to reduce the acreage of soil-depleting crops and rebuild the land. But this approach did not work well to reduce total crops either. Surpluses increased in 1937-1938 and prices declined again. So Congress supplemented the soil conservation program with the Agricultural Adjustment Act of 1938, known as "the second AAA." This seminal legislation shaped all future farm policies, and forms the basis for farm support programs that continue today. The 1938 AAA continued acreage restrictions and added direct support payments to farmers, marketing controls, crop storage loans, and surplus disposal plans. All these schemes tried to limit the flow of farm products into the market in order to lift prices to "parity" levels, which were more in line with the prices farmers had to pay for goods. In 1938, 5.25 million farmers received AAA payments (Saloutos 1982: 265; Tweton 1981: 17-19; Tweton 1988: 121-124; Cochrane 1993: 142-144, 317).

One of the ways the 1938 AAA supported crop prices was through the "Ever-Normal Granary," which attempted to control the volume of commodities reaching commercial markets. Under this plan, the Commodity Credit Corporation made nonrecourse loans to farmers on their surplus crops at a level slightly below parity. This created a price floor. The crops under loan were to be stored on the farm, and sold later when market prices presumably would rise above parity. The farmer would then repay the government loan. If prices did not rise, the grain was forfeited to the government which stored or destroyed it, thus removing it from trade channels (Cochrane 1993: 143; Tweton 1981: 18-19; Tweton 1988: 121-124). The Ever-Normal Granary program spawned a great wave of grain bin construction as Minnesota farms stored grain under loan (Minnesota Institute 1939: 17). By 1940, the nation's supply of stored surplus crops was, as one report put it, "exceptionally strong" (Saloutos 1982: 259).

In addition to AAA farm support payments and crop loans, there were many other New Deal programs designed to help farmers weather the Great Depression. Among them:

The Emergency Farm Mortgage Act (1933) helped farmers refinance their mortgages at lower interest rates. By the end of 1935, about 14 percent of the nation's mortgaged farms had been refinanced, saving thousands of farms from foreclosure (Tweton 1988: 125; Cochrane 1993: 113).

The Farm Credit Administration (1933) reorganized farm credit programs and established Production Credit Associations to make loans to farmers. The law also established a system of banks to make loans to cooperatives. As private credit dried up during the Depression, the Federal Land Banks greatly increased lending activities. Long term loans secured by "normal" land values could be used for buying cropland, machinery, and livestock. Land Bank real estate loans reached a peak of $2.85 billion in 1936 and then declined to $2.4 billion in 1940 (Saloutos 1982: 269; Tweton 1988: 125-126; Cochrane 1993: 113).

Feed and Livestock Programs. The droughts of 1933, 1934, and 1936 left many farmers with little or no livestock feed. Both the federal government and the State of Minnesota established emergency feed-loan programs that saved many drought-stricken farmers, especially in west central and central Minnesota (Tweton 1988: 126-127).

During the drought years, the government also bought cattle that farmers couldn't afford to feed. In Otter Tail County, for example, farmers sold 23,000 head of cattle in 1934 through the federal government's emergency livestock purchasing program, thereby reducing county herds by about 20 percent (Tweton 1988: 119).

The Federal Emergency Relief Administration (FERA) provided "work off" loans for seed and animal feed. Rather than repaying the loans in cash, farmers worked on FERA projects, usually building local roads (McNelly 1960: 123; Cochrane 1993: 224). The road projects were a particular boon to farmers since, according to Jerome Tweton, "Except for the main highways, before the New Deal most farm-to-market roads were little more than wagon ruts" (Tweton 1988: 165).

The Civilian Conservation Corps (1933) employed young men to do conservation work, such as erosion control, drainage projects, forest and park improvements, tree planting, and road and trail construction. The CCC employed an average of 13,000 Minnesota men a month (Tweton 1981: 23; Cochrane 1993: 293).

The Shelterbelt Program (1934) was created after the drought and dust storms of 1934 to alleviate soil erosion. Millions of trees were planted on private land by CCC and WPA workers to save soil in prairie states.

The Soil Conservation Service (1935) was established to promote conservation through contour plowing, strip-cropping, field terracing, and other preservation methods and land use practices. The SCS worked with the CCC to build farm erosion control systems in Minnesota, especially in the southeast. Today the agency is called the Natural Resources Conservation Service.

The Resettlement Administration (1935) found new homes for destitute rural and urban families. In Minnesota, the Resettlement Administration relocated 300 families living near Lake of the Woods from submarginal lands to better farms nearby.

The Rural Electrification Administration (1935) made loans to rural cooperatives to build power lines and distribute electricity to farms. Electricity made farmers more efficient, allowed the use of new machinery like milking machines, decreased farm labor costs, and improved living conditions. According to Tweton, "No New Deal program was more popular with farmers than the REA" (Tweton 1988: 145).

The Federal Crop Insurance Act (1938) offered federal insurance to protect wheat growers against crop losses. Federal insurance was later offered on other crops.

The New Deal also poured enormous funds into work relief programs, beginning with the Federal Emergency Relief Administration (FERA) and continuing with the Works Progress Administration (WPA) and other agencies. These programs put unemployed people to work on an array of civic projects – for example, building streets and roads, water and sewer systems, libraries, hospitals, playgrounds, schools, and bridges – and many other types of work. In addition, the federal government in the 1930s began comprehensive road construction programs and water resource development projects that included navigation, flood control, drainage, irrigation, and water power. All of these improvements supported agriculture (Cochrane 1993: 224-226).

Many New Deal farm programs were run through the Minnesota Extension Service in each county. County agents administered myriad aid programs, led efforts to combat grasshoppers, and helped organize Rural Electric cooperatives – to name a few. Public dollars for agricultural research and extension jumped almost 40 percent during the 1930s (McNelly 1960: 72-75, 93-129; Cochrane 1993: 247).

The start of World War II in Europe in 1939 created, once again, huge demand for food and fiber. Again, farm prices rose rapidly and American farmers responded to the demand, producing record crops during the war. Blegen explained, "An extraordinary chapter in the history of World War II is that of the American miracle of production. It has been characterized as a 'joint effort by managers of industry, engineers, technicians, scientists, laborers of all categories of skill, and farmers.' . . . There was an exuberant, but purposeful, release of energy after the sagging years of the depression" (Blegen 1975: 545).

CHARACTERISTICS OF FARMS FROM THE DEPRESSION AND INTERWAR PERIOD, 1920-1940

- farms mixing horse power with gasoline engines
- newly-electrified farms
- farms that were rented rather than owned
- farms on which lenders foreclosed
- farms associated with resettlement efforts
- farms associated with the "back to the land" movement
- larger fields to accommodate new machinery
- conservation techniques and erosion control structures
- drainage structures
- windbreaks, woodlots, and shelterbelts planted in prairie areas
- farms with lots of fencing
- pastures
- minimal new construction
- remodeled and reused buildings

- silos
- general purpose or combination barns
- barns with hay mows
- dairy barns
- early examples of one-story dairy barns with separate milking parlors
- milk houses
- pole-framed beef barns
- bull barns
- hog barns, hog cots
- corncribs
- new grain bins
- sheep barns
- automobile garages
- implement sheds
- structures of poured concrete, concrete block, cement staves, sheet steel, sheet iron
- buildings of dimensional lumber and other purchased materials
- plank and balloon frames
- gambrel, gothic arch, and rounded arch roofs
- pre-cut "kit" or mail-order buildings
- designs influenced by science, engineering, management principles
- designs influenced by materials manufacturers, agricultural engineers
- designs influenced by technical bulletins

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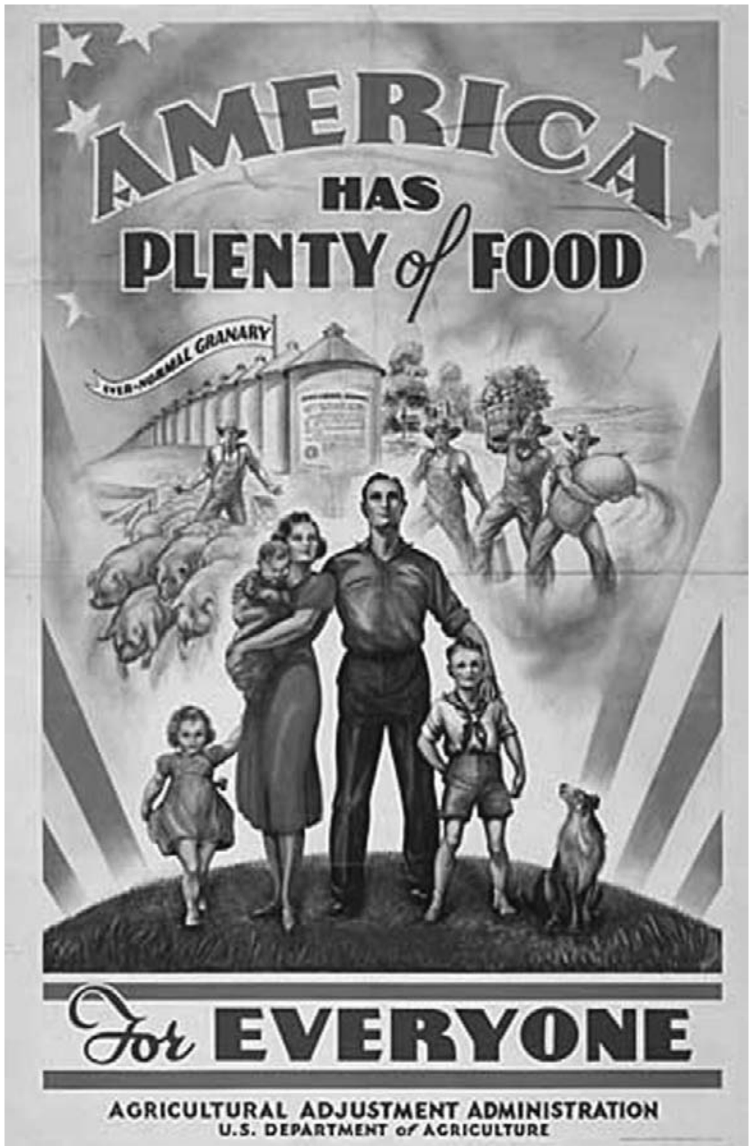
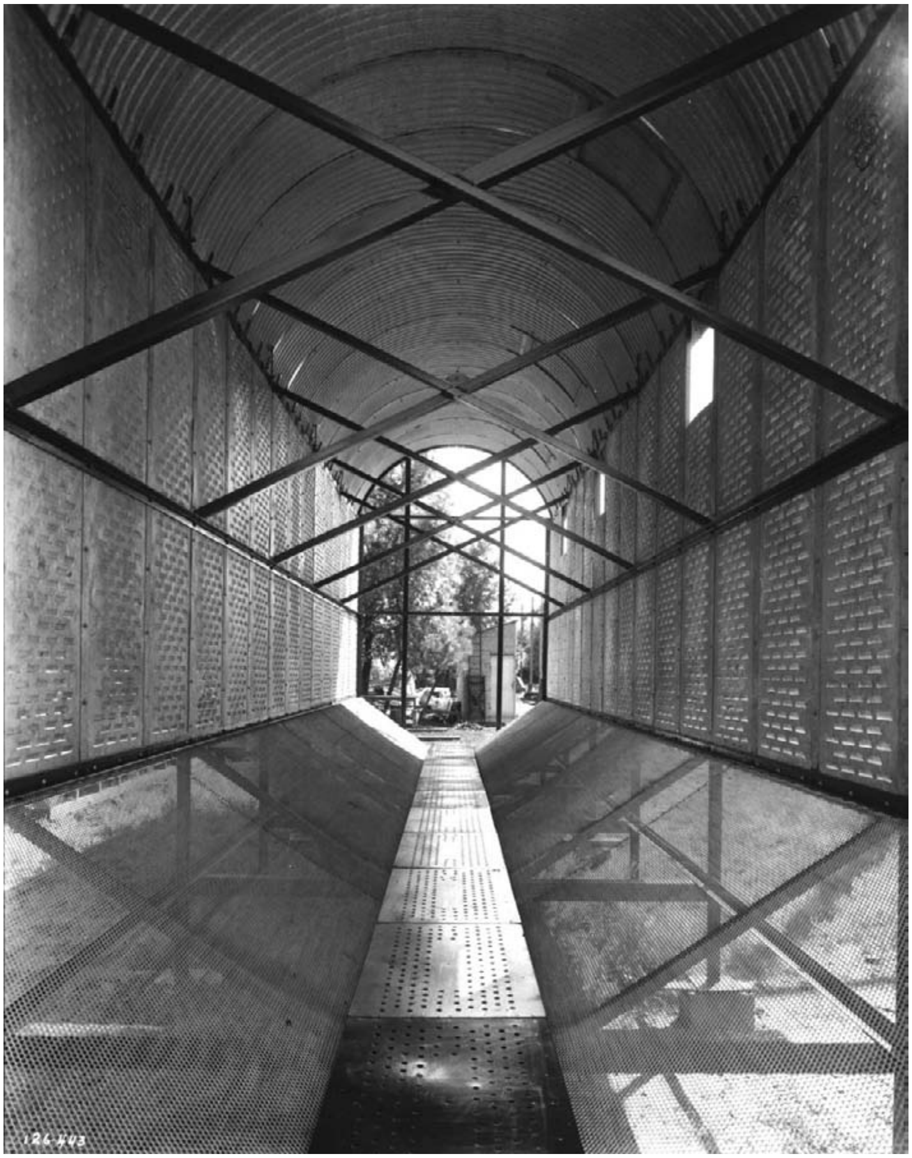
Feeding pigs during the Depression. To the left of the large farmhouse are three very modest buildings, one of which may be the preceding farmhouse. Location unknown, 1932. (MHS photo)

At the beginning of the Depression, nearly 100 percent of Minnesota farms used work horses. About 17 percent also had a tractor and about 10 percent had a truck. These farmers are harvesting oats with two four-horse teams. Bangard Farm, near Holloway, Swift County, circa 1938. (MHS photo)



A poster for the Ever-Normal Granary, a New Deal program of the Agricultural Adjustment Administration of the USDA. Its purpose was to stabilize farm prices by controlling the flow of grain into the market. A secondary goal was to insure a national crop reserve against drought or other unforeseen conditions. Farmers were given loans on grain placed in storage, spurring a wave of grain bin construction in the U.S. The policy continued into the early 1970s. USDA poster, 1940. (MHS photo collection)

This farm has a concrete block barn and attached milk house. The silo appears to be wood or brick. St. Louis County, circa 1930. (MHS photo)



A new perforated steel corncrib ready for the crop. Location unknown, 1938. (MHS photo by Norton and Peel)

PERIOD 8: WORLD WAR II AND THE POSTWAR PERIOD, 1940-1960

With the start of World War II, the farm economy recovered from the Great Depression and entered a period of prosperity that lasted until 1959. Farm productivity and yield increased dramatically in the postwar period, boosted by technological advances. As a result of mechanization and the cost of capitalization, farms increased in size and decreased in number. After decades of diversification, Minnesota farmers began to specialize in the 1950s. There was a boom in farm building construction and repair after many years of Depression and war. New types of farm buildings and building materials appeared, and farmhouses and living standards improved dramatically.

Milestones of this Period

1930s	–	Pole-framed buildings originated in the early 1930s, credited to H. Howard Doane
1939	–	Insecticide DDT introduced
1939	–	USDA issued a bulletin on glue-laminated arches; Rilco Laminated Products founded in St. Paul
1940	–	Almost seven of eight Minnesota farmhouses had a radio, placing Minnesota ninth nationally in the number of rural radios
1940	–	9,763 Minnesota farms generated electricity with on-farm electric plants
1940	–	Minnesota ranked 27th among states in farmhouses with electricity
1940s	–	Fiberglass introduced
1941	–	Pearl Harbor bombed, U.S. entered World War II
1941	–	Quonset-type buildings introduced to U.S.
1941	–	University of Wisconsin built experimental steel dairy barn, milk house, and silo, and began loose housing study
1941	–	Minnesota Extension issued a bulletin on straw buildings
1943	–	Prefabricated grain bins, hog cots, and brooder houses becoming common
1943	–	Per-person consumption of meat passed previous high points
1945	–	Grade A milk program established
1945	–	Herbicide 2,4-D introduced
1945	–	World War II ended
1946	–	University of Minnesota began a soybean breeding program
1946-59	–	Postwar boom
1948-50	–	Bulk tanks replacing milk cans
1950-53	–	Korean Conflict
1954	–	Minnesota ranked 4th nationwide in hog production
1955	–	Most Minnesota farms had phased out draft horses
1956	–	Minnesota ranked 4th nationwide in beef cattle production
1956	–	Minnesota ranked 2nd nationwide in chicken production and 4th in turkeys
1957-58	–	Recession

See also

Farms
Milking Barns
Farm Shops
Irrigation Structures
Appendix: Focus on Mechan Techno
Appendix: Focus on Biotech and Agrichem

After the collapse of the farm economy in 1920 and the hardships of the Great Depression, agriculture boomed again during World War II. "Good rains, bumper crops, and worldwide demand pulled farmers out of the depression and pushed them into a new era of prosperity," according to historian Jerome Tweton (Tweton 1989: 263). Crop and livestock prices rose during the war years, increasing 138 percent between 1940 and 1946. Net farm income rose nearly 250 percent (Cochrane 1993: 124).

A united country geared up for World War II, and farmers played their part. "The job of the United States farmer is to produce more food than has ever been produced before in this country," wrote one farm expert in 1942 (Zink 1942: 77). Farmers were urged to think of their farms as factories, and themselves as production managers, wringing the maximum food possible from land, labor, buildings, and machinery. Farmers rose to the challenge. In 1942, agricultural production reached new peaks that were, in the words of another expert, "well above previous records for grain crops, hay crops, oil-seed production, sugar crops, fruits, and vegetables. Livestock, dairy, and poultry products reached unparalleled levels. Good weather and high yields contributed to the 1942 farm victory" (Hamilton "Wartime Farm Building" 1943: 43). While Minnesota farmers produced record crops, thousands of city people grew "Victory" or "war" gardens.

FARM PRICES

When World War II ended, there were fears of a farm depression like the one that had followed World War I. In the early 1940s, like in the 1910s, "American farmers produced more than Americans could possibly consume" and it was feared the surpluses would dash prices (Schlebecker 1975: 277-278). Agriculture was rescued by the Marshall Plan, an immense relief program for Europe that began in 1947 and by 1953 had provided $13 billion in economic aid to the continent. According to historian John Schlebecker, "The Marshall Plan amounted to an export subsidy on a grand scale. . . . The program helped to restore the ailing European economies; it gave farmers subsidized prices; and it fed millions" (Schlebecker 1975: 277-278).

After the war, farm prices jumped and remained near or above immediate postwar levels for a decade. Both land values and the rate of farm ownership increased. Government price supports and fairly strong domestic and world demand kept farmers in a favorable economic position until the late 1950s. Good times lasted until about 1959, when the farm economy slumped, suffering from high production costs and sluggish markets. Farm profitability then sagged from 1959 to 1973, when another period of prosperity began (Blegen 1975: 545; Tweton 1989: 263; Cochrane 1993: 124; Roberts et al 1956: 513).

Although its relative importance in the state's economy began to shrink after World War II, agriculture remained one of Minnesota's foremost enterprises. During the 1950s, manufacturing officially surpassed agriculture as the state's leading industry (although, according to Blegen, the manufacturing industries included many processors of agricultural products). The number of people employed in farming continued to drop, while other sectors of the economy gained workers (Blegen 1975: 556-557; Tweton 1989: 289-290).

FARMS AND FARM LABOR

World War II created millions of jobs, accomplishing what the New Deal could not. During the war, "Young men and women literally flowed out of the rural areas in torrents . . . eager to leave farming for higher paying, more productive jobs in the city," according to economist and historian Willard Cochrane (Cochrane 1993: 125). The farm population nationwide fell by one-third between 1939 and 1953. In Minnesota, wrote historian David Nass, "Farmers on marginal land, tenants without a future in agriculture, and young people seeking careers in urban centers moved from the farms" (Nass 1989: 146). By 1950, more than half of Minnesotans lived in cities, and just eight percent farmed. In the following decades, the farm population continued to decline – Minnesota lost nearly 16 percent of its farm population between 1950 and 1960, for example. In 1981, farmers made up less than three percent of the U.S. population, and by 1990, less than two percent (Blegen 1975: 554-557; Danbom 1995: 266).

As the postwar farm population slid, the number of farms fell, too, while their average size rose. Minnesota farm numbers dropped by one-third between 1945 and 1964, falling from 189,000 farms to 131,000. During the same period, the average farm size increased 40 percent, from 165 acres in 1940 to 235 acres in 1964 (Cavert 1956: 26; Nass 1989: 147). According to one Midwest historian, "Farmers who managed well and had capital for land and machines operated larger and larger acreages. The gap between bigger, more prosperous farmers and those who were just getting by widen[ed]" (Fite 1989: 297-298). Farm tenancy, which had been common in Minnesota, increased considerably as farmers chose to rent new land to expand their acreage without an overly large capital outlay.

Unable to compete, many small-scale farmers called it quits. The University of Minnesota's William Cavert explained in 1956, "The shift is frequently made by the departure of most of the youth for town jobs, while the old folks continue to live on the farm. . . . When the old folks are no longer able to farm, the land is combined with that of a neighbor either by sale or rental" (Cavert 1956: 26). Many farmsteads were subsequently abandoned. By the 1960s, relatively few large Minnesota farms were producing most of the state's agricultural products.

PRODUCTIVITY

In June 1948, near the beginning of the postwar period, only 56 percent of Minnesota farms had electricity. Yet the most important development in agriculture in the 1940s and 1950s, according to historian David Danbom, was the "revolution in productivity spurred by machines, chemicals, and improved plant and animal breeds." Hybrid seeds, tractors, combines, gasoline engines, electric milking machines, powerful electric water pumps, DDT, 2,4-D, anhydrous ammonia – these were just some of the technological marvels that spurred the tremendous productivity gains of the postwar era (Danbom 1995: 233-238). Rising farm prices and incomes finally enabled farmers to buy these new technologies, which the Extension Service and the farm press had been urging them to adopt since the early 1930s. "And this they did with a vengeance. They jammed these new technologies into practice, reduced their unit costs, and expanded their farm output," according to Cochrane (Cochrane 1993: 125). Total agricultural output in 1954 was 42 percent higher than in the prewar period, and it was produced with 3.5 million fewer workers. In 1960 farm income totaled $1 billion in 1960, placing Minnesota fifth among the states in farm receipts (Shaw 1956: 423; Blegen 1975: 564).

Surging farm productivity stimulated the construction of new granaries, corncribs, implement sheds, and beef barns – sometimes built of alternative materials developed during the war. It also generated what historian Theodore Blegen called "an appalling surplus" of farm products – "a crisis of abundance" (Blegen 1975: 556). Jerome Tweton explains:

> Overproduction was the number-one enemy of farmers after World War II. Technology and science worked a revolution on Minnesota farms. Chickens laid many more eggs, cows gave much more milk, each head of livestock produced substantially more meat, and acres yielded abundantly more crops. . . . Hybrid corn seed doubled and even tripled yields. . . . Chemical fertilizer replaced barnyard manure. . . . Greater production demanded larger, more sophisticated machinery. On the eve of World War II only one in three corn-belt farmers owned a tractor. By 1949 almost all had at least one. Vastly greater investment in machinery tended to increase farm size, as farmers sought the most efficient use of their equipment. . . . The post-World War II agricultural revolution considerably altered Minnesota's rural landscape and forever changed the nature of farming (Tweton 1989: 264-265).

In the three decades following the war, American agriculture completed the shift from a labor-intensive industry to a capital-intensive one. Farmers substituted new machinery, chemicals, feed, and seed – all of which had to be purchased – for labor. From 1933 to 1970, the input of labor in American farm businesses declined more than 70 percent, while chemical inputs rose 1,800 percent, and purchased feed, seed, and livestock rose 270 percent (Cochrane 1993: 132). When farmers adopted the new technology, their costs of production rose. Profit margins per unit narrowed, forcing them to produce more units. The catchword of the Corn Belt, for example, became "Get Bigger or Go Under" (Hart 1986: 55; Hart 1998: 289).

As farmers substituted capital for labor, they had to improve their management and technical skills. Good farm management had always been important. But it gained new urgency after World War II, when a poor manager could "also lose money faster than could his father" (Cavert 1956: 24). More than ever, successful farming in the postwar era required brainpower and a good education. It was these demands that led one observer to predict in 1956, "twenty years hence most of the farmers in good farming areas will have had formal training in agriculture, in school or college" (Cavert 1956: 24).

By the late 1950s after decades of diversified farming, Minnesota farmers were forced by competitive economic pressures to specialize. Cattle producers enlarged their herds and raised animals in feedlots, using machinery to bring the feed to the stock instead of taking the animals to the pasture. Hog and poultry farmers shifted to high-volume confinement production in automated, climate-controlled buildings. Specialized crop farmers enlarged and lengthened their fields and removed fences for more efficient machinery operation. They also eliminated their traditional crop rotations, concentrating on the most profitable ones (Cavert 1956: 24; Tweton 1989: 264-265; Hart 1998: 373-375).

In a bulletin on poultry raising in 1951, the Agricultural Experiment Station summarized a dilemma facing Minnesota farmers that would become increasingly relevant during the next decades:

> With increased efficiency have come increased poultry numbers and greatly increased production since 1940. Consumers have responded by eating more eggs per capita, but only at lower prices relative to pork and dairy products. Hence, a part of the advantage of increased efficiency was quickly passed on to the consumer and not retained by the farmers. The upward trend in efficiency is likely to continue regardless of price changes. Farmers cannot retrogress in efficiency without sacrificing income (Hady and Nodland 1951: 16).

FARM BUILDINGS

Just as they did during World War I, farmers during World War II had to cope with labor and materials shortages. "Farmers . . . must produce required food with minimum labor, materials, and equipment," wrote a farm expert during the war in February 1943. "New machinery and equipment will be hard to get. There will also be shortages of labor, insecticides, fertilizers, nails, fence, lumber, and rubber" (Hamilton "Building" 1943: 43). To help offset the wartime shortages, Minnesota county agents promoted labor-saving tools and methods. Among the structures farmers were encouraged to adopt were portable hog houses, grain self-feeders for livestock, hay feeding racks, and portable grain elevators. The extension service continued to distribute plans for farmers who wanted to build their own structures and equipment. The result, wrote one Minnesota historian, was "one of the biggest 'do-it-yourself' programs in history" (McNelly 1960: 139).

Farmers were encouraged to repair machinery and buildings, rather than getting new ones. One method recommended for repairing wooden barns was to replace the deteriorating lower walls with hollow tile, an unrestricted building material, leaving intact the upper walls and roof (Anderson 1942: 326; Hamilton "Building" 1943: 43; Hamilton "Lumber" 1943: 268). Building trade groups such as the Portland Cement Association promoted the role of good farm facilities – and their products – in the war effort: "Farm structures, like war factories, are fighting equipment. Every improvement which helps the farmer increase production makes gains on the fighting front that much easier. . . . Such necessary improvements as sanitary milk houses, concrete dairy barn floors, paved barnyards and feeding floors or firesafe, ratproof storehouses are more important than ever before" (Portland 1944: 66).

However, new construction was limited during wartime to conserve resources. Farm structures were adapted to minimize the use of restricted materials such as steel, large timbers, electric wiring, and metal pipes. Farmers used cement, brick, and tile to save on nails and new lumber. Other common lumber substitutes included fiber, gypsum, plywood, composition roofing and siding, and cement-asbestos wallboards. Farmers were also urged to use straw sheds, pit and trench silos, and buildings constructed of adobe, rammed earth, sod, and logs (Hamilton "Building" 1943: 43-44; Matthews 1944: 91).

After World War II, American farmers embarked on long-overdue building improvements that had been delayed, in some cases, for 20 years during depression and war (Pond and Nodland 1958: 20; Ashby 1949). According to a Wisconsin agricultural engineer in 1944, growers were faced with "perhaps the largest single program of capital investment that the American farmers have ever before undertaken" (Clark quoted in Giese 1957).

Among the immediate postwar work was the widespread repairing, remodeling, and modernizing of farmhouses. Next in priority, wrote one USDA expert, was "improvement of dairy barns and milkhouses to meet Grade A requirements. Old dairy barns are being improved and ventilated and some new two-story barns are being built, though with smaller mows than the older barns. In other cases old buildings not suitable for stanchion barns are being remodeled for loose housing and many new milking stables [barns or parlors] and milkhouses are being built" (Ashby 1949: 236).

Not only did farmsteads need reconstruction, but buildings needed to be modified for the new machinery and methods that were fast coming into practice. "Profound changes in agriculture have forced a departure from conventional practices in virtually every phase of agriculture," an agricultural engineer wrote in 1956. "Now a distinctly different type of building need coincides with the time when a great deal of the farm plant must be rebuilt" (Carter 1956: 259). Those changes included "mechanization, the high value placed on labor efficiency, the shift from general-purpose farming to specialization, the consumer demand for clean, high-quality products, the need to prevent loss, and provision for a versatile farm establishment that can change with the times" (Carter 1956: 259). Among the results were dairy barns that were one story rather than two because hay came in huge machine-made bales, pen barns that reduced dairy herd care, and multipurpose buildings that could serve many purposes depending on the season.

To meet new demands, agriculture called on many of the industrial production techniques that had helped win the war including new materials, standardization, and prefabrication. A Wisconsin expert later recalled, "There were exciting new construction materials, new architectural designs, new and better methods and equipment for heating, ventilating, electrical conveniences and all the other features that would make buildings better meet the needs and desires of farm people" (Clark quoted in Giese 1957). As part of the effort, the Midwest Plan Service (a cooperative farm building plan service of which the University of Minnesota was a founding member) was revitalized in 1949 and issued a new series of farm building plans – the first since 1937 (Midwest Plan 1949).

After the war, a construction boom, combined with shortages in both construction labor and farm labor, stimulated further interest in low-cost materials and labor-saving methods. In describing the postwar construction the USDA's Wallace Ashby wrote:

> Home-sawed lumber has generally been used where available but shortage and cost of shipped-in lumber have favored the use of masonry blocks, especially those made with cinder or other lightweight aggregates. . . . Metal roofs are in great demand and aluminum and aluminum-painted roofs are becoming a prominent feature of the countryside. In barns for loose housing of dairy cows as well as beef cattle there is demand for trussed roofs or steel beams to eliminate close-spaced posts and girders that interfere with tractor loading of manure. There is also growing use of paved lots and lanes to keep the animals out of the mud. In areas of heavy poultry and egg production a good many new broiler and laying houses have been built and many older buildings have been repaired and improved. In the corn and wheat belts the number of new permanent cribs and granaries of conventional type is about average, but fabricated metal buildings for these purposes are being introduced. Some buildings used for corn storage have tight walls and are equipped with blowers and ventilating ducts. . . . In the corn belt a large number of new semipermanent and temporary corncribs have been built to handle the tremendous 1948 crop. Also, in the corn and wheat belts many new machine sheds and shops have been built. Arch-roof, metal-covered buildings, with either steel or laminated wood ribs, are coming into general use for these purposes (Ashby 1949:236).

Aluminum tubing made irrigation less expensive for average Minnesota farmers. Farmers also used more wood-glue-laminated timbers, which had been advanced as a substitute for steel. In 1950, Minnesota's Rilco Laminated Products was advertising rafters "for every type of farm building from small hog and poultry houses to large post-free machine sheds, granaries, and barns" (Rilco 1950: 91). Plywood became common for both structural and finishing uses. Other new materials included fiberboard, asbestos-cement, and corrugated fiberglass panels (Aldrich and Boyd 1959: 336; Crow 1941: 15; Lauber 2000: 19; Kaiser 1955: 440; Neubauer and Walker 1961: 569, 574-577; Tomlinson 1958: 25).

In the 1950s, farm buildings were configured to be more flexible and serve a variety of purposes – a principle of modern efficiency adopted by farmers. One agricultural engineer wrote of dairy barn design, "It must be constantly borne in mind that flexibility of the entire system is of utmost importance because of rapidly changing technology. A good solution last year may not be a good solution now and very likely will not be the best solution next year. It must be possible to change the facility with changing production requirements and farming methods" (Clayton 1960: 603).

One of the most versatile forms was the pole-framed building, made of timber wall posts, lightweight, prefabricated steel trusses and metal siding and roofing. Pole-framed buildings could serve many purposes including livestock barns, implement sheds, garages, and grain dryers and storehouses. Quonset-type buildings also became common on American farms after World War II. The familiar arched, corrugated-metal buildings were, like pole-framed buildings, versatile and quick to construct. The use of prefabricated farm buildings of all types spread rapidly after the war, in response to the high cost of construction labor. In Minnesota they included sectional and prefabricated poultry buildings, hog cots, grain bins, corncribs, implement sheds, and others (Carter 1956: 259; Stran-Steel 1948; Stran-Steel 1957; Neetzel and Otis 1959).

A study conducted by the Illinois Agricultural Experiment Station in the 1950s identified several trends in Illinois farm buildings for the period 1945-1955. They are listed below. The same trends may apply to Minnesota farms over the ten-year period:

- no change in the total number of buildings per farm over the ten years
- buildings were getting gradually larger
- buildings were getting gradually older
- fewer general-purpose barns, poultry houses, and "miscellaneous" buildings
- more silos, dairy buildings, implement sheds, and factory-built corncribs and grain bins
- most common structural features on new buildings were gabled roofs, metal roofs, wood framing and siding, and concrete foundations
- greater proportion of buildings with masonry walls, pole frames, and steel and aluminum exterior sheathing over the ten years (Carter 1956: 260).

According to USDA figures, in 1949 American farmers built 840,000 new outbuildings. The most numerous type were poultry houses, which accounted for about 23 percent of the new structures. The next category, accounting for about 18 percent of the new outbuildings, were machine sheds, shops, and garages. Next were general purpose barns, which comprised about 12 percent of the new outbuildings, and corncribs, which accounted for about 9 percent. American farmers also built 83,000 new farmhouses in 1949 (Neubauer and Walker 1961: 9).

CROPS

Minnesota agriculture as a whole continued to diversify in the 1940s and 1950s, producing record crops of all types. By 1961, for example, the state was producing 325 million bushels of corn, 160 million bushels of wheat, 54 million bushels of soybeans, 6.4 million bushels of flaxseed, 14 million hundredweight potatoes, 1.3 million tons of sugar beets, and 370,000 bushels of apples (Blegen 1975: 564).

After the war, farmers in southeastern and southwestern Minnesota concentrated on cattle, hogs, corn, and soybeans. Southeastern Minnesota, which raised about a quarter of the state's farm products, also produced poultry, dairy products, eggs, cheese, vegetables, and apples.

The Red River Valley produced spring wheat, sugar beets, and about two-thirds of the state's potato crop. The potato industry attracted large-scale growers who farmed extensive tracts of land. Potato and sugar processing became major industries in the region. Farmers in the southern Red River Valley also grew soybeans, but cattle feeding and dairy farming did not become prevalent in the Valley.

Central Minnesota, extending from the Minnesota River north as far as Otter Tail, Wadena, Cass, and Crow Wing counties, developed a concentration of turkey farms. As late as the 1970s, however, no single crop dominated this region, which had a thriving tourist industry but was still primarily agricultural. The region became strong in livestock – especially dairy, hogs, poultry, and. Central Minnesota farmers also raised corn, oats, soybeans, and vegetables.

Farmers in the east central counties bordering Wisconsin specialized in truck farming and growing potatoes and vegetables for canning. Rutabagas were important in Pine County, and apples in Washington County. The forest cutover in northern and northeastern Minnesota remained poorly suited to farming. According to Blegen, cutover agriculture "has been minor and unduly laborious. Some farmers have remained long on their rugged lands. Many have combined farming with work in mines or woods. But the number of farms has declined, farm profits have been modest, and farm living standards have been meager" (Blegen 1975: 563-568).

Corn, which became Minnesota's leading crop, helped fuel expansion of the state's livestock industry. During World War II, Minnesota farmers embraced hybrid seed corn after the University issued its first corn hybrid in 1930. Corn yields, which had been below 40 bushels an acre until 1940, rose to about 50 bushels an acre during the war, and then soared in the postwar period (Hart 1986: 52). In the early 1960s a new type of corn hybrid was introduced, and yields surged again.

Wheat crops in the Midwest were devastated by stem rust in the 1950s and yields dropped by 70 percent. Flax, which had been an important Minnesota crop early in the 20th century, declined after World War II. So did oats, which were no longer needed to feed draft horses. In 1975 Minnesota was third nationwide in rye and flax seed produced, fifth in barley, and eighth in wheat (Wayne 1977: 9).

Soybeans, used for cooking oil, livestock feed, and industrial products, became a major Minnesota crop in the 1940s. Before the war, soybeans had been grown on a small scale and harvested green as forage. The war had disrupted trade and created a new domestic demand for soy oil, so farmers in south central Minnesota began growing soybeans for the food industry. After World War II, soybean acreage "shot up as miraculously as Jack's beanstalk," according to Blegen (Blegen 1975: 564). The University of Minnesota began a soybean breeding program in 1946. By 1949, about 20 percent of Minnesota farms were growing soybeans, and "the wonder crop of the Corn Belt" had become the state's third-ranking cash crop (Hart 1986: 62). The same year, the U.S. became a net exporter of oils and protein meal, mainly because of soybeans.

Soybean processing mushroomed along with soybean fields, especially in southern Minnesota. Soybean meal became a mainstay of the Minnesota livestock feeding industry, and by 1951 the state had eight crushing plants. During the 1950s, soybean production and value increased dramatically. Minnesota was the nation's third-largest soybean producer in 1957. "The soybean changed the face of southern Minnesota agriculture," says Tweton. "By the 1980s it had become Minnesota's second cash crop," worth more than $900 million (Tweton 1989: 281; Roberts et al 1956: 148; Blegen 1975: 564).

Sparked by the boom in vegetable oil demand, sunflowers also became an important Minnesota oil crop during and after World War II. Farmers in the southern Red River Valley, particularly in Wilkin and Traverse counties, grew most of the state's sunflowers, rotating them with grains (Tweton 1989: 281, 290).

Minnesota sugar beet production expanded after World War II when sugar demand rose and labor-saving technology reduced the need for expensive hand labor. By 1960 nearly all sugar beets were harvested mechanically. American Crystal Sugar built sugar refineries in Moorhead in 1948 and Crookston in 1954. In 1957, Minnesota was eighth among states in the value of sugar beets produced. Today, Minnesota is the nation's leading sugar beet growing state (Rasmussen 1967: 33, 35; Tweton 1989: 287-289).

By 1945, American farmers were growing more snap beans, green peas, sweet corn, and tomatoes than ever before. Vegetable production continued to increase after the war, spurred by strong consumer demand, improved processing and transportation, and the growing use of home refrigerators and freezers. By 1947 Minnesota had 37 vegetable processing factories. One author wrote in 1956, "The indications are that the frozen food market will provide the vegetable growers with new market outlets for increasing quantities of high-quality vegetables" (Roberts et al 1956: 226). In 1956, Minnesota was second nationally in sweet corn production and one of the top five potato growing states.

After the war, farmers began to preserve hay and clover as "haylage" (also known as grass silage) in new, glass-lined silos. These tall blue cylinders were were often known by their trade name, Harvestore. They cost much more than traditional silos and became the mark of a prosperous Minnesota livestock farmer. Trench and bunker silos also became popular after the war. These horizontal structures proved efficient for filling, unloading, and self-feeding. Like glass-lined silos, they were often used for grass silage (Noble 1984: 79; Blegen 1975: 391; Noble 1984: 78-79).

LIVESTOCK

After World War II, the U.S. population increased significantly. As Americans' incomes rose in the postwar period, meat consumption went up, prompting expansion of livestock farming. By 1960, livestock products accounted for three-fourths of farm receipts (Blegen 1975: 565-568).

Beef. Specialized beef operations grew in size and number after World War II. Some Minnesota farmers bred cows and sold feeder calves; others bought feeder calves and fattened them for market, or finished cattle in feedlots. Still other cattle producers raised breeding stock. Some groups of farmers formed consortiums that passed animals from farm to farm through the animals' life cycle. By 1956, Minnesota ranked fourth nationwide in beef cattle production (Roberts et al 1956: 335).

Hogs. The hog industry also grew rapidly after World War II, spurred by rising consumer demand for pork. Raising hogs in confinement – a practice rare before 1945 – became common. Eventually many pigs were raised entirely indoors from birth to marketing, allowing farmers greater control over feeding, manure handling, barn sanitation, climate, and animal health. Because of the large investment required for special buildings and equipment, confinement hog farms were usually larger in scale than traditional hog farms, often raising thousands of animals a year. Minnesota ranked fourth in hog production in 1956 (Britton 1983: 20-21; Tweton 1989: 271-272).

In the 1950s, feeding, barn cleaning, and other hog chores became increasingly automated. In 1958, for example, agricultural engineers were testing multi-step feeding systems that moved feed from steel bulk bins to feed mills, then mixed and ground the grain, conveyed it to the feeding area, and distributed it to the hogs. At the same time, pressure washers for barn cleaning became more sophisticated (Puckett et al 1958: 692).

Artificial insemination of hogs was commercialized in the early 1960s. Farmers timed breeding so that sows would farrow year-around in order to make full use of expensive buildings. Some hog farmers raised the animals through their entire life cycle, but others specialized. Some raised only piglets, for example, while others bought the piglets and fattened them to market weight. Piglet producers typically had little land or capital, but "plenty of time to give to this more labor-intensive end of production" (Britton 1983: 21).

Dairy. After World War II dairy farms changed rapidly. "They are no longer diversified with cows, hogs and a flock of chickens," a Minnesota dairy industry historian wrote, "but have become highly specialized" (Wayne 1977: 25). Fewer Minnesota farmers milked cows in the postwar period, but individual herds got larger, and each cow produced more milk. The number of Minnesota dairy herds dropped from 164,000 in 1945 to 67,000 in 1965, and the number of cows in the state fell from 1.6 million to 1.2 million (Wayne 1977: 29). Thanks to improvements in selective breeding, feeding, disease control, housing, and animal care, Minnesota's average annual milk production per cow rose steadily, increasing from 4,400 pounds of milk per cow in 1940 to 12,139 pounds in 1984. In 1975 Minnesota ranked first nationwide in creamery butter and nonfat dry milk produced, third in total number of milk cows, and fourth in total milk produced (Wayne 1977: 9; MAES ca. 1995).

In the 1940s, Midwestern dairy farmers became interested in loose housing after research, which began at the University of Wisconsin in 1941, found that cows in pen barns required less labor, produced well, and usually had longer productive lives, fewer injuries, less stiffness, and a better appetite. (The Wisconsin Dairy Barn Research Project also tested steel's suitability as a building material for one-story dairy barns, granaries, and silos.) In 1950, Minnesota's Clarence H. Eckles wrote that loose housing was "becoming increasingly popular" (Eckles 1950: 514).

Confinement housing – in which dairy cows spent their entire lives inside – was introduced to Midwestern dairymen in the late 1950s and early 1960s. Wisconsin dairy expert S. A. Witzel explained in 1960 that intensive cropping and mechanical harvesting were producing high crop yields per and farmers were finding it more profitable to grow feed crops and keep their animals inside than to use their land for pasture. As dairy herds got larger, confinement housing reduced labor costs and offered better control over all facets of milk production. Air conditioning for confinement barns, which held promise to alleviate the overheating inherent in confinement systems, was just beginning to be discussed in 1960 (Witzel 1960; Stewart 1960).

The first artificial insemination of a dairy cow was done at the University of Minnesota in 1936. The resulting calf is thought to be the first born in North America as a result of artificial insemination. Artificial insemination associations formed in Minnesota beginning in 1939. Many of these groups ran into financial trouble and failed. Two that survived and became prominent were Minnesota Valley Breeders Association and Southern Minnesota Breeding Federation. In 1946, Land O' Lakes Creameries also established an artificial insemination service, which later merged with Southern Minnesota Breeding Federation (Wayne 1977: 45-47).

Dairy herd improvement associations, which had nearly disappeared during the Great Depression, were revived after 1945. Association staff visited member farms to test, consult, and monitor improvements. By 1956, nearly 6,000 Minnesota herds owned by association members were being regularly tested and tracked for butterfat content, health, reproduction history, and response to feeding.

Disease control also improved. A statewide effort to reduce bovine tuberculosis was conducted along with a broad program to treat and eradicate tuberculosis in humans. Bovine tuberculosis was reduced in the 1930s and 1940s, and by 1976, Minnesota cattle were declared free of the disease. Brucellosis was another serious cattle disease that sometimes spread to humans. Anti-brucellosis campaigns in the 1930s and 1940s were successful in eliminating the disease from about half of the state. There was another targeted effort in 1952-1953, and by 1957 it was largely eradicated (Wayne 1977: 33-35, 44-45).

Minnesota's dry milk industry developed after 1940. Before then, some buttermilk was dried for animal feed, but most milk was skimmed on the farm and fed to calves and pigs while the butterfat or cream was sold for butter. During World War II there was a tremendous demand for food, especially protein. This created a market for dried milk, which was nutritious, could be shipped in concentrated form, and had a long shelf-life. Several milk drying plants were built in Minnesota in the early 1940s, and dry milk production rose from 11 million pounds in 1935 to 169 million pounds in 1945. In 1943 Minnesota ranked second nationwide in total dry milk output, and had 102 drying plants (some of which dried only for animal feed). By 1965 Minnesota was producing 606 million pounds of dry milk annually (Wayne 1977: 39-40).

In 1919, the USDA had begun a successful national campaign to increase milk consumption. State and national milk merchandising programs began in the late 1930s, and the American Dairy Association was formed in 1940 to promote dairy products (Wayne 1977: 42-43).

In 1945 the State of Minnesota established the "Grade A" milk program, one of many efforts through the decades to protect public health, promote food quality, and regulate the food and dairy industries. The law set minimum requirements for Grade A certification – including standards for dairy barn and milk house operation. The law required inspections of dairy farms and processors, as well as handlers and vendors of milk. Grade A milk, for which the farmers received top price, was meant for fluid consumption, while Grade B milk was made into cheese and other processed foods. In 1949 the State required pasteurization of all milk and milk bottles.

During World War II, the number of Minnesota cooperative creameries began to decline. Originally, creameries had to be located close to the farms they served to receive milk deliveries by horse, and some counties had 20 or 30 small plants. But as roads and transportation improved, small, low-volume creameries were no longer profitable and many merged or closed. Some added dry milk processing equipment to stay in business. In the 1960s, creameries rapidly consolidated, and by 1970, three large cooperatives – Land O' Lakes, Mid-America Dairymen, and Associated Milk Producers – were marketing nearly all the milk produced in Minnesota (Wayne 1977: 41-42). According to one Minnesota historian, "the consolidation and merging of cooperative creameries was a painful process for many people" (Wayne 1977: 19, 42). Another wrote that their role "often compared to that of churches because of their importance and standing in the community" (Brinkman 1988: 15).

Poultry. No other Minnesota livestock sector experienced more sweeping changes after World War II than the poultry industry. Until the 1940s, most Minnesota farms raised chickens (and a few turkeys) and sold eggs. That changed after the war when poultry and egg production became concentrated on a few large-scale farms, mainly in central and west central Minnesota. A broiler industry developed as poultry meat became more popular, and a demand for dried egg powder grew. Between 1910 and 1990, per capita consumption of poultry rose 500 percent nationally, helping to fuel a tremendous expansion of the Minnesota turkey industry (Cochrane 1993: 394). According to Tweton, "A well-designed national campaign and a growing emphasis on low- or no-fat diets increased substantially the demand for poultry – especially turkey." In 1972, just 62 farms sold nearly two-thirds of Minnesota turkeys (Tweton 1989: 277).

At the same time, rapid improvements were made in poultry breeds, feeding efficiency, disease control, and husbandry methods. In the 1940s, for instance, more sophisticated brooding equipment dramatically reduced chick losses and the labor cost of raising poultry. A decade later, chickens had been bred that needed half as much feed as in 1940, and egg output per hen had risen 75 percent. By the mid-1950s, flocks of 500 to 1,000 chickens were common on Minnesota farms, and turkey flocks of 1,000 birds or more had become the rule. In 1956, Minnesota ranked second in chicken production and fourth in turkeys (Cavert 1956: 23; Shaw 1956: 423-424; Roberts et al 1956: 396).

In the 1950s and 1960s, the state's poultry industry expanded rapidly and was concentrated in central Minnesota, primarily in Kandiyohi, Swift, Meeker, and Stearns counties. Chicks, or poults, were produced in a small number of hatcheries. The poults were fattened to market weight on large farms handling thousands of birds. Poultry processing developed in the same region, close to where the flocks were raised. In 1949, for example, Earl B. Olson established the Farmer's Produce Company in Willmar, later renamed Jennie-O. The company became Minnesota's leading turkey processor. In addition to processing birds, Jennie-O operated farms, manufactured feed, distributed poultry-growing supplies, and marketed turkey products worldwide (Britton 1983: 21-22; Tweton 1989: 277-278).

TYPES OF MINNESOTA FARMS

Federal statistics provide basic information about postwar trends in Minnesota farming. In 1945 and 1964, for example, Minnesota farms represented the types listed below, based on which farming activity supplied at least 50 percent of a farm's annual income. The category "general" farming was used if no single activity exceeded 50 percent or more of income.

Minnesota Farms by Type, 1945 and 1964

Farm Type	Number of MN farms 1945	Number of MN farms 1964
Fruit and nut	306	100
Vegetable	990	274
Horticulture	241	not given
Field crops	17,716	26,809
Dairy	38,930	42,474
Poultry	9,967	1,974
Livestock	42,639	23,358
Forest products	1,162	not given
General	60,445	13,278
Subsistence	14,208	not given
Other	not given	21,426
Unaccounted		1,470
TOTAL	186,604	131,163

Source: *Statistical Abstracts*, various years.

In the list above, the decrease in the number of "general" or diversified farms between 1945 and 1964 is striking.

FARM LIVING STANDARDS

Farm living standards greatly improved in the 1940s and 1950s. At the start of the war, 40 percent of Minnesota farm families lived in homes built between 1900 and 1920, and more than 29,000 lived in houses built before 1890. Less than one-third of Minnesota farmhouses had electricity in 1940, and only 12 percent had running water. Minnesota ranked 33rd among the states in the number of flush toilets in farmhouses; 34th in running water, and 38th in number of refrigerators (Davies 1947). After the war ended, the Minnesota Extension Service began a major push to encourage farm home improvements such as running water and sewage disposal systems, central heating, kitchen modernization, and farmstead landscaping. By the mid-1950s, electrification had become nearly universal. At the same time that they electrified their barns, farmers installed home lighting, plumbing, refrigerators, modern cooking stoves, and other appliances.

Automobiles, telephones, radio, and television alleviated rural isolation. According to Blegen, by the late 1950s "radio was very nearly universal in farm as well as city and town homes," and about a third of farmhouses had television. He noted, "The total scene reveals a swift lessening of old disparities between living in town and living on the farm." The traditional distinctions were further blurred as people who worked in town began building homes in the countryside. He explained, "This has meant an increasing nonfarm population in farming country. Thanks to the automobile these urban-country families are within easy reach of the cities and towns" (Blegen 1975: 572, 575).

CHARACTERISTICS OF FARMS FROM THE WORLD WAR II AND POSTWAR PERIOD, 1940-1960

- farms phasing out horses, using more tractors and trucks
- improved farm layout
- farms of increased size
- fields enlarged for mechanized equipment, fences being removed
- decreasing diversification, more specialization
- long-delayed building and infrastructure improvements
- early confinement, specialized, and large-scale livestock and poultry operations
- feed bunks with mechanical feed carriers, stockyards, stock chutes, stock tanks
- hog barns with concrete floors and yards
- fewer poultry houses
- fewer bull barns
- one-story buildings with low-pitched gable and shed roofs
- general purpose or dairy barns with attached silos
- early milking parlors, barns with loose housing
- milk houses
- metal grain bins and corncribs
- early grain dryers
- glass-lined silos
- automobile garages
- larger implement sheds
- multipurpose buildings
- pole-framed buildings
- quonset-type buildings
- steel-sided buildings
- plank and balloon frames of dimensional lumber
- factory-made parts and materials
- prefabricated and sectional buildings and structures
- designs influenced by science, engineering, management principles
- designs influenced by materials manufacturers, agricultural engineers
- designs influenced by technical bulletins

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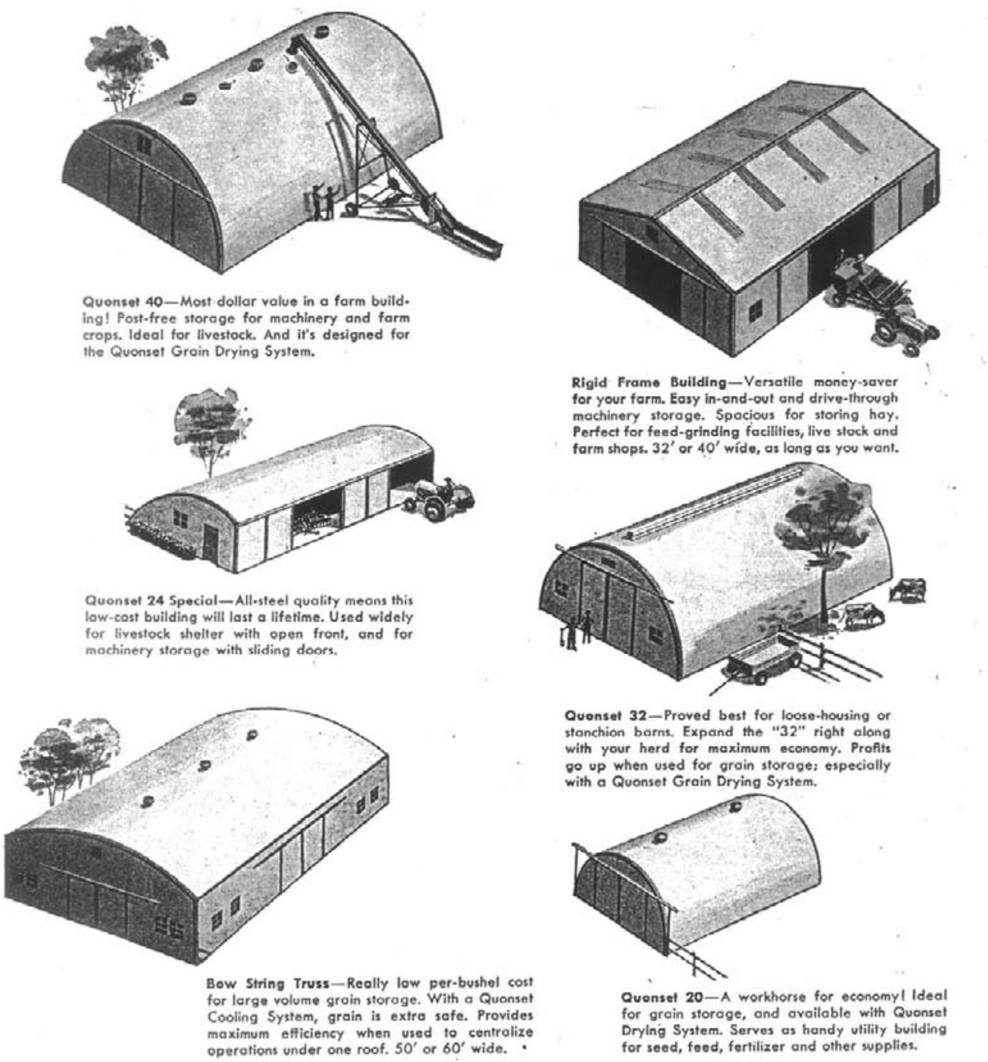
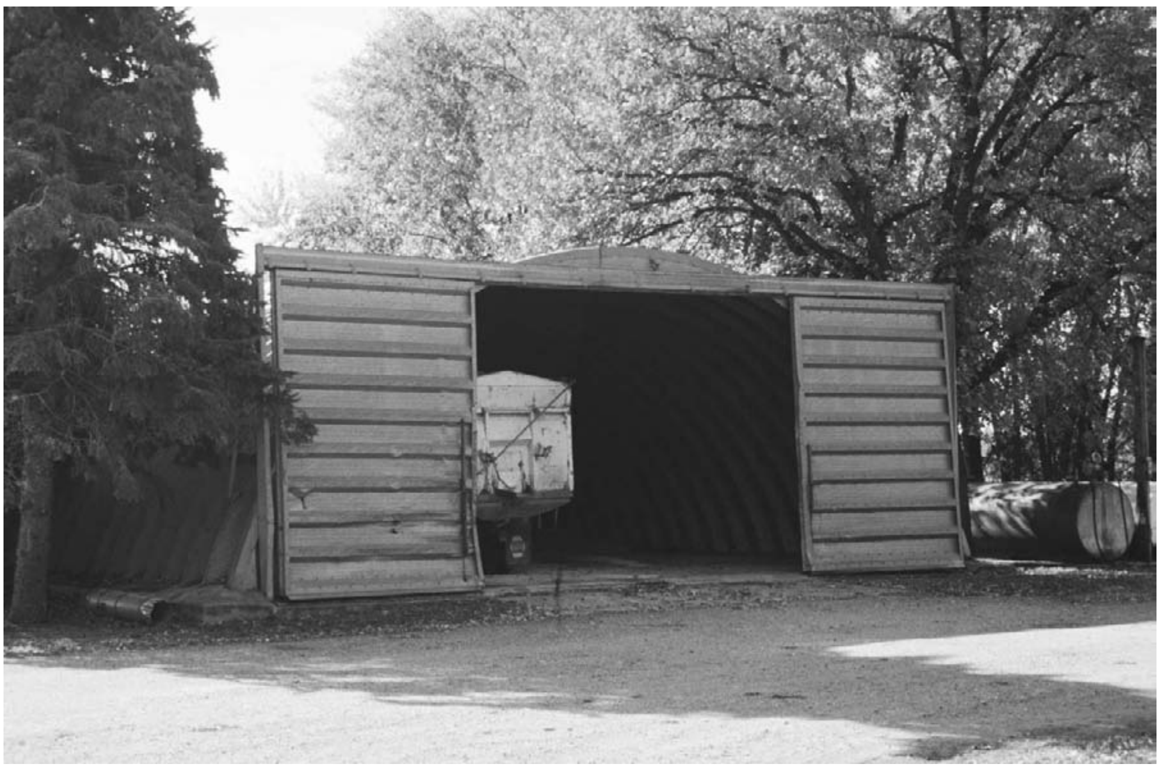
In 1940 less than one-third of Minnesota farmhouses had electricity, and only 12 percent had running water. That year Minnesota ranked 33rd among states in the number of farmhouses with flush toilets, 34th in farmhouses with running water, and 38th in farmhouses with refrigerators. After the war ended, the Minnesota Extension Service began a major push to encourage farm home improvements including indoor bathrooms, central heating, and kitchen modernization. Gramsey Farm, Dakota County, 1978. (MHS photo by Jack Kennelly)

Until the late 1940s, most poultry was distributed on diversified farms throughout the state. After World War II, poultry and egg production became increasingly concentrated on a few large-scale farms, mainly in central and west central Minnesota. By 1956 Minnesota ranked fourth nationwide in turkey production. Turkey barn, location unknown, circa 1947. (MHS photo)

The number of farms in Minnesota dropped by one-third between 1945 and 1964. During the same period, the average farm size increased 40 percent from 165 acres to 235 acres. Mechanization was expensive, and farmers needed to increase acreage to make the investment in machines pay off. Unable to compete, many small-scale farmers left the business, or their land was rented or sold to neighbors when they retired. Their farmsteads were often abandoned. Konopatski Farm, Dakota County, circa 1954. (MHS photo)



In 1957 Stran-Steel's line of buildings – including the "Quonset" brand – was marked for implement sheds, work shops, livestock barns, grain drying and storage, etc. Metal buildings tended to be cold and damp for livestock so were sometimes lined and insulated. The Stran-Steel Corporation had a regional office in Minneapolis. From *Agricultural Engineering* (Feb. 1957).



For much of the year this building is used as a granary, and after the grain is sold it stores vehicles and equipment until the next harvest. The steel's deep corrugation makes the structure strong and self-supporting. The building likely came in prefabricated sections that were bolted together. Retzlaff Farm, Framnas Township, Stevens County, 2004. (Gemini Research photo)

SNAPSHOT OF FARMING REGIONS IN 1940

Most Upper Midwestern farmers, including those in Minnesota, were subject to a similar set of broad geographic, economic, technological, and political influences. This regional similarity was one of the arguments that led land-grant universities from 12 Midwestern states to form the Midwest Plan Service in 1932 to reduce duplication of efforts as farm building plans were developed and disseminated.

Within Minnesota, however, there was variation in farm types and farming practices. Many of the differences were a matter of scale or intensity in the type of farming. While farms all over Minnesota milked dairy cows, for example, those that specialized in dairying (i.e., derived the largest proportion of their income from dairying) were concentrated in particular geographic areas where land was too hilly to raise row crops but was well-suited to maintaining pastures and growing hay.

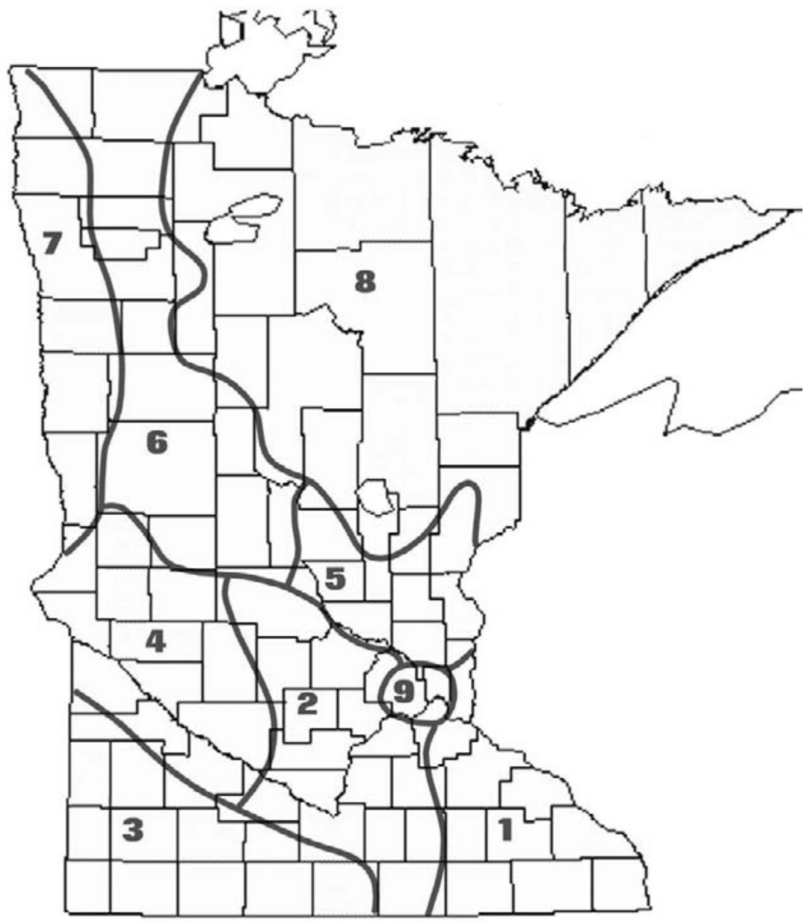
Much of the variation within the state was influenced by geographic factors. Chief among them were environmental conditions (e.g., length of the growing season, topography, and types of soils) and the distance away from major markets. These factors often translated into different levels of farm profitability. For example, in 1929 farms in the southwestern quarter of Minnesota earned the highest income, while those in the northeastern quarter of the state brought in the least (Engene and Pond 1940: 45).

One way to understand statewide variation is to look at the scheme of nine production regions developed by the Minnesota Agricultural Experiment Station (MAES) in the early 20th century. MAES staff used the nine farming areas to help explain the nature of Minnesota farming, to plan their research and outreach activities, and to help other agencies and industries formulate farm policy and programs.

In both 1929 and 1940, the MAES released statewide studies based on the nine farming areas. The 1929 bulletin, written by L. F. Garey, used pre-1925 farm statistics and data gathered in 1925. The 1940 bulletin, written by S. A. Engene and G. A. Pond, expanded and updated the 1929 bulletin and slightly altered the boundaries of the production areas. It was based on 1929 and 1930 data. Engene and Pond also issued a statistical supplement in 1944 that included some data gathered in 1939 (Garey 1929; Engene and Pond 1940; Engene and Pond 1944).

Engene and Pond's nine farming regions from 1940 are shown on the accompanying map and used as a basis for the discussion below. While this discussion provides just a snapshot of Minnesota farming, referencing this information during cultural resource surveys should help predict and explain some of the historic farm resources likely to be encountered in various parts of the state. (For more information on average farm size in Minnesota, see also this context study's individual farm elements section entitled "Farms.")

Farming Regions in Minnesota in 1940



1 Southeast Dairy and Livestock
2 South Central Dairy and Livestock
3 Southwest Livestock and Cash Grain
4 West Central Livestock and Cash Grain
5 East Central Dairy and Potatoes
6 Northwestern Dairy and Livestock
7 Red River Valley Small Grain, Potatoes, and Livestock
8 Northern Cutover Dairy, Potatoes, and Clover Seed
9 Twin City Suburban Truck, Dairy, and Fruit

source: Engene and Pond 1940

▪ AREA 1 – SOUTHEAST DAIRY AND LIVESTOCK

The Southeast Dairy and Livestock area included the hilly southeastern corner of the state and the region immediately east of the Twin Cities. Dairying was the principal type of farming here in 1940.

In 1940 this region contained the highest proportion of wooded, steep, and untillable land in the state. It had more rainfall than any other area and its growing season was longer.

Most untillable farmland was used for permanent pasture in 1929. The grazing capacity of this land was limited by woods and by the type of grass, however, so that farmers in this area also used tillable land for pasture in larger percentages than anywhere else in the state.

Erosion was a serious problem in 1940 and the federal Soil Conservation Service was helping devise farm methods that controlled the erosion. In more level areas, good drainage and lack of stones made it possible to cultivate fields.

Farmers in southeastern Minnesota in 1940 needed to add powdered lime to the acidic soil to grow the alfalfa and sweet clover needed for crop rotation. In some areas phosphorous fertilizer was added to boost crop yields (Engene and Pond 1940: 48).

Number and Size of Farms. In 1939 there were about 22,800 farms in Area 1. They averaged 161 acres in size – about the same as the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 15 percent of farmhouses in Area 1 postdated 1920. About 37 percent of occupied farmhouses had electric lights, 13 percent had mechanical refrigerators, 13 percent had flush toilets, and 20 percent had running water (Davies 1947: 15). In 1939 about 61 percent of farms in Area 1 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 89 percent of farms in Area 1 had an automobile, 23 percent had a truck, and 52 percent had a tractor (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Based on 1930 data, most farms in Area 1 were classified by Engene and Pond as one of four types. The authors defined 42 percent of farms in Area 1 as dairy farms, 17 percent as animal specialty farms, 26 percent as general farms, and about 4 percent as cash grain farms (Engene and Pond 1940: 49-50).

Dairy Farms. The dairy farms (i.e., farms earning at least 40 percent of income from dairying) averaged about 12 cows per farm in 1930. Most of the cows were specialized dairy breeds. Most of the calves not needed to replenish the herd were sold for veal. Dairy farms in the area raised an average of four hogs that ate the skim milk and corn and barley that was grown. The dairy farms derived most of their income from selling dairy products and dairy cows, but most also sold some other livestock (often hogs) and some crops.

Animal Specialty Farms. The animal specialty farms (i.e., those with 40 percent of farm income from beef cattle, hogs, sheep, and wool) were larger than the dairy farms and were concentrated near the Iowa border. The animal specialty farms had an average of 12 cows per farm in 1930, most of which were milked. Most were either beef or dual-purpose breeds. Because of the lack of grain grown in this area, most beef cattle were sold as one- or two-year-old stock to be fattened by others or slaughtered young. Animal specialty farms in the region also raised an average of eight hogs per farm in 1930. A majority of the animal specialty farms received the most income from selling livestock and, secondly, from livestock products such as milk and butter. Small amounts of crops were also sold off the farm.

General or Diversified Farms. General or diversified farms (i.e., those with income from more than one activity with no single source dominating) comprised about 26 percent of farms in the area in 1930. These farms generally kept a combination of cattle (either 1) dairy cattle, or 2) beef or dual-purpose cattle) which were usually milked. The farms raised an average of four hogs and some crops. Farms that met Engene and Pond's classification of "general or diversified" farms were operations that either took in less than 40 percent of income from a single source, or received at least 40 percent of income from each of two sources.

Cash Grain Farms. Cash grain farms (i.e., farms earning at least 40 percent of income from the sale of corn and small grains) comprised about 4 percent of the farms in Area 1 in 1930.

CROPS

In 1929 most tillable land was used to grow small grains and hay, and/or was used for pasture. Most crops were raised for livestock feed, while other crops, especially small grains, were sold off the farm (Engene and Pond 1940: 48-49).

Small Grains. In 1929 small grain production in Area 1 was led by oats (the state's leading small grain crop at the time), followed by barley, with smaller amounts of wheat, rye, and flax.

Cultivated Crops. Much less corn was planted in southeastern Minnesota in 1929 than in counties farther west. In 1939, Area 1 was the only farming area in the state that had more than one percent of its tillable land planted in soybeans – the figure for Area 1 in 1939 was 3.6 percent of tillable land planted in soybeans (Engene and Pond 1944: 13).

Forage Crops. Hay and other forage crops were dominated by timothy and clover in 1929, but alfalfa acreage was increasing.

LIVESTOCK

Cattle. In 1940 dairying was the principal type of farming in this area. In 1930, this part of the state had the third-highest concentration of cows per acre among the Engene and Pond's nine farming regions. Most of the cows were specialized dairy breeds in the northern part of the area (near Northfield or Red Wing, for example), and were bred for beef or dual purposes in the southern part of the area (close to the Iowa border). Many of the beef and dual-purpose cows were milked as well as being sold for beef (Engene and Pond 1940: 49-50).

Hogs. Hogs were raised in the area in 1930, but in fewer numbers than in other parts of southern Minnesota because of the lack of productive cornfields.

Sheep. About 20 percent of the farms in Area 1 raised sheep in 1930, with an average of 24 ewes per flock.

Poultry. Nearly all farms in the area raised poultry in 1930, with an average of 100 hens per farm. Turkey raising was more common in Areas 1, 2, 3, and 9 than elsewhere in the state. In 1939 there was an average of 375 turkeys raised per farm in Area 1 (Engene and Pond 1944: 18).

Horses. A typical farm in this region kept about four horses and mules in 1930.

▪ AREA 2 – SOUTH CENTRAL DAIRY AND LIVESTOCK

The South Central Dairy and Livestock area was located in the south central part of the state, extending from Stearns County on the north to the Iowa border near Albert Lea on the south. Dairying was the principal type of farming here in 1940 (Engene and Pond 1940: 51).

Most of the land in this area was level to rolling. In 1940 it had many poorly-drained low spots and small rough areas that could not be tilled.

Much of the untilled land was used for permanent pasture and, to a lesser extent, to harvest wild hay. The productivity of the permanent pasture areas supported intensive livestock production.

The soil in the area was fertile and the growing conditions favorable for high crop yields. The amount of tillable land used for pasture was low in 1929.

Number and Size of Farms. In 1939 there were about 37,300 farms in Area 2. They averaged 143 acres in size – slightly smaller than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 18 percent of farmhouses in Area 2 postdated 1920. About 46 percent of occupied farmhouses had electric lights, 15 percent had mechanical refrigerators, 13 percent had flush toilets, and 20 percent had running water (Davies 1947: 15). In 1939 about 44 percent of farms in Area 2 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 94 percent of farms in Area 2 had an automobile, 20 percent had a truck, and 55 percent had a tractor (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Engene and Pond classified 45 percent of the farms in Area 2 as dairy farms, 32 percent as general farms, 10 percent as animal specialty farms, and 4 percent as cash grain farms in 1930 (Engene and Pond 1940: 50-53).

Dairy Farms. The dairy farms (i.e., farms with 40 percent or more of income from dairying) averaged about 12 cows per farm in 1930. By many measures, the dairy farms were like those in Area 1. Most of the cows were specialized dairy breeds. Dairy farms in Area 2 each raised an average of five hogs that ate the skim milk. The dairy farms also raised crops such as corn and barley, largely for feed.

General or Diversified Farms. In 1930 about one-third of farms in Area 2 were general or diversified farms (i.e., earned income from more than one activity with no single source dominating). They were similar in character to the general or diversified farms in Area 1 (see above).

Animal Specialty Farms. In 1930 the animal specialty farms (i.e., those with 40 percent of farm income from beef cattle, hogs, sheep, and wool) were similar in characteristics to those in Area 1, except that more hogs were raised on animal specialty farms in Area 2. In 1930 the animal specialty farms in Area 2 milked an average of 12 cows and raised an average of nine hogs.

Cash Grain Farms. About four percent of the farms in Area 2 in 1930 were cash grain farms (i.e., farms earning at least 40 percent of income from the sale of corn and small grains). The most important crops were corn and small grains.

CROPS

In 1929 crop yields in Area 2 were higher than anywhere else in the state. Corn and small grains were the most important crops. Most crops were grown for livestock feed (Engene and Pond 1940: 51).

One study reported in 1932, "Athough the growing season is short for corn production, many farmers get yields of corn fully as large as those obtained on the better farms of the central Corn Belt [i.e., farther south]. A large proportion of the crop is in small grain and hay each year. Most of the crops are marketed in the form of dairy products and pork. . . . On some of the farms sugar beets, canning peas, sweet corn, or potatoes are grown but for the most part only feed crops are raised" (Wilcox et al 1932: 5).

Small Grains. In 1929 small grains in Area 2 consisted of 50 percent oats (the state's leading small grain crop at the time), 25 percent barley, and 25 percent wheat. The wheat was planted mostly in LeSueur, Scott and nearby counties.

Cultivated Crops. Corn was the major inter-tilled crop in 1929, although some potatoes were grown, especially in Freeborn, Wright, and Stearns counties.

Forage Crops. In 1929 more than one-third of the tame hay grown was alfalfa.

LIVESTOCK

Cattle. In 1930 dairying was the principal type of farming and dairy cows were the most prevalent livestock. In 1930, two important measures in Area 2 – the number of cows per acre and the income per acre from the sale of livestock and livestock products – were second only to those in the Twin Cities suburban area. Most cows kept in Area 2 were specialized dairy breeds, although some beef and dual-purpose cows were kept. The number of beef cattle was relatively low and they were more often found in the southwestern part of the area (Engene and Pond 1940: 50-52).

Hogs. In 1930 hog raising was the second most important livestock activity, with the number of hogs per acre higher in Area 2 than in all other parts of the state except Area 3 in Minnesota's southwestern corner.

Sheep. Relatively few sheep were raised in Area 2 in 1930. In 1939, the number of sheep in Area 2 averaged 17 ewes per farm (Engene and Pond 1944: 18).

Poultry. Income from poultry was important and the number of chickens was large in 1930. In 1939 there was an average of 136 chickens per flock in Area 2. More turkeys were raised in Areas 1, 2, 3, and 9 than elsewhere in the state. In 1939 there was an average of 220 turkeys raised per farm in Area 2 (Engene and Pond 1944: 18).

Horses. A typical farm in this region kept about four horses and mules in 1930.

▪ AREA 3 – SOUTHWEST LIVESTOCK AND CASH GRAIN

The Southwest Livestock and Small Grain area comprised nearly a dozen counties in the southwestern corner of the state. Farms Area 3 were a mixture of types in 1940 (Engene and Pond 1940: 16-17, 53-56).

The southwestern Minnesota farming region had been settled about 20 years later than counties in the southeastern corner of the state. The land in Area 3 was level to rolling. It had many areas of poor natural drainage which, by 1940, had been drained artificially. In 1929 tilled acreage predominated, constituting about 78 percent of the area's farmland. Only 4 percent of the land was used for wild hay and 13 percent for permanent pasture in 1929.

In 1930 crop yields were fairly high in the eastern parts of Area 3, but were lower and fluctuating in the northwest (near Marshall and Canby. for example).

The level land and soil types allowed the use of large machinery, which favored concentrate crops such as corn, rather than forage crops. The concentrated crops, in turn, favored the fattening of livestock for meat.

Number and Size of Farms. In 1939 there were about 21,300 farms in Area 3. They averaged 204 acres in size – larger than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 18 percent of farmhouses in Area 3 postdated 1920. About 40 percent of occupied farmhouses had electric lights, 15 percent had mechanical refrigerators, 9 percent had flush toilets, and 13 percent had running water (Davies 1947: 15). In 1939 about 54 percent of farms in Area 3 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 95 percent of farms in Area 3 had an automobile, 18 percent had a truck, and 73 percent had a tractor. The tractor rate was much higher than the state average of 49 percent (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

In 1930 farmers in this area earned important income from the sale of livestock and from the sale of crops – a more diverse mix than found, for example, in intensive dairying regions (Engene and Pond 1940: 53-55).

In 1930, 34 percent of farms in Area 3 were classified as general or diversified farms, 32 percent were animal specialty farms, 22 percent were cash grain farms, and only 7 percent were dairy farms. Other types of farms were small in number.

General or Diversified Farms. General or diversified farms had incomes from more than one activity with no single source dominating. In 1930 most of these farms in Area 3 raised hogs and milked cows. Some fattened calves born on the farm and a very few shipped in calves to be fed. In 1930 these farms received income about equally from selling crops, selling livestock, and selling livestock products like milk and butter.

Animal Specialty Farms. In 1930 the animal specialty farms (those with 40 percent of farm income from beef cattle, hogs, sheep, and wool) averaged 217 acres and were larger than those in counties farther east. Raising beef for meat was important. Although four-fifths of all cows in the area were milked in 1930, most of them were beef or dual-purpose breeds whose calves were fattened and sold for slaughter. Farmers on animal specialty farms also shipped in calves to feed. The area's animal specialty farms also fattened large numbers of hogs.

Cash Grain Farms. The cash grain farms in 1930 were larger than the animal specialty farms. (Cash grain farms earned at least 40 percent of income from the sale of corn and small grains.) About 90 percent kept milk cows, with an average of six milk cows per farm. Many of the calves were fattened and sold for beef.

Dairy Farms. In 1930 only about 7 percent of farms in the area were dairy farms (i.e., farms earning 40 percent or more of income from dairying). They averaged about 12 milk cows per farm, with most cows being specialized dairy breeds. The number of hogs raised on dairy farms in Area 3 was larger than the number raised on animal specialty farms, presumably as a way to use the skim milk. Dairy farms sold fewer crops than other types of farms in the area.

CROPS

In 1940 southwestern Minnesota was a transition area between predominant cornfields to the south, small grain production to the west and northwest, and intensive dairying to the east and northeast. Cropping systems characteristic of all three were found within Area 3. Most of the crops were used for animal feed (Engene and Pond 1940: 53-55).

Small Grains. In 1929 small grains were the largest crop in Area 3, occupying 45 percent of tillable land. Principal grains in 1929 included oats (about 50 percent of tillable land), barley (about 25 percent), and flax (about 3 percent). Oats were the state's leading small grain crop at the time.

Cultivated Crops. With its level fields and fairly high corn yields, this part of Minnesota was considered to be within the U.S. Corn Belt. In 1929 about 40 percent of the land in southwestern Minnesota was used for inter-tilled or cultivated crops – mostly corn. This was the highest percentage of inter-tilled crops anywhere in the state. In 1929 about 90 percent of the area's corn was husked, while 10 percent was used for fodder or silage.

Forage Crops. Relatively small amounts of tame hay were raised in 1930.

LIVESTOCK

Cattle. Dairy cows were the most common type of cattle in southwestern Minnesota in 1940, but dairying was less intensive in Area 3 than in counties to the east and northeast. Most of the milk cows were beef breeds or dual-purpose cows, rather than being high milk producing breeds (Engene and Pond 1940: 53-55).

In 1930 the area's high corn production led farmers to raise more hogs and beef cattle than were raised farther east and northeast where less corn was grown and where dairy cows were more prevalent.

In 1930 about eight percent of farmers in this area had cows "kept mainly for beef." About 25 percent of the state's cows raised for beef were raised on farms in Area 3. Despite these numbers of beef cattle, there were still about 10 milk cows for every beef cow in Area 3 in 1930. Many farmers fattened calves, either their own calves or feeder calves shipped in from other areas (mostly areas farther west).

Hogs. Most farms in Area 3 raised hogs in 1930, taking advantage of local corn production. About 30 percent of the hogs raised in Minnesota in 1930 were raised in Area 3. The area also had more sows per farm than any other part of the state, typically with at least ten litters per year per farm.

Sheep. In 1930 about 20 percent of farms in the area raised sheep, with an average of 24 ewes per flock. During the 1930s the practice of fattening lambs that had been shipped into the region from elsewhere was becoming increasingly common (Engene and Pond 1940: 54). By 1939, the number of sheep in Area 3 averaged 27 ewes per farm (Engene and Pond 1944: 18).

Poultry. Poultry were kept on nearly all farms in Area 3 in 1930. The average flock size was the largest in the state, averaging about 150 hens per farm. Turkey raising was more common in Areas

1, 2, 3, and 9 than elsewhere in the state. In 1939 there was an average of 398 turkeys raised per farm in Area 3. This was the highest number per farm in the state (Engene and Pond 1944: 18).

Horses. Farms in this region each kept about six horses and mules in 1930.

▪ AREA 4 – WEST CENTRAL LIVESTOCK AND CASH GRAIN

The West Central Livestock and Cash Grain area was located in west central Minnesota and extended from Grant County on the north to near New Ulm on the southeast. It encompassed much of the upper Minnesota River Valley. Dairying and small grain farming predominated in 1940.

Engene and Pond reported that the topography, soils, and amount of tillable land were very similar to those of Area 3 (see above), although the amount of rainfall in Area 4 was less and the growing season was slightly shorter (Engene and Pond 1940: 56). West central Minnesota suffered some of the state's most severe droughts in the 1930s.

Number and Size of Farms. In 1939 there were about 23,100 farms in Area 4. They averaged 233 acres in size – larger than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 16 percent of farmhouses in Area 4 postdated 1920. About 27 percent of occupied farmhouses had electric lights, 9 percent had mechanical refrigerators, 6 percent had flush toilets, and 9 percent had running water (Davies 1947: 15). In 1939 about 43 percent of farms in Area 4 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 93 percent of farms in Area 4 had an automobile, 20 percent had a truck, and 71 percent had a tractor. The tractor rate was much higher than the state average of 49 percent (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Engene and Pond indicated that the mix of farm types in this area was similar to that of southwestern Minnesota (Area 3), except for slightly more dairy farms and slightly fewer animal specialty farms. Farms were slightly larger than in Area 3. In 1930, 35 percent of farms in Area 4 were classified as general or diversified farms, 24 percent were animal specialty farms, 24 percent were cash grain farms, and 11 percent were dairy farms (Engene and Pond 1940: 56-57).

General or Diversified Farms. In 1930 general or diversified farms (i.e., those with income from more than one activity with no single source dominating) were slightly larger than those in Area 3. They were otherwise similar except they raised slightly more livestock.

Animal Specialty Farms. Animal specialty farms (i.e., those with 40 percent of farm income from beef cattle, hogs, sheep, and wool) were slightly larger than those in Area 3 and otherwise similar except they raised fewer livestock.

Cash Grain Farms. Cash grain farms in 1930 were slightly larger than those in Area 3 but otherwise similar. Cash grain farms were defined as farms earning at least 40 percent of income from the sale of corn and small grains.

Dairy Farms. In 1930 dairy farms (i.e., farms earning at least 40 percent of income from dairying) were slightly larger than those in Area 3 and otherwise similar except they raised slightly fewer livestock.

CROPS

In 1929, small grains occupied about 55 percent of tillable land. Inter-tilled (also called cultivated) crops occupied about 30 percent, and hay and forage crops occupied about 11 percent (Engene and Pond 1940: 56).

Small Grains. In 1929 more small grains were grown in Area 4 and in the Red River Valley (Area 7) than in other parts of the state. In 1929 oats were the principal small grain in Area 4, followed by barley, wheat, and flax. Oats were the state's leading small grain crop at the time.

Cultivated Crops. West central Minnesota was considered to be the northern edge of the U.S. Corn Belt. Corn was the major inter-tilled crop in 1929, although it was less important in Area 4 than in Area 3 to the south.

Forage Crops. Tame hay – mostly alfalfa – occupied six percent of tillable land in 1929.

LIVESTOCK

In 1940 Engene and Pond explained that, like Area 3, Area 4's level terrain facilitated the use of large machinery, which favored growing crops like grain and corn, which in turn favored raising livestock that could be fed the concentrate feeds. Engene and Pond reported, however, that farmers in west central Minnesota saw depressed and unpredictable crop yields in 1917-1936 that hindered the development of the local livestock industry and led farmers to sell off their stock, especially during droughts. As a consequence, Area 4's livestock industry was not as well-developed as that of southwestern Minnesota (Engene and Pond 1940: 56-57).

Cattle. In 1930 the numbers and types of cattle in Area 4 were similar to those in Area 3, although farmers imported fewer feeder calves than did their counterparts farther south.

Hogs. "Considerably" fewer hogs were raised in Area 4 than in Area 3, according to Engene and Pond in 1930.

Sheep. Farmers in west central Minnesota raised "slightly" fewer sheep than did those of Area 3 in 1930 (Engene and Pond 1940: 56-57). However, in 1939, the number of sheep in Area 4 averaged 29 ewes per farm, slightly above the average number of ewes in Area 3 (Engene and Pond 1944: 18).

Poultry. Poultry were kept on nearly all farms in the area in 1930. In 1939 there was an average of 122 chickens per flock in Area 4 (Engene and Pond 1944: 18).

Horses. A typical farm in this region kept about six horses and mules in 1930.

■ AREA 5 – EAST CENTRAL DAIRY AND POTATOES

The East Central Dairy and Potatoes area encompassed counties north and northwest of the Twin Cities. It extended from Morrison and northeastern Stearns counties on the west to the Wisconsin border on the east. Dairying was the principal type of farming here in 1940.

Engene and Pond reported that the area was level to rolling with some hilly land. Most of the land had been covered with hardwood and coniferous forests that had been logged in the late 19th and early 20th centuries. Part of the region contained poorly-drained peat bogs. In the southwestern section (near southern Mille Lacs and Sherburne counties, for example), the soil was sandy to a sandy loam and did not hold moisture well during drought. This soil also had many stones, lacked nitrogen, and was acidic so that farmers added powdered lime before the alfalfa and sweet clover needed for crop rotation could be grown. Area 5 had large amounts of permanent pasture because of the high percentage of untillable land (Engene and Pond 1940: 58-60).

Number and Size of Farms. In 1939 there were about 19,200 farms in Area 5. They averaged 130 acres in size – smaller than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 29 percent of farmhouses in Area 5 postdated 1920. About 22 percent of occupied farmhouses had electric lights, 5 percent had mechanical refrigerators, 5 percent had flush toilets, and 10 percent had running water (Davies 1947: 15). In 1939 about 41 percent of farms in Area 5 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 86 percent of farms in Area 5 had an automobile, 12 percent had a truck (a little lower than the state average of 18 percent), and 27 percent had a tractor (lower than the state average of 49 percent) (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

In 1930, 55 percent of farms in Area 5 were classified as dairy farms, 23 percent were general or diversified farms, 7 percent were crop specialty, and 4 percent were self-sufficient (Engene and Pond 1940: 58-60).

Dairy Farms. Dairy farms (defined by Engene and Pond as those earning 40 percent or more of income from dairying) were smaller than those elsewhere in the state, averaging only 131 acres per farm in 1930. Despite the small farms, the number of cows per farm – an average of ten – was nearly as large as that seen in southern Minnesota. Nearly all of the cows were specialized dairy breeds. Nearly one-half of the dairy farms also raised a small number of hogs.

General or Diversified Farms. In 1930 about 23 percent of the farms in Area 5 were general or diversified (i.e., earned income from more than one activity with no single source dominating). Most of these farms combined dairying, with an average of seven cows per farm, with the sale of crops – mostly rye and potatoes.

Crop Specialty Farms. About 7 percent of farms in this area in 1930 derived at least 40 percent of their income from the sale of potatoes, sugar beets, hay, tobacco, and other minor crops and were therefore categorized by Engene and Pond as crop specialty farms. Potatoes predominated and, in fact, farmers in Area 5 grew proportionally more potatoes in 1929 than did farmers in any other part of the state except the Twin Cities suburban area. Crop specialty farms in Area 5 kept fewer livestock than did the dairy and general farms in the region. Most of the crop specialty farms were located in Isanti County in 1929.

Self-sufficient Farms. About 4 percent of farms in Area 5 were self-sufficient in 1930 – that is, at least 50 percent of the value of all agricultural products were used on the farm rather than being sold, and the farms had only limited outside income. The self-sufficient farms were small – an average of 70 acres – and kept one to three milk cows. Pigs were farrowed on only 20 percent of the farms. Some farms bought pigs from neighbors to be fattened and slaughtered for home use. The cash income from farm products on self-sufficient farms was generally very small.

CROPS

In 1929, Area 5's tillable land was divided as follows: 42 percent small grains, 24 percent inter-tilled (cultivated) crops, and about 27 percent hay and forage crops (Engene and Pond 1940: 58-60).

Small Grains. In 1929 small grains occupied about 42 percent of tillable land in Area 5 – a smaller portion of tillable land than in most other regions in the state. The small grains included about 50 percent oats (the state's leading small grain crop at the time), about 25 percent rye, and about 6 percent barley. The proportion planted in rye was the largest in the state in 1929.

Cultivated Crops. Inter-tilled crops in Area 5 were led by corn, which occupied a comparatively low one-sixth of tillable land in 1929 but was rising by 1940. About one-third of the corn was husked, one-third was cut for fodder, and one-third was used for silage. Large numbers of potatoes were also grown (Engene and Pond 1940: 58-59). In 1939, 2.4 percent of tilled land was planted with potatoes. This was the fourth-highest proportion among the nine farming areas (proportionately more potatoes were grown in Areas 7, 8, and 9) (Engene and Pond 1944: 13).

Forage Crops. Tame hay, especially timothy and clover, accounted for about 25 percent of tillable land in 1929.

LIVESTOCK

Cattle. Most farms in the area kept milk cows in 1930, as they did in most other parts of the state. The concentration of cows was nearly as high as that of southeastern Minnesota. Most cows were specialized dairy breeds (Engene and Pond 1940: 58-59).

Hogs. In 1930 only about one-half of farms in Area 5 raised hogs, compared to southwestern Minnesota, for example, where most farms kept hogs. The number of hogs per farm (measured by the number of sows per farm) was also lower in Area 5 than in many other regions.

Sheep. Sheep were plentiful in Area 5 in 1930, especially in Kanabec County. In 1939, the number of sheep in Area 5 averaged 20 ewes per farm (Engene and Pond 1944: 18).

Poultry. Most farms in the area raised chickens in 1930, with an average of 72 birds per flock. This average flock size was lower than in regions such as Area 3 (where there were 150 hens per flock) and Area 1 (where there were 100 hens per flock).

Horses. Farms in this area kept an average of three horses and mules in 1930.

▪ AREA 6 – NORTHWESTERN DAIRY AND LIVESTOCK

Located east of the Red River Valley and west of the state's north-south axis, the Northwestern Dairy and Livestock region was a large area that stretched from the Canadian border to Stearns County. Dairying was the principal type of farming here in 1940 (Engene and Pond 1940: 60).

All three of the state's original vegetation types were represented in this area: coniferous forests along the eastern edge, hardwood forests in the southern half, and grassland prairie in the northwest. The topography varied from north to south. The northern portion had level to rolling terrain with large areas of poorly-drained land. The southern part had level to hilly terrain, many lakes, and fewer areas of poorly-drained land. Soils included loams, sand, and some areas of poorly-drained peat.

The growing season was 30 days shorter near the Canadian border (the northern end of Area 6) than near Stearns County (the southern end of Area 6). All but the southern part of Area 6 was a cool farming region characterized by long cold winters, cool soil temperatures, and late spring and early fall freezes. The area suffered especially low crop yields during the years 1917-1936.

Number and Size of Farms. In 1939 there were about 24,100 farms in Area 6. They averaged 199 acres in size – larger than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 28 percent of farmhouses in Area 6 postdated 1920. About 15 percent of occupied farmhouses had electric lights, 3 percent had mechanical refrigerators, 3 percent had flush toilets, and 4 percent had running water. These were the lowest percentages for household improvements in the state in 1940 (Davies 1947: 15). In 1939 about 40 percent of farms in Area 6 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 87 percent of farms in Area 6 had an automobile, 11 percent had a truck (a little lower than the state average of 18 percent), and 36 percent had a tractor (a little lower than the state average of 49 percent) (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Engene and Pond explained in 1940 that Area 6 exhibited a diversity in farming types, in part because it contained both logging cutover and prairie regions. In 1930, 51 percent of farms were categorized as dairy farms, 30 percent were general or diversified farms, and 4 percent were self-sufficient (Engene and Pond 1940: 61-62).

Dairy Farms. Dairy farms in Area 6 (i.e., farms earning at least 40 percent of income from dairying) were predominant in 1930, but they operated with less intensity – including fewer cows – than those further south in the state. Dairy farms milked an average of ten cows per farm, most of them specialized dairy breeds. More than half of the dairy farms also kept pigs.

General or Diversified Farms. This region's general or diversified farms (i.e., those with income from more than one activity with no single source dominating) typically milked cows, raised some other livestock, and sold some crops for income. The general or diversified farms usually had fewer livestock than the area's dairy farms in 1930.

Self-sufficient Farms. About four percent of farms were self-sufficient in 1930. Engene and Pond reported that the self-sufficient farms in Area 6 were quite similar to those in Area 5 (see Area 5 above).

Other Farms. Engene and Pond reported that Area 6 had significant cash grain farms (i.e., farms earning at least 40 percent of income derived from the sale of corn and small grains) in Red Lake and Pennington counties, with most income from wheat and flax in 1930. The authors also reported significant crop speciality farms in Kittson, Roseau, and Marshall counties that raised and sold clover seed. Crop specialty farms were defined as farms earning at least 40 percent of their income from the sale of potatoes, sugar beets, hay, tobacco, and other minor crops.

CROPS

In 1929 Area 6 had relatively small amounts of inter-tilled or cultivated crops compared to other parts of Minnesota. Instead, small grains and hay and forage crops were planted on nearly 80 percent of tillable land. In 1929 small grains occupied 48 percent of tillable land, inter-tilled crops 13 percent, and hay and forage crops about 30 percent (Engene and Pond 1940: 60-62).

Small Grains. In 1929 small grain acreage in Area 6 was dominated by oats, which was the state's leading small grain crop at the time. Barley was grown in the southern counties, wheat was grown throughout the area, and some flax was grown in the northern counties.

Cultivated Crops. Corn was grown on about 10 percent of the tillable land in 1929, mostly in the southern counties of Area 6. Some potatoes were grown, but this crop was declining in 1940.

Engene and Pond reported that in the northern counties where corn was not grown (and therefore rotation with legumes was not as essential), a large part of the tillable land was left fallow each year to help control weeds.

Forage Crops. In 1929 hay and forage crops occupied about 30 percent of tillable land.

LIVESTOCK

Cattle. More than 90 percent of farms in the area kept milk cows in 1930, although the number of cows per farm was lower than in the state's intensive dairying areas. Most cows were specialized dairy breeds. The number of cows raised for beef production was very small (Engene and Pond 1940: 61).

Hogs. In 1930 about one-half of the farms raised hogs, although the number of hogs per farm was smaller than in many parts of the state.

Sheep. About 25 percent of farms in Area 6 raised sheep in 1930. The northern counties had the largest number of sheep. In 1939, the number of sheep averaged 30 ewes per farm (Engene and Pond 1944: 18).

Poultry. Most farms in the area raised chickens in 1930 but flocks were smaller than those in many parts of the state. In 1939, Area 6 farms kept an average of 71 chickens per farm (Engene and Pond 1944: 18).

Horses. Farms in this area kept an average of four horses and mules in 1930.

▪ AREA 7 – RED RIVER VALLEY SMALL GRAIN, POTATOES, AND LIVESTOCK

The Red River Valley Small Grain, Potatoes, and Livestock area was located in northwestern Minnesota along the North Dakota border. It included about five entire counties, plus small parts of several adjacent counties. Milking cows and raising small grains predominated in 1940 (Engene and Pond 1940: 60-62).

Much of the land in Area 7 had been settled about 20 years later than southeastern parts of the state.

Soils near the Red River were clay loams and silt loams, while near the eastern edge of the region there were sandy loams and sands. Much of the land had poor natural drainage but had been drained artificially by 1940.

This was a cool farming region characterized by long cold winters and cool soil temperatures. Area 7 had late spring and early fall freezes, making the growing season shorter than in most parts of the state. It was a dry area with periods of drought, high daytime summer temperatures, and low humidity. During the growing season, high temperatures and drying winds removed more moisture from the soil than was usually added via rainfall. The frequent winds also eroded soil and carried airborne particles that damaged crops. Soils in Area 7 were highly alkaline. The land was very flat land and prone to flooding.

Area 7's level topography facilitated the use of large machinery in 1940. These machines worked well for the small grain crops that were most suitable for the soil types and relatively short growing season.

Engene and Pond indicated in 1940 that the distance from farm to market for Red River Valley farmers was greater than for farmers in any other part of the state. They explained that "Crops of high value per pound hold an advantage over the more bulky commodities because shipping costs represent a smaller proportion of their value" (Engene and Pond 1940: 63). Red River Valley farmers marketed their wheat through direct rail connections to mills in Minneapolis and to the port in Duluth where the grain could be shipped to the East Coast and Europe.

Number and Size of Farms. In 1939 there were about 14,000 farms in Area 7. They averaged 246 acres in size – the largest in the state and well above the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 20 percent of farmhouses in Area 7 postdated 1920. About 16 percent of occupied farmhouses had electric lights, 4 percent had mechanical refrigerators, 4 percent had flush toilets, and 7 percent had running water (Davies 1947: 15). In 1939 about 42 percent of farms in Area 7 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 87 percent of farms in Area 7 had an automobile, 24 percent had a truck, and 63 percent had a tractor. The tractor rate was higher than the state average of 49 percent (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Engene and Pond wrote in 1940, "Although this is the principal small grain area in the state, dairy farms are more numerous than either cash grain or crop specialty farms." In 1930, 36 percent of farms were classified as general or diversified farms, 21 percent were dairy farms, 19 percent were cash grain farms, 12 percent were crop specialty farms, and 4 percent were animal specialty farms (Engene and Pond 1940: 63-65).

General or Diversified Farms. General or diversified farms (i.e., those with income from more than one activity with no single source dominating) were the most prevalent type in the Red River Valley in 1930. Most kept an average of seven milk cows and some raised hogs and sheep. Small grains and potatoes were sold by many, and some farms sold clover seed and hay.

Dairy Farms. Dairy farms (i.e., farms earning 40 percent or more of income from dairying) averaged 239 acres in 1930 and were larger than dairy farms in other parts of the state. They milked an average of ten cows per farm, and kept few other livestock.

Cash Grain Farms. Cash grain farm (i.e., farms earning at least 40 percent of income from the sale of corn and small grains) were the largest farms in Area 7 in 1930. Wheat, oats, barley, and smaller amounts of flax were the principal crops. About 80 percent of cash grain farms also had milk cows and about 50 percent of them also had hogs.

Crop Specialty Farms. About 12 percent of farms in Area 7 in 1930 earned at least 40 percent of their income from the sale of potatoes, sugar beets, hay, tobacco, and other minor crops and were therefore categorized by Engene and Pond as crop specialty farms. Potatoes were the most important crop. In Clay County, crop specialty farms were the most numerous type and accounted for one-quarter of farms in the county.

Animal Specialty Farms. Animal specialty farms in Area 7 (i.e., those with 40 percent of farm income from beef cattle, hogs, sheep, and wool) were concentrated in the southern end of the Red River Valley and were comparatively large in 1930. On these farms many of the cows were beef or dual-purpose breeds that were also milked. Calves not needed to replenish the herd were often sold as feeder calves or fattened on the farm and sold for beef. Some farmers also bought calves or lambs from other regions to finish.

CROPS

In 1929, 55 percent of tillable land in Area 7 was used for small grains, 9 percent for inter-tilled (i.e., cultivated) crops, 18 percent for hay and forage crops, percent, and 18 percent for other uses such as lying fallow. Area 7 had the lowest crop yields in the state in 1929 (Engene and Pond 1940: 62-63).

Small Grains. Wheat was a principal crop in this region, even though it had declined in importance statewide. To combat problems that accompanied the wheat monoculture like soil infertility, crop diseases, insects, and weeds, farmers increasingly diversified their crops by replacing much of the wheat with oats, barley, and forage crops. Among popular crops were small grains and oil seeds such as safflower, rape, flax, sunflower, and mustard.

In 1940, the production of grain was the primary farming activity in the Red River Valley. Engene and Pond reported that in 1929 Area 7 was the only region in the state where the income from crops was equal to the income from livestock sales and livestock products combined. This was despite the fact that this area had the lowest crop yields in the state.

The Red River Valley was also the only region in 1929 where oats was not the predominant small grain. Instead, oats, barley, and wheat were being planted in roughly equal amounts.

Cultivated Crops. Because of the short growing season, corn was a minor crop, occupying less than five percent of tillable land in 1929.

Potato fields comprised another approximately five percent of tillable land in 1929. This represented nearly one-third of total potato acreage in the state. Engene and Pond explained that potato production in Area 7 was on the increase as Minnesota's concentrated potato growing area was shifting from east central Minnesota to the Red River Valley (Engene and Pond 1940: 62-63). In 1939, about three percent of tilled land in Area 7 was planted with potatoes. This was the second-highest proportion among the nine farming areas, surpassed only by the Twin Cities suburban area (Area 9) (Engene and Pond 1944: 13).

Forage Crops. Forage crops, which could generally be grown during a short season, were also prevalent in Area 7 in 1929.

LIVESTOCK

Engene and Pond reported in 1940 that livestock production was increasing in the Red River Valley, but was still less intensive than in other parts of the state (Engene and Pond 1940: 63-64).

Cattle. Dairying was the most important livestock activity in 1930. About 90 percent of the region's farms had dairy cows – an average of more than seven cows per farm. About 80 percent of the cows were specialized dairy breeds. The number of cows raised mainly for beef was small.

Hogs. About 40 percent of the farms in Area 7 raised pigs in 1930.

Sheep. About 20 percent of Red River Valley farmers raised sheep in 1930. This was the only area in the state where the number of ewes was more than the number of cows in 1930 (Engene and Pond 1940: 63). In 1939, the number of sheep in Area 7 averaged 41.6 ewes per farm – the highest average in the state (Engene and Pond 1944: 18).

Poultry. Most farms in the area raised chickens in 1930 but the flocks were smaller than those in many parts of the state. In 1939 there was an average of 77 chickens per farm in Area 7 (Engene and Pond 1944: 18).

Horses. In 1930 farms in this area kept about six horses and mules.

▪ AREA 8 – NORTHERN CUTOVER DAIRY, POTATOES, AND CLOVER SEED

The Northern Cutover Dairy, Potatoes and Clover Seed region encompassed a vast territory in northern Minnesota beginning west of Red Lake on the west, extending south of Mille Lacs Lake on the south, and including the entire Arrowhead region. It was the largest of Engene and Pond's farming regions. Dairying was the principal type of farming here in 1940.

In 1939 only about 18 percent of the land in Area 8 was in farms. This number was quite low compared to Area 3 (southwestern Minnesota, for example) where 97 percent of the land was in farms (Engene and Pond 1944: 8).

Engene and Pond indicated that the characteristics of the northern cutover area – Area 8 – were unique in the state. The area had been settled by Euro-Americans later than other parts of Minnesota and by 1930 only 15 percent of the land area was used for farms. The farms were small, still under development, and generating low income. The authors wrote in 1940, "Costs of clearing have been high, and large areas with soils of low productivity have been encountered." They also wrote, "There are many serious economic problems which must be solved before this can become a stable agricultural region" (Engene and Pond 1940: 16-17; 65-66).

The cutover had been covered by coniferous forests that had been mostly logged by 1940. Clearing the stumps for farmland was extremely difficult. Stones were prevalent, especially in the eastern counties, often making tillage impossible. The terrain varied from level to rolling to hilly with many knolls and ridges. Low spots included poorly-drained depressions left by glaciers, as well as numerous peat bogs that were especially plentiful in the northern counties. The area had large amounts of untillable land that were used as permanent pasture. In 1929, 42 percent of farmland was in permanent pasture and mostly wooded, and another 17 percent was wooded and not used for pasture (Engene and Pond 1940: 65-66). In 1939, about 34 percent of farm land in Area 8 was "woodland" – by far the largest percentage in the state (Engene and Pond 1944: 8).

The region's soils were extremely poor in some areas and in others consisted of well drained loams, sand plains, wet clay loams, and peat bogs. According to Engene and Pond, "Areas of good soils are intermingled with soils of such low productivity as to have little agricultural value" (Engene and Pond 1940: 65).

The growing season was relatively short. Annual crop yields were about average for the state.

Engene and Pond explained in 1940 that the local timber industry was beneficial in two ways: by creating off-farm jobs for farmers, and by bringing many workers to the region which created a local market for farm products. The local timber workforce was declining in 1940, however, because of the depletion of wood resources and increases in labor-saving mechanization.

Like logging, iron mining was an important industry in 1940 that employed large numbers of people, including some farmers, and created a local market for farm products.

In 1940 some farmers in the region also augmented their farm income by catering to tourists. They served as fishing or hunting guides, for example, or built small rental cabins or resorts on their lakeshore property. The tourism industry also provided a market for farm products.

Number and Size of Farms. In 1939 there were about 30,000 farms in Area 8. They averaged 103 acres in size – considerably smaller than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 58 percent of farmhouses in Area 8 postdated 1920. About 20 percent of occupied farmhouses had electric lights, 3 percent had mechanical refrigerators, 4 percent had flush toilets, and 7 percent had running water (Davies 1947: 15). In 1939 about 34 percent of farms in Area 8 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 73 percent of farms in Area 8 had an automobile, 15 percent had a truck, and 24 percent had a tractor (lower than the state average of 49 percent) (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

Dairying was the principal farm endeavor in this area in 1930. In that year, 40 percent of farms were categorized as dairy farms, 18 percent were general or diversified, 13 percent part-time, 12 percent were self-sufficient, and 7 percent were crop specialty (Engene and Pond 1940: 65-68).

Dairy Farms. Dairy farms (i.e., farms earning 40 percent or more of income from dairying) were fairly small, averaging only 134 acres in 1930. They kept an average of seven cows per farm. About half of dairy farms also sold some forest products.

General or Diversified Farms. General or diversified farms (i.e., those with income from more than one activity with no single source dominating) earned income from a mixture of crop sales, sales of agricultural products or livestock, and sale of forest products. In 1930 about one-half of diversified farms in this area earned income from forest products.

Part-time Farms. About 13 percent of farms in this area were part-time farms in 1930. These were defined by Engene and Pond as farms on which at least 150 days were spent on work away from the farm or the operator's occupation was reported to be other than that of farmer *and* total income from farm products was low (e.g., $750 in 1929). Engene and Pond reported in 1940, "These farms are smaller than the self-sufficing farms, but other information concerning their organization is not available" (Engene and Pond 1940: 68).

Self-sufficient Farms. About 12 percent of farms in this area were categorized as self-sufficient in 1930. These farms were small – an average of 84 acres – and typically had few livestock. Engene and Pond explained in 1940, "Many of these farms represent new developments where the settlers have not yet had time to clear land and obtain the livestock that is necessary for satisfactory incomes, but a large proportion of them represent farms that are permanently on a subsistence basis with a very low standard of living" (Engene and Pond 1940: 68).

Crop Specialty Farms. In 1930 about 7 percent of farms in Area 8 were classified by Engene and Pond as crop specialty farms because they earned at least 40 percent of their income from the sale of potatoes, sugar beets, hay, tobacco, and other minor crops. Potatoes and clover seed were the principal crops raised on these farms, and forest products were sold on about one-quarter of them.

CROPS

In 1929, 23 percent of tillable land in Area 8 was used for small grains, 9 percent for inter-tilled (i.e., cultivated) crops, and 59 percent for hay and forage crops (Engene and Pond 1940: 65-66).

Small Grains. In 1929 about two-thirds of the small grain fields were planted with the state's leading grain crop – oats – and about one-third with barley.

Cultivated Crops. About nine percent of the region's tillable land was inter-tilled crops in 1929. About one-half was corn and the other half potatoes. In 1939, 2.5 percent of tilled land in Area 8 was planted with potatoes. This was the third-highest proportion among the nine farming areas, behind Area 7 and Area 9 (Engene and Pond 1944: 13).

Forage Crops. According to Engene and Pond in 1940, "The outstanding characteristic of the cropping system of Area 8 is the large proportion of tillable land that is used for the production of tame hay." The hay crop and the area's large amounts of permanent pasture helped enable the local dairy industry. However, many of the concentrate feeds needed for dairy cows (e.g., corn and small grains) had to be imported because they could not be grown locally (Engene and Pond 1940: 65-66).

LIVESTOCK

Cattle. About 80 percent of farms in Area 8 milked cows in 1930, with an average of more than five cows per farm. Most of the cows were specialized dairy breeds (Engene and Pond 1940: 64-67).

Hogs. Hog production in Area 8 was "very limited." For example, in 1930 only 14 percent of farms were farrowing any pigs.

Sheep. In 1930, "some" sheep were raised in the area (Engene and Pond 1940: 67). In 1939, the number of sheep in Area 8 averaged 24.5 ewes per farm (Engene and Pond 1944: 18).

Poultry. Most farms in the area raised chickens in 1930 but the flocks were comparatively small. In 1939 there was an average of 43 chickens per farm in Area 8 – the smallest average number in the state (Engene and Pond 1944: 18).

Horses. In 1930 this region had one to two horses and mules per farm, the lowest average in the state.

▪ AREA 9 – TWIN CITY SUBURBAN TRUCK, DAIRY AND FRUIT

This production area immediately surrounded Minneapolis and St. Paul, which in 1940 had a combined population of about 750,000.

In 1940 the Twin Cities Suburban farming area was a region of intensive, small-scale agriculture, generally organized to supply food to Twin Cities residents. The metropolitan area created a large market for perishable foods such as vegetables, berries, small fruits, milk, cream, and eggs.

The terrain ranged from level to hilly, with a large proportion of rolling land. The growing season was relatively long – averaging about 160 days in much of the area.

The soils included both loams and large areas of sand and peat that were less productive.

In 1929, according to Engene and Pond, the proportions of farmland that were tillable, that were used for wild hay, and that were used as permanent pasture were similar to those in Area 2, southwest of the Twin Cities (Engene and Pond 1940: 68).

Number and Size of Farms. In 1939 there were about 5,100 farms in Area 9. They averaged 57 acres in size – the smallest in the state and considerably smaller than the 1939 state average of 165 acres (Engene and Pond 1944: 24).

Farmhouses. In 1940, about 37 percent of farmhouses in Area 9 postdated 1920. About 76 percent of occupied farmhouses had electric lights, 34 percent had mechanical refrigerators, 35 percent had flush toilets, and 44 percent had running water. These were the highest percentages in the state by a considerable margin (Davies 1947: 15). In 1939 about 49 percent of farms in Area 9 had a telephone. The state average was 49 percent (Engene and Pond 1944: 28).

Autos, Trucks, Tractors. In 1939, about 85 percent of farms in Area 9 had an automobile, 37 percent had a truck (the highest percentage in the state and higher than the state average of 18 percent), and 30 percent had a tractor (Engene and Pond 1944: 28).

PREDOMINANT TYPES OF FARMS

In 1930 this region had more diversity in the types of farms than other regions. In that year, 40 percent of farms in this region were classified as dairy farms, 10 percent were general or diversified, 10 percent were truck farms, 8 percent were crop specialty farms, 6 percent were fruit farms, and 4 percent were poultry farms (Engene and Pond 1940: 69-70).

Dairy Farms. Dairy farms (farms earning 40 percent or more of income from dairying) were most numerous in this region in 1930. Dairy farms were also the largest type of farms in the region but, at an average of 92 acres each, were small compared to dairy farms elsewhere in the state. The number of cows per herd was about equal to levels elsewhere in Minnesota in 1930. Some farmers bought replacement calves rather than raising their own, and few young calves were raised in the area for any reason other than to enter dairy herds.

General or Diversified Farms. Most general or diversified farms in this region (i.e., those with income from more than one activity with no single source dominating) kept dairy cows for the sale of milk or cream, as well as raising either potatoes, vegetables, or fruits for sale.

Truck Farms. In 1930, ten percent of farms in Area 9 were truck farms. This region was the only part of the state that had a significant number of truck farms, which were defined as farms that derived significant income from raising crops such as vegetables and flowers that were generally sold fresh rather than being processed before selling. These farms were very small, averaging only 24 acres with an average of 16 acres of harvested crops and few livestock. The income per acre generated on these farms was high compared to income per acre on other farms in the state.

Crop Specialty Farms. Crop specialty farms were those with 40 percent of farm income derived from the sale of crops. They comprised eight percent of farms in this area in 1930. The sale of potatoes was especially important.

Fruit Farms. In 1930, Area 9 was also the only region with a significant number of fruit farms (i.e., farms that derived a significant portion of income from selling small fruits such as berries). They accounted for six percent of all farms in the region and were especially concentrated west and southwest of Minneapolis. Strawberries and raspberries were the predominant fruits grown in 1930. Like truck farms, these were small farms, averaging 23 acres. They had few livestock. Like truck farms, they generated relatively high income per acre.

Poultry Farms. In 1930, poultry farms accounted for four percent of farms in Area 9. (Poultry farms were farms that derived a significant portion of income from poultry raising.) Most raised fresh eggs for Twin Cities markets. In size they averaged only about 14 acres per farm, but each kept an average of 250 hens. They averaged only seven acres of harvested crops and purchased much of their chicken feed. They had few other livestock.

Other Farms. Engene and Pond reported that in 1930 this region also had some part-time, self-sufficient, and other types of farms.

CROPS

In 1929, only 27 percent of tillable land in Area 9 was used for small grains, a percentage that was low compared to most of the rest of the state. About 31 percent of tillable land was devoted to inter-tilled (i.e., cultivated) crops, 31 percent to hay and forage crops, and 10.5 percent to other uses including truck crops and berries (Engene and Pond 1940: 68-69).

Small Grains. In 1929, about 27 percent of tillable land in Area 9 was used for small grains. Oats and barley were the principal grains planted.

Cultivated Crops. About 31 percent of the region's tillable land was used for inter-tilled or cultivated crops in 1929 – about two thirds of this was corn and about one-third potatoes. The proportion of tillable land devoted to potatoes was larger here than in any other region in the state in both 1929 and 1939 (Engene and Pond 1944: 13).

Forage Crops. Nearly one-third of tillable land was planted to hay and forage crops in 1929.

Other Crops. Area 9 produced about one-third of the state's small fruits and vegetables in 1929, excluding sweet corn and canning peas. About six percent of the tillable land in this region was used for these types of special crops – a larger percentage than in any other region in the state.

LIVESTOCK

Cattle. In 1930, dairy cattle were the predominant type of livestock. Most of the cows were special dairy breeds. There were relatively few beef cattle in 1930 (Engene and Pond 1940: 69).

Hogs. A small percentage of farms raised hogs in 1930. Some of the hogs were fed on garbage from the city.

Sheep. There were relatively "few" sheep raised in the region in 1930. In 1939, the number of sheep in Area 9 averaged 30 ewes per farm (Engene and Pond 1944: 18).

Poultry. Poultry was kept on most farms in the area in 1930. Most flocks were relatively small but there were also several large poultry operations (Engene and Pond 1940: 69). In 1939 there was an average of 83 chickens and 311 turkeys per farm in Area 9. Turkey raising was more common in Areas 1, 2, 3, and 9 than elsewhere in the state (Engene and Pond 1944: 18).

Horses. In 1930 farms in this region had an average of two to three horses and mules.

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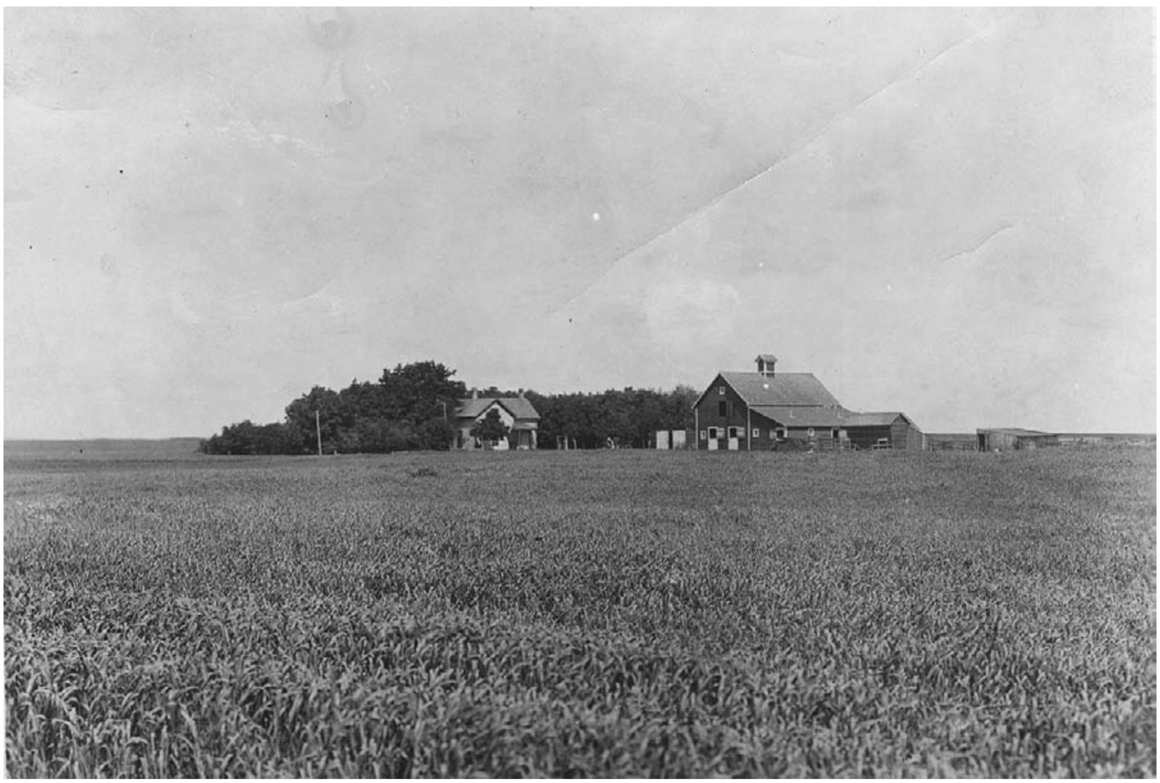
Farms in Area 8 – northeastern Minnesota's cutover region – averaged 103 acres in 1939, considerably smaller than the state average of 165 acres. Most farm buildings were modest as well. Near Graceton, Lake of the Woods County, circa 1919. (MHS photo)



In 1929 more small grains were grown in Area 4 (west central Minnesota) and in the Red River Valley (Area 7) than in other parts of the state. Western Minnesota's flat terrain was well-suited to expansive grain fields that could be profitably worked with large machines. This farmstead's windbreak offered its only protection from the ever-present wind. Western Minnesota, circa 1930. (MHS photo by Harry Darius Ayer)

Farms in Area 9, the Twin City Suburban Truck, Dairy, and Fruit region, raised vegetables, fruit, potatoes, poultry, milk, and eggs for Twin Cities markets. The farms were small because of high land prices, and many eventually succumbed to urban development. Tierney Farm, Richfield, Hennepin County, 1954. (MHS photo by *Minneapolis Star*)

DESIGN CONSIDERATIONS

"Farm buildings are the farmer's factory," wrote agricultural engineer E. A. Fowler in 1913. Thirty years later one of Fowler's colleagues wrote, "adequate buildings are as essential in the efficient production of farm products as up-to-date equipment is in the factory for producing manufactured goods" (Fowler 1913: 106; Kaiser 1943: 288).

Economist Martin Primack noted in 1965, "The construction and improvement of farm buildings in the United States during the latter half of the nineteenth century was a task of farm-capital formation exceeded only by the effort to clear the land itself" (Primack 1965:114).

The planning, financing, and construction of farm buildings was a significant part of the operation of every Minnesota farm, whether the owner was a German-speaking subsistence farmer in the 1860s, or a Wadena County dairy farmer expanding into turkey production in the 1950s. One farmer wrote in 1912, "I know of no work about the farm which requires better judgement than to plan and arrange a set of farm buildings" (Henry 1912: 137). Land and buildings were the assets of highest value on most Minnesota farms, followed by livestock and then machinery (Engene and Pond 1940: 42).

Farm building designs were generally slow to evolve, in part because of the buildings' considerable expense. Because of the risk involved, farmers often built structures with which they were familiar. (This helps explain the persistence of certain building practices within particular locales.) The University of Minnesota's John Neetzel and C. K. Otis wrote in 1959, "High initial cost limits the opportunities for experimenting with farm buildings. Once constructed, a building must remain serviceable for many years to justify the cost. Consequently we hesitate to take chances on buildings that vary a great deal from accepted construction practices" (Neetzel and Otis 1959: 21).

When planning new buildings, Minnesota farmers considered factors such as the following:

Economy in Construction. Economy was almost always important as Minnesota farmers made the significant investment necessary to construct a building. Funds for building construction were also needed for feed and livestock, machinery upgrade and repair, and food and clothing for the family, so farmers had to allocate resources carefully.

"In many localities a small barn is all that is needed," wrote University of Minnesota staff in 1936. They suggested farms could begin with a 16' by 18' barn for two cows, two horses, and hay storage, and Dutch doors to provide both access and ventilation (White et al 1936: 6-7). Similar advice went out to settlers in northern Minnesota's cutover region: "The first buildings should be small, but serviceable unless the settler has a large amount of capital. There is more happiness and comfort in small quarters that are within one's means than in a large place that is not paid for" (Worsham 1920: 18). Careful planning to make the best use of limited space was important, as was learning from the experience of others (Ashby 1916: 26).

See also

Designers and Builders
Building Materials
Barn Forms and Terminology
Appendix: Focus on Farm Journalism
Appendix: Focus on U of M Programs
Appendix: Focus on USDA & Minn Dept of Ag

In the early settlement period, most Minnesota farmers built small structures that might serve for 20 years as fields were slowly created, as cash crops eventually planted, and as settlers fought drought, storms, insects, illness, and other challenges of the frontier (Brinkman and Morgan 1982; Tishler 1986; Noble and Cleek 1995: 13).

Remodeling and enlarging farmhouses, barns, and other outbuildings was very common. Many farmers built modestly at first with the knowledge that they could expand a building later as production grew. Farm experts wrote articles and drew plans that promoted this practice and described how expansions could best be accomplished. In 1933, for example, a Midwest Plan Service catalog described a modest 18′ by 32′ shed-roofed, wooden barn (designed for four horses and four dairy cows) as being "rather complete and serv[ing] as a workable unit until funds permit additions" (Midwest Farm 1933). Some plans for farm buildings clearly showed the footprint of future additions.

Minnesota farmers also cut building costs by supplying their own materials when they could. It was common to use home-sawn timbers for beams, planks, and shingles. Logs were often hauled to a local sawmill and the cut timbers or boards then hauled back. Other native materials included field rock for foundations and sand and gravel for concrete. Window sash and some types of siding such as shiplap were generally purchased. One World War I-era author advised that farmers could lower construction costs by furnishing their own gravel, stone, rough lumber, and labor, but they should expect to pay for cement, shingles, paint, nails, hardware, and some additional construction labor (Ashby 1916: 27).

Farmers built structures with salvaged materials to reduce costs. Wood, which was traditionally the most popular building material in Minnesota, was highly-reusable, as well as being readily available and easy to work. One 1961 source suggested that reusing building materials was one way farmers could mitigate the fact that some farm structures would become obsolete as systems and methods changed (Neubauer and Walker 1961: 14-15).

For reasons of economy, moving buildings around the farm was also common, as was adapting structures to new uses. In the 1910s, proponents of the new field of "farm management," including Minnesota's Andrew Boss, suggested that farmers redesign the entire layout of their farmsteads (many of which had evolved somewhat haphazardly) along sound scientific and modern management principles, and then slowly follow the plan and reorganize structures, roads, and fields as time and resources would permit.

The cost of labor to erect farm structures was often considerable, but many farmers reduced this cost by doing much of the work themselves (and many had more time than cash). There were other labor considerations as well: in an article about the advantages of cement staves for silos (which were introduced in 1905 and proliferated in the 1910s), one expert wrote, "Speed of erection is a big argument to the farmer's wife who is called upon to board the men" (Kaiser 1919: 9). The need to be cost-effective in new construction drove the quest for new materials that could be assembled more efficiently. Wartime labor shortages intensified the situation and eventually led to prefabricated buildings.

One answer to economy in building was standardization, which lowered costs by simplifying construction and reducing the number of unique building materials and parts needed.

Standardization encouraged the factory production of parts and reduced "the variety of materials carried by local dealers" (Ashby 1949: 237). Standardization changed building designs in several ways. Door and window widths, for example, were standardized to allow the use of factory-made sash, and the width of cow stalls was standardized to to allow farmers to buy factory-made stanchions.

The desire to encourage standardization was one factor that compelled 12 land-grant colleges, including the University of Minnesota, to jointly create the Midwest Plan Service (MWPS) in 1932. (See this context study's "Designers and Builders.") In one barn plan developed by the MWPS in the 1930s, 75 percent of the lumber needed was standard-sized dimensional lumber that required no cutting before placement (Giese "Midwest" 1957; Giese 1943: 70).

Standardization also sped the dissemination of ideas. One agricultural engineer explained in a 1942 article on corncribs, "prefabrication of storage structures can play a much greater part in this market than it has in the past. It is much easier to demonstrate to a few manufacturers the basic requirements for corncribs, than it is to educate all the farmers who grow corn [and build their own structures]" (Malcom 1942: 83).

Standardization was largely a post-World War II phenomenon. According to farm building expert Henry Giese, there was still "comparatively little standardization in the farm building field" by the 1940s (Giese 1943: 70).

Farm Labor Efficiency. Reducing farm operating labor was another major focus of farm building design. One author wrote in 1912, "Fifteen minutes saved each morning, noon and night in doing the barn chores is an important item. . . . Forty-five minutes each day constitute 274 hours each year. At 15 cents an hour this amounts to $41.10, enough to pay six percent interest on $685" (Marsh 1912: 141; $685 translates to a loan of $12,800 in 2003 dollars).

The debate about whether dairy barns should be designed with the stanchioned cows facing in toward the center or out toward the side walls was focused on the labor of twice-daily milking. When the cows faced inward, some argued, labor was saved through better illumination of the milking process by light coming in the side wall windows. When the cows faced outward, however, the farmer could more easily move the milking stool, wash pails, and milking equipment from cow to cow across the central alley.

Technical materials on building design almost always mentioned labor efficiency. A 1916 source, for example, suggested that barns have no more than two rows of stalls to make best use of window light, that they have multiple doors so that each type of livestock could be easily let into their yard, that hay chutes and grain bins be located near feeding troughs, and that mow doors be freely accessible to wagons (Ashby 1916). A 1936 University of Minnesota source recommended that stairs, ladders, chutes, litter and feed carriers, and similar devices in buildings all helped save valuable time (White et al 1936: 4).

Building Maintenance and Operation. Lowering building maintenance and operating costs were also important design goals. Wooden farmhouses, barns, and other buildings had to be repainted frequently to prevent deterioration, for example, leading some farmers to choose brick, hollow clay tile, concrete block, and other materials that required less maintenance. Corrugated sheet metal became popular for durability as well as speed of erection. Many farmers also used masonry and sheet metal to reduce the fire loss threat inherent in wood.

Optimizing Output. One goal of farm building design was to increase production by making buildings function as well as possible for their intended purpose. Technical bulletins, magazine articles, and advertising circulars were full of examples of milk gone sour, poultry so cold they wouldn't eat, and piglets dying because of inadequate buildings. The losses hurt individual farmers and the entire agricultural industry, which was a huge part of the U.S. economy. On the other hand, technical sources were rich with examples of building improvements that easily paid for themselves in productivity gains, whether they involved labor saved, grain preserved, or gains in livestock weight.

The trend toward analyzing the specific functional requirements of each type of agriculture, and then customizing farm buildings to meet these requirements, began in earnest in the 1910s. This research accelerated considerably in the mid-century and resulted in huge productivity gains after World War II.

Livestock farmers and agricultural engineers continually sought ways to increase production by improving animal health. Hog cholera, bovine tuberculosis, and the parasites and viruses that plagued poultry were just a few of the diseases that challenged designers. Farmers experimented with concrete floors to increase sanitation, well-placed flues to increase stable ventilation, compartmentalized mangers so cows wouldn't share food, and movable poultry and farrowing houses to avoid soil-borne parasites. Farmers added guardrails to pig stalls so sows wouldn't accidently crush piglets, created cool areas in brooder houses so chicks would feather out faster and therefore not peck each other, and built wider doors in sheep barns so ewes wouldn't be injured when they all tried to enter the barn at the same time.

In cold climates like Minnesota, some experts recommended that dairy and general purpose barns be no wider than 34' so the heat generated by the animals would keep the interior temperature optimal with no supplemental heat. (Dairy cows didn't produce well if they were cold and uncomfortable.) Storing hay and straw in the mow also helped conserve heat.

Heat conservation also figured into a debate about hog house design. In the early 20th century many hog houses were built with monitor roofs incorporating a row of windows to allow light from the south to shine into the stalls during farrowing. "This was done on the assumption that the sunshine would, first, warm the house, second, keep it dry and, third, provide for an ultraviolet bath for the little pigs." Instead, farmers in northern states found that in February and March, when the sows farrowed, the sun only shone directly into the monitor windows for about two hours per day and, for the rest of the time, the monitor caused heat loss as the heat traveled upward into the monitor and out the windows. Water also condensed on the window glass and dripped into the stalls. The result was a cold, damp hog house and pig losses, rather than the warm dry house that had been sought (Strahan 1928: 3).

Attention to the particulars of building design could be quite detailed. In 1916 the American Society of Agricultural Engineers' "Subcommittee on Barn Floors" reported on their continuing study of the best materials for barn flooring. The committee agreed that most floors needed to be durable, warm, waterproof, noiseless, somewhat cushioning, and provide good traction. "Cork brick," "mastic asphalt," and poured concrete over a layer of insulating hollow tile were recommended for stall floors. Creosoted wood blocks were recommended for work floors such as in feed rooms. Poured concrete and mastic asphalt were recommended for chore alleys, and thick wooden planks or poured concrete over hollow tile were recommended for mow floors and upper storage rooms. Each material had its drawbacks for large areas: poured concrete was cold, slippery, and prone to cracking; brick was cold and hard to clean; creosoted wood was slippery and absorbed odors; wood planks warped, splintered, and were hard to clean; cork brick was too expensive; and mastic asphalt was slippery and soft in hot weather (Niemann 1916).

Response to Changing Methods. Farm building design evolved as farm methods changed. Granaries were made taller for the use of mechanical elevators. Hay mows were enlarged to accommodate hay carriers. Doors and manure alleys were widened as tractor-drawn manure spreaders replaced hand carts. Cow stalls became a standard size to receive factory-made stanchions and other fixtures. Implement sheds grew larger to house more machinery. The speed of change intensified with electrification and the labor-saving devices it brought to the farm, and increased again around World War II when labor shortages spurred the adoption of more new technology. According to one designer, buildings constructed after the war needed to assume "electric lights, water systems, milking machines, improved types of self-feeders and feed bunks, mechanical feed handling and conveying equipment, silo unloaders, manure cleaners, poultry waterers, and similar devices" (Ashby 1949: 236).

As farm mechanization increased, the need for a building to respond to shifting methods became more urgent, until finally flexibility itself became a leading design goal.

Prior to about 1930, many farm buildings were designed for permanence. Barns were expected to last for several generations, and farm couples sought to pass on to their children a collection of solid, well-made buildings. Materials were chosen to be as long-lasting as could be afforded, with many experts arguing that repair costs would be less on "the durable building" (Marsh 1912: 142). In 1935 William Boss, head of Agricultural Engineering at the University of Minnesota, argued in the pages of *Agricultural Engineering* that farmers should be building barns and homes to last 100 years or more (Boss 1935). Several months later, however, another agricultural engineer cautioned in the same publication that farmers shouldn't invest too much on structures that might eventually become obsolete. He wrote:

> We know in recent years the idea of permanence has been rather strongly emphasized, and I do not want to be understood as discarding it without further and most thoughtful consideration. . . . There are today barns built of so-called permanent materials which are so permanent that they cannot be economically rebuilt to take advantage of new and improved methods and practices. . . There is no justification in putting up a long-lived masonry structure if we have to destroy it with dynamite within a few years. In American agriculture there is no value in such ruins (Ekblaw 1935: 268).

The goal of flexibility was not completely new. For years some farmers and experts had favored wooden buildings over those of masonry because they could be remodeled more easily. And designers had tried to reduce the number of interior structural bents in barns so that interior spaces could be modified more easily (Ashby 1916: 26).

By the mid-1930s, however, the goals of adaptability and flexibility were receiving new emphasis. A 1933 advertising circular warned farmers, "Farm conditions are changing faster today than ever before . . . To meet changing conditions may require farmers to readjust building and equipment to serve such production as is most promising from a market standpoint" (Spahn 1933). A Minnesota farmer wrote in 1939, "Farming is not static. Methods, machines, and practices of today are outmoded tomorrow" and "We need to recognize the changing character of production." He then went on to describe the changes in farming methods he had seen in the nine short years he had owned his farm (Benitt 1939: 304-305).

Agricultural engineer D. Howard Doane stated emphatically in 1941, "I want short, rather than long life buildings." He argued that few in the industry could see forward 20 years, which was the average depreciable life of a woodframe building (Doane 1941: 313). He explained that he wanted his farm buildings "to have maximum, continuous, and alternate use." He suggested "Well-planned buildings with removable partitions can be used for beef cattle, horses, mules, sheep, and dairy loafing barns. . . . Alternate use makes maximum use possible" (Doane 1941: 314).

After World War II, the desire for flexibility increased, and new clear span designs, strong lightweight materials, and prefabricated and modular units met the need. In 1956 the Midwest Plan Service began to draw plans for "shells of farm buildings," including dairy barns, whose interiors could accommodate a variety of arrangements and functions (Pederson 1956).

In 1956 agricultural engineer Deane Carter explained that farm buildings were becoming obsolete because of changes in farming practice – rather than due to deterioration of the buildings – and that single-use buildings were deficient because they weren't readily adaptable to other purposes. In his view the best buildings were "so adaptable in nature to fulfill the multipurpose objectives characteristic of today's farming needs" (Carter 1956: 259).

Agricultural engineer J. T. Clayton wrote of dairy barns in 1960, "It must be constantly borne in mind that flexibility of the entire system is of utmost importance because of rapidly changing technology. A good solution last year may not be a good solution now and very likely will not be the best solution next year. It must be possible to change the facility with changing production requirements and farming methods" (Clayton 1960: 603).

And in 1955, Indiana agricultural engineer William Yaw wrote:

> Farm buildings seem to be developing in two widely varying directions at the same time. The first is the highly specialized type where buildings are used essentially for one purpose. These can be justified only when the enterprise is developed sufficiently and is large enough to warrant the overhead for such a structure. The second is the flexible type where the building is nothing more than a shell which can be adapted for a wide variety of uses, even to the point of making the shells movable (Yaw 1955: 583).

Aesthetics. The role that aesthetics should play in farm building design was a matter of frequent debate through the decades. Throughout the period covered by this context study, most farm buildings were designed and built with a single over-arching goal – that of supporting the survival or profit-making operation of the farm. Aesthetic concerns were almost always secondary. While farm buildings were often neat and well-maintained, they were not usually ornate or highly decorated.

One farm building designer wrote in 1912, "It pays to consider the appearance of a building when it is built," both for the satisfaction of the owner and for resale. But "To be beautiful to the owner or others, a building must be erected which best fits its intended use. A building that is beautiful for beauty's sake is not a satisfactory one. Architecture is a useful art, and the beauty of a structure must be a utilitarian one. Over-ornamentation is a bad mistake. Any part of a building improperly placed, and not harmonizing with other parts, is meaningless" (Marsh 1912: 143).

Farm building specialist Henry Giese wrote that practical consideration "does not infer that we should neglect beauty or harmony in design which have a very direct bearing upon morale, but that the emphasis should be put upon the securing of lower production costs by giving attention to management and fundamental [livestock] housing requirements" (Giese 1930: 3).

And a Minnesota farmer wrote in 1939, "While it may appeal to a man's vanity to have a beautiful farm factory, that in itself may not spell satisfactory returns. And beauty from a strict business point of view can justify a capital expenditure only when it brings added returns" (Benitt 1939: 303).

According to barn historian David Stephens, "most midwestern barns are not decorated." When barns were decorated, he wrote, "the most common decorative element" was "some combination of date and the name of the farm or owner," usually in paint. Other decorative elements sometimes seen on Midwestern outbuildings involved rooftop cupolas, ventilators, weather vanes, and, more rarely, special roof shingle patterns (Stephens 1995: 238-255).

Farmhouses were the building most often designed with aesthetics in mind. One early 20th century author expressed the common sentiment that farmers shouldn't think "that they cannot have a beautiful home or a convenient one, for they are entitled to both" (Henry 1912: 137).

R. Nicholson, an architect who worked for one of the Canadian government's experimental farms, addressed aesthetics in a 1927 piece in *Agricultural Engineering*. He wrote, "There are, of course, old farm buildings which possess considerable architectural merit, but the present day designers, while improving the ventilation, lighting and floor arrangements, have discarded most of the features which made the older buildings so effective in appearance" (Nicholson 1927: 113).

In pondering how to improve building aesthetics, Nicholson wrote:

> In the first place all rigid ideas of symmetry must be discarded in the design as the requirements [of functional farm buildings] are so many and so varied that absolute freedom of plan must be allowed. The various buildings on a farm cannot be made to harmonize according to the accepted traditions of architectural design without seriously affecting their practical requirements. The proportions of a cattle barn, for example, are largely predetermined and the designer has little latitude in the length, breadth, or height of the various portions of the structure; these bear a certain relationship to each other governed by considerations not within the control of the designer. . . .
>
> A good plan involves the location of the various units with reference to each other in such a manner as to afford proper functioning with the least lost motion and waste of space, operation with the minimum of labor, ease of access and communication and, in some cases, allowance for expansion. . . . The result may, and often will, be a rambling type of plan in which each unit is treated according to its special requirements. . . . [Ornamental] planting, frequently neglected, will help to soften otherwise hard outlines. Ornament should be used sparingly and should be large in scale (Nicholson 1927: 113).

Nicholson also pointed out, "Molding on doors, windows, etc., should be entirely dispensed with, as well as all interior corners as no projections must be allowed which permit the lodgement of dust" (Nicholson 1927: 114). He also noted, "One of the most difficult problems of architectural treatment is the silo. If slightly separated from the barn, it might be treated as a tower and many interesting and charming examples of this may be found among the old farmsteads of France. It is, however, difficult to harmonize a tower, reminiscent of medievalism, with a modern hip-roof [gambrel] barn" (Nicholson 1927: 113).

INFORMATIONAL NETWORK

Most farmers learned of trends in building plans and materials in the same way that they learned about other technical information – through a growing informational network. Within the networks, information passed from centralized sources to farmers, from farmers to experts, and between farmers themselves (Lindor 2004). Through these channels Minnesota farmers were able to avail themselves of the steady advancements in research and technology that helped fuel a dramatic increase in farm productivity in the 20th century. (For more information on these networks see the appendices on Farm Journalism, University of Minnesota Programs, the USDA and the Minnesota Department of Agriculture, and Farmers' Organizations.)

Much of the information focused on the arrangement of farms and the design and construction of farm structures. Many Minnesota farmers considered these views when they made decisions about the physical development of their operations, and – because ideas and accounts traveled both ways – this information also served as a general reflection of what was actually being built on farms throughout the state (Lindor 2004).

Farmers' earliest sources of information included discussions with each other and with family, friends, and neighbors. This traditional way of sharing information was important throughout the period covered by this context study (Lindor 2004), and is often cited by historians when they describe the transfer of designs and construction methods within particular ethnic communities (Brinkman and Morgan 1982; Tishler 1984; Peterson 1998; Wilhelm 1995: 64-67).

During the late 19th century, the early farm press and the first agricultural societies stimulated farmers' discussions with information exchanged through meetings, publications, and fairs.

The federal government began gathering and disseminating technical information to farmers in the late 19th century by establishing the USDA (1862) and funding land-grant colleges (1862), state experiment stations (1887), and an agricultural extension service (1914). In many cases, the Minnesota Legislature preceded federal action. The Legislature established, for example, the University's College of Agriculture (1869), the State Dairy Commission (1885), Farmers' Institutes (1886), the Minnesota Experiment Station (1885), and Minnesota Extension Service (1909). Many of these agencies and institutions were placed at the University of Minnesota. Their founders and staff joined colleagues in Wisconsin, Iowa, and Illinois in becoming national leaders in various specialities within the field of agriculture.

Another important piece of the informational network was private industry. A vast array of enterprises – railroad companies, flour mills, food processors, farm equipment manufacturers, building materials makers, lumberyards, hardware distributors, seed companies, and fertilizer and chemical firms – were interested in the continued productivity of American farmers. These companies launched technical help desks, demonstration farms, immigration bureaus, research services, outreach offices, plan bureaus, magazines, radio shows, and advertising circulars, all to help farmers succeed, and to highlight the role of their company's own products in that success.

Technical information on farming was widely disseminated. Farmers' clubs and county agricultural fairs, for example, were organized in almost every county, and by the end of World War I nearly every county had a county extension agent. A majority of the state's farmers subscribed to at least one agricultural newspaper or farm magazine, and later tuned in to farm radio broadcasts.

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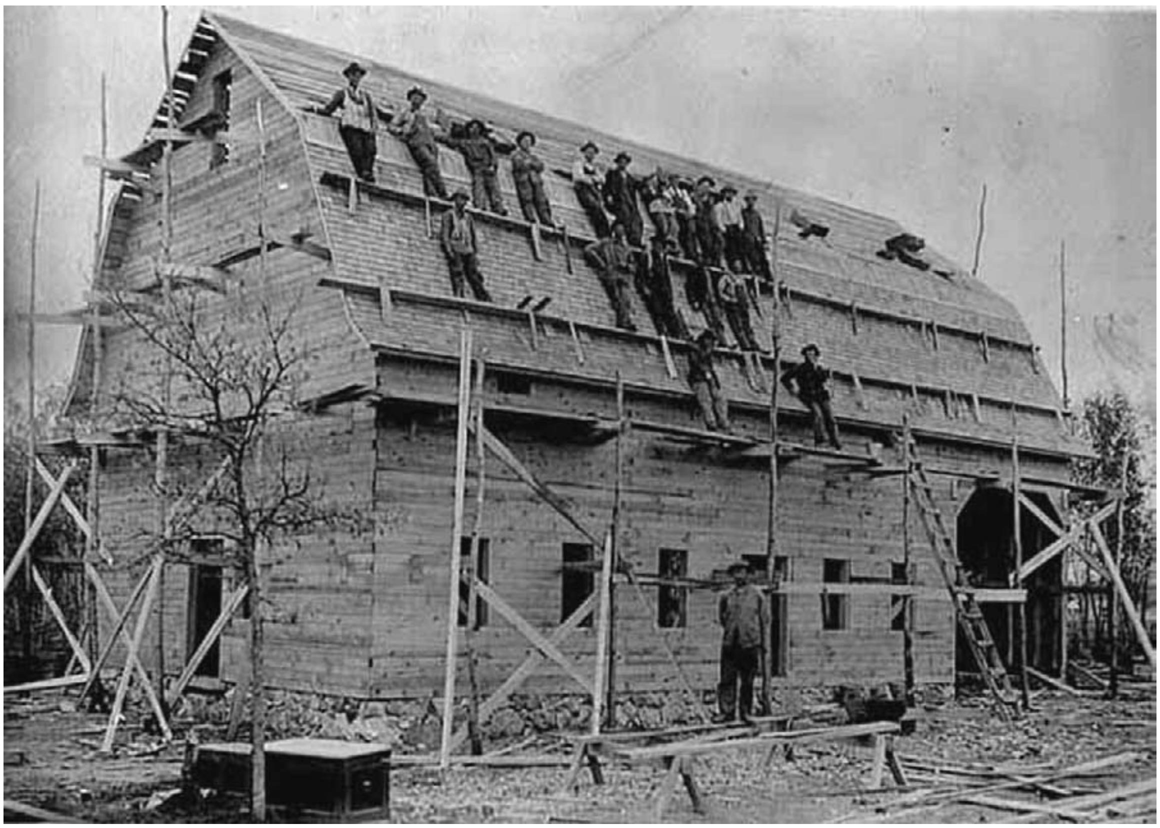


Group construction of a barn on the Johnson Farm, near Almelund, Chisago County, 1913. (MHS photo)

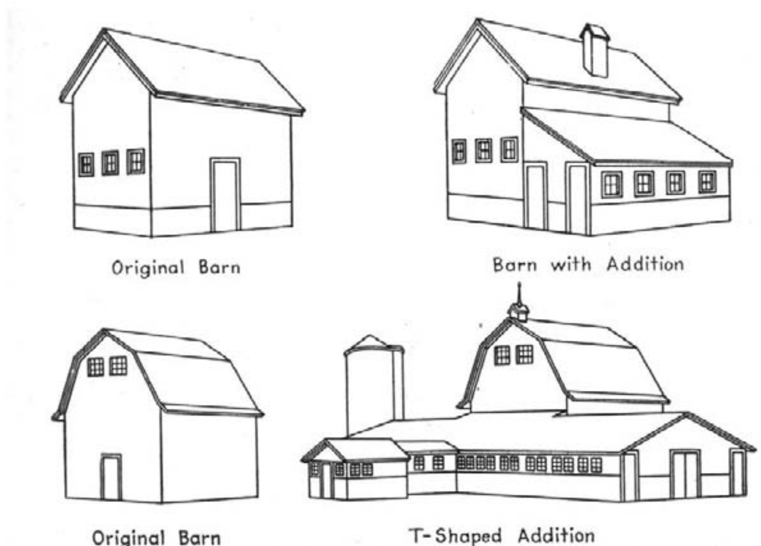
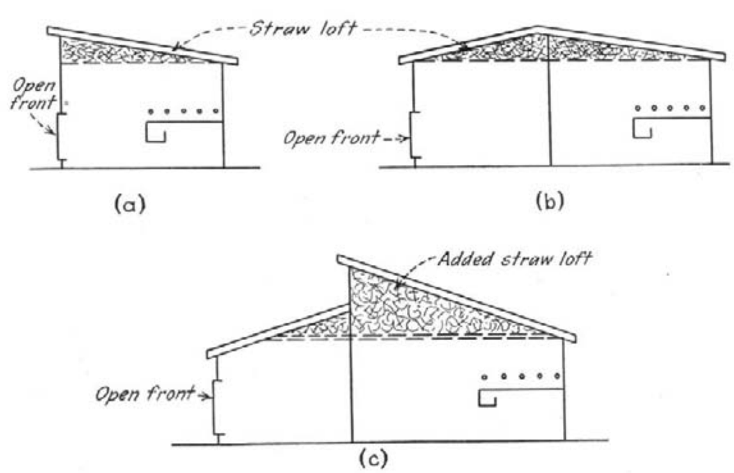


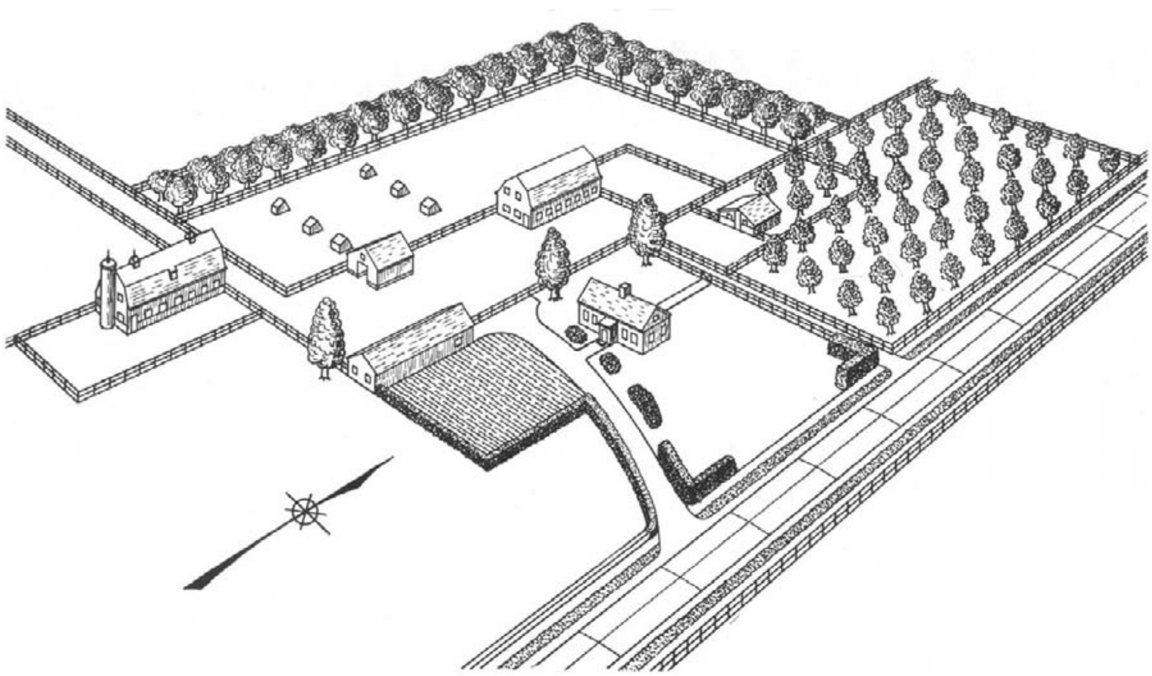
FIG. 102.—Additions to existing barns to accommodate a dairy enterprise.



Farmers commonly built only what they needed, and later added on. They also moved structures to new locations, and remodeled buildings for new uses. This illustration appeared in a 1946 farm building text by John Wooley, an agricultural engineer from the University of Missouri (*Farm Buildings* 1946).

Some experts recommended barn expansions that formed an L-shape, similar to the photo above. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

Sanford Farm, Sanford Township, Grant County, 1983. (MHS photo)



This drawing from a 1945 text was used to illustrate good farmstead planning. The farmstead is well-organized and attractive. It has two large barns, one for dairy and one perhaps general-purpose. It has a poultry house in the orchard, hog cots near a double corncrib, and a long implement shed near the center. The yards and fields are all fenced, a northwest windbreak protects the site, and there is a large vegetable garden south of the farmhouse. Note that the "modern" public road is paved with concrete and the farm has no windmill – probably removed because the farm has been electrified (Wooley 1946).

DESIGNERS AND BUILDERS

BUILDERS

Most farm buildings were constructed by farmers themselves, often with the help of relatives and neighbors. By necessity, most farmers were good mechanics and skilled at carpentry, concrete-laying, plumbing, and welding, and many were also adept at surveying, electrical work, and brick-laying (Peterson 1983: 32; Lindor 2004). In some cases, even hardware such as hinges and latches were made on the farm if the farmer had blacksmithing skills. Window sash was often purchased.

Large buildings such as barns were sometimes erected by groups of neighbors who assembled for a "barn raising" day (Dieffenbach 1955; Rippley 1977). Historian John Fitchen, who studied the raising of timber frame barns by Dutch immigrants in New York state, wrote,

> There was a stringent limitation on the amount of time [the farmer] could ask of his neighbors to give [because they were as busy as he]. So he had to have all in readiness before they arrived to help him. The trees would have been felled, the logs cured, and then snaked to the site; so much, he could have managed himself. But unless the farmer also happened to be a skilled [joinery] carpenter, the shaping of the timbers and the cutting of mortices in accordance with a carefully laid out plan would have been the work of a professional and experienced carpenter (Fitchen 1968: 59-60).

Assembly usually happened in one long day, which Fitchen says was different from traditional practice in Europe where farmers lived closer together and could gather several times for shorter periods as needed (Fitchen 1968: 59-60). Because of the time constraint, it was important that the master builder in charge was well organized and had all barn components cut and shaped correctly.

After the turn of the 20th century, professional carpenters and building contractors were increasingly involved in farm building construction. Some builders furnished plans as well as constructing buildings (Sculle and Price 1995).

In Minnesota, the construction of specialized structures like silos and the construction of structures made of manufactured materials like cement staves or concrete blocks, was often handled by companies that worked in particular trade territories or sold specific or patented products. Farmers would hire company crews to build the structure, in part because, through their experience, the crews had become specialists in the material or equipment, and could therefore best adapt it to the particular needs of the farm (Lindor 2004; Kaiser 1953: 34).

See also

Design Considerations
Barn Forms and Terminology
Appendix: Focus on Farm Journalism
Appendix: Focus on U of M Programs
Appendix: Focus on USDA & Minn Dept of Ag
Appendix: Focus on Farmers' Organizations

DESIGNERS

Most farm buildings before World War II were designed by farmers themselves "without the assistance of an architect or engineer" (Giese 1929: 121; Kaiser 1953: 34). Professional architects were rarely involved in farm building design, "possibly because few farmers could afford the professional fees involved" (Nicholson 1927: 113).

Farmers were often influenced by what their neighbors were building, and variations in building types sometimes developed locally. Farmers were often active innovators of buildings and equipment, and as a technical problem was solved on one farm it would be spread to other farmers in the region (Lindor 2004; Marsh 1912: 141). USDA agricultural engineer Wallace Ashby explained in 1957, "The ingenuity of a single farmer in finding a better way to do a certain thing has been the starting point for many a new development. His improvement caught the attention of a neighbor, a research worker, a farm equipment salesman, or a writer for a farm magazine and thus formed a link in the chain of improvement" (Ashby 1957: 431).

Agricultural engineers bemoaned the lack of professional planning, explaining that, as a result, many buildings did not serve the farmer well, made farm work more difficult, and required frequent repairs. Designer W. G. Kaiser wrote in 1943, "Farm structures have been the stepchild of the construction industry; the architectural profession is seldom called in to design farm buildings. There are no building codes or regulations to govern farm construction – no inspection to insure structural soundness. There is no financing organization like the Federal Housing Administration which exercises a certain supervisory control over design and construction. Every farm structures engineer knows how desperately the farmer needs technical assistance" (Kaiser 1943: 287-289, 292).

In the late 19th century the void in professional design expertise, and the desire to increase national farm productivity through the design of good buildings, led government agencies such as the USDA and state agricultural colleges and experiment stations to begin to establish agricultural engineering offices, to design and promote rural road-building and farm drainage, and to draw plans for farm buildings and supply them to farmers at little or not cost.

Like most land-grant colleges, staff of the University of Minnesota drew plans for farmers. One staff member wrote in 1914, "for several months past the Poultry Section at University Farm has received almost daily requests for plans of a poultry house suitable to Minnesota farm conditions" (Smith 1914: 165). Once a successful plan was developed, it was often distributed for several years, even decades. The University of Minnesota's 1953 plan book, for example, contains plans that were drawn many years before (*Farm Building Plans* 1953).

Drawing and distributing farm building plans was an important part of the spread of "scientific agriculture." Henry Giese of Iowa State University, a founder of the agricultural engineering profession, explained: "A building plan is perhaps our most effective means of transmitting results of research to the farmer." He felt plans transferred information more readily than technical bulletins, which required "considerable ingenuity" in adapting research findings to actual construction (Giese 1943: 71). By 1929 there were more than 2,800 plans for farm buildings and equipment available to farmers from the state agricultural colleges and the USDA (Giese 1943: 69).

The need for designers who also understood farming gave rise to the field of agricultural engineering. The University of Minnesota added college-level courses in agricultural engineering in 1895, the

American Society of Agricultural Engineers was established in 1907, and the University established a Division of Agricultural Engineering in 1909. (For more information, see below and the appendices to this report.)

Materials and equipment manufacturers also disseminated drawings, although it was rare that these sources published full, detailed building plans. Much of this type of information was distributed through local lumberyards. Industry groups such as the Portland Cement Association, the Hollow Tile Building Association, the National Lumber Manufacturers Association, the Common Brick Manufacturers' Association, and the Douglas Fir Plywood Association promoted the construction of buildings using their products, established "farm bureaus," and/or published plans, as did individual companies such as Reynolds Aluminum, Louden Machinery Company, and the makers of silo materials. The Northern Pine Manufacturers' Association created the St. Paul-based "White Pine Bureau," for example, and the Northwestern Lumberman's Association published plans through Brown-Blodgett of St. Paul (see White Pine series ca. 1925; Brown-Blodgett ca. 1940).

Other companies that offered plans and planning services included Hunt, Helm, Ferris, and Company; James Manufacturing Company; National Plan Service; Radford Architectural Company; and Sanders Publishing Company (Sears 1981: 4).

Beginning in the early 20th century, farm buildings were also available in "mail-order" kit packages from companies such as Rilco Laminated Products of St. Paul and Merickel Buildings of Wadena. Historian Sally McMurry indicates that advertisements for mail-order farmhouses from at least four companies were published in the farm press in the early 20th century. Among the manufacturers were Gordon-Van Tine of Davenport, Iowa, and Alladin of Bay City, Michigan (McMurry 1988: 212-213).

In 2001, historic preservationist Joy Sears conducted extensive research on pre-cut, kit barns available in the Midwest from mail-order companies during the period 1900-1930. According to Sears, the popularity of mail-order architecture peaked in the 1920s, declined during the Depression and World War II, and was resurrected after the war but in slightly different form with more emphasis on preassembly and prefabrication. Barns and other farm buildings were available starting about 1910. Sears discovered that mail-order kit barns were available from several companies. Her information includes the following:

Aladdin Company of Bay City, MI, founded in 1906, offered barns in the 1910s and 1920s.

Chicago House Wrecking/Harris Brothers Co. of Chicago first sold plans for farm buildings and then entire kits. The company went out of business circa 1938.

Gordon Van-Tine Company of Davenport, IA, offered kit barns from about 1915-1940. In 1940 the company had 350 employees and five plants.

Montgomery Ward and Company of Chicago was selling mail-order kit barns by 1912. In 1918, for example, barns were available in widths of 24', 28', 32', and 36' and lengths up to 144'.

Sears, Roebuck and Company of Chicago began selling kit homes in 1908 and began selling barns about 1910. In 1918 they placed their kit farm buildings into a catalog separate from their

> kit houses. The farm buildings included barns, hog houses, chicken houses, and granaries. Sears, Roebuck and Company sold barns until about 1934.

According to Joy Sears, kit farm buildings were delivered by railroad, truck, or wagon. She writes, "Most of the barns offered required only a few simple tools, usually two or three people, and the ability to follow plans for assembly. Since the kits came with everything (excluding masonry materials), assembly was relatively quick and inexpensive compared to finding skilled barn builders or paying local prices for questionable dimensional lumber" (Sears 1981: 9). Kit buildings could be economical because middle men were eliminated and waste could be reduced because the customer only paid for the exact lumber needed. Some companies offered farmers credit, customized design services, and extra interior elements and equipment such as hay carriers. Sears was unable to ascertain how many barns might have actually been ordered from these companies (Sears 2001: 3, 6-9, 15).

Giese's Summary. In 1932, after a nationwide review, Henry Giese of Iowa State University indicated there were "five agencies at present functioning in the field of farm building design." His annotated list included:

> **Agricultural engineering staff at agricultural colleges.** Furnishing plans was seen as part of the function of the colleges, although resources for drawing plans were stretched thinly.
>
> **Architects.** Professional architects accounted for a small fraction of farm building design in 1932.
>
> **Building materials industry.** According to Giese, "Trade associations concerned with cement, lumber, tile, brick, steel, etc., have contributed much valuable literature on farm building design. The largest part of it is in bulletin form and is intended to stimulate the proper use of specific materials." The materials industry did not generally issue complete plans, but instead produced concept drawings or partial plans.
>
> **Barn equipment industry.** Giese reported, "In the field of animal housing, this industry has contributed perhaps more than any other agency to advance in matters of design. At least three of the larger companies maintain planning departments that practice in the field of farm buildings with as close an approach to professional standards as any other existing agency. . . . Fees charged range from 1 to 10 percent depending upon the type of service rendered and the size of the project."
>
> **Local contractors.** "Many farmers rely on local builders for assistance in planning their buildings." According to Giese, these buildings might be structurally sound, but they were often not designed for functional efficiency, so the farmer might be stuck for years using a building that did not serve his farming methods well. "The country carpenter needs a guide, and the farmer needs an expert advisor," wrote Giese (Giese 1932).

The American Society of Agricultural Engineers. The rise of the agricultural engineering profession had a tremendous impact on the design and construction of farm buildings in the Midwest. The field was young when the American Society of Agricultural Engineers (ASAE) was founded in 1907 at the University of Wisconsin. The ASAE became the discipline's leading professional organization and a principal clearinghouse for new information on farm engineering and farm building design and construction.

ASAE members were engineers from academia, industry, and government. They lived in both the U.S. and Canada. Ironically, none of the 17 ASAE founders had a degree in agricultural engineering because it wasn't yet a recognized engineering specialty. (The University of Minnesota's Division of Agricultural Engineering, for example, was established in 1909. Its undergraduate degree was first offered in 1925, and graduate courses were first offered in 1930.) Mary A. Ives became the first female member of the ASAE in 1921.

By applying the scientific principles of engineering to farm operations, agricultural engineers aimed to increase farm efficiency, productivity, and profits; reduce the hazards of farming; remove drudgery from farming operations; and make farm life more enjoyable ("Foreword" 1957: 348). The ASAE also helped establish uniform standards for products, equipment, and building technology, and helped educate new generations of agricultural engineers.

While the ASAE provided technical information to farmers so they could build their own structures, the group also encouraged farmers to seek professional engineering advice for farm building design, land drainage systems, and other improvements.

The ASAE advocated unbiased, accurate research of farm structures. In the 1920s, for example, the ASAE stressed the need for basic research on dairy barns, poultry houses, and crop storage buildings. In 1930 one ASAE member explained the need for research by noting that agricultural extension agencies were not in a position to conduct research, that farmers themselves were "hazy" in their understanding of how to best increase productivity and profits through improved farm structures. He also explained that much of the existing information on farm buildings was of questionable value because it had been prepared by "powerful industrial organizations acting in an extension capacity," and presumably self-interested (Strahan 1930: 328).

Early in its history, the ASAE established technical committees on power and machinery, farm structures, rural electricity, land reclamation, soil and water, and education and research. The Committee on Farm Structures promoted and publicized advances in building materials, structural and mechanical systems, architectural design, and farmstead layout. The Committee on Farm Structures was instrumental in the formation of the Midwest Plan Service in 1932.

First led by Henry Giese, the Committee on Farm Structures investigated a range of farm building questions. In 1916, for example, the committee attempted to bring order to the diverse field of farm buildings by identifying 18 basic barn forms that it felt were most suited to an average farmer's needs. (See illustration in the "Barn Forms and Terminology" section of this context study.) The list of barn forms was developed by culling through thousands of buildings and plans. The committee considered factors such as functionality, cost, availability of building materials, building skills needed, and adaptability to various kinds of farming practices (Niemann et al 1919: 268-275).

After World War II the ASAE was active in efforts to mechanize crop and livestock systems and to create buildings and structures that would best support new methods and increased scales of production. In 1960, for example, the ASAE held a national conference on a new development in livestock farming – confinement housing. The ASAE's journal *Agricultural Engineering* collected research papers and related materials from the confinement conference in a "comprehensive handbook on the subject, suitable for the engineer, manufacturer, dealer, and the farmer alike" (Basselman 1960: 565).

The ASAE published conference findings in *Transactions* beginning in 1907. In 1920 it launched a monthly professional journal called *Agricultural Engineering*. The magazine became widely recognized as the major source for information on advancements in the field. It covered a broad range of topics pertaining to farm building design and construction; farm infrastructure such as water and sewage systems; field drainage, erosion control, and irrigation; and equipment, materials, and technology. Readers included professional engineers and scientists, farmers, students, university and high school faculty, county extension agents, and farm equipment manufacturers and dealers.

The ASAE had more than 5,000 members in 1957 and today has about 9,000 members. The group's headquarters are in St. Joseph, Michigan.

Midwest Plan Service. The Midwest Farm Building Plan Service, soon renamed the Midwest Plan Service (MWPS), was founded in 1932. It was a collaborative effort of 12 Midwestern universities in collaboration with the USDA and the American Society of Agricultural Engineers (ASAE). The University of Minnesota was among the founding members, which soon numbered 15 colleges. Plans to organize the service had been in the works since 1929 when ASAE members from the Upper Midwest met in Fargo and discussed the idea.

The driving force behind the Midwest Plan Service was Henry Giese, Iowa State University professor and a leader in the ASAE. The project was the first collaboration of its kind in the country. Following the MWPS model, several other cooperative farm building plan services were formed in other parts of the U.S.

Among the MWPS's goals was to improve farm efficiency and productivity by encouraging best-practices in farm building design. The Service was a response to an increasing number of requests for blueprints that were coming in to land-grant universities from farmers in the region. Member colleges hoped to reduce costs by eliminating the need to draw plans for something available in a neighboring state. They also hoped to resolve conflicting building advice being issued by various state agencies. The partnership would also help members conduct cooperative research (Giese 1930).

The MWPS encouraged standardization in farm building design, which engineers felt would simplify advice to farmers, lower costs overall, and lead to efficiencies by reducing the variables that materials and equipment manufacturers needed to anticipate. In 1936, for example, MWPS participants proposed to redraw their barn plans to only show widths of 32', 34', and 36', with variations focused on the length of the barn and its floor plan, rather than width ("Midwest Plan Book Agenda" 1936).

The Midwest Plan Service collected the best information on farm structures from its participating members (who often gathered designs from farmers themselves), prepared standardized plans and materials lists, published a catalog, and distributed this information to farmers at minimal cost. Plans issued by the Service were often based on the review of thousands of standing buildings and existing plans in an attempt to identify designs that were most cost-effective and functional. The designs covered everything from a one-seat outhouse to a cooperative creamery. Plans were also drawn for numerous pieces of equipment such as feeding racks and stock tanks. In explaining one advantage of professional plans Giese wrote, "Many of our farm building plans [until now] have been little more than suggestions for the arrangement of space, leaving structural problems at the mercy of the builder" (Giese 1943).

The University of Minnesota participated in the development and operation of the Midwest Plan Service. At the time of the 1937 MWPS catalog, for example, the University's representatives in the MWPS were agricultural engineers William Boss and H. B. White. C. K. Otis was the University's representative in 1949.

To formulate its first set of plans, the MWPS gathered existing drawings from the USDA and 12 of the 15 member states – 1,400 building plans in all. It culled the plans, modernized and redrew them, and issued its first set of 113 drawings in a 96-page catalog in 1933 (Midwest 1933). Five thousand copies were printed. The catalog was promoted by Kirk Fox, editor of *Successful Farming* magazine, in a series of eight monthly articles beginning with the June 1933 issue. Fox was an early supporter of the MWPS who also contributed financially to the publication of the catalog. The full catalog was revised and republished in 1937 with 122 plans (Midwest 1937; Gustafson 1967: 2). Catalogs issued in subsequent years focused on single subjects.

The MWPS sought wide distribution of its plans. Catalogs were furnished to each county extension agent in member states and distributed through experiment stations, agricultural schools, lumber dealers, vocational schools, building contractors, and insurance companies (Harmon et al 2004; Scharf 2004; Giese 1933). The MWPS allowed its plans to be included, with proper credit, in any agricultural extension circular ("Midwest Plan Book Agenda" 1936). Despite its desire to disseminate the plans, however, it was with some dismay that the MWPS learned in 1934 that the National Plan Service, a for-profit entity, had used about 50 of the MWPS plans in a book that was selling for considerably less than the MWPS catalog (Giese 1934).

The MWPS collaborated with building material manufacturers. For example, the MWPS apparently allowed companies to "rebind the plan book to include material showing the adaptability" of the plans to their particular product (e.g., concrete block or structural clay tile), as long as the MWPS drawings were not altered. The Weyerhaeuser Lumber Company adopted the Midwest Plan Service as its "official plan service" and distributed the catalogs to 3,500 lumber dealers (Giese "Midwest" 1957; Giese 1932; Quisno 1934). The MWPS also entered into agreements with Douglas Fir Plywood, American Zinc Institute, Reynolds Aluminum, and others for MWPS plans that would show how particular building materials could be properly used (Pederson Nov. 1956).

In a 1943 article in *Agricultural Engineering*, Henry Giese indicated that, before creation of the MWPS, agricultural colleges and the USDA had collectively drawn more than 2,800 plans to be distributed to farmers. He noted about them:

> It would seem that with so many the field ought to be thoroughly covered and little should be lacking. On the contrary there was still much to be desired. The large number of plans reflected the diversity of opinion on the part of designers and the exploitation of personal ideas not necessarily substantiated by experimental data. Widely divergent recommendations from contiguous states tended to confuse and mislead rather than to clarify and inspire confidence among the consuming public (Giese 1943).

Giese also wrote in 1943 that despite some efforts toward standardization (including the creation of the Midwest Plan Service), there was still "comparatively little standardization in the farm building field. In a maze of plans being distributed by the federal department of agriculture, state agricultural colleges, and commercial groups, the prospective builder has little to guide him in his choice or to direct his management program later" (Giese 1943).

After World War II, the land-grant colleges involved in the Midwest Plan Service renewed their pledge to cooperate and launch a new era of shared research. The goal was to avoid duplication, best use of each institution's slender resources, and position the engineers to help direct the postwar catch-up in farm building construction faced by American farms – a situation that a Wisconsin participant in 1944 called "perhaps the largest single program of capital investment that the American farmers have ever before undertaken" (Clark quoted in Giese "Midwest" 1957). The group proposed to continue to standardize plans so that manufacturers could use "mass production methods" to supply economical buildings for farmers. It also proposed to evaluate many of the new construction materials that had been developed during the late 1930s and 1940s but had not been tried on farms. The Wisconsin engineer wrote in 1944, "farmers are going to be deluged with sales promotion programs regarding the new products developed since the war began," and would need advice on their effectiveness (Clark quoted in Giese "Midwest" 1957). He later recalled, "the need was for more penetrating analysis of the factors involved [in farm building research], the development of improved designs, and their rigorous testing under closely controlled conditions. . . . New and better designs and materials, developed and tested by competent research workers, were recognized as necessary" (Clark quoted in Giese "Midwest" 1957).

After the war, the MWPS was also called into service to quickly design crop storage structures for postwar bumper crops left without storage facilities because of Depression and wartime building curtailment. An estimated one billion bushels of storage was needed. Federal funds paid the MWPS to modernize and redraw plans for grain storage structures, resulting in the 1949 MWPS catalog, *Grain Storage and Building Plans*, which was distributed with assistance from the Northwestern Lumberman's Association (Giese "Midwest" 1957; Midwest 1949). During this time, in 1948, the MWPS was more formally organized and hired full-time staff, although the Service remained chronically under-funded.

Today the Midwest Plan Service is still in operation and is still headquartered at Iowa State University in Ames, its original home. According to the group's web site, more than 2 million agricultural building plans and 1.3 million related publications have been disseminated by the MWPS.

Plans supplied by the Midwest Plan Service are believed to have been widely used in Minnesota by farmers who accessed the plans through county extension agents (Lindor 2004; Scharf 2004). No study of the influence of the service on Minnesota farm buildings is known to have been conducted.

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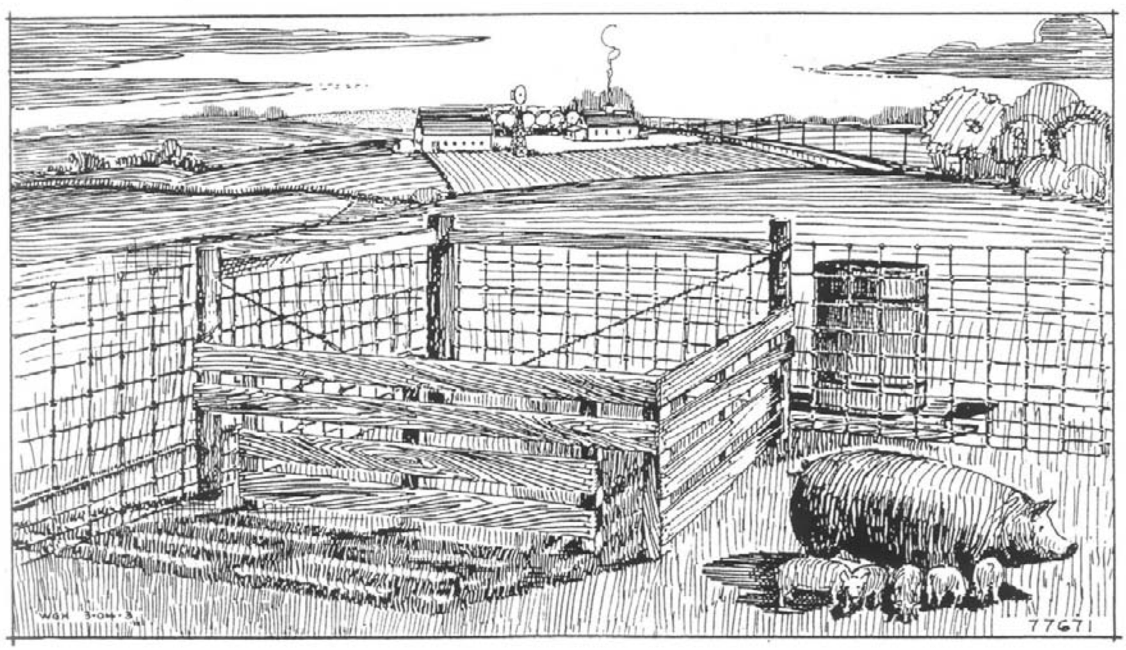
Wooden pegs and carpenter's "marriage marks" in a mortise and tenon timber frame barn built circa 1895 on a German immigrant farm. Dahm Farm, Nicollet Township, Nicollet County, 2006. (Gemini Research photo)

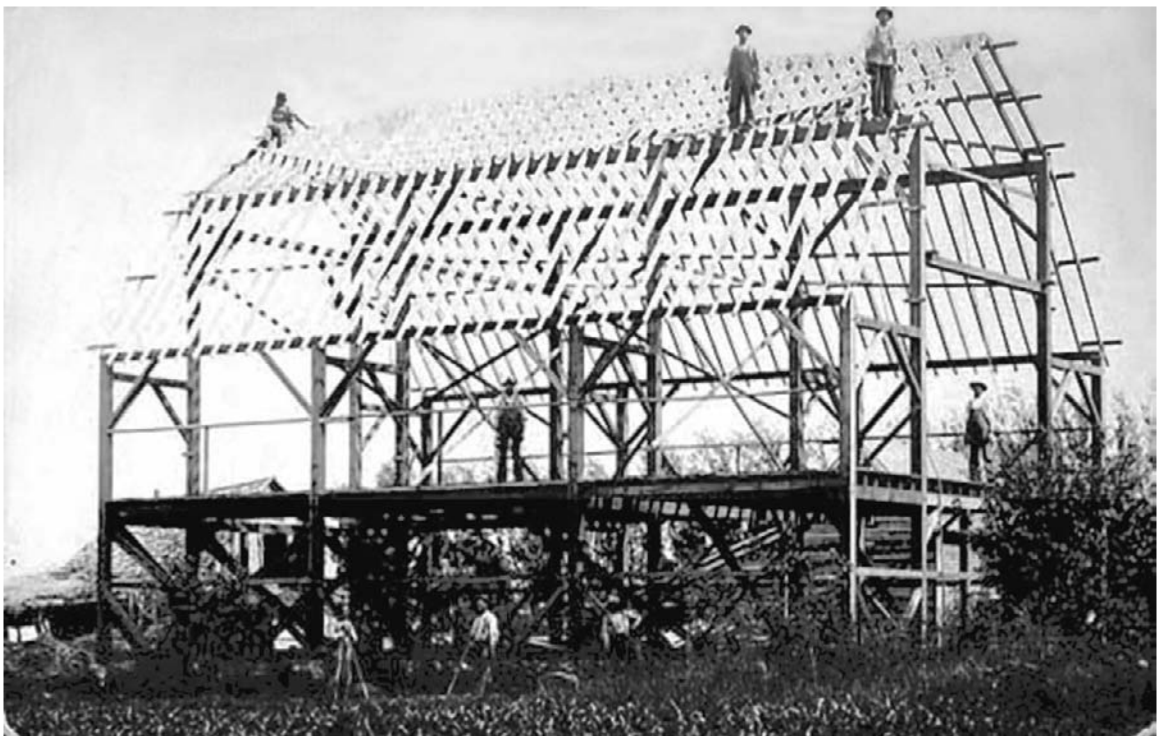
Few farm buildings were designed by professional architects. Instead, beginning in the late 19th century, designs were often influenced by agricultural engineers and other professionals working through colleges, experiment stations, the USDA, the agricultural press, and industry. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)



A page from a 1937 Midwest Plan Service catalog. In addition to a bucolic scene and plans for a creep feeder, the catalog offered a few words of advice on pig care. From Midwest Farm Building Plan Service, 1937.

Gothic arches were introduced about 1916. This barn stood in west central Minnesota. Quaal Farm, Lac qui Parle County, circa 1920. (MHS photo by Chalmers and Son)

"This new appearing round roof building is the answer to your pole free loafing barn" according to *Merickel Buildings for Farm and Ranch*, a circa 1960 promotional piece by Merickel Buildings of Wadena. Plans and materials were available for three sizes of these metal-sided buildings. Merickel's offerings are just one example of the many labor-saving, prefabricated, modular, and kit buildings available to Minnesota farmers after World War II.



A barn under construction. Location unknown, circa 1908. (MHS photo)

BUILDING MATERIALS

Between 1820 and 1960, the period covered by this historic context, most Minnesota farm buildings were framed and sided with wood. However, a wide variety of other materials were increasingly employed as farmers sought to make their buildings durable, functional, and cost-effective. Building materials were studied, evaluated, and critiqued by individual farmers, by agricultural experts, by building and equipment manufacturers, and by industry trade groups. The development of alternative materials quickened during World War I and II when the U.S. faced shortages of traditional materials such as steel and when defense industries rigorously pursued new research and methods. After World War II several factors, including a boom in domestic construction in cities that reduced the availability of labor for farm construction, stimulated further interest in low-cost and labor-saving materials and methods.

Aluminum

Advantages: long-lasting, low maintenance, lightweight, did not need paint, construction ease, resistant to corrosion

Disadvantages: expensive, less strong than steel, less resistant to wear and abrasion

Timetable: little use on farms before World War II

Although developed in the 19th century, aluminum was not broadly used until after World War II when wartime aluminum factories sought new markets, defensive uses were applied to the domestic realm, and the U.S. faced continuing steel shortages. Aluminum house siding that resembled clapboard was developed in the late 1930s and was widely marketed after World War II (Lauber 2000: 19). Reynolds Metals, Kaiser Aluminum, and other companies made aluminum sheet roofing and siding used by industry and agriculture. Aluminum sheets were more expensive than galvanized steel sheets for farm use, but were less prone to rust and more heat-reflective (Neubauer and Walker 1961: 571).

In a 1955 advertisement in *Agricultural Engineering*, Kaiser Aluminum offered aluminum roofing in 26"- and 48"-wide sheets and materials and plans for ten one-story, aluminum-clad, pole-frame buildings: an implement shed, dairy barn, milking barn, general purpose barn, multipurpose storage shed, broiler house, broiler-layer house, and portable shelters and houses for poultry, beef, and hogs (Kaiser 1955: 440).

Aluminum panels, both triangular and diamond-shaped, were used to create self-supporting hemispherical aluminum domes (i.e., geodesic domes) on farms by 1961. Some had diameters up to 145' and heights of 50'. One source wrote in 1961, "It is possible that structures of this type may find a place in large agricultural building services" (Neubauer and Walker 1961: 574).

See also
Design Considerations
Designers and Builders
Barn Forms and Terminology
World War II & Postwar, 1940-1960

Aluminum shingles, most embossed, were also used for farm buildings in 1961. Some had interlocking edges and others were installed like asphalt shingles (Neubauer and Walker 1961: 574).

Asbestos-Cement Boards

Advantages: waterproof, acid-resistant, rot-proof, fireproof, insect-proof, non-warping, long-lasting

Disadvantages: brittle, hard, difficult to shape on site, nail holes needed predrilling

Timetable: used on farms beginning in the early 20th century

Asbestos-cement boards were made of 85 percent Portland cement and 15 percent asbestos fiber. Asbestos-cement was available in several thicknesses, textures, and colors and was sold from the early 20th century and until the 1970s. This material was one of the best fire-resistant materials according to agricultural engineers.

In 1939, factory-cut panels of asbestos-cement were being suggested for the construction of fireproof, maintenance-free one-story dairy barns (Schaffhausen 1939). Because of its acid-resistance, cement-asbestos was also recommended for interior walls for dairy barns, milk houses, hog barns, and poultry houses (Engelbach 1948: 14).

A 1940 publication by *Successful Farming* magazine illustrated "something new in the farm building field" – corncrib slats made of asbestos cement. The slats were nailed to the crib's wooden frame with leaded nails (Fox 1940: 56-57).

In 1961 asbestos-cement boards were widely used on farms for siding, roofing, and other purposes (Neubauer and Walker 1961: 576-577).

Asphalt Composition Siding

Advantages: waterproof, rot-proof, easy to install

Disadvantages: heavy, easily torn

Timetable: used on farms beginning in the early 20th century

Asphalt composition rolled roofing was available in the 1880s and almost immediately used for siding as well as on the roof. Pigmented granules were developed in the early 20th century. Asphalt composition siding – both rolled and in shingle form – was widely used to side and re-side farm buildings.

A 1924 article in *Agricultural Engineering* written by a railroad company agricultural engineer references this building material for settlers in Minnesota cutover: "One of our favorite [recommended] house plans has three rooms and sometimes a basement, and can be added on to two sides. It is 20 by 24 feet and is built of shiplap covered with heavy composition roofing on sides and roof. . . . The materials in such a house cost about $450 [about $4,800 in 2003 dollars] and it is quite roomy and comfortable judged by pioneer standards" (Ashby 1924: 28).

Brick

Advantages: durable, widely adaptable, could be glazed and therefore washable, could be highly decorative, did not need paint

Disadvantages: smaller units than concrete block or hollow tile therefore required longer construction time, was difficult to cut on site, more expensive than wood, masonry skills required

Timetable: used on farms beginning in the 19th century, less popular by the 1940s

Brick could be an economical and long-lasting farm building material if a brickyard was located nearby and if the local brick was of good quality. In a 1998 study of German immigrant farm buildings in central Minnesota, art historian Fred Peterson found that about one-third of the late 19th century farmhouses in the rural Catholic parish at Meire Grove were built of brick. Peterson described the brick-making process and noted that some farmers worked for the local brickyard during the winter months in exchange for bricks for their own houses (Peterson 1998: 66, 79). Minnesota's German immigrants, in particular, appear to have favored brick farmhouses if brick was available (Martens 1988; Peterson 1998).

Brick was most often used for farmhouses and for special-purpose or fireproof structures like silos and smokehouses. However, brick was also used for barns, milk houses, and other farm structures.

Concrete

Advantages: strong, more expensive than wood but more durable, moldable, waterproof, fireproof, decay proof, resistant to wear and abrasion, less expensive and faster to install than brick, smooth and cleanable, did not need paint, generally did not require special masonry skills

Disadvantages: heavy, reinforcing steel rods could corrode, concrete could crack and spall

Timetable: both reinforced concrete and concrete blocks were widely used after 1900, blocks with special designs were sold from 1900 through the 1930s, cement staves were introduced in 1905 and quite popular by 1920

Reinforced concrete was developed in the 1860s and 1870s, but not widely adopted until 1900. As early as 1902 experts were urging farmers to install concrete floors in farm buildings to help keep them clean, reduce loss of feed, and make work more efficient through proper design of floor slopes and gutters. A 1911 article in the *Minnesota Farmers' Institutes Annual* began, "Concrete is a comparatively new building material which few farmers have acquired the habit of using . . . " and then noted, "The intelligent farmer . . . is beginning to realize that the supply of his old-time building materials is becoming scarce and expensive, and that he must study concrete and become acquainted with its adaptability to his uses" (Arp 1911: 197; "Cement" 1902: 156).

Repeating University of Minnesota advice given at least as early as 1904, A. D. Wilson wrote in 1909, "The floor of the back porch, or at least a good large step at the back door, made of cement, is a 'joy forever' to the housekeeper. Here the slops from the milk cans, calf pails, slop buckets, and dirt tracked in from outside are all taken care of much easier and in a more sanitary way than can possibly be done on a wooden platform" (Wilson 1909: 86). Wilson also promoted building cement stock tanks, barn floors, root cellars, sidewalks, and other structures (Wilson 1909).

In 1913 the Universal Portland Cement Company built a concrete demonstration barn in Sheridan, Illinois, that was featured in a leading journal, *Agricultural Engineering.* The barn had concrete block walls and reinforced concrete floors, stalls, mow floor, and roof. The roof had a shallow gabled shape and a gable-roofed, industrial-looking monitor. The barn measured 34' x 54' and housed 8 horses and 12 cows, grain bins, alleys, and an upper mow (Fowler 1913). A monolithic concrete barn that received national coverage was built circa 1920 near Fergus Falls by the Denniston-Sprague Construction Company. The commentator estimated that a 36' x 72' barn of this type would cost about $366 to build ($3,700 in 2003 dollars) (Fenton 1921: 36).

By 1925, farmers were apparently "the most extensive users of concrete," taking advantage of "more than 500 uses for concrete on the farm and about the home," according to an industry piece published that year (quoted in Aggregate 2005). Carter and Foster wrote in 1941, "Concrete is the most widely used material for footings, foundation walls, walks, pavements, farm service building floors, and tanks for sewage disposal, milk cooling, and similar uses" on the farm (Carter and Foster 1941: 66). Many parts of barns including floors, stalls, and gutters were formed of concrete. Another common use for concrete was to plaster the insides of masonry silos and cisterns to make them waterproof and to protect the bricks from the corrosive silage.

Many Minnesota farmers made concrete using sand and gravel found on the farm.

Concrete Blocks. Concrete blocks were available in the U.S. about 1900 and became widely used in 1900-1920. Before 1915 about 75 percent were used for foundations, basement walls, and partition walls. Block sizes were standardized in 1924. Special blocks popular through the 1930s imitated cobblestone, brick, and ashlar, or had ornamental scrolls, wreaths, and roping. The most popular special shape was rockfaced (Simpson et al 1995: 83).

Cement Staves. Cement staves (called "cement" although "concrete" would be more accurate) were units about 30" long, 10" wide, and 2.5" thick. Their patented design differences generally focused on the way they were joined. Cement staves were invented in 1905 by the S. T. Playford Company (located in Elgin, Illinois, in 1919). The first cement stave structure was a circular stock tank built in 1905 in Michigan. Staves were designed for silo construction, but by 1919 were also being used for barns, hog houses, poultry houses, corncribs, granaries, milk houses, pump houses, smokehouses, and garages. Five large cement stave barns, for example, were built near Fergus Falls in 1918 by the Minnesota Cement Construction Company of Fergus Falls. The company also built 258 silos and a number of hog houses and other buildings during the 1918 season. Stave structures were fast to build and did not need the masonry expertise that hollow tile, brick, or concrete block required, or the forms needed for monolithic concrete. There were more than one dozen major manufacturers of staves in 1919 (Kaiser 1919: 41).

Fiberboard

Advantages: easily worked, lightweight, curvable, easily paintable, insulative, soundproof

Disadvantages: tended to absorb water, some types not strong, not long-lasting

Timetable: first used on farms around 1920, widely used after World War II, superceded in the 1960s by plywood and particleboard

Rigid panels of compressed wood and fiber products – called fiberboard – generally fell into three categories – insulation board, medium density fiberboard, and hardboard – none of which was readily available before the 1910s. One product, a rigid insulation board called Insulite was made in International Falls, Minnesota, beginning in 1915. The Mason Fiber Company's hardboard (called Presdwood, Tempered Presdwood, Masonite) was first made in 1926.

Shortages of money and materials during the Depression and World War II stimulated fiberboard research and application. In 1937, for example, agricultural engineers were testing and recommending structural insulation board for poultry houses, an outbuilding that especially needed to be dry and warm during the winter (Ward 1937: 44).

By the 1950s fiberboard was widely used. In 1952, for example, the Masonite Corporation was advertising Masonite Tempered Presdwood as exterior milk house sheathing. The board had to be finished with sealer and two coats of paint (Masonite 1952: 735).

By 1961 fiberboard was in common use for farm buildings as flooring, siding, roofing, wall partitions, sun shade shelters for livestock, bunker silo walls, cylindrical silos, hog and poultry houses, brooders, pecking boards, feed storage bins, lining for boxes and bins, automatic feeders, concrete forms, and interior surfaces. Asphalt-impregnated insulating boards were being used as mat liners for lakes, reservoirs, pools, canals, and ditches (Neubauer and Walker 1961: 574-577). In the 1960s fiberboard was superceded in many applications by plywood and particleboard (Gould et al 1995: 120-123).

Fiberglass

Advantages: strong for its weight, waterproof, decay proof, heat-resistant, moldable which facilitated prefabrication and reduced on-site labor

Disadvantages: thermal expansion, yellowed in sunlight, deteriorated by weathering

Timetable: developed in the 1940s, translucent sheets for roofs and windows used beginning in the early 1950s

Fiber-reinforced plastic (fiberglass) was formulated in the 1940s, although precursors were developed earlier in the century (Walker 1995: 142-143).

Corrugated, fiber-reinforced translucent sheets were first made in the late 1940s and became one of the most important uses of fiberglass in the building industry. As of 1959, these panels were nearly the sole use of fiberglass on farms. They were being used for translucent roofing, for temporary surfacing for greenhouses, on silos, and for temporary storage facilities for produce and machinery. Fiberglass in other forms was being tested for farm applications in 1959 (Aldrich and Boyd 1959: 336).

Glued Laminated Rafters

Advantages: labor savings because preassembled, precut, predrilled; allegedly four times stronger than nailed rafters therefore greater resistance to wind and snow loads

Disadvantages: some variation in lamination causing uneven moisture absorption, rafters are large and heavy

Timetable: introduced in the 1930s with farm use beginning in the late 1930s

Glued laminated wooden arches were developed in Europe and introduced in the United States in 1934 in Wisconsin. The pioneering company was Unit Structures Inc. of Peshtigo, WI, founded that year. Five years later, in 1939, the USDA issued a technical bulletin on laminated arches based on the work of the Forest Products Laboratory in Madison (created by the USDA and the U.S. Forest Service). A Minnesota leader, Rilco Laminated Products, was founded in St. Paul in 1939 as a subsidiary of Weyerhaueser Lumber Company. Another Minnesota company was Super Structures, founded in 1943 in Albert Lea by a former Rilco general manager. Steel shortages during World War II helped increase interest in structural laminated timber.

Rilco's gothic arches for farm buildings were "factory-fabricated and engineered" in standard sizes, and were sold only through lumberyards (Rilco 1948: 507). The structures were shipped as half-arches that needed assembly at the ridge. Holes were predrilled and all hardware was included. The arches were generally spaced 2′ on center, with hay hoods and provision for hay carriers offered. Conventional roofing was used. Typical spans for barns were 30′, 32′, 34′, 36′, 38′, or 40′. A 1950 advertisement suggested that a crew could erect all rafters for an average-size barn in one day. Another Rilco style, a tied arch, was designed for 30′ to 50′ spans with arches spaced 8′ on center. This shallow arch could be used in pole- or post-framed barns or in other applications (Rilco 1955: 6-7, 18).

In 1950 Rilco was advertising rafters "for every type of farm building from small hog and poultry houses to large post-free machine sheds, granaries and barns" (Rilco 1950: 91). Clearspans of 110′ or more were "commonplace" (Rilco 1948: 507). Other Minnesota sources for "glue-lam" rafter buildings included lumberyards such as Tomlinson Lumber (East Grand Forks, Willmar, Callaway, and Verndale), which in 1958 was offering pre-cut materials for a 34′ x 50′ dairy barn with a gothic-arched roof supported by three-ply rafters (Tomlinson 1958: 25).

Logs

Advantages: strong, warm in winter and cool in summer, material readily available in most parts of the state, could form the core of an eventually larger building

Disadvantages: heavy, needed special skills to build properly, hard to enlarge

Timetable: used during the early settlement phase in all parts of Minnesota except the treeless areas, use persisted in the northeastern cutover through the Depression

Many Minnesota farmhouses, barns, and other outbuildings were built of logs either left round or hewn square with a broadaxe and smoothed with an adze. The logs were often assembled into a single-pen structure with corners joined in dovetail, half-dovetail, or similar joinery style

(Brinkman and Morgan 1982; Roberts 1995). Log buildings were most often built during the early settlement period before local sawmills, rail service, and commercial lumberyards were established. They were most common in heavily wooded areas of the state.

In the northeastern Minnesota cutover, log farmhouses and outbuildings were still being constructed through the 1930s. A 1936 article in *Agricultural Engineering*, for example, discusses the use of logs to build small farm buildings in forested areas, including those where Depression-era resettlement projects were being established (Witzel 1936).

Log Cobbling. In their circa 1980 fieldwork on historic farm structures in central Minnesota, Brinkman and Morgan encountered a combination barn built in 1874 that had what they termed a log-cobbled floor in the horse stall area (Brinkman and Morgan 1982: 124).

Metal Sheets (Iron and Steel)

Advantages: fire-resistant, long-lived, low maintenance, resistant to abrasion and wear, strong (sheet steel was stronger than sheet iron), kept out air and moisture, no special building skills needed, less overlap than wood siding therefore less material used, lighter shipping weight than wood, fast to apply, could be applied over old roofing, siding, or ceilings to renew appearance, cheaper for roofing than tin, slate, or wood shingles, slippery so less snow build-up on roofs

Disadvantages: metal's conductivity produced temperature extremes, condensation or sweating created uncomfortable and unhealthful environment for livestock and led to rust, iron rusted more than steel, required repainting every five or so years

Timetable: sheets of iron and steel (as well as iron and steel shingles) were used on farms beginning in the 1880s; used to cover entire barns by 1910, sheet steel superceded sheet iron around World War I, stamped brick and stone patterns were sold through World War II, corrugated sheets were popular from the 1880s to the present

Galvanized iron sheets were widely available in the U.S. by the mid-1850s. Galvanized sheet steel was available beginning in the late 1860s and its price lowered considerably in the 1880s, making it more popular. Corrugation became common around the late 1860s. Roofing shingles of sheet iron and steel became widespread in the 1880s and 1890s (Simpson 1999: 34-42, 47).

Galvanized iron and steel sheets could be corrugated, joined with standing seams, V-crimped, and stamped in various patterns to resemble weatherboard, beadboard, brickwork, or stone masonry. This decorative stamping was available beginning in the late 1880s and popular until World War II.

As early as 1888 an advertisement by a St. Paul company for corrugated iron sheet roofing with standing seams claimed "our roofing over shingles has been tested for the past ten years, and found to be the only practical covering for old [wood] shingles." The sheets were 8' long and 26" wide (Moies 1888).

Galvanized sheets of both iron and steel were widely used in the early- to mid-20th century to cover farm buildings, grain elevators, warehouses, and similar structures. Sheet iron was increasingly superceded by sheet steel around World War I (Bartells and Ekblaw 1932: 47-49).

Galvanized steel sheets were especially popular to resurface aging farm structures. A steel industry engineer explained in 1941, "Many cases can be cited in our own repair work where, at the expenditure of one-third to one-fourth of the renewal cost of an old weather-beaten, ramshackle dwelling slated for tearing down we have remade it into a neat, new appearing structure with a longer and more economic life than it had when new, because of the lower maintenance cost built in" (Crow 1941: 17).

Corrugated galvanized iron sheets were nailed over wooden frames to make early metal-sided buildings. A 1911 issue of the *Minnesota Farmers' Institutes Annual*, for example, contained an article on a new barn built in Minnesota of dimensional lumber that was sided entirely with 28-gauge corrugated galvanized iron sheets (Payne 1911: 211-213).

In 1922 the United States' first all-steel barn was built in Michigan. Measuring 36' x 72', it had a steel frame and 22-gauge corrugated sheet steel siding and roof (Jones 1926: 176).

Sheet steel's fire-resistance was questioned by at least one agricultural engineer who argued in 1926 that even though steel roofing wouldn't ignite if a large firebrand landed on it, the metal roof could transfer heat to the hay inside *faster* than wood, leading to ignition of the hay. The same agricultural engineer questioned the purported longevity of steel sheets compared to wood, stating that wood was long-lasting, even if unpainted (Cartwright 1926: 241-242).

In the mid-1930s steel grain bins, silos, and fencing had been in use for several years but steel hay storage buildings and all-steel barns were relatively new. In 1934 farms were the sixth largest market for U.S. steel and in 1936 the fourth largest market. About ten percent of finished steel went to farms in 1935, presumably for both building materials and implements (Anderson 1937: 164).

By 1941 metal roofing sheets were very popular for farm building roofs, especially in the southern U.S. Sheets with a factory-baked primer coat of metallic paint were also available by 1941 (Crow 1941: 15).

By 1961 aluminum-coated steel sheets were used for farm building siding and roofing (Neubauer and Walker 1961: 569).

Paint

Advantages: protected wood, renewed the appearance of buildings, whitewash could be made inexpensively from lime

Disadvantages: deteriorated in sun and rain, required regular renewing

Timetable: commercial barn paints were developed by about 1850 and widespread in the 1880s, in the Midwest painted barns were rare before the early 1860s

Barns in Pennsylvania and other eastern states were being painted by commercial painters by 1850. According to David Stephens, "Barn painting in the Midwest was rare until after the Civil War" (Stephens 1995: 238).

In Minnesota, as in the rest of the Midwest, most barns and other farm outbuildings were painted either red or white (Stephens 1995: 238-240). There are several theories explaining why barns and other farm outbuildings in the U.S. were traditionally painted red. The most frequently-given explanation attributes red barns to an early European practice of adding rust (ferrous oxide) to the mixture of linseed oil, milk, and lime used to coat barns. The ferrous oxide protected the siding against fungus and moss, and stained the wood a dark orange-red. The traditional red color was then apparently continued in commercial red barn paint, which was made with relatively inexpensive and long-lasting ferrous oxide earth pigment.

White barns, also common in Minnesota, were popular because of the low cost of whitewash, which was made from substances such as slaked lime (calcium hydroxide) and chalk. Whitewashed dairy barns were sometimes used to give the appearance of being clean and sanitary. Whitewashed walls and ceilings helped reflect light in the dimly-lit interiors, making barns easier to keep clean and improving light levels for workers as they milked and did other chores.

Painting outbuildings with a contrasting color of trim paint was a common way to "decorate" farm buildings (Stephens 1995: 238-240).

Plastic Films

Advantages: waterproof, strong, decay-proof, insect- and rodent-proof

Disadvantages: deteriorated when exposed to sunlight thereby needing frequent replacement, could be torn

Timetable: began to be used on farms in the 1950s

According to sources published in 1956 and 1961, plastic films were used on farms for mulch, vapor barriers, moisture barriers, waterproofing under floors, concrete curing, roof coverings, greenhouses and cold frames, temporary windows, machinery protection, experimental silage bags, coverings for hay stacks, trench silos, and bunker silos. and liners for tanks, ponds, and irrigation canals (Staff 1956: 741; Neubauer and Walker 1961: 577).

Plywood

Advantages: strong, rigid, lightweight, easily worked, did not split when nailed, paintable, little shrinking, swelling, or twisting

Disadvantages: not as long-lasting as other materials

Timetable: used on farms after World War II

Plywood was developed in the 19th century and the name was coined in 1919. The U.S. Forest Products Laboratory in Madison, WI, tested plywood in the 1920s and built an experimental plywood house in 1934. Plywood was being made in 4' x 8' sheets by the 1930s. A 1939 article in *Agricultural Engineering* discussed testing plywood for lightweight but strong portable brooder houses (Giese and Dunkelberg 1939). Defense needs during both World War I and II advanced plywood's development. The industry's greatest growth occurred after World War II (Jester 1995: 134).

Plywood was in common use for farm buildings by 1961. Structural uses included beams, columns, subflooring, flooring, wall sheathing, roof sheathing, and as a base for stucco. Finish uses included siding, exterior soffits, concrete forms, fences, signs, furniture, doors, and other interior work (Neubauer and Walker 1961: 574-575).

Pole Framing

Advantages: little lumber needed, easy assembly, low maintenance, economical, strong, durable, adaptable

Disadvantages: poles tended to rot at base and therefore needed chemical treatment

Timetable: developed in the 1930s, used on farms beginning in the 1930s and widely after World War II

According to barn historian Lowell Soike, a precursor to a pole barn was described in the May 31, 1889, issue of *Iowa Homestead*. The building was a tall "Midwestern hay barn" for beef producers, with optional one-story shed additions for beef housing. The central hay section could be framed either with massive, upright, square timber columns spiked to posts set in the ground, or with full-length telephone poles (Soike "Affordable" 1995: 90-91).

Harper and Gordon trace the origins of the ubiquitous pole barn to the 1930s and to agricultural use. They explain:

> The modern concept of utilizing round poles as the principal structural support for farm buildings was initially developed by H. Howard Doane in the early 1930s. Doane, founder of Doane's Agricultural Service of St. Louis, and Bernon George Perkins, his farm manager, devised a system of creosoted, pressure-treated poles as primary framing, with two-by-fours spaced four feet apart as sheathing [support] material. Perkins' pole-building design concept, patented in 1953 [many years after development], significantly reduced the amount of lumber needed and could be erected in considerably less time than traditional wood-frame buildings (Harper and Gordon 1995: 226).

The poles supporting a pole barn were usually set directly into the ground, and the building either had no floor or simply a concrete slab.

The success of pole-frame buildings was reliant on the wide availability of chemical treatments for wood and galvanized iron and steel sheets that could span the widely-spaced poles to serve as sheathing. Prefabricated, lightweight steel trusses and lightweight metal roofing materials were also important (National Frame 2004).

Doane's pole-framed, gable-roofed, steel-clad, concrete-floored buildings were useful to farmers during the austerity imposed by the Depression and World War II. They were first used as beef barns, implement sheds, hay barns, and for other crop storage. A 1933 plan by the Midwest Plan Service for a wood-sided pole building indicated that the posts could be built up from dimensional lumber. In circa 1960 Merickel Buildings of Wadena offered pole barns in three sizes sheathed with either corrugated steel, fir plywood, or shiplap siding (National Frame 2004; Midwest Farm 1933; Merickel ca. 1960).

During the 1960s pole buildings proliferated on farms and about this time began to be called "post-frame" buildings. Pole buildings spread from farms to urban areas where they were used for industry, storage, and other purposes (National Frame 2004).

Prefabricated Buildings

Advantages: less waste of materials in fabrication, less shipping of material that would be wasted, accurate fabrication in the factory, efficiency in production, minimal on-site planning and labor needed, could be designed for moving and rebuilding to maximize salvage value, presumably lower cost to farmer for the quality received

Disadvantages: sometimes not easy to modify the design

Timetable: an early use – metal grain bins – began around 1910, prefabrication was widespread beginning in the 1950s

The term "prefabrication" was variously used to describe pieces precut in factories, licensed pole frames, laminated arches and roof trusses, pieces preassembled into panels, and pieces preassembled into complete structures that were shipped all in one piece. Some structures were prefabricated at the factory and others at the lumberyard. (For more on prefabricated buildings, see also "Steel Framing" below.)

Grain bins were among the first prefabricated buildings widely used on family farms. A 1943 source indicated that prefabricated grain bins, hog houses, poultry brooder houses, and similar structures were increasingly popular at Midwestern lumberyards and other retailers (Long 1943: 8; see also Economy ca. 1940). A 1956 source stated that small hog houses, brooders, self-feeders, holding bins, milk houses, and grain storage structures were being sold ready-made. Masonry silos, pole-frame barns, and other buildings were being sold and built by the seller on the farm. Utility buildings, storage sheds, and storage bins and cribs were being sold as packages or kits. Also available in various prefabricated forms were laying houses, chopped hay storage, feed bins, corncribs, hay drier-feeder combinations and numerous portable animal shelters and equipment including feeders, chutes, brooders, holding bins, and sun shades (Carter 1956: 258-259).

After World War II several factors favored the spread of factory-built structures to farms. Construction labor was scarce in rural areas and construction wages were high. Technical advances had been made during the war in treated wood, structural steel, steel and aluminum sheets, plywood, laminated framing, timber connectors, and millwork. Industrial structures built during the war were being copied or modified for farm use. And wartime defense industries had proven the efficiency of mass production (Carter 1956: 259).

Stran-Steel, Armco, Kaiser Aluminum, and Butler Manufacturing were among many companies offering prefabricated buildings after the war. In 1949 Blaw-Knox's "Universal" buildings, for example, could be made of preassembled steel wall panels in three heights for easy assembly of buildings. The wall units came either with or without windows, rolling or sliding doors, and walk-in doors. Roofs were gently-arched half trusses that were bolted in the field to form clear spans 24′, 32′, 40′, or 60′ wide. Roof ventilators and skylights were offered. The buildings were faced with 26-gauge steel sheets. One size of bolt was used throughout to simply construction. The buildings were used on farms for warehouses, poultry houses, seed-processing plants, feed storage, machine sheds, dairy barns, crop-drying sheds, and farm shops (Erdner 1949: 477-478).

One agricultural engineer predicted in 1943: “It may safely be stated that prefabrication in the farm field is here to stay. It will not supplant conventional construction, but it will prove a worthy competitor . . . “(Long 1943:10). In 1956 the prefabricated or factory-built farm building industry was “still very young” with most farm buildings still built conventionally with home or local labor (Carter 1956: 260).

Steel Framing

Advantages: strong, fire-resistant, did not shrink or warp, lightweight, resistant to decay, adaptable to various exterior sheathing materials, could provide post-free interiors or larger open storage area than wooden bents, could be enlarged in modular fashion, facilitated factory-made buildings

Disadvantages: lack of local design expertise, corrosion (which could be reduced somewhat by painting, providing a dry atmosphere, or encasing the members in another material), required welding experience and an electric arc welder in the field, more expensive than wood, materials not widely available

Timetable: early use in grain bins began around 1910, first all-steel barn made in 1922, quonset-type buildings were introduced to the U.S. in 1941 and became common on farms after World War II, deeply-corrugated and frameless and trussless arched buildings apparently became common in the 1950s

Cylindrical steel grain bins were one of the first agricultural uses of steel framing (also called “light-load” steel framing). The Butler Manufacturing Company of Kansas City, for example, sold its first steel bins in 1907. Three years later the company sold its first Butler building, a metal garage built of corrugated steel culvert sheets bolted together (Butler 2004).

In 1922 the country’s first all-steel barn was built in Michigan. Measuring 36′ x 72′, it had a poured concrete foundation, steel frame, and 22-gauge corrugated sheet steel siding and roof (Jones 1926: 176). Many early steel-framed buildings used studs, beams, joists, rafters, etc. that were similar to dimensional lumber components and used accordingly.

Steel’s advantages as a framing material, including its reputed fire-resistance, were questioned by agricultural engineers. One argued in 1926 that steel would lose strength in a fire and that reinforced concrete was the only material that allowed a building to be reused after a fire (the best definition of fire resistance in his opinion). The same engineer explained that steel framing was prone to deterioration from dampness and did not have wood’s ability to be chemically treated against rot (Cartwright 1926: 241-242).

In the 1920s and 1930s steel-framing was used on farms for a variety of buildings and structures including garages, machine sheds, grain bins, corncribs, brooder houses, chicken houses, crop warehouses, hay barns, hog houses, two-story barns, and one-story dairy and beef cattle barns (Parsons 1927: 112; "New Steel" 1933; Driftmier 1938: 159).

In 1941 the University of Wiconsin, Madison, built a one-story, gable-roofed, steel dairy research barn, attached milk house, and "experimental site-welded silo" in cooperation with Carnegie-Illinois Steel Corporation. The project was designed as a significant test of steel's use as a building material as well as an experiment of various dairy management practices. The study found the steel satisfactory after ten years, except where used for a warm, insulated barn where condensation became a problem (Witzel 1945: 415; Witzel and Heizer 1946; Witzel and Derber 1952). Butler Manufacturing and other companies increased research and production of steel frames during World War II.

Steel-framed Quonset buildings – "Quonset" being a trademark of Detroit's Great Lakes Steel – became widely available after World War II. They were sometimes called hangar-type buildings. In 1948 the Stran-Steel division of Great Lakes Steel was advertising a popular 40' x 100' building called the "Quonset 40" which was a grain storage building that could serve as a machine shed at other times of the year. Using the slogan "There's a Quonset for Every Job on Your Farmstead," Stran-Steel also sold the Quonset 16 [meaning 16' wide], Quonset 20, Quonset 24, and Quonset 32 for machinery storage, livestock housing (both loose and stanchioned), farm shops, hay barns, feed and seed houses, and utility buildings. Stran-Steel had a regional office in Minneapolis (Stran-Steel 1948; Stran-Steel 1957).

In 1946 another company, Flintkote, was offering Quonset-type buildings "from brooder pens to dairy barns." Flintkote reduced the problems of condensation and coldness that were common to all-steel buildings by using fiberglass insulating wool, interior insulation board, and an exterior asphalt emulsion coating (Flintkote 1946).

A 1948 advertisement in *Agricultural Engineering* for U.S. Steel's site-welded steel buildings indicated they were "a new development," that "approximately 60" U.S. Steel Site-Welded Buildings had been built the previous year, and that "materials are as yet available only in limited quantities." They were available in standard sizes such as 24' x 60' and 36' x 60' with the first dimension varying in multiples of 12' (Carnegie 1948).

A "recent" development in 1961 was the "trussless, deeply-corrugated sheet-metal arch." It was commonly either parabolic or circular. The arches were available, for example in spans of 30' to 60' and of 18- to 20-gauge steel. The 2' wide arched pieces were bolted together side to side to create a building with no columns, trusses, or tie rods (Neubauer and Walker 1961: 568).

Stone

Advantages: durable, readily available in many areas, low cost materials if gathered on the farm, work could be done slowly as time allowed, long-lasting

Disadvantages: slow construction, units were heavy

Timetable: stone construction began during the early settlement period, especially 1850s-1870s; cobblestones used chiefly in the 1910s-1940

Local stone was one of the first building materials available to settlement-era farmers. Throughout the state, field stones were gathered and used in small quantities for building foundations and similar purposes. Entire stone buildings were constructed in southern Minnesota where soft workable limestone was locally available, and less often in other parts of the state.

Interest in building with cobblestones or small round field stones rose in the 1910s-1930s with the popularity of the Craftsman Style. Articles on field-collected cobblestone buildings in 1928 and 1932 issues of *Architectural Engineering* feature a poultry house, brooder house, milk house, barn, and farmhouses built of stones (McPheeters 1928).

Straw

Advantages: inexpensive, materials readily available, could be temporary

Disadvantages: needed annual repair, impermanent although could last several years

Timetable: built throughout Minnesota from the early settlement period through the 1950s, special interest during building material shortages of World War II

Buildings made of straw – either fully or partially – were used throughout Minnesota from the early settlement period through at least the 1950s. The West Central Experiment Station in Morris, for example, erected at least two successive large straw buildings for feeder cattle in the 1950s (Hanke 2004). During World War II there was special interest in straw buildings in Minnesota while building materials were in short supply.

Straw buildings were inexpensive to construct, warm in the winter, and cool in the summer. Some were built to last for several years (although they needed annual repair), while others were built for temporary or emergency purposes (Cleland 1941: n.p.).

In Minnesota straw buildings were used as shelter for lambs, calves, or hogs being fattened; as farrowing and lambing barns; as poultry houses; for wintering young cattle, sheep, and brood sows that were outside the rest of the year; for dairy cows; as multipurpose or general barns; and as summer shade for pastured animals (Cleland 1941: n.p.).

The framework of straw buildings was usually built of wooden poles or planks. To build the walls, some farmers simply piled loose straw over the frame. Sturdier walls, or walls that could withstand animal damage, could be made with two layers of poles (or poles and wire mesh) with straw packed or tramped between them. Walls were also built of straw bales that were sometimes secured or reinforced with wire fencing. Roofs were built of loose straw or conventional building materials. Some straw buildings had movable doors and windows. Most straw buildings had dirt floors. If used for poultry, however, the building needed a raised floor to keep conditions dry, and a roof that did not leak (Cleland 1941: n.p.).

Farmers also used loose straw as insulation above the ceilings of woodframe poultry and hog houses. Many farmers banked straw bales around buildings to keep out cold drafts. Straw bales were also used for windbreaks in stockyards.

Structural Clay Tile

Advantages: could be glazed or unglazed, waterproof, fireproof, smooth and washable, contained an insulating airspace, long-lasting, lightweight, more economical than brick, did not need paint, attractive, easy to build

Disadvantages: brittle, difficult to cut on site, made by fewer manufacturers than common concrete block therefore freight costs could be higher than for block

Timetable: use began in the first decade of the 20th century, still popular in the 1940s

The first curved tile silo was built in 1908 at Iowa State College in Ames. A 1910 source mentioned that "a few" corncribs had been built of tile, as well as houses, barns, storage buildings, elevators, chicken houses, hog houses, and smokehouses. The author recommended hollow tile particularly for small to medium sized buildings (King 1910: 48). In a follow-up article in 1916, the author indicated that the clay block "Iowa silo" had become "a standard" and "the most uniformly successful type of silo that has ever been developed." The corncrib he described in 1910 had become standard, and circular grain bins were in "common use" (King 1916: 62).

A promotional booklet published by the Structural Clay Products Institute in 1941 showed numerous examples of clay tile houses, garages, a 22'-diameter grain bin, silos, other crop storage structures, various barns, milk houses, implement sheds, water tanks, cisterns, and numerous smaller structures. Many were built in the 1910s and were still in good condition in 1941. According to the Institute, "The leading dairy farmers throughout the Midwest are using tile almost exclusively for barn walls" (Structural Clay 1941: 13). Clay tile was also commonly used for foundations.

During World War II structural clay tile was an unrestricted building material and some farmers used it to repair or replace first-story barn walls, leaving the wooden upper mow walls and roof intact.

Because of the reduced danger of fire, buildings built of hollow tile could be sited closer together, even sharing common walls, to increase efficiency (Structural Clay 1941: 10).

In 1941 Carter and Foster wrote that most hollow clay or structural clay tile used in farm buildings was 5" by 8" by 12" and used to form 8"-thick walls. Curved tanks, grain bins, milk houses, and other small buildings were made from curved and radially cut tiles, sometimes called silo tiles. Hollow tile was also utilized for floors for barns and poultry and hog houses. Clay tile was extensively used for subsurface field drains (Carter and Foster 1941: 73).

Tar Paper

Advantages: inexpensive, waterproof, quickly applied, readily available, another siding could be added later

Disadvantages: impermanent, easily torn, absorbed heat, flammable

Timetable: popular during the early settlement phase, especially in western and northern Minnesota

Tar paper, also called roofing felt or saturated felt, was a common material for siding and roofing during the early settlement phase in several parts of the state. Tar paper covered many "claim shacks" on many new farms, was used for the roofs of log houses, and was used to improve sod houses. (A layer of tar paper beneath the sod on a roof, for example, could make the roof more watertight.)

Tar paper was usually applied to woodframe buildings with strips of lath or large-headed tacks. A layer of more permanent siding could be applied over it as finances allowed. Tar paper seems to have lasted longer as an exterior sheathing in forested areas where trees helped block the wind. Asphalt composition (sold in both shingle and roll form) was a more durable alternative.

In their 1999 study of farmsteads in Minnesota's cutover counties, Henning, Henning, and Roberts wrote, "Tar paper emerges as the material of choice in the later years of [cutover] settlement. A county history for St. Louis County noted that whereas in 1900 log houses were the typical material for a settler's first house, 'the homesteader of today, however, favors the tarpapered shack for the first year or two of pioneer effort'" (Henning et al 1999: 51).

Wood (Heavy Timbers and Dimensional Lumber)

Advantages: stronger by weight than steel or concrete in tension and flexure, timbers readily available in wooded areas, timbers available in large units, dimensional lumber readily available in many sizes once railroads were built, thin planks or boards could be sandwiched together to make stronger units, wood could be worked by semi-skilled laborers, wood was salvageable and reusable, could be worked into fancy shapes such as shingles, trim, and millwork

Disadvantages: timber framing required special joinery skills, timbers were heavy, dimensional lumber could warp, wood was flammable, could deteriorate if wet

Timetable: very popular during the period of this context study, 1820-1960

Wood was the most common farm building material in Minnesota during the period covered by this study. See standard sources including those listed below. See also this context study's "Planning and Building Farm Structures: Barn Forms and Terminology."

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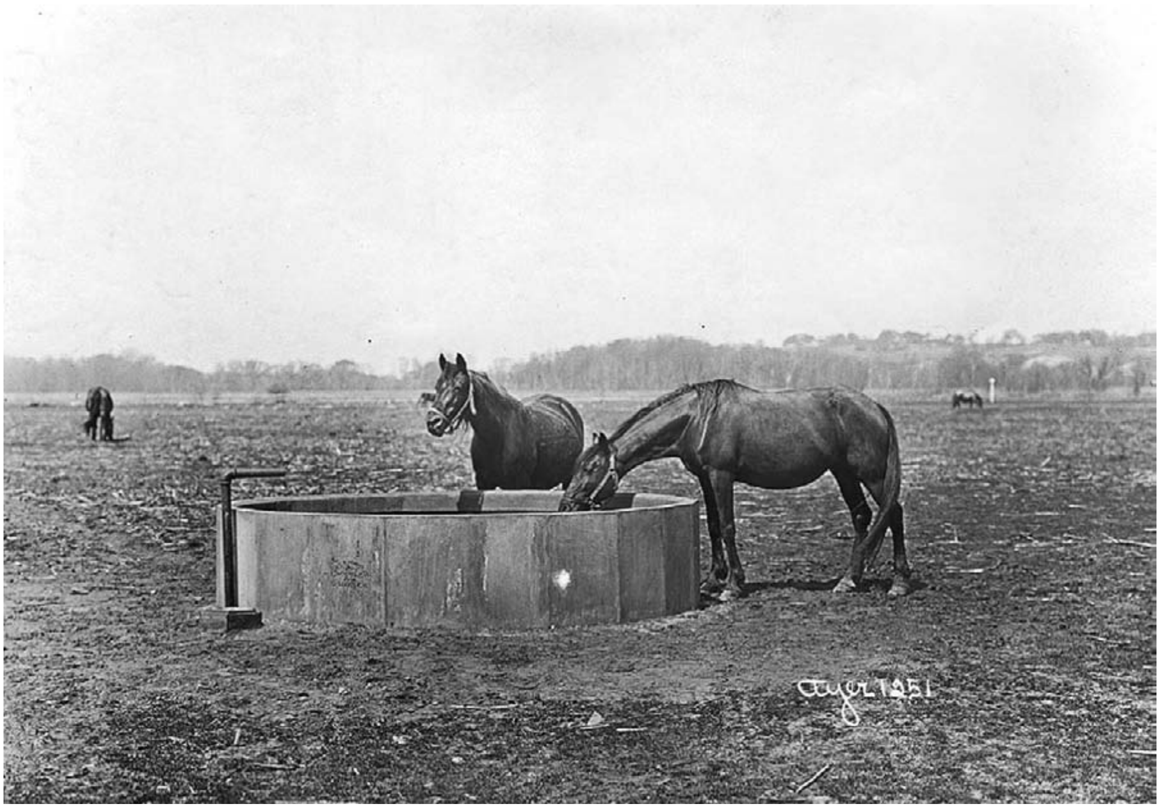
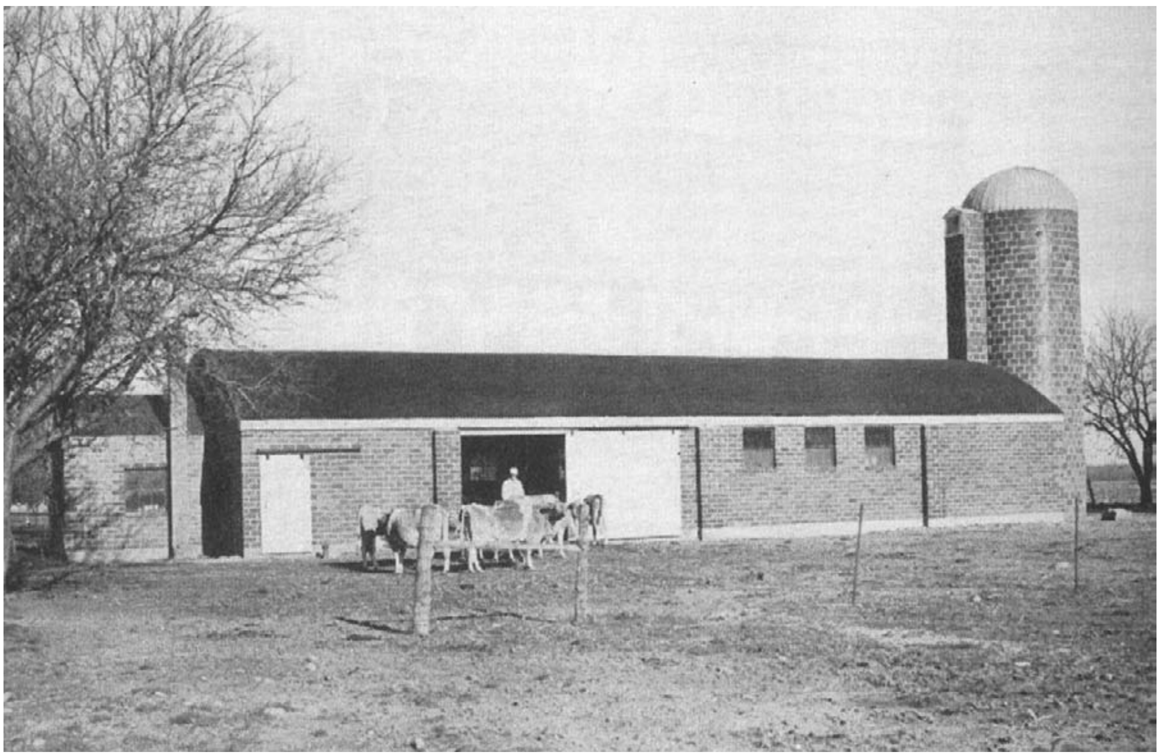
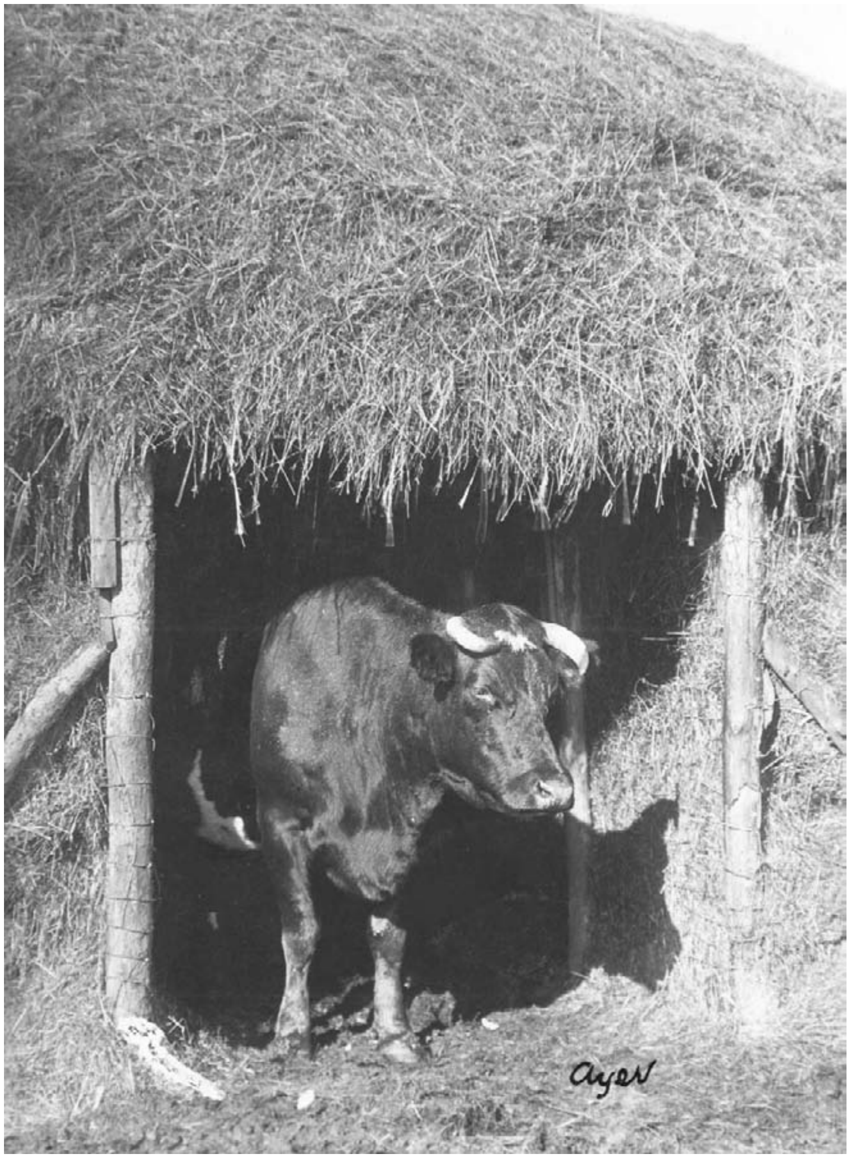
A stone barn in Houston County with a corrugated metal roof. Photographed in 1976. (MHS photo)



The first cement stave structure in the U.S. was a stock tank built in Michigan in 1905. This photo of a cement stave stock tank was taken circa 1910 on the Savage Farm, presumably in Minnesota (location unknown). (MHS photo by Harry Darius Ayer)



A one-story dairy barn and attached silo, both built of structural clay tile. Tile was usually glazed on one side to provide a sanitary, waterproof, cleanable interior for the barn, milk house, and silo. From *Dairy Cattle and Milk Production* by the University of Minnesota's Clarence H. Eckles (1950).



Straw buildings were used in Minnesota for housing all types of livestock and poultry, including shorthorn cattle (shown here). They were built early in the 20th century, during wartime when building materials were scarce, and well into the 1950s. Photo location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

This farm building was sheathed in steel sheets stamped with a rockfaced masonry design – the most popular special pattern. The roof of the building was covered with a corrugated version. Iron and steel sheets were widely used to renew the appearance of woodframe and wood-sided buildings, and were sometimes the original exterior material. Grove Township, Stearns County, 2004. (Gemini Research photo)

A poured concrete bridge (reinforced with iron) that carries a narrow farm lane over a stream in Stearns County. 2004. (Gemini Research photo)

A farmhouse with asbestos-cement siding. Kathio Township, Mille Lacs County, 2003. (Gemini Research photo)

The roof of this gothic arch barn is comprised of a series of glue-laminated rafters made by Rilco in St. Paul. The mow has maximum unobstructed space. West Central School of Agriculture and Experiment Station (now University of Minnesota, Morris), Stevens County, 2004. (Gemini Research photo)

BARN FORMS AND TERMINOLOGY

BARN FORMS

Minnesota barns passed through some evolution over time as farming shifted from a small-scale subsistence endeavor – which might require only a simple one-room log barn – to an increasingly specialized, mechanized, and capital-intensive industry. Early barn forms were more likely to be influenced by ethnic traditions, local practice, and responses to native conditions and materials, while later barn forms were more likely to be influenced by the field of agricultural engineering, published plans, and the development of prefabricated materials, components, and equipment.

In a study of barns in southern Ontario, geographer Peter Ennals describes a succession in barn forms that appears to be applicable to Minnesota. Most of the first farmers in southern Ontario first built a log barn. According to Ennals, "This barn usually had a life expectancy of up to 30 years, by which time it would have deteriorated and a second more permanent [timber] frame barn would be built." The second barn's form depended on the region and era in which it was constructed. In the earlier-settled areas Ennals studied – perhaps comparable to southeastern Minnesota – the second-phase barn was a threshing barn suited to wheat monoculture. The farm's few animals were usually kept in other small shelters. In areas settled later, the second-generation barn was a general purpose or combination barn. This form was chosen because, by the time the log barn had deteriorated, farming practices had diversified to include livestock and dairying. The second-generation barns were often modified or enlarged as dairy herds grew. Ennals found that specialized dairy barns, including the "Wisconsin" dairy barn form, were built as third-generation barns when the second-generation barns began to deteriorate. On farms where the second-generation barn was still in good condition and continued to suit its purpose, the third phase of barn-building might be delayed until a one-story pole barn was built after World War II (Ennals 1972: 267-268).

An overview of the structural development of Minnesota barns includes the following types:

Single-Pen (e.g., Log) Barns. The term single-pen barn usually describes a simple form comprised of four walls enclosing one rectangular room or pen. These barns were often built on subsistence-level, settlement era farms, and were often topped by a gabled roof. The upper level interior was sometimes used as a small storage loft. In much of Minnesota, single-pen barns were built of logs during the early settlement era. Sometimes a log single-pen barn was originally built as a log dwelling and later used as a barn.

Timber Frame Barns. Timber framing was used for all types of buildings during the 19th century, and on Minnesota farms timber framing is found in barns, granaries, and a few other types of structures. Timber frame barns often superceded earlier, smaller subsistence-level barns or outbuildings, serving as the second-generation barn on the farm. Timber frame barns were most

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often built in the southeastern quarter of the state. By the time farms farther west and north needed large (i.e., non-subsistence-level) barns, railroads had been built, pre-cut dimensional lumber was available from commercial trackside lumberyards, and new framing styles were in use.

The superstructure of a timber frame barn was comprised of a series of bents (e.g., four to six) that were typically pre-assembled on the ground and tipped up into place on a stone foundation to support the barn. The barn's gabled roof was often built of rafters made of rounded logs flattened on one side. It was common for structural timbers to be long, locally-felled logs that were hewn square with a broadaxe or hauled to a nearby sawmill to be squared off. Large timbers ranging from 8" x 8" to 12" x 12" in cross-section were used as principal elements, and smaller timbers were used for braces, girts, and other components. The timber frame was generally assembled with mortise and tenon joints fastened with wooden pegs. Joints were either custom-cut into unique mortise and tenon pairs (in rare cases, using scribe carpentry) or, if very even saw-cut timbers were available, joints could be mass-cut into mortise and tenon units that were more interchangeable. A few timber frame barns in Minnesota – usually found in ethnic enclaves – display framing styles and carpentry techniques that represent very late examples of medieval European traditions. These techniques include scribe carpentry, the use of curved timbers, long diagonal braces, and "fachwerk"-style square panel wall framing (Tishler 1984; Tishler 1986; Witmer 1983; Perrin 1981; Upton 1981). (See illustration on page 5.76.)

Timber frame barns had several advantages, including their strength. Cash-strapped farmers could cut wood on their own land and hew it themselves. Mortise and tenon joints required a skilled barn-builder, but the farmer and neighbors could comprise much of the semi-skilled crew.

The bents in timber frame barns were usually set a regular distance apart, creating a set of evenly-sized interior bays. The **three-bay barn** – formed from four bents – was common in southeastern Minnesota and in states farther east. Three-bay barns are sometimes called English barns. They were also sometimes called **threshing barns** because before mechanical threshers were used (e.g., before the 1850s and 1860s) the central drive of three-bay barns was used as a floor for hand-flailing or threshing grain. Large doors on either side of the central bay could be opened so the wind blew through to help winnow the chaff. Three-bay barns often functioned as general purpose or combination barns that housed oxen, horses, cows, other livestock, bedding, and crops. Crops were stored in wooden bins, straw or hay could be stored in bins or in loft platforms above one or both outer bays, and wagons or machinery could be stored in the central drive. As farm productivity grew, three-bay barns could be expanded by the addition of more timber bents, thereby creating additional bays.

If the farm had more than a few animals, it was common to place a three-bay barn on a stone basement, creating what some historians call a **raised three-bay barn**. (See illustration on page 5.81.) The basement usually served as the cow and horse stable. A typical form of raised three-bay barn was the **bank barn** (sometimes called the side-hill barn), which was built against a hillside so that both basement and upper level could be entered with wagons. If the farmstead wasn't hilly, an earthen drive could be built to the upper level. **German or forebay barns**, in which the barn's upper level projected out (extended over) the lower level, were generally not built in Minnesota, although they were constructed in Wisconsin, mostly by German immigrants.

Timber frame barns were built in Minnesota at least through the 1920s. While by then timber framing had largely been superceded by lighter framing techniques, some farmers preferred to fell their own trees to reduce cash outlay on purchased lumber (or to obtain a strong barn in an area where pre-cut lumber wasn't yet commercially available) (Perrin 1981: 42; Visser 1997: 21-22).

Plank and Balloon Frame Barns. Although they were strong and large, timber frame barns had some disadvantages, including the fact that long straight timbers were unavailable in many parts of the state. Many timber frame barns also had limited storage lofts. As farms diversified and dairying increased, it became important to maximize storage capacity for winter feed such as hay and to accommodate the labor-reducing mechanical hay carriers that were becoming common by the 1870s.

By the turn of the 20th century, Minnesota farmers were increasingly substituting plank framing and similar techniques for heavy timber framing. A new development in the 1880s, the **gambrel roof**, created barns with greater storage capacity via a large interior mow accessed by an endwall hay mow door. Gambrel roofs could be supported by newly-developed plank frames, in which long relatively thin planks were combined to form supporting elements. (See illustration on page 5.80.) The Shawver truss, developed in Ohio in the late 19th century, became an important model, as did the Iowa or Clyde truss, developed around 1920, which had the advantage of requiring fewer very long pieces of lumber than did the Shawver version (Soike "Within" 1995). Barn historians Harper and Gordon explain:

> A standard 36' by 48' barn constructed of plank framing could be put up faster than, and required only half the lumber of, a conventional braced-frame [timber frame] barn. Since every rafter was made to form a truss, no scaffolding was needed, and the trusses could be bolted and assembled on the ground or in the haymow. In essence, the truss created a self-supporting arch which, when completed, formed a rigid structure as strong or stronger than mortise and tenon framing. Moreover, the size of the loft could be increased without building the barn higher at the plate or ridge. According to the *Ohio Farmer*, the substitution of plank for square timbers was the greatest advance made in barn framing during [the] period [1890-1930] (Harper and Gordon 1995: 222).

A further development, the balloon frame barn, depended not on a few very heavy bents or plank trusses but on many closely-spaced rafter trusses that worked together to share structural support. The **gothic arch roof**, offering slightly greater storage capacity and faster assembly than the gambrel roof, was developed around 1920 using built-up or laminated rafters that were also light and self-supporting. Beginning in the 1930s, some gothic arched and **rounded arch roofed** barns (sometimes called **rainbow arched**) were made with rafter systems that were **glue-laminated**, rather than nailed. Most glue-laminated rafters were factory-made.

Gambrel, gothic, and rounded arched roofs were sometimes used in barn remodeling to replace earlier gabled roofs, thereby expanding storage capacity. Some remodeling projects also included replacing wooden first story barn walls with strong, cleanable hollow tile or concrete block that helped support the new roof (Harper and Gordon 1995).

Another type of modern barn form common in Minnesota is termed by barn historians Noble and Cleek the **midwest three-portal barn** or **three-alley barn**. (See illustration on page 5.82.) It was a plank or balloon frame barn with a central aisle flanked by enclosed side aisles, all covered by an encompassing roof, usually gabled. Noble and Cleek write, "Sometimes [the side] aisles are later additions and often result in a broken roofline. Early gable roofs have sometimes been replaced with gambrel roofs, and in the 20th century barns were built with original gambrel roofs spread to cover the side aisles. This barn was standard in the south-central United States in the late 19th and early 20th centuries. It often has a hay hood and large gable-end loft doors. Plank frame versions are usually called feeder barns as they house livestock." Midwest three-portal barns usually have separate doors leading into the central aisle and the side aisles. Some gambrel roofed examples are apparently smaller than those with gabled roofs (Noble and Cleek 1995: 74-75; Noble 1984: 64).

The barn forms that superceded timber framing were predicated on lumberyard-distribution of standard-sized sawn boards and machine-made nails. The new types of barns did not require skilled joinery craftsmanship, were faster to build, and required less wood than timber frame barns, which tended to be over-built. Most of the new barn forms also represented the influence of agricultural engineers and farm experts. By drawing and publishing barn plans and working through the agricultural press, the USDA, agricultural colleges, experiment stations, extension services, and agri-businesses, these professionals promoted barn designs that accommodated more livestock, more efficient use of labor, increasing mechanization, greater emphasis on animal health, and similar factors.

The new framing techniques not only made barn-building easier, increased mow capacity, and allowed mechanical hay carriers to be installed, but they also revolutionized barn floor plans. Farmers operating within older timber frame barns had to work around the heavy bents necessary to support the structure. In barns with plank frames, balloon frames, and laminated rafters, much of the weight was supported by rafter trusses and the first-story side walls. Stable floors could now be freely arranged for maximum efficiency, with rows of stalls, feed alleys, cleaning alleys, manure gutters, and other mechanical devices installed to reduce labor and support more livestock. Barns could also be built with more windows, which improved ventilation and animal health, and provided more interior light for milking and barn cleaning. The **Wisconsin Barn** or **Wisconsin Dairy Barn** was an important dairy barn style (also used for general purpose or combination barns) that was developed around the turn of the 20th century and incorporated many of the best features made possible by the new light barn framing including maximum loft size, numerous windows, thoughtfully-planned stall rows and chore alleys, and an attached silo.

In 1916 the American Society of Agricultural Engineers' subcommittee on farm structures identified 18 basic barn designs that were most suitable to meet the typical farmer's needs. (See illustration on page 5.79.) The 18 were culled from a reported 10,000 buildings and plans, most then in use in the Midwest. The designs were chosen for flexibility in building materials and adaptability to various kinds of farming practices. They represented compromises between the amount of lumber needed and barn capacity. They used dimensional lumber, which was widely available and weighed less than heavy timbers. Some barns were designed with driveways into the mow or main floor, while others had a second-story mow accessible only by ladders and a hay mow door. Various truss styles were used. Because most originated in the Midwest, the 18 designs may be a fair reflection of barn forms in use in Minnesota at the time (Niemann et al 1919: 268-275).

Quonset Roof Barns and Pole Frame Barns. The strong, lightweight, self-supporting advantages of glue-laminated rafter systems were also achieved with quonset-style and pole frame buildings. First promoted during the 1940s, quonset-style buildings typically had a rounded-arched roof – often made of corrugated steel – that extended to the ground thereby also creating side walls. Pole frame buildings, first developed in the 1930s and very popular after World War II, were based on a framework of widely-spaced wall posts (e.g., wooden telephone poles treated with preservative) that supported a shallow-pitched gabled roof made of lightweight rafter trusses. Both roof and walls were often covered with corrugated sheet metal. Both quonset-style and pole frame buildings provided open, post-free interiors that supported flexible and changeable floor plans, loose housing of livestock, and increased mechanization. Both types of buildings were quickly erected and available in pre-fabricated (or ready to assemble) form, which helped farmers obtain cost-effective buildings in the time of rural labor shortages during and after World War II.

BARN TERMINOLOGY

The glossary below is designed to serve only as an introduction to barn terminology. Many good glossaries, some with illustrations, are available in sources such as Arthur and Whitney's *The Barn: A Vanishing Landmark in North America* (1972), Ensminger's *The Pennsylvania Barn* (1992), and Noble's *To Build in a New Land: Ethnic Landscapes in North America* (1992). Barn components are also described and illustrated within the text of many works like Noble and Cleek's *The Old Barn Book* (1995). The information below was drawn largely from these sources.

Alley. A longitudinal walkway or drive, often perpendicular to the stalls, that allowed the worker to deliver feed, remove manure, and bring in milking equipment. Animals were walked down the alley to go outside or to a milking parlor. Alleys often ran down the center of a barn and along the outer walls. Sometimes called a feed alley, litter alley, chore alley, or cleaning alley. See illustration on page 6.112.

Balloon Frame Barn. A barn in which the major weight of the roof superstructure is shared by many pairs of rafters and wall studs, rather than being carried by a few heavy bents or trusses. Built with dimensional lumber. See illustration on page 5.77.

Bank Barn. A two-level barn with ground access to both levels. Bank barns were often built into a hillside so the upper level was entered from the side of the hill. If the terrain was flat, an earthen ramp often accessed the upper level. The upper level usually stored crops, haw, straw, and some machinery (e.g., in the central alley), while the basement level housed animals. Sometimes called a side hill barn or a basement barn. See illustration on page 6.109.

Barrel Arch. See Rounded Arch.

Basement Barn. A barn with a basement. Often a bank barn.

Bay. A portion of a building that is defined by repeated structural elements such as bents or window openings. A barn with three interior bays could be created with four bents – two bents holding up the outer walls and two interior bents – that were usually spaced a regular distance apart. See illustration on page 5.75.

Beam. A heavy horizontal timber element, often made from a squared log or tree trunk. See illustration on page 5.75.

Bedding. Loose material such as straw used to cover the floor in stalls or stables. Sawdust, wood chips, and other materials were used if inexpensive and readily available. See illustration on page 6.111.

Beef Barn. A barn primarily used to raise or fatten beef cattle. Also called a feeder barn. The Midwest Three-Portal Barn was a common form. See illustration on page 5.82.

Bent. A heavy timber unit comprised of vertical posts, horizontal beams, and other supports and braces. The bent was tied to other bents with longitudinal sills and plates to create the barn's structural framework. See illustration on page 5.75.

Brace. A piece of wood, usually diagonal, placed between posts and beam in a bent to stiffened the structure. Often used in matched pairs. A brace could be relatively short, or extend the entire height of the story (e.g., from plate to sill or floor). Sometimes called an angle brace, knee brace, or strut. See illustration on page 5.76.

Carpenter's Marks. Simple marks (such as hatches) made on timbers with a carpenter's tool to help the builder keep track of which timbers would be fit together when the building was assembled. Most often used in timber frame joinery in which mortises and tenons were custom-cut to fit in unique pairs. Also called marriage marks. See illustration on page 5.28.

Clerestory. An upper portion of wall rising above the main roof, usually to provide additional high windows. Also called a monitor. See illustration on page 3.87.

Clyde or Iowa Truss. A gambrel roofed barn framing system developed circa 1920 as an improvement over timber framing. See illustration on page 5.77.

Collar Beam. A horizontal beam that connected opposing principal rafters in a roof system. Often located at the rafters' half-way point.

Combination Barn. See General Purpose barn.

Cross Beam. A heavy horizontal beam that ran transversely through a structure (i.e., perpendicular to the center line). For example, a cross beam could run from end post to end post in a bent. Sometimes called a tie beam. See illustration on page 5.75.

Dairy Barn. A barn primarily used for the housing (and usually milking) of dairy cattle. See illustration on page 6.107.

English Barn. Also called Connecticut, New England, or Yankee barn. See Three-Bay Barn.

Feed Bunk. A livestock feeding station or trough. Sometimes also called a manger or trough. See illustration on page 6.28.

Feed Carrier. An elevated mechanical track, usually metal, that extended along the stalls of a stable. Feed was loaded into the carrier's buckets or baskets and distributed to the livestock.

Feeder Barn. See Beef Barn.

Forebay or German Barn. A two-story barn with a projecting or overhanging upper portion that extended out over the lower level on the eave side. Commonly built by German immigrants in Pennsylvania, Ohio, Wisconsin, and other states; believed very rare in Minnesota.

Gambrel Roof. A roof whose two opposing sides were each formed by two slopes. See illustration on page 5.80.

General Purpose or Combination Barn. A barn in which a variety of livestock were housed. This was the most common functional barn type on Minnesota farms, housing dairy cows, horses, and perhaps hogs and a bull. See illustration on page 6.232.

German Barn. See Forebay Barn.

Girt. A horizontal framing member that connected posts at a level below the plate and above the sill. See illustration on page 5.75.

Glue-Laminated Rafter. Used in a lightweight, self-supporting barn form in which the rafters, often curved, were sandwiched together with glue, rather than nails. See illustration on page 5.62.

Gothic Arch. An arch with a point at the top. A gothic arch roof has an arched shape and a ridge at the top. See illustration on page 5.31.

Gutter, Manure. A channel in the barn floor designed to collect manure and urine (often called liquid manure). Usually built of concrete and located below floor grade, perpendicular to the ends of the stalls. Gutters were often cleaned by hand with shovels. A gutter cleaner (also called a barn cleaner) was a mechanical device, usually made with chains and metal paddles, that moved through the gutter gathering the manure. See illustration on page 5.80.

Hay Carrier or Track. A mechanical device installed longitudinally within a mow, usually near the peak of the roof. Used to move hay or straw along the length of the mow where it could be dropped on the mow floor for storage. Hay or straw was hoisted into the barn with the carrier's system of ropes and pulleys. See illustration on page 6.103.

Hay Chute or Drop. An opening in a hay mow floor, often framed with wood, down which hay (or straw) was dropped from the mow to the stable below.

Hay Hood. An extension of the peak of a gable or gambrel roof over a hay mow door. Built to protect hay carrier equipment and the mow door from weather. See illustration on page 6.110.

Iowa Truss. See Clyde Truss.

Joists. A set of horizontal members extending from wall to wall to support a floor or ceiling.

Lean-to. A common form of barn addition with a shed (i.e., single-pitched) roof. Sometimes called a shed addition. See illustration on page 5.13.

Litter Carrier. An elevated mechanical track running through a stable and often out into the yard. Manure could be shoveled into the carrier's buckets, moved out of the barn, and dumped into a wagon or manure spreader to be hauled to the fields. A feed carrier operated in a similar fashion.

Loafing or Pen Barn. A barn in which livestock such as dairy cows were housed "loose" rather than confined in stalls. The barn often had large door openings, or one side entirely open, so the animals could freely move outside. See illustration on page 6.114.

Hay Loft or Mow. Upper level of a barn in which hay (or less often straw) was stored. In three-bay barns, which lacked full-sized mows, smaller loft platforms located in the outer bays could provide limited hay storage. See illustration on page 5.62.

Manger. A container from which livestock ate food. Usually built of wood, metal, or concrete. Sometimes also called a feed bunk or trough. See illustration on page 6.104.

Marriage Marks. See Carpenter's Marks.

Midwest Three-Portal Barn. A plank or balloon frame barn, usually gable roofed, with a central aisle flanked by enclosed side aisles, all with separate doors. Sometimes called a beef barn or feeder barn. See illustration on page 5.82.

Monitor. See Clerestory.

Mortise. The slot or hole in a piece of timber into which a tenon (a projection or tongue on the end of another piece of timber) was inserted. Mortise and tenon joints were often secured with a wooden peg or pin. See illustration on page 5.28.

Mow. See Hay Loft.

Pen Barn. See Loafing Barn.

Plank Frame Barn. A barn in which long, built-up, plank supports served a purpose similar to the heavy bents in a timber frame barn. See illustration on page 5.80.

Plate. A longitudinal horizontal timber, usually placed on top of the bents, that supported the ends of the rafters. Sometimes a plate, like other long timber elements, was made of two timbers spliced or "scarfed" end-to-end. Also called a roof plate. See illustration on page 5.75.

Pole Frame Barn. A barn, usually gable roofed, whose framework consisted of treated wooden wall posts supporting a low pitched roof made of lightweight rafter trusses. External roof and wall sheathing was usually corrugated metal.

Post. A heavy vertical support. See illustration on page 5.76.

Principal Rafter. A heavy rafter located at the bent in a timber frame. (The rafters located between the bents were called common rafters.)

Purlin. A horizontal timber placed longitudinally beneath the rafters (for example, half-way between the ridge pole and the plate) to help support the rafters. See illustration on page 5.77.

Raised Three-Bay Barn. A three-bay barn on a basement. See illustration on page 5.81.

Ridgepole or Ridge Board. A horizontal timber or board against which the ends of the rafters butt at the peak or ridge of a roof.

Rafters or common rafters. Boards extending from the ridgepole to the eaves to support the roof. See illustration on page 5.80.

Rainbow Arch. See Rounded Arch.

Roof Plate. See Plate.

Rounded Arch. A semi-circular arch (as opposed to a gothic arch, which has a point at the top). Sometimes called a barrel arch or a rainbow arch. See illustration on page 6.110.

Quonset. A name brand of prefabricated building, made by Great Lakes Steel (Stran-Steel) Corporation, in which the corrugated metal roof (usually rounded arched) also created the side walls. The term was sometimes used informally to refer to all buildings of this type, not just Stran-Steel's. Generally pre-fabricated. See illustration on page 5.84.

Queen Posts. Short vertical support posts used in pairs within a bent to support purlins, which in turn supported rafters. The queen posts rested on a tie beam (which connected a pair of opposing principal rafters near their lower ends) and supported the rafters at a point somewhere between the apex of the roof and the tie beam. (This differed from a king post, which was used singly, and supported the roof at its apex.) The tops of the queen posts were sometimes joined with a horizontal tie piece or straining piece. Queen posts could be angled outward. See illustration on page 5.77.

Saltbox Roof. A two-sided roof form in which one of the two opposing sides was longer than the other and therefore extended farther toward the ground. The roof was therefore asymmetrical in cross-section. See illustration on page 6.314.

Shawver Truss. A gambrel roofed barn framing system developed in the late 19th century as an improvement over timber framing. See illustration on page 5.80.

Sill. A heavy horizontal timber, often resting on a stone foundation, that supported the vertical end posts of a bent at the outside wall. See illustration on page 5.75.

Single-Pen Barn. A simple barn generally consisting of one room beneath a gabled roof. See illustration on page 3.13.

Stanchion. A wood or metal device that closed around a dairy cow's neck, against her shoulders, to restrain her movement in a stall. See illustration on page 6.104.

Stall. A rectangular area, sometimes boxed with wood, in which livestock were kept, either individually or in small numbers (e.g., a matched team of horses). See illustration on page 6.104.

Stable. The part of a barn that housed livestock.

Tie Beam. A horizontal beam in a timber frame. Often used to connect a pair of end posts or a pair of opposing rafters at their ends. See illustration on page 5.75.

Tenon. One half of a mortise and tenon joint. A tenon was a projecting shaft in the end of a length of timber that fit into a corresponding mortise or slot in another length of timber. See illustration on page 5.28.

Three-Bay or English Barn. A timber frame barn form comprised of four bents forming three bays, usually about even in size. The central bay was usually a drive-through space, historically used for threshing. Often set on a basement to create a raised three-bay barn. Sometimes also called a threshing barn. See illustration on page 6.496.

Three-Portal Barn. See Midwest Three-Portal Barn.

Threshing Barn. See English or Three-Bay Barn.

Threshing Floor. Often the central bay of a three-bay barn on which grain was hand-threshed. The threshing floor was also used to store wagons and crops. See illustration on page 6.496.

Timber Frame Barn. A barn whose superstructure was supported by bents of heavy squared timbers, generally assembled with mortise and tenon joints. See illustration on page 5.76.

Trough. See Manger.

Truss. An assembly of two opposing rafters and other components (e.g., a tie beam or a set of braces) that formed a rigid framework to support a roof. See illustration on page 5.77.

Wisconsin Dairy Barn. A dairy or general purpose barn form based on light roof framing, a large mow, abundant windows, an attached silo, and a floor plan with stalls and alleys arranged for maximum efficiency. See illustration on page 6.110.

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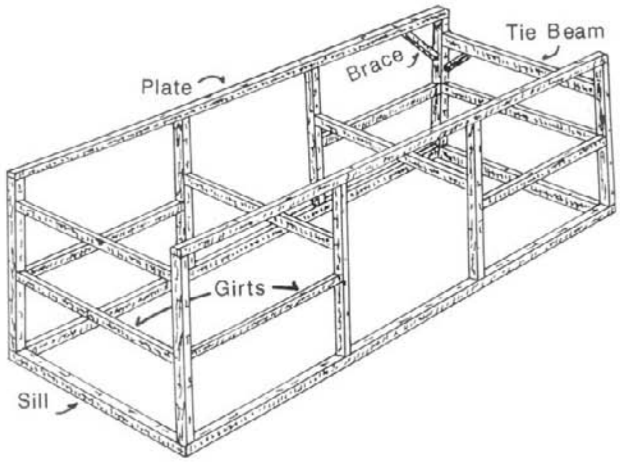


Fig. 3.1 The basic structure of a timber frame barn.

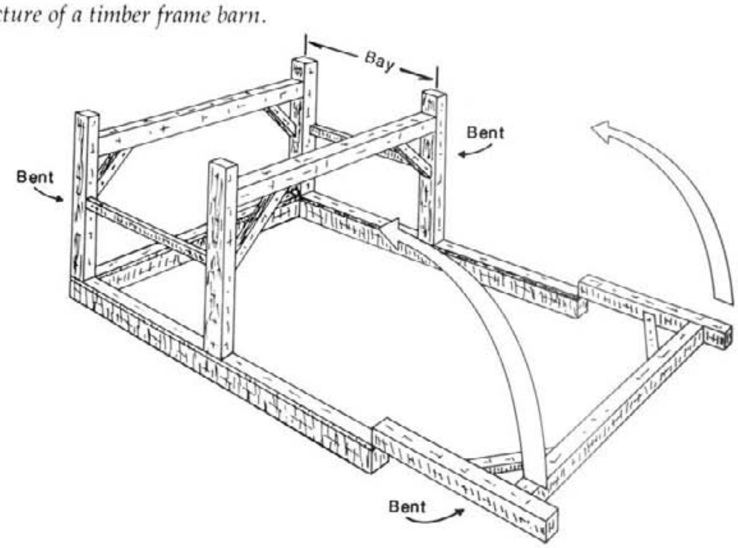
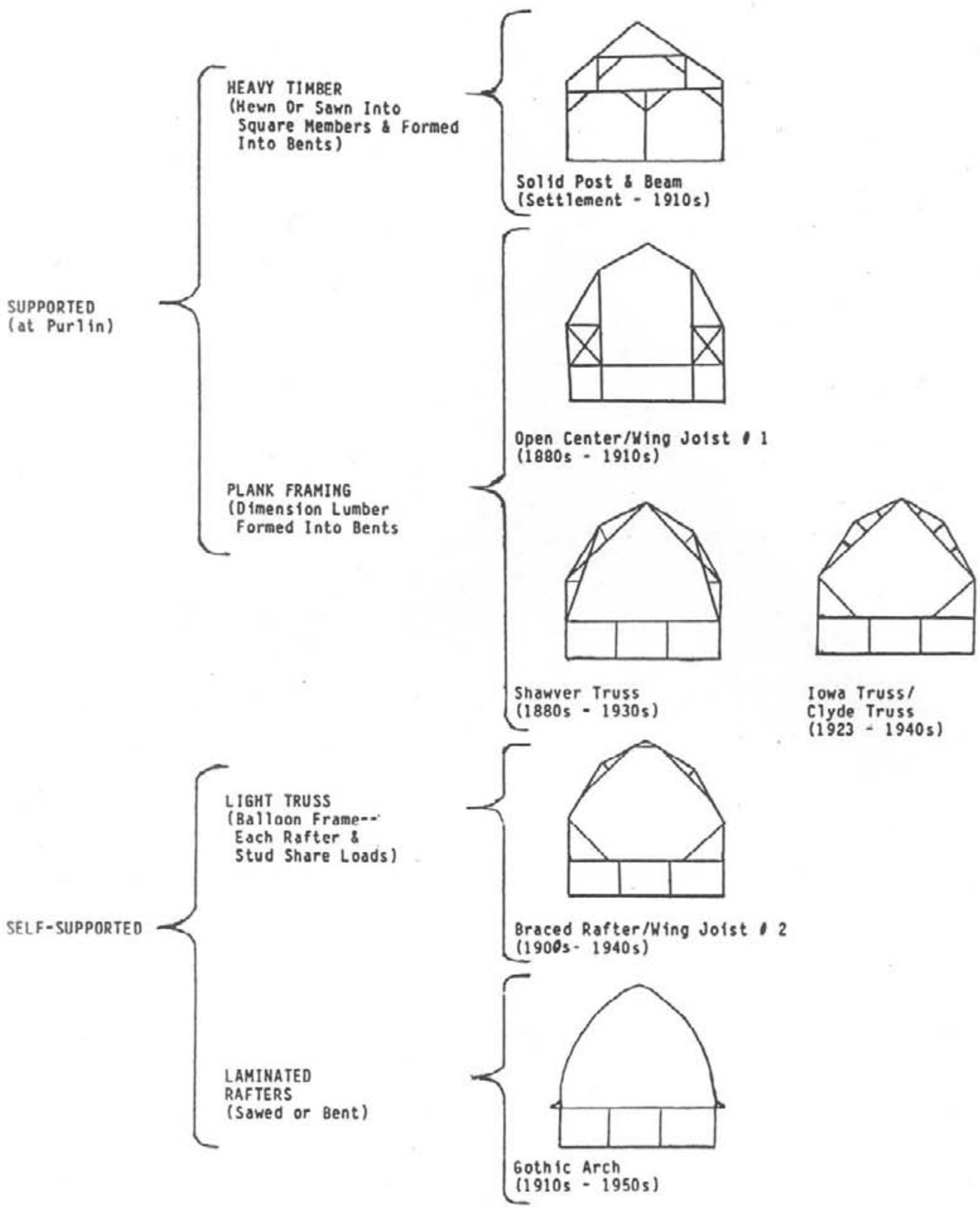


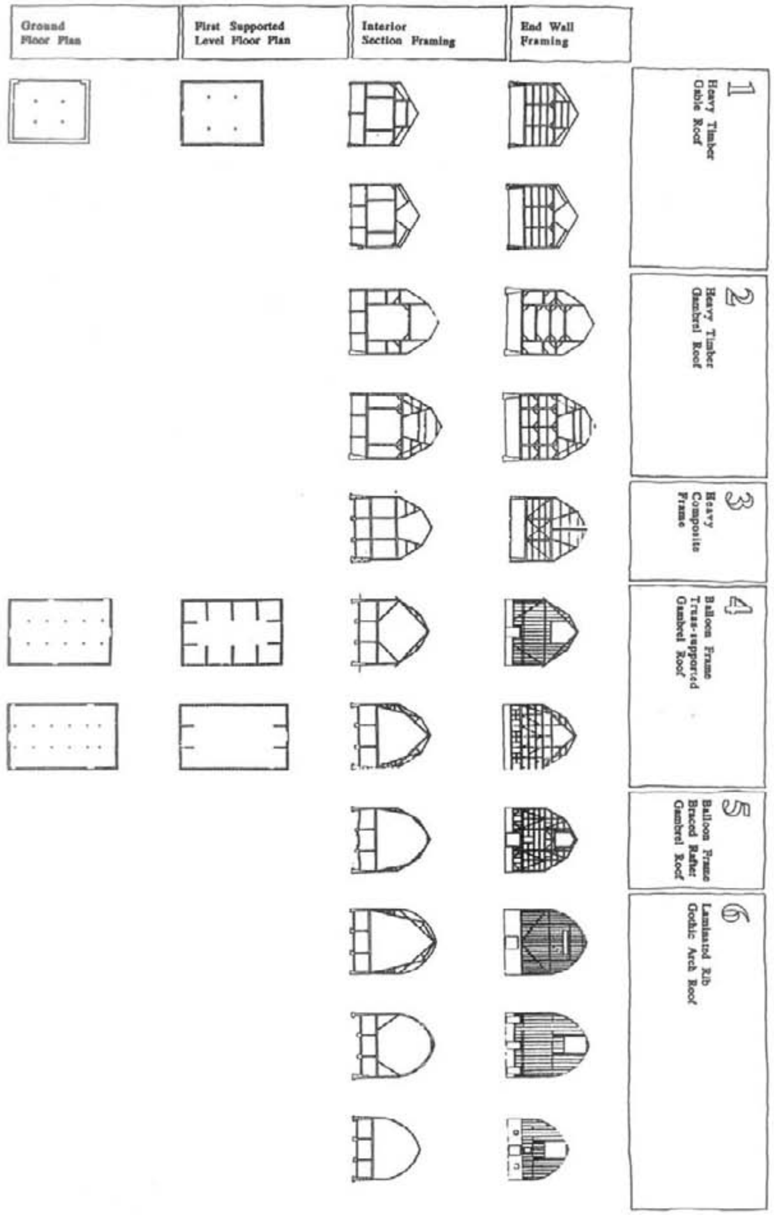
Fig. 3.3 Bents and bays of a timber frame barn, suggesting the method of erecting the frame of many barns.

Components of a timber frame, as illustrated by Allen G. Noble and Richard K. Cleek (with M. Margaret Geib) in *The Old Barn Book* (1995).

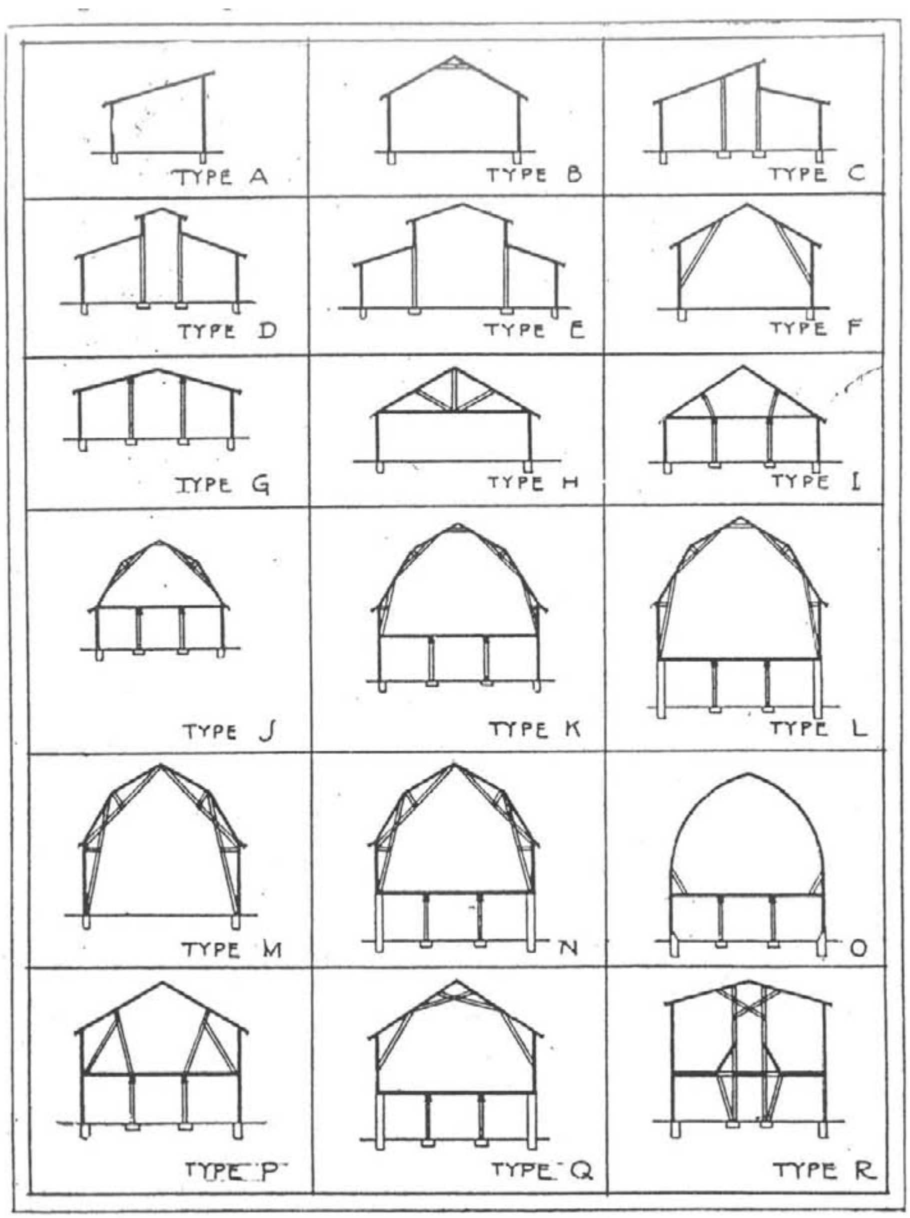
A circa 1880 timber frame barn built on a German immigrant farm in Nicollet County. The barn displays rare Old World construction techniques including plate-to-floor diagonal braces, use of curved timbers, scribed joinery, and fachwerk-style square framing of the exterior walls. Seeman Farm, Courtland Township, Nicollet County, 2005. (Photo by Daniel R. Pratt for Mn/DOT)



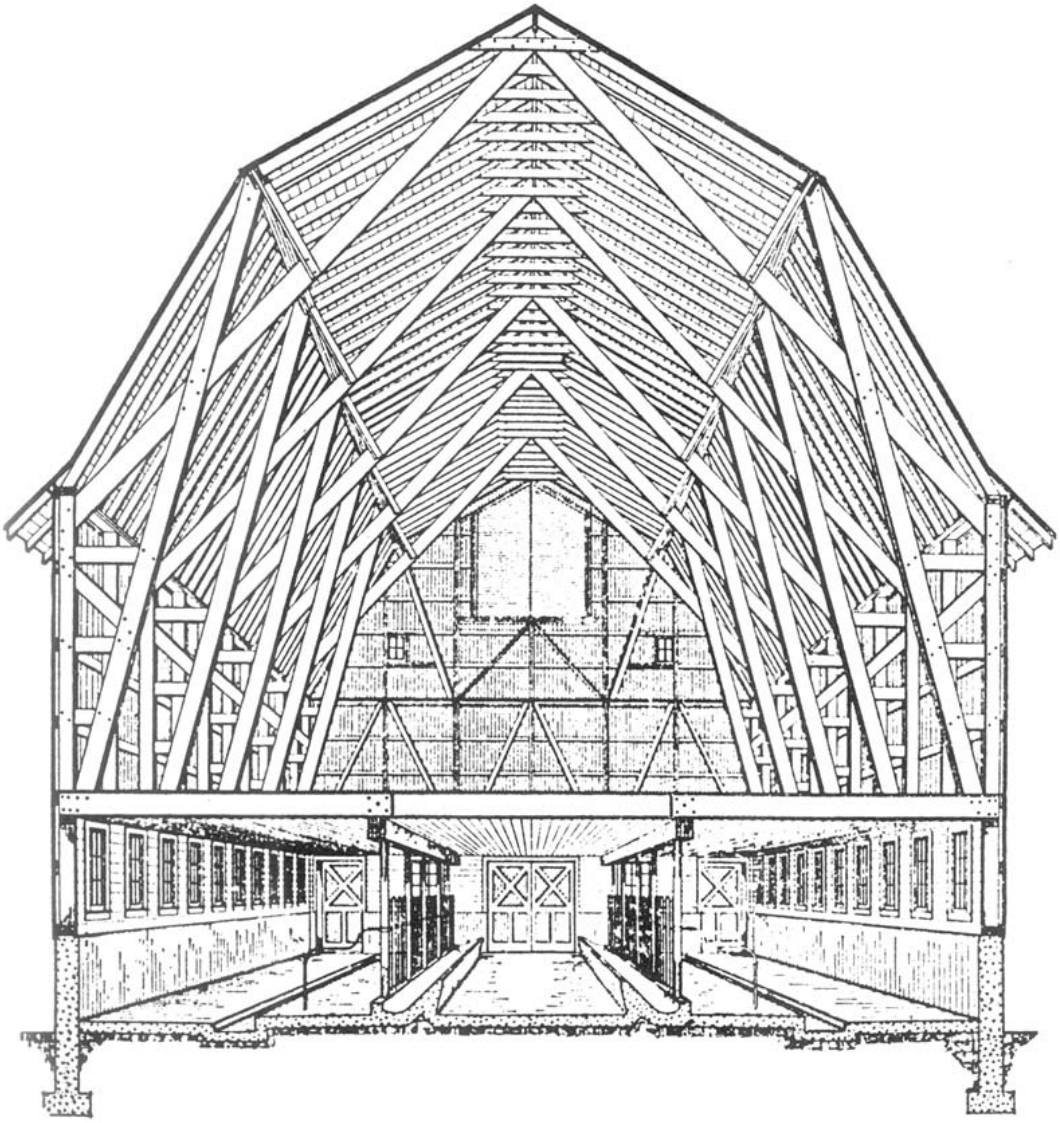
Iowa barn expert Lowell Soike used this illustration of the evolution in barn roof framing in a recent discussion of barn types in the Midwest. From Soike's "Within the Reach of All: Midwestern Barns Perfected" (1995).



Dandekar and McDonald included this chart in a 1995 article on Midwestern barns to help illustrate the evolution in barn design from heavy timber framing to increasingly lighter structural systems. The authors drew their information from agricultural extension bulletins. From Dandekar and McDonald's "Preserving the Midwestern Barn" (1995).



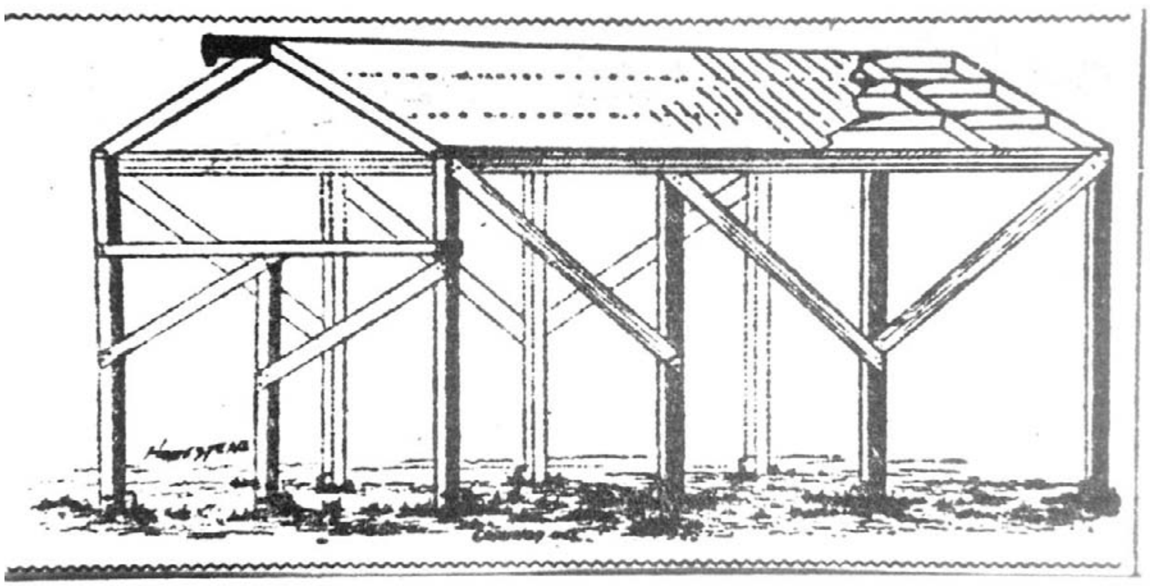
In 1916 these 18 basic barn designs were identified by the American Society of Agricultural Engineers as being most suitable to meet the typical farmer's needs. The designs were reportedly drawn after reviewing 10,000 buildings and plans. The 18 designs were flexible in building materials and adaptable to various farming practices. From Niemann et al "Report of Committee on Farm Structures" (1919).



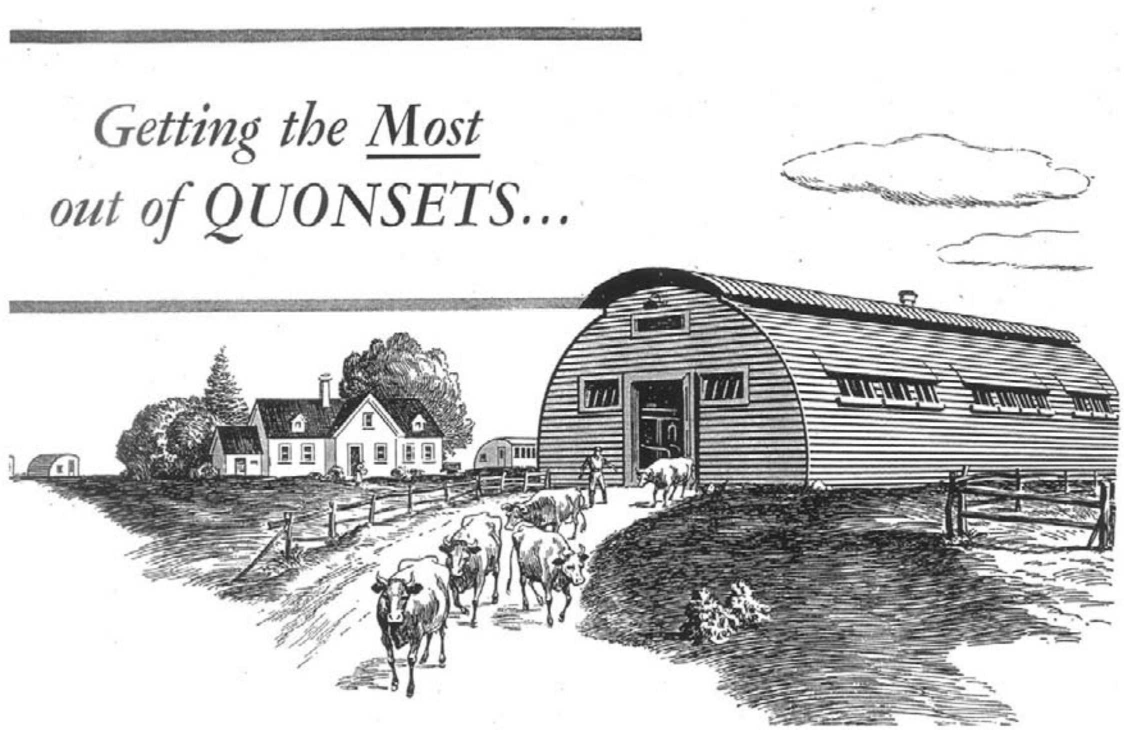
This 1946 illustration of a Shawver truss plank-frame barn appears in a recent essay by Glenn A. Harper and Steve Gordon on the 20th century development of Midwestern barns. According to the authors, "In the 'modern' plank-frame barn, roofs were supported by purlins which, in turn, were supported on specially designed, self-supporting trusses, or the roofs themselves were self-supporting" (1995: 217).

A raised three-bay barn of typical form. It had a gabled roof, central entrance, a long narrow transom window above the door, and few other windows. Placards on the gable end read "1892" and "Hazel Hurst Farm." Location unknown, circa 1900. (MHS photo)

This type of barn has been called a “midwest three-portal barn” by historians such as Noble and Cleek (1995). The side aisles were often added later, sometimes resulting in a “broken” roofline. There were usually doors leading into each of the three aisles, as well as a hay mow door. Walsh Barn, North Hero Township, Redwood County, 1978. (MHS photo by Gimmestad)



Barn historian Lowell Soike discovered this precursor to the 20th century pole barn in a May 21, 1889, issue of *Iowa Farmstead*. It was a hay storage barn for cattle feeders that could be supported by either massive, upright, square timber columns spiked to posts set in the ground, or with full-length telephone poles. Cattle housing and manure storage sheds could be added around three sides. From Soike's "Affordable Barns for the Midwest: Beginnings" (1995).



A quonset-type dairy barn, offered by the Flintkote Company in a 1946 issue of *Agricultural Engineering*. The advertisement also listed other materials sold by Flintkote including asbestos-cement shingles and siding, asphalt shingles and roll roofing, damp-proofing materials, decorative insulation board, and asphalt coated sheathing. From *Agricultural Engineering* (Sept. 1946: 435).

INDIVIDUAL FARM ELEMENTS

This section of the historic context study considers a wide range of elements likely to be found on Minnesota farms. These elements are presented in alphabetical order, as listed below. "Barns" are listed by primary function (e.g., Beef Barns, Bull Barns, Dairy Barns, General Purpose or Combination Barns, Hay Barns, Hog Barns, Horse Barns, Milking Barns, Sheep Barns, Threshing Barns, and Tobacco Barns).

Acetylene or Carbide Gas Structures
Airplane Hangars
Animal Underpasses
Beef Barns
Boundary Markers
Brooder Houses
Bull Barns
Cattle Guards
Cesspools and Septic Tanks
Cisterns
Combination Buildings
Corncribs
Dairy Barns
Drainage Structures
Erosion Control Structures
Farm Shops
Farmhouses
Farms
Farmsteads
Farmyards
Fences
Field Rock Piles
Fields and Pastures
Garages
Gardens (Vegetable)
General Purpose or Combination Barns
Granaries, Elevators, Bins, Dryers
Greenhouses, Hotbeds, Coldframes
Hay Barns or Sheds
Hired Workers' Housing
Hog Barns and Hog Cots
Horse Barns
Housebarns
Icehouses
Implement or Machine Sheds
Irrigation Structures
Landscaping and Ornamental Plantings
Manure Pits or Bunkers
Milk Houses
Milking Barns
Orchards
Other Animal Husbandry Elements
Other Crop Husbandry Elements
Other Domestic Elements
Other Service and Utility Elements
Potato Warehouses
Poultry Houses
Power Houses
Privies
Propane Gas Structures
Pumps and Pump Houses
Roads, Lanes, Tracks, Sidewalks
Roadside Markets
Root Cellars
Saunas
Scale Houses
Sheep Barns
Shelterbelts
Silos
Smokehouses
Springhouses and Springboxes
Stock Tanks
Stockyards
Sugarhouses
Summer Kitchens
Threshing Barns
Tobacco Barns
Utility Poles and Equipment
Water Power Structures
Water Tanks and Tank Houses
Wells
Wetlands
Windbreaks
Windmills
Woodlots
Woodsheds

Historical archaeological resources are addressed separately in Volume 4.

Landscape elements that were created, used, or manipulated by people are included on the list above. Examples include fields, pastures, gardens, ornamental plantings, woodlots, wetlands, and erosion control structures. For a discussion of farm landscape elements and their evaluation, see McClelland et al, *Guidelines for Evaluating and Documenting Rural Historic Landscapes [National Register Bulletin 30]* (1990).

To understand the development and operation of Minnesota farms, it may be useful to see that most of the farm elements on the list above fall into one of four broad categories based on use:

- crop husbandry elements
- animal husbandry elements
- domestic elements
- service and utility elements

Minnesota farms from the period covered by this context study – 1820-1960 – were generally comprised of elements from all four categories.

Information on the number and size of farms in Minnesota and how this changed through time can be found in the individual farm elements section entitled “Farms”.

Farm kids on a spring day. Location unknown, circa 1930. (MHS photo by Chester Sawyer Wilson)

▪ ACETYLENE OR CARBIDE GAS STRUCTURES

- Farm-generated gas for lighting, cooking, water heaters, and irons
- Found on an estimated 12,000 farms in the U.S. by 1912
- Generators were installed either indoors or, more commonly, in an underground pit

Acetylene was colorless gas used as a fuel in farm lighting plants by at least the 1910s. In the years before farms were electrified, some farmers installed acetylene plants (also called carbide plants) for lighting, while others generated electricity using water, wind, or gasoline engines. Because of the significant investment involved, many of the farms outfitted with acetylene were fairly prosperous.

Acetylene was made on the farm by combining water and calcium carbide, which was a granular material delivered in 100-pound, air-tight steel drums. The result of mixing water and calcium carbide was acetylene, a highly flammable gas (also known as carbide gas) with a pungent, penetrating odor. A by-product of acetylene gas production was slaked lime, which collected at the bottom of the generator tank. Farmers used the lime as a disinfectant, soil additive, whitewash, and wood post preservative (Musselman 1912: 132-133; Woolworth 1928: 218).

Acetylene was burned in specialized household lamps, cooking stoves, water heaters, and self-heating irons. Acetylene gas lamps produced a bright white light, gave off less heat than kerosene lamps, and didn't need fragile mantles. The acetylene was piped to the house and other buildings through ordinary gas pipes. In the house, the gas pipes were generally concealed in walls, floors, or ceilings, with periodic outlets (Woolworth 1928: 217-218; Mowry 1915: 4).

Acetylene generators were widely available and operated quite inexpensively. However, reports of acetylene gas plant explosions were fairly common and acetylene was considered somewhat risky for barns and outbuildings because of fire danger. In the 1920s, safety improvements in the technology made acetylene "worthy of serious consideration in connection with the lighting of practically all buildings and premises which are located out of range of low-priced and satisfactory service from central electric and city gas plants" (Woolworth 1928: 217-218; Mowry 1915: 4; Musselman 1912: 133-135).

There were many variations in acetylene generators and lighting plant designs, and they were generally more simple than farm-generated electricity plants. The generators were of two types: indoor and the outdoor pit. Indoor generators were typically installed in the farmhouse basement, although, for safety, some experts recommended that the generator be located in an isolated spot on the farmstead, or in a frost-proof building some distance from the house and other buildings. Because of space constraints, indoor generators ordinarily had a capacity of less than 100 pounds of carbide, and therefore, had to be cleaned and replenished every month or two. In addition, the disagreeable odors from basement generators tended to penetrate the house. For these reasons, outdoor pit generators were more popular (Woolworth 1928: 217-218; Mowry 1915: 1).

See also

Power Houses
Farmhouses
Appendix: Focus on Farm Electrification

Outdoor generators, the more popular type, were usually buried in concrete pits lined with galvanized metal, and placed 50' to 100' from the house. Outdoor installations had to be protected from freezing. Pit-type generators could be much larger than indoor generators – a capacity of 200 pounds of carbide was common. An average farm in 1928 used 200 to 500 pounds of carbide a year for lighting, so a 200-pound generator needed cleaning and replenishing only a few times a year (Musselman 1912: 134; Mowry 1915: 3-5; Woolworth 1928: 217).

Acetylene systems had to be handled carefully. Though intended to operate automatically, experts warned that "a perfectly-working acetylene gas system is a delicate piece of machinery" and susceptible to fire and explosion (Mowry 1915: 7). Still, carbide gas lighting systems were popular, and reports claimed that more than 200,000 farms in the U.S. had installed acetylene systems by 1912 (Musselman 1912: 133; Kline 2000: 98; Woolworth 1928: 218).

PREVALENCE

It is not known how many acetylene systems were in Minnesota, but they were not uncommon. It is assumed that most systems were eventually abandoned soon after farms were electrified in the mid-1930s through the mid-1950s. Extant acetylene structures are probably rare today. Evidence at ground level may include covers, rods, and pipes located in an area about 8' in diameter.

SOURCES

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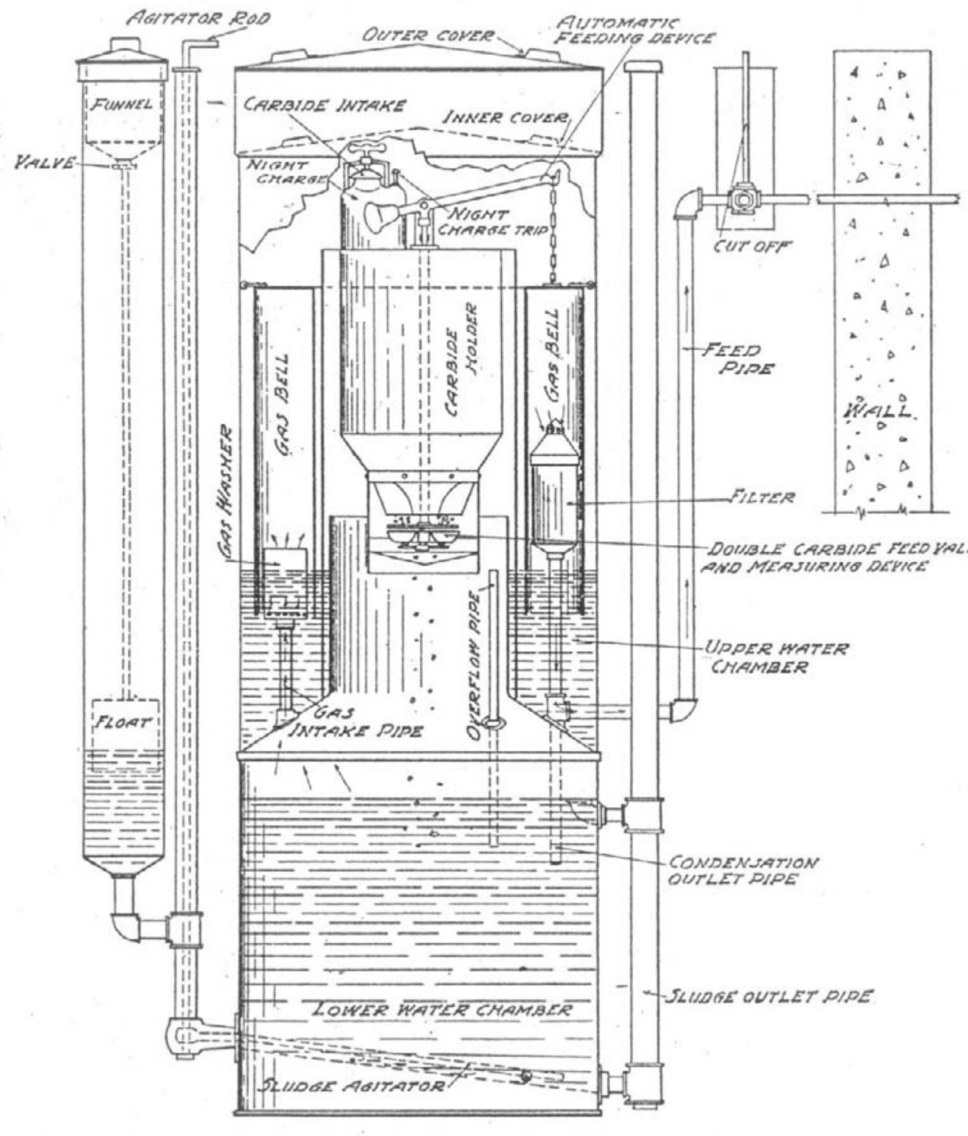
Woolworth, Clara. "Lighting Farm Buildings with Carbide Gas." *Agricultural Engineering* 9 (1928): 217-218.



This acetylene or carbide gas plant was designed to be buried in a pit about 12′ deep. The pit was usually located 50′ to 100′ from the farmhouse. Ground-level evidence of such a pit might include a circular pit cover, an agitator rod, and pipes, all located within an 8′-diameter circle. From Mowry's *Lighting Farm Buildings* (1915).

■ AIRPLANE HANGARS

- Barnstormers introduced many Minnesota farmers to the experience of flying
- Few farmers learned to fly or owned a plane before World War II
- Many farmers built their own farm landing strips and hangars
- Planes had some farm uses but were owned primarily for pleasure

This individual farm elements section discusses both airplane hangars and landing strips.

Farmers and flying are linked in the earliest history of Minnesota aviation. Many Minnesota farmers saw their first airplanes in the 1920s when "barnstormers" visited rural areas, flying into farm fields. These early pilots demonstrated aerobatic stunts and carried passengers for sightseeing rides. In their history of Minnesota aviation, Allard and Sandvick quoted an early barnstormer who recalled, "If you set down by a threshing crew, you didn't have to put up a sign or anything, because in about ten minutes, you'd have the whole crew around the airplane, digging into their pockets for money. . . . The only person who didn't care for that was usually the farmer whose land they were harvesting" (Allard and Sandvick 1993: 72).

According to Allard and Sandvick,"many of the earliest [Minnesota landing] fields were nothing more than farm strips that became the locally accepted places for aviators to gather, to purchase fuel from a local service station, or to tie down for the night." A few early pilots "made a living, flying from farm to farm, selling machinery as well as airplanes, to the farmers" (Allard and Sandvick 1993: 147,149).

Some farmers were able to fly and own planes prior to World War II, but it wasn't until after the war that it became very popular. Many farmers learned to fly through World War II readiness or military programs including the Civilian Pilot Training program, the War Training Service, or the U.S. Army Air Corps. The state's agricultural schools, including the West Central School of Agriculture in Morris, offered ground school flight training during World War II that many farmers attended.

While some farmers owned their own planes, it was typical for two or more farmer-pilots to jointly own a plane that was stored on one person's farm.

Farm landing strips were often 2,600' to 3,300' long and twice as wide as a plane. Farms frequently had two perpendicular landing strips so planes could land in all wind conditions. Most often the landing surface was planted with alfalfa that could be cut and baled for farm use. (One 89-year old former pilot, Charlie Schmidt, recalls having to dodge bales when landing.) Brome grass was considered the best landing surface, but it did not have alfalfa's advantage as livestock feed. Some farmers seeded their strips with a special combination of Kentucky bluegrass and various legumes, and occasionally canary grass was used. Farmers also landed on rural roads surfaced with gravel or bituminous (Schmidt 2005).

See also
Roads, Lanes, Tracks, Sidewalks

Farm landing strips were very seldom paved and infrequently lighted. Many farmer-pilots did land on their fields at night, however, using ingenious methods to land safely such as stringing fences with reflector-surfaced license plates to mark the ends of the strip and positioning lighted flares along one side. Windsocks to indicate wind direction were frequently mounted on 4' x 4' poles, about 10' high, placed next to the strip (Schmidt 2005).

Most farmers built a hanger when they bought a plane so the aircraft wouldn't be damaged by weather. Hangars were also sometimes used to store farm equipment. Hangars were frequently T-shaped but also square or rectangular, particularly if they needed to house two airplanes (Schmidt 2005). In 1961, agricultural engineers Neubauer and Walker suggested an economical hangar that was T-shaped – roughly the shape of a plane – and just slightly larger than a plane (Neubauer and Walker 1961: 280).

Most early hangars were woodframe with gabled roofs and wood siding. Asphalt shingled roofs were common, but occasionally a farmer scavenged supplies for a metal roof. Hangar doors were usually sliding or rolling, although sometimes other methods of opening were used. One farmer is known to have used a plywood door that he would lower onto the ground and then taxi over. Returning from his flight he would taxi across the door into the hangar and then raise the door back up into place (Schmidt 2005).

Farm landing strips were not usually plowed to clear the snow, so in winter planes were often equipped with skis, custom-made by a local mechanic. If a farmer was headed for a warmer part of the country in winter, he would fly off of his farm on the skis and land at a snow-covered airport where he removed the skis. He could then taxi out to the public road where he could take off on the plane's tires (Schmidt 2005).

After World War II the number of farmer-pilots and their farm landing fields grew rapidly, in part because so many had either learned to fly or became interested in flying during the war. The U.S. government also sold large numbers of surplus planes after the war. In one west central Minnesota county, Stevens, there were landing strips on at least nine farms between 1946 and 1955. It was reported that the Schmidt Farm's landing strip near Morris had more aviation activity in the late 1950s than the local airport (Schmidt 2005; Schultz 1991: 13).

Used primarily for pleasure, planes were also useful to farmers for various farm chores. They were used to travel to distant communities to pick up parts or supplies, to locate stray cattle, and to check on irrigation systems, crops, and livestock.

Planes were also valuable for crop spraying. Crop-dusting began in the early 1920s, but became common after chemicals like DDT and 2,4-D were introduced in the 1940s. Early crop-dusters used jerry-rigged tanks and sprayers (e.g., a chemical-filled tank sitting on the seat next to the pilot), but eventually more sophisticated equipment was used. The use of planes to dust or spray chemicals kept crops from being crushed by tractor tires and protected fields from becoming rutted with deep tire grooves. Spray planes often landed on public roads to take on additional chemicals during the spraying process (Schmidt 2005).

The Minnesota Flying Farmers, a statewide group, was organized in 1946. Membership was especially high in the 1960s. The group provided opportunities for farmer-pilots to promote flying, to socialize, and to fly together to meetings and events.

Flying among farmers declined considerably after the 1970s. Many farm landing strips were eventually plowed and planted with crops, and hangars were converted to implement sheds and other uses (Schmidt 2005).

PREVALENCE

Farm aircraft hangars and landing strips were built throughout Minnesota, particularly after World War II. Some hangars survive, especially those that were converted to implement sheds and kept in good repair. Some landing strips also remain today.

SOURCES

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Neubauer, Loren W., and Harry B. Walker. *Farm Building Design*. Englewood Cliffs, NJ: Prentice-Hall, 1961.

Schmidt, Charles [of Morris, MN, retired farmer-pilot, past president of Minnesota Flying Farmers; the only living charter member of that organization]. Interview with Arden Granger. 2005.

Schultz, Steven R. *Pilots, Planes, and Politics*. Undergraduate research paper. University of Minnesota, Morris, 1991.

A typical western Minnesota farm hangar, sided with metal. Its eastern side is entirely open. The landing strip, still in use, is aligned north and south and is located along the edge of the field shown in the foreground. Solvie Farm, Pope County, 2005. (Gemini Research photo)

▪ ANIMAL UNDERPASSES

- Structures that allowed cattle and other livestock to move beneath obstructions like roads and railbeds
- Especially prevalent between the late 19th century and the 1950s

Animal underpasses (also called cattle passes or pass-throughs) were structures built to allow livestock to pass beneath roads, railbeds, or similar obstructions. Those that crossed roads were often built to replace at-grade livestock crossings and were considered safer for both stock and vehicles. Underpasses were often built by or for farmers working in cooperation with a public road authority or railroad company.

Underpasses were especially used between the late 19th century and the 1950s, which was the period during which most Minnesota farms had livestock. Underpasses were important for allowing cattle, sheep, and other stock to reach permanent pastureland, and for providing access to fields so that animals could eat crop residue after the harvest. They were also built to allow livestock to move between the stockyard and a natural source of water, or between stockyards, pastures, or fields. Dairy cows, for example, might move twice a day between a milking barn on one side of a highway and a pasture on the other. Most underpasses in Minnesota were used for cattle, but sheep, hogs, and horses were also accommodated. Using an underpass for beef cattle might save a farmer from driving feeder cattle several extra miles to cross an impediment – a trip that could cause the fattening cattle to lose precious weight if made too frequently.

Underpasses were commonly made of stone, concrete block, or poured concrete. Some resembled the “box culverts” commonly used to carry water under roads. An underpass from the early 20th century might be 3′ to 4′ wide, 6′ tall, and as long as the width of the roadbed – perhaps 60′ to 100′. They sometimes had wing walls at the openings to support the adjacent slope. To help wary livestock enter the tunnel, it was recommended that it be straight so the animals could see down the entire length. The floor of the structure was sometimes scored, roughened, or filled with sand or gravel to keep it from being slippery. The fencing that formed part of an animal lane, or surrounded the adjacent stockyard, field, or pasture, was generally attached to (or erected close to) the ends of the underpass.

Underpasses built in the late 19th or early 20th century were sometimes rebuilt or replaced when a road or railbed was improved. Thus underpasses are often the same age as the associated road.

Modern monolithic livestock underpasses can be difficult to distinguish from concrete drainage culverts. Typical modern underpasses for cattle and horses are 4′ to 5′ wide and 5′ or 6′ tall and made of precast concrete or metal culvert material.

See also
Fences
Fields and Pastures
Diversification & Rise of Dairy, 1875-1900
Develop of Livestock, 1900-1940

Some farmers also built structures to allow livestock to pass over ditches, low spots, or streams. These structures (sometimes called pass-throughs) were often simple, above-ground bridges with fenced sides or railings (Howe 1940: 16).

PREVALENCE

Animal underpasses were built in all parts of Minnesota, but were likely more prevalent in areas where more livestock were raised. Underpasses are often rebuilt or removed when roads are reconstructed, making early examples more rare. Because they are integral with the road, however, the underpass usually remains in place if the road bed has not been rebuilt.

SOURCES

Howe, O. W. "Planning the Physical Layout of Farms." *University of Minnesota Agricultural Extension Division Special Bulletin* 350 (1940).

This poured concrete animal underpass in central Minnesota is approached by a scored concrete walkway. The walkway provides traction for animals and reduces erosion on the steep slope. Stearns County, 2004. (Gemini Research photo)

▪ BEEF BARNS

- Often called feeder barns
- Built from about 1890 through the post-World War II period
- Tall, fully-enclosed beef barns included storage for hay and feed inside; many had attached silos
- One-story semi-open and open barns had openings facing south and east to maximize sunlight but protect from winds
- Beef barns often had large openings to allow cattle to move in and out freely
- Most beef barns were framed with dimensional lumber, with pole barns becoming popular after World War II
- Metal siding became especially popular after World War II

During the early settlement period, most hogs and cattle on Minnesota farms were kept outdoors, or in very crude or temporary shelters.

In the 19th century some Minnesota farmers raised beef for home consumption (or occasionally slaughtered dairy cows), but relatively few raised beef cattle for sale. Free grasslands and wild hay fields – the low-cost resources on which early cattle farmers depended – were diminishing by the 1890s as the last undeveloped land was settled. Minnesota farms were not yet growing large quantities of concentrate feed crops such as corn. In addition, the state lacked good-quality beef breeds, as well as marketing and processing facilities (Shaw 1894).

By the 1890s, however, experts were recommending livestock farming as a way for farmers to diversify from wheat-dominated farming systems. After a period of remarkable growth, by 1915 Minnesota ranked fifth in the nation in the number of beef cattle. The increase was due in part to the diversification of Minnesota farms, to increased acreage planted to corn, to the introduction of the silo which allowed economical winter feeding, to the creation of markets, to improvements in breeding stock, and to the optimization of feed rations (Shaw 1894; Barns 1915: 22-23).

Another significant rise in Minnesota beef production followed World War II. This was fueled by increases in U.S. population, by increases in consumer demand for red meat, by new acreage planted to corn and other feed crops, by improvements in feed mixtures, and by improvements in breeding.

Like most animal enclosures, beef cattle barns (also called feeder barns), were best sited on well-drained land, down-wind from the farmhouse. Most farms that raised beef and other livestock had fenced fields and pastures to allow stock to eat crop residue and to graze on forage plants.

Adjacent to the cattle barn was a stockyard with a strong fence. The yard usually contained a feeding structure (see "Feeding" below), a large water tank that was usually equipped with a heater to prevent freezing, a structure or stock to hold animals during breeding or veterinary procedures,

See also

Dairy Barns
Stock Tanks
Bull Barns
Develop of Livestock, 1900-1940

Appendix: Focus on Minn Livestock

and possibly a loading chute. All of these structures were generally made of wood until after World War II when metal structures became popular. By 1954 the USDA was recommending paving a portion of the stockyard or feedlot with concrete, and surfacing the surrounding areas with gravel (Neubauer and Walker 1961: 66).

BARNS THAT HOUSED CATTLE AND STORED FEED AND BEDDING

Beef cattle were often raised in combination or general purpose barns that also housed dairy cattle and horses. (See "Dairy Barns" and "General Purpose or Combination Barns," two separate farm elements sections, for information on barn design, ventilation, mows, feeding and manure handling, etc.) However, several specialized structures for beef cattle were also developed.

The largest beef cattle barns housed the herd as well as feed and bedding for a season. These barns were built from the 1860s through the 1950s. After about 1910, many had attached silos. These barns needed to be warm, dry, well-ventilated, and provide light. Many had rooms in which feed could be ground and mixed. Most furnished "loose" housing, meaning the animals walked around freely. This exercise kept them healthy and some experts believed it stimulated their appetite. Stalls and pens were provided for bulls and calving. In some barns all beef cattle were housed in stalls. Early barns had windows to provide light; later styles usually had large door openings instead. Some barns included an interior stock tank for water (Midwest Farm 1933; Carter and Foster 1941: 223-225).

Some barns were large, complex, multi-compartmented buildings. For example, in 1894 the University of Minnesota's Thomas Shaw recommended a basement-barn in which the feed was stored on the first floor and cattle were housed in the basement. This barn, which Shaw considered relatively expensive, measured 60' x 110' and housed 30-40 animals. The first floor had a central alley, seven hay storage compartments, two grain storage bins, a room for chopping feed, and feed bins. The basement had two root cellars, a central feed room, three pens for bulls, eight calf pens, 25 box stalls, numerous windows, and an office (Shaw 1894: 116, 121-125; the barn described by Shaw had been built in 1886).

In barns without basements, hay and straw were generally stored in a loft and dropped from there to the floor below. Many had a central alley wide enough for a feed wagon and manure equipment. One typical example from 1951 had a 36' x 60' footprint (National Plan Service 1951). Another, in a plan offered by the University of Minnesota in 1953, measured 24' x 50' (*Farm Building Plans* 1953).

A form of beef or feeder barn common in the Midwest is called the "midwest three-portal barn" by historians Noble and Cleek (Noble and Cleek 1995: 74-75). (See illustration from Morris and Harvey (1950) at the end of this chapter. See also this context study's "Building and Planning Farm Structures: Barn Forms and Terminology.")

A variation, popular from the late 19th century through the 1950s, was a barn in which the entire central section from floor to eaves served as a tall, narrow hay mow, with animals housed in two parallel spaces along the barn side walls, or around three sides in a "U" shape. These were sometimes called "shed" barns. According to barn historian Lowell Soike, a barn of this style – but with an innovative pole support system that he considers a precursor to the common pole barn – was described in the May 31, 1889, issue of *Iowa Homestead*. The central hay section was framed either with massive, upright, square timber columns spiked to posts set in the ground, or with full-length telephone poles. The barn could hold 35 to 40 tons of hay (Soike 1995: 90-91).

Barns with tall, central hay storage often had gable or gambrel roofs, with roof pitches that could break into shed or hipped roofs over the lower housing areas. Farmers could load hay into the barn via a blower pipe at the peak of the roof. A barn with a central hay mow was usually wider than a barn with a second-story hay loft. A plan published by the National Plan Service in 1951, for example, had 54'-wide gable ends and 60'-long sidewalls, making the footprint of the barn almost square (National Plan Service 1951; Neubauer and Walker 1961: 69).

The housing areas could have large doors (usually left open), or openings with no doors, or could be entirely open-sided. All three variations allowed cattle to move freely in and out during good weather, but be sheltered from rain and extreme cold (Wooley 1946: 109-110; National Plan Service Circa 1950; Neubauer and Walker 1961: 68).

Another variation of the housing and storage barn provided storage for only a small supply of feed and bedding – perhaps two weeks' worth. In this case, the barn was accompanied by another storage building nearby (Wooley 1946: 111). In another variation, farmers built an addition onto an existing building to house their beef cattle, and sometimes feed and bedding.

PROVISIONS FOR MILKING

Between the late 19th century and the 1950s a significant number of Minnesota farmers milked their beef cows, raised "dual-purpose" breeds, or raised beef cattle along with dairy cows. These farmers needed the most substantial barns to support milking operations, and to protect specialized dairy breeds (which were more cold-sensitive than dual-purpose and beef breeds). These barns had stalls with ties or stanchions for milking, calving pens, and provisions for handling feed and milk. They were also subject to dairy sanitation laws.

In one example from 1934, a University expert recommended that a barn at least 32' x 70' could house 30 dual-purpose cows, plus their calves, plus a bull. The calves – an estimated 26 to 28 each season – would need to be fattened in an additional shed. That shed would need to measure 30' x 50' if the calves were fed indoors, or 20' x 50' if the feeding was done outside (Crickman et al 1934: 56-57).

SIMPLIFIED BUILDINGS

As more Minnesotans added beef cattle to their farms, and as herds grew larger, beef barns evolved from fully-enclosed buildings that were sometimes shared with other stock, to barns with one or two fully-open sides. These were often called beef "sheds."

Experts long recommended that beef cattle needed fresh air more than they needed warmth, and that good ventilation was important to preventing disease. As early as 1911 one expert was advising that "The experience of many feeders in the state [of Minnesota] shows clearly that, where the feed lot is fairly well-protected from cold winds, the open shed, facing south or east, is all that is necessary" as long as sufficient bedding was provided (Handschin 1911: 116; Sheffield 1910).

Ohio State University's Charles S. Plumb wrote in 1918, "Steers fed under sheds open to the south, with yards into which they can freely go, have given better results in growth and fattening than those kept in stalls in warm barns" (Plumb 1918: 318). Another expert, John Wooley, wrote in 1946 that exposure to the weather "sharpens" the appetite of the cattle (Wooley 1946: 108).

Because beef cattle required less shelter than other livestock, they were seen as adaptable to most any space as long as there were 30-40 sq. ft. per animal, not including storage and feeding areas (Handschin 1911: 115; Morris and Harvey 1950: 17; Neubauer and Walker 1961: 66).

At the same time that beef barns became more open, many were being built as one-story, rather than two-story structures. These buildings were simpler and less expensive to build, and were seen by some as more efficient to operate since the feed and bedding were stored on the same level as the animals. With the development of field pickup hay balers in the 1930s, more farmers stored their hay and straw in compressed bales that were sometimes too heavy for loft storage.

One-story, semi-open or open cattle barns became popular in the early 20th century. These barns had open "loafing" areas to which cattle had free access, as well as enclosed areas for calving and newborn animals. The barns were placed at the northwestern corner of the stockyard, with openings facing south, so the animals had protective cover but optimal sunshine. Feeding equipment could be placed either inside or outside of the building (Midwest Farm 1933; Carter and Foster 1941: 223-225). Farmers who used semi-open and open sheds that did not have storage areas needed to provide a structure for bedding and feed storage nearby.

A typical open rectangular beef barn – described in a 1950 source – could be 24' deep and any length (recommended to be in multiples of 12'). Each 12' of length could accommodate six cows, eight yearlings, or ten calves. A similar building in an "L" shape could have wings 48' long and 72' long, and be 24' deep (Morris and Harvey 1950: 15, 17). An inside height of 9' was recommended so that manure could accumulate during winter months since such barns were only cleaned once or twice per year. Feeding was done outside. Around 1960 Merickel Buildings of Wadena was offering plans and materials for open cattle barns measuring 20' x 30', 24' x 30', and 30' x 48' (*Merickel* ca. 1960).

Many farmers used their beef cattle barns for other purposes during much of the year since the cattle only required shelter during the winter.

CATTLE FEEDING ONLY

If the farm was simply going to feed or finish cattle – with no breeding, calving, or milking – the cattle shelter could be the simplest animal housing on the farm (Crickman et al 1934: 57-58; Wooley 1946: 108). Open sheds such as those described above were common.

FEEDING

The Minnesota Agricultural Experiment Station recommended in 1934, "Because the labor of feeding is considerably reduced by feeding out-of-doors and because fattening cattle will gain almost as rapidly and on very little more feed when fed out-of-doors . . . the majority of cattle fatteners prefer the outdoor feeding plan" (Crickman et al 1934: 56-58).

Feeding outside was also recommended to keep the food separate from rising piles of manure, especially in barns or sheds that were cleaned infrequently. Newborn calves and cows that were milked, however, were often fed inside.

Most feeding structures were made of wood, with metal structures introduced after World War II. Feeding structures included mangers (a term usually referring to an inside feed structure), racks (which held large loose material like hay and whole cornstalks), and bunks or troughs (which held liquids, grain, silage, and other particulate material). Some were called "self-feeders."

Outside racks and bunks were often on skids so they were portable. Racks and bunks were filled in several methods: by hand, from horse- or tractor-drawn wagons, with mechanical equipment (including augers) that extended from a barn, or with tractors equipped with front-end loaders.

Special feeding structures called "creep" feeders were built to allow nursing calves to access a feed source like grain, while preventing the adult cows from reaching it.

MANURE HANDLING

Cattle manure was deposited on fields and pastures in two ways: by the grazing animals as they walked, and by the farmer who spread manure-laden straw bedding on the land, either letting it incorporate passively or tilling it under. All but the earliest barns had openings large enough for manure-handling equipment to enter them.

Keeping manure within the barn and only removing it once or twice per year was advantageous: little of the precious manure was lost since it was mixed with absorbent bedding and kept out of the rain and, for farmers in northern climates who couldn't spread manure in the winter, the barn stored the manure until spring (Ashby 1916: 24). During the winter, the "manure pack" in the barn began to compost and heat up, providing a small amount of warmth for the animals (Lindor 2004).

In more recent decades, modern confinement buildings were sometimes built with slotted floors to allow manure to fall into a pit beneath the floor. The practice was discontinued by some farmers because it caused feet and leg problems for the cattle (Lindor 2004).

Modern feedlots use liquid manure pits, manure lagoons, and other methods to handle much larger quantities of manure than were historically produced on typical Minnesota farms. Manure lagoons first appeared in the 1970s (Hanke 2005).

MATERIALS

Buildings made of straw were used for winter beef housing in Minnesota from at least the 1870s through the 1950s.

Through the 1950s most beef barns were framed with dimensional lumber. Pole buildings framed with creosote-treated poles were introduced in the 1930s. By the 1930s metal-framed buildings were also being used by some farmers (Morris and Harvey 1950: 17; *Minnesota Farmscape* 1980: 9; *The Reynolds Pole Barn* 1953; Soike 1995).

Barns that housed beef cattle, feed, and bedding often had Gothic-arched, gambrel, or gabled roofs. Additions often had shed roofs. Semi-open and open buildings were usually gable-roofed, although a circa 1960 publication by Merickel Buildings of Wadena offered a "new appearing" modified quonset-like roof on a building whose walls and roof were corrugated metal (*Merickel* ca. 1960). Roofs were commonly covered with wood shingles, asphalt shingles, rolled asphalt roofing, or corrugated metal.

Floors were often wood or packed dirt or clay. Concrete was recommended for alleys for efficient cleaning, and sometimes for the entire floor. Floors were covered with bedding (e.g., straw, wood shavings, sawdust, or chopped corn stalks) to keep the cattle dry. More bedding was added as needed, and the manure and bedding removed when the barn was cleaned.

The earliest buildings were wood-sided. By the 1930s metal-sided buildings were introduced. A 1941 promotional publication by the Structural Clay Products Institute indicated at that time (perhaps optimistically) that tile was "rapidly gaining favor" for beef barns (Structural Clay 1941: 13).

After World War II metal-sided pole buildings became increasingly popular because of their durability, modular construction, and low maintenance (*The Reynolds Pole Barn* 1953). By the mid-1950s factory-built or "kit" beef barns such as those by Merickel Buildings of Wadena were also available (U.S. Steel 1957; *Merickel* ca. 1960).

PREVALENCE

It is expected that beef barns will be found throughout Minnesota. It is likely they are especially prevalent in corn- and soybean growing areas including southern and west central Minnesota. Because Minnesota's beef production rose significantly after World War II, it is likely that many post-1945 beef barns will be encountered. Pre-1900 beef-only barns are likely rare, and pre-1940 beef barns are likely uncommon. It is suspected that small structures like feed racks and feed bunks from pre-1945 operations may not have survived.

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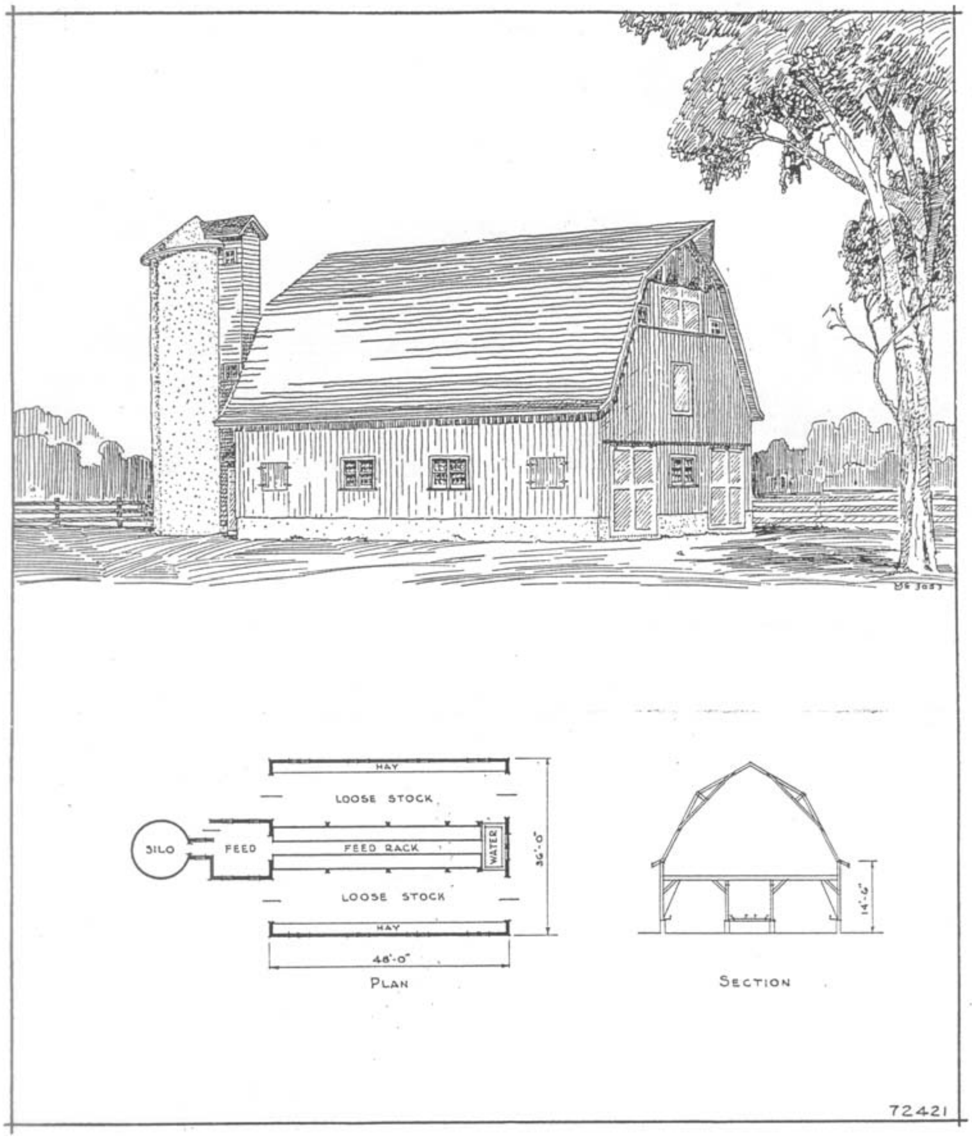
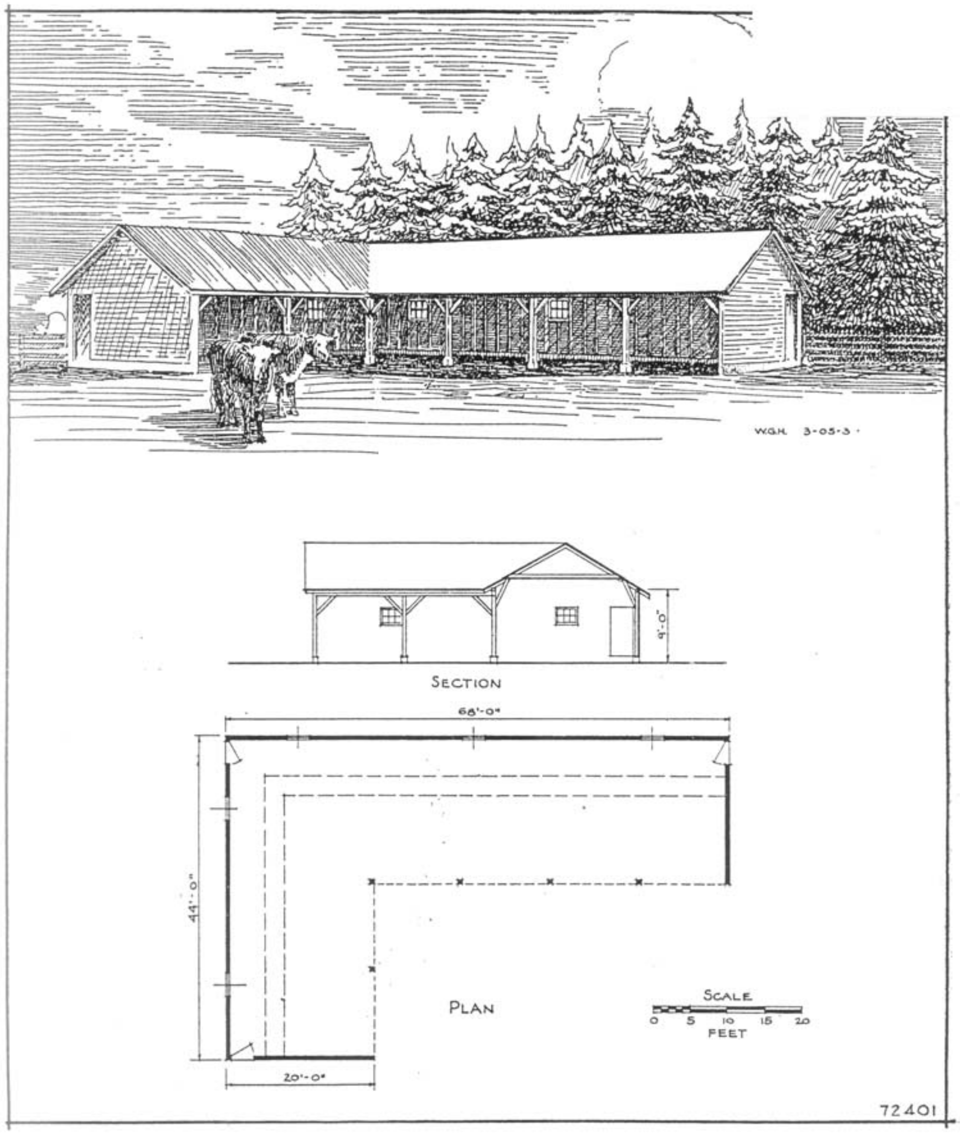
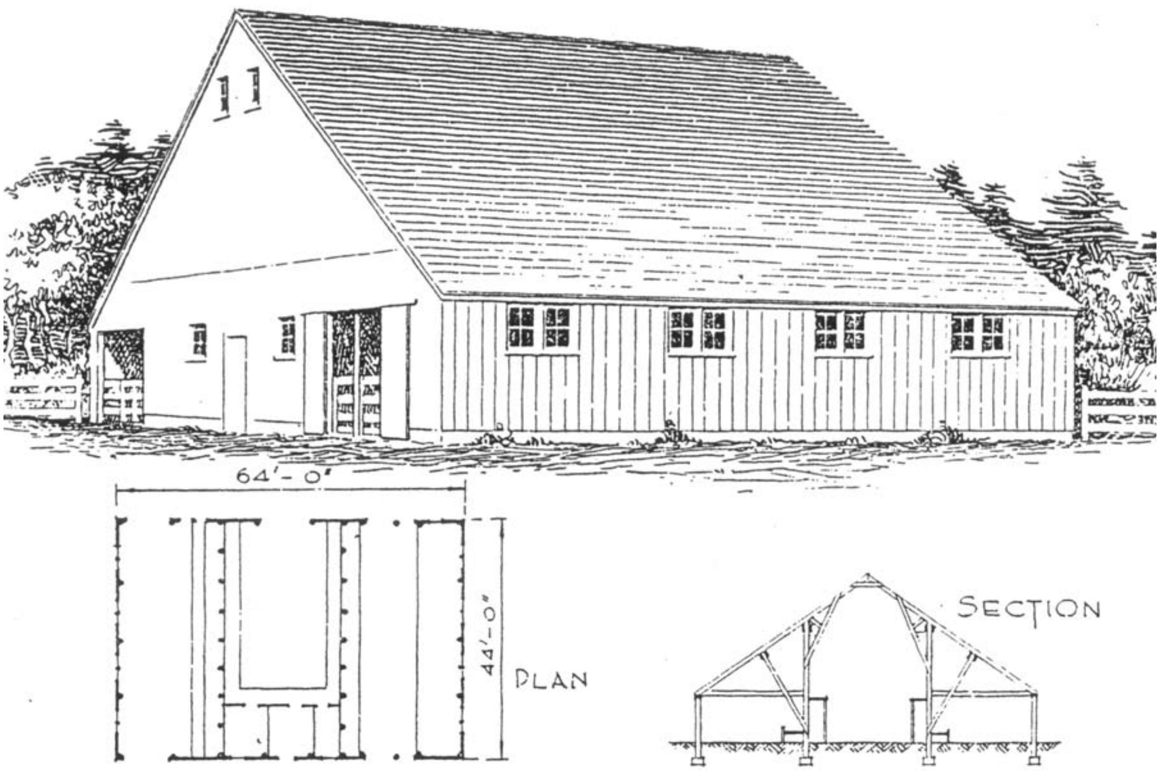


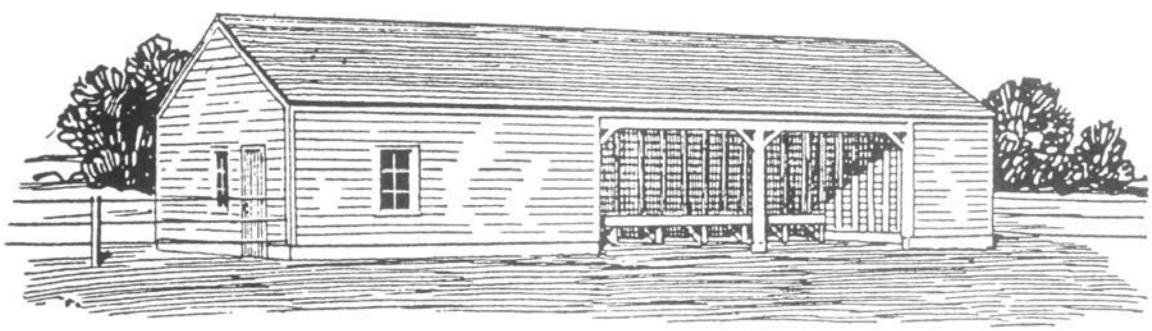
A “conventional two-story” cattle barn with a gambrel roof from a 1933 plan book for farmers. The barn had loose housing, hay and feed storage, mangers, a water tank, and an adjacent silo. From a Midwest Farm Building Plan Service catalog of plans, 1933.



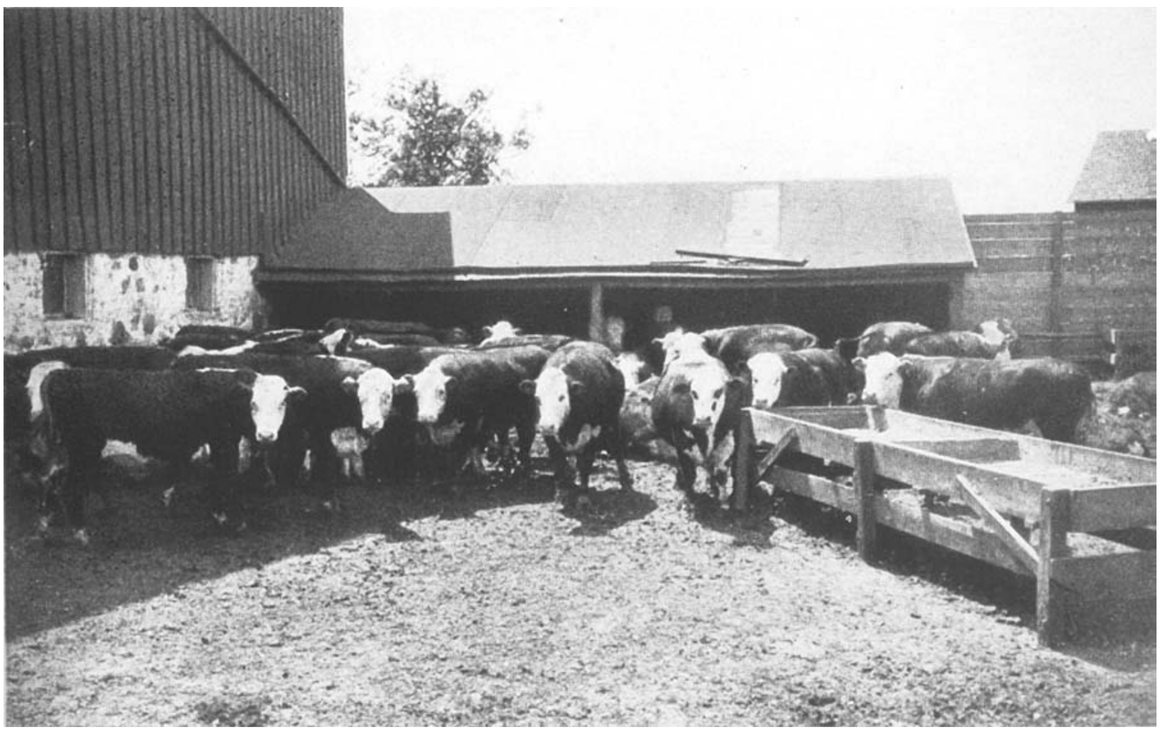
Open sheds were often L-shaped. This barn had wings 44′ and 68′ long. From a Midwest Farm Building Plan Service catalog of plans, 1933.



A beef cattle or feeder barn with hay storage from floor to ridge pole in the center of the structure, and loose housing on either side. This plan was published in *Beef Production*, a 1950 Minnesota Extension bulletin by Morris and Harvey.



A 24′ x 56′ semi-open beef cattle barn designed by the National Plan Service. Plans were offered to farmers in a 1951 plan book (National Plan Service 1951).



An open cattle barn and feed bunk, probably in Minnesota. From the 1951 book *Modern Farm Management* by the University of Minnesota's Andrew Boss and George Pond.

■ BOUNDARY MARKERS

- The Public Land Survey divided the landscape into six-mile-square townships and one-mile-square sections
- The Public Land Survey was the basis of modern land descriptions, civil divisions, road systems, and farm ownership and size patterns
- Township, section, and quarter section boundaries are marked with corner monuments and witnesses
- Original corner monuments, set between 1847 and 1903, are now rare

The United States Public Land Survey began in Minnesota in 1847 and continued until 1903. Established in 1785, the survey divided Minnesota and other western territories into townships, sections, and quarter sections using a rectangular township and range surveying system. The rectangular survey provided short, precise, legal descriptions of public domain lands so the land could be sold and settled. The law required the land to be surveyed before private individuals could own it, although "squatting" on land during the early settlement period was common (Hart 1998: 149, 151; Jarchow 1949: 41).

The land was divided into townships six miles square, oriented in the cardinal compass directions. Each township was subdivided into 36 sections, with each section measuring one mile square or 640 acres. Townships were identified by latitude and range with respect to the principal meridian and baseline of the survey district; sections were numbered from 1 to 36.

The early survey influenced the location of roads, set many civil divisions, and laid the groundwork for land ownership. Today land survey lines still "determine the boundaries of most properties, and all but the most important highways follow property boundaries instead of cutting across them" (Hart 1998: 151).

Because of this historical land division, Hart wrote in 1998 that American farmers still "reckon their land in terms of sections of 640 acres, quarters of 160 acres, and 'forties,' or quarters of quarters." Even in 1998 "property boundary lines show astonishing tenacity and permanence," and in many regions the size of farms remained "closely related to the size of the parcels of land that the first settlers purchased" (Hart 1998: 151, 153, 157-158).

Land survey boundaries were identified on the ground with "monuments" and "witnesses" set at half-mile intervals along section lines. Monuments marked quarter section, section, and township corners. Monuments also marked "meander corners," which were places where the township, section, or quarter section boundaries intersected a stream or lake. In early surveys double sets of corner monuments were often set on all four boundaries of a township. Later, double monuments were used only when the northern boundary of a township was a standard parallel or served as a survey baseline (Moffitt and Bouchard 1992: 730-732).

See also

Early Settlement, 1820-1870
Appendix: Focus on Gov Land Programs
Farms

Minnesota's original corner monuments were set between 1847 and 1903. The first corner monuments were made of a wide variety of handy materials, many of them perishable. Materials included a wooden post, a charred stake or a quart of charcoal buried under a mound of earth, a big stone, or a rock mound. When a sound living tree stood at a corner point, it was often marked with grooves and notches indicating the number of miles to the township line in each direction (Moffitt and Bouchard 1992: 736, 743).

Whenever possible, early surveyors also marked the lines between corners with "blazes" or "hacks" on living trees that stood along the boundaries. Two hacks, resembling a sideways "W," were generally made to distinguish survey marks from accidental marks. The marks were cut at breast height on the sides of the tree facing the survey line (Moffitt and Bouchard 1992: 732).

Today corner monuments in Minnesota are made of concrete-filled pipes about 3' long and 1", 2", or 3" wide. Three-inch pipes mark township corners, 2" pipes mark section corners, and 1" pipes mark quarter section corners. The pipes are topped with brass or plastic caps inscribed with identification. Monuments mark all boundary corners including those adjacent to roads. When a corner point falls on solid rock that cannot be excavated, an "X" may be cut into the rock to mark the boundary, or a stone mound may be built to support a monument (Moffitt and Bouchard 1992: 736; Giese 2004).

To help people find corner monuments, they were "witnessed" by marking nearby trees, rocks, or other natural objects. In rocky areas early surveyors used stone mounds as witnesses. On the open grass prairie where there were few trees or rocks, corner points were witnessed by a pit in the ground near the monument. When these methods were not available, a monument could be witnessed by some other durable object placed at the base of the monument such as glassware, stoneware, metal, a stone with an "X," or a charred stake. Today these witnessing methods are falling out of use. Modern surveyors often witness the location of corner monuments with GPS coordinates (Moffitt and Bouchard 1992: 737; Giese 2004).

Most land survey lines have been "re-monumented" and early surveyors' monuments and witnesses are rare. Although the original monuments are still held as the true boundary corners, there was no systematic program to maintain them and many were lost to fires or farming practices. Likewise, "witnesses were wanting in permanence" and "early settlers made little effort to perpetuate either the corner monuments or the witnesses" (Moffitt and Bouchard 1992: 732, 734-735). According to one County Engineer, the most likely place to find an original monument would be on land that has never been tilled, such as a meander corner at a stream or lake (Giese 2004).

PREVALENCE

Boundary markers were used throughout Minnesota. It is expected that original boundary markers will be rare. Far more common will be replacement markers installed after 1945.

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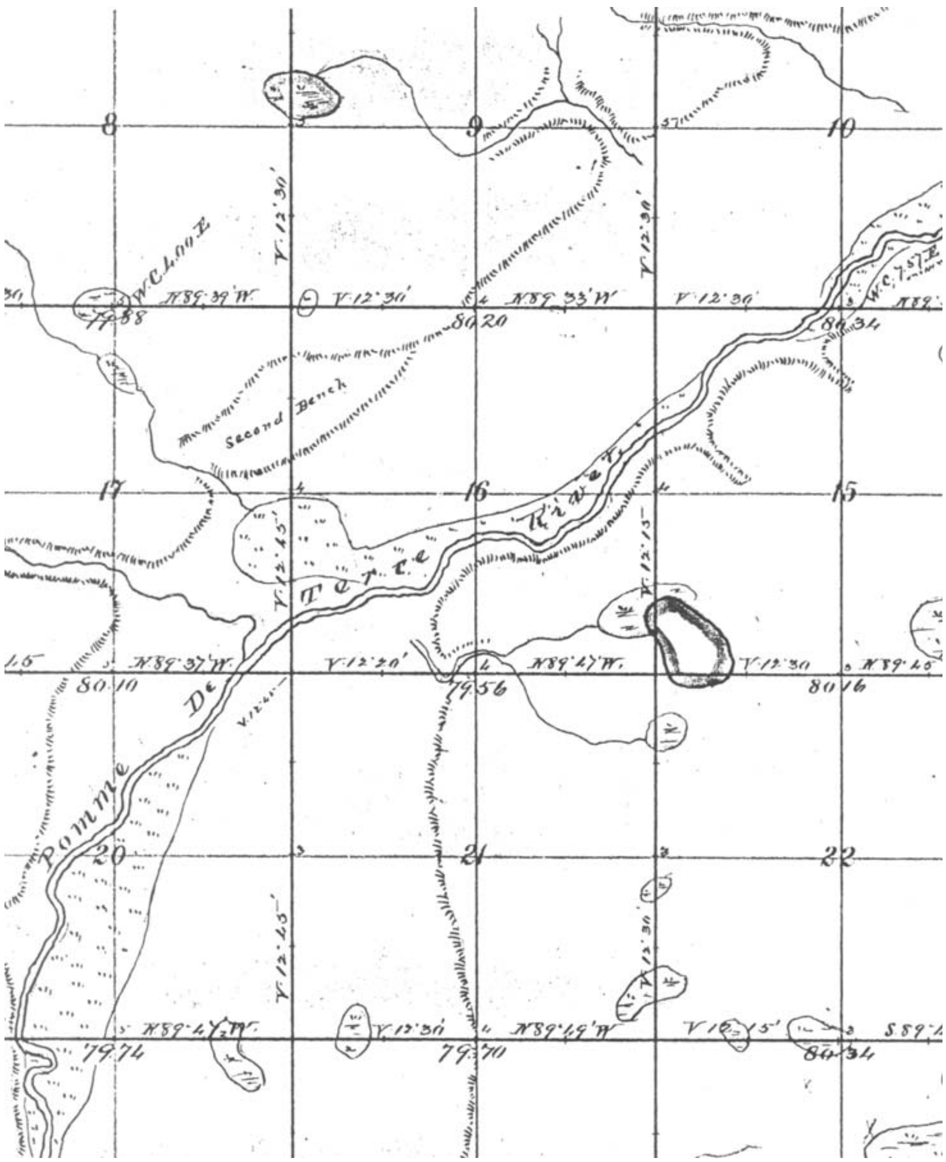

This map, dating from 1891, is an early copy of the surveyor's data that translated the township and range system of land division into real space. The original surveyors placed boundary markers or monuments on the land to mark the section and quarter-section lines. Maps like this are still used at county recorders' offices to form the basis for land ownership documentation. (Courtesy Stevens County Recorder's Office)

■ BROODER HOUSES

- Commonly built beginning in the 1930s
- Used to raise very young poultry that needed more care than older birds
- Chicks needed extra warmth for 6-8 weeks and were very susceptible to soil-borne diseases
- Brooder houses could either be stationary or portable
- Some farms divided the chicks into small groups in portable "colony" houses
- Electric brooder heaters, heat lamps, and incubators became common as farms electrified
- After 1915 farmers increasingly bought newborn chicks from local hatcheries

Brooder houses, which became prevalent in the 1930s, were special poultry houses in which baby chicks were raised. Between 1915 and 1950, Minnesota farmers increasingly purchased chicks from hatcheries, rather than incubating eggs on the farm, and usually received the newborn chicks when they were only a few days old. Because chicks were often born in the early spring, keeping them warm was difficult. They were also more vulnerable than older birds to the diseases that plagued poultry. (See also "Poultry Houses," a separate farm element section.)

Prior to the 1930s, farms often arranged temporary quarters to serve as brooder houses. This might include closing off part of the general poultry house, using a makeshift structure, or using the attic, basement, or another room in the farmhouse (Smith et al 1936: 2).

Chick losses were high when farms used an improvised nursery because such spaces were often cold, overheated, unevenly heated, poorly ventilated, or crowded. They often provided no sunshine, which caused the chicks to be weak and frail. If part of the poultry house was used as the brooder house, the adult birds might be over-crowded, and there were problems controlling diseases and parasites to which chicks were especially susceptible. Using part of the general poultry house as a brooder house also limited the number of chicks the farm could raise (Smith et al 1936: 1-3).

For the reasons described above, poultry experts recommended that farmers build a specialized brooder house as part of their strategy to maximize poultry profits. Brooder houses could be used for storage or another purpose when not needed for chicks.

GENERAL CHARACTERISTICS

Brooder houses were similar to general poultry houses, which are described as a separate farm element section called "Poultry Houses." The discussion herein is generally limited to those characteristics unique to brooder houses.

Brooder houses and general poultry houses were often indistinguishable from the outside, although brooder houses sometimes had a projecting stove pipe for the heater. Inside, brooder houses were less likely to have built-in equipment like roosts and nesting boxes.

See also

Poultry Houses
Appendix: Focus on Minn Livestock

Location and Portability. Brooder houses could either be stationary or portable. Like poultry houses, brooder houses were typically located in a sheltered area, facing south.

Stationary brooder houses were sometimes, but not always, larger than portable models. Some farmers felt stationary houses to be a better investment because they were more durable with proper foundations and heavier building materials. Because of the threat of soil-borne diseases, stationary houses often had elevated mesh runways which allowed chicks to exercise without coming into contact with the soil. These runs were sometimes called “sun porches” and sometimes had glazed ceilings to provide sunlight but retain heat.

Portable houses usually had temporary foundations, or were built on creosote-treated skids so they could be moved periodically to fresh ground. Portable houses often took more fuel to heat because their walls and ceilings were lighter for portability. Tenant farmers sometimes used portable brooder houses because they could take them along to new farms.

Portable Colony Houses. Some farmers used “colony” brooder houses, which were a set of small, usually identical, structures. Dividing the flock into small groups allowed the chicks to get better care and helped prevent the spread of disease. Colony houses were small and could be efficiently moved to fresh ground each season. New houses could be built as the farm gradually increased its flock. Colony houses had the disadvantage of requiring proportionally more building materials and maintenance than a single brooder house. Colony houses were especially popular in the 1930s.

Size. In general the size of a brooder house depended on the number of chicks being raised. Portable houses were sometimes smaller than stationary houses, and colony houses were sometimes as small as 4′ x 8′. Some experts recommended that no more than 50 chicks be raised together so that the correct temperature could be maintained. A 1936 source suggested that a 12′ x 14′ brooder house was sufficient to raise 200 chicks, providing approximately one square foot per chick (Smith et al 1936: 4-5). A University of Minnesota plan from 1953 recommended an 11′ x 14′ portable quonset-like brooder house on skids (*Farm Building Plans* 1953).

Materials. Stationary brooder houses were usually built of the same materials as general poultry houses, while portable houses tended to be more lightweight. By the late 1930s agricultural engineers were experimenting with strong, lightweight plywood for portable brooder houses (Giese and Dunkelberg 1939).

Brooder houses often had shed or saltbox roofs. By the 1930s and 1940s, however, some farmers and other experts were describing the advantages of rounded-arched roofs. According to one author from the University of Minnesota, “The most serious handicap to be overcome in portable houses is the difficulty of moving them if they are built warmly enough to conserve fuel. This disadvantage is largely overcome in the round-top houses because the shape reduces the weight and the space to be heated by about one-fifth” (Cooke 1943: 11).

In addition to being built by the farmer, ready-made colony houses could be purchased by about the 1930s. Around World War II, the Economy Portable Housing Company was selling factory-built hexagonal brooder houses made with wall panels and floors of tongue-and-groove fir. The houses had asphalt-covered polygonal roofs with central metal ventilators, four large windows (leaving two rear sides windowless), and “no cold corners” because of the six-sided design (Economy ca. 1940: 9-15).

Interior Arrangement. Stationary brooder houses were often divided into two pens to provide a warm area near the heater and a cooler exercise area. Having a cool area was important so the chicks would feather out faster. (If a chicken's feathers were missing, they were more vulnerable to the pecking of other chickens. In severe cases, this "cannibalism" led to chick losses.) Some two-pen brooder houses had a stove in each pen rather than separate warm and cool areas.

Colony houses typically consisted of a single interior space rather than divided pens.

Because chicks had a tendency to huddle in corners for warmth, partitions or bales of straw were often used to round out interior corners to prevent smothering.

Equipment. Whether stationary or portable, brooder houses did not typically have the permanent nesting boxes, roosts, or other built-in equipment found in a general poultry house. The brooder house's principal piece of equipment was an oil-, coal-, or electric-powered heater that was often placed near the center. It was recommended that the heater be placed within a structure called a "hover," which formed an elevated ceiling over the heater and chicks. The hover kept the chicks from crowding around the heater by heating the space more evenly. By the 1930s many types of electrically-heated incubators, brooder heaters, and heat lamps were commercially available. Large-scale brooder houses were sometimes heated by hot water systems. By 1960 radiant-slab brooders were in use (Plumb 1918: 378; Neubauer and Walker 1961: 95).

Once the heater and hover were removed at the end of six to eight weeks, portable roosts and sometimes portable partitions could be moved in. Some brooder roosts had two levels. When the young birds were able to get on the higher roosts, the lower roosts were removed.

PREVALENCE

Poultry was raised on at least 90 percent of Minnesota farms in the first half of the 20th century. While nearly all farms had a poultry house, they did not all have a separate brooder house. The prevalence of pre-1960 brooder houses is not well understood, and it is not known how many are still standing. It is likely that fewer portable brooder houses will have survived because they were built with lightweight materials. An entire intact colony would probably be uncommon.

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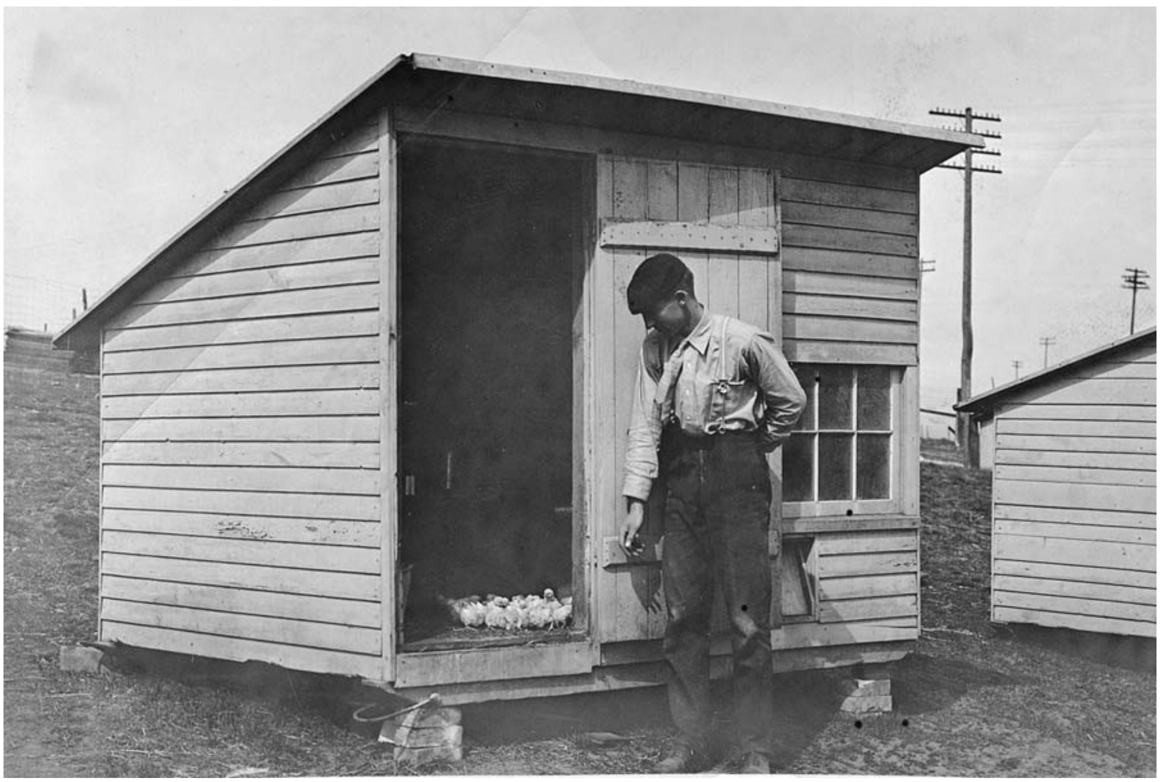
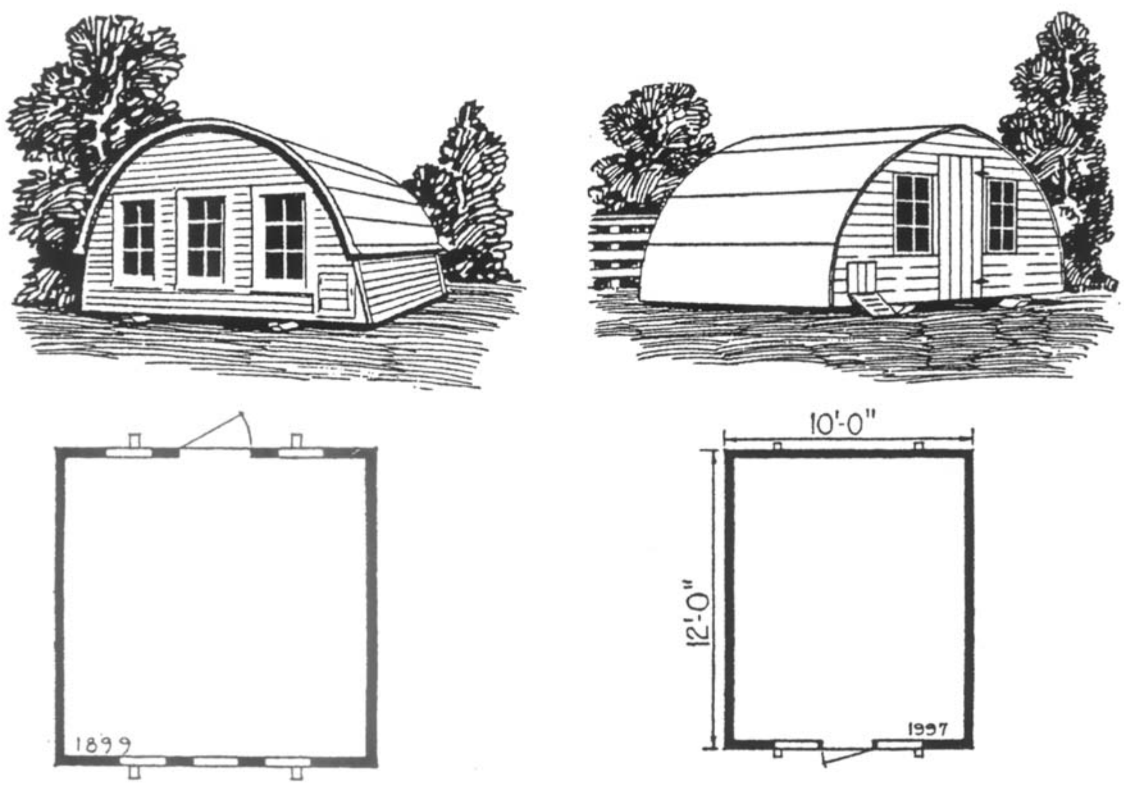
Colony brooder houses were used to raise chicks in small groups. Segregating the groups helped prevent the spread of parasites and disease, which were a serious problem. Because they required more materials and maintenance than a single structure, they were often used by farms raising large flocks and then only while the birds were young. The houses above appear to be sided with tar paper. Figreans Farm, St. Louis County, circa 1930. (MHS photo)



A colony brooder house with just-hatched chicks. Most brooder houses had little fixed equipment inside. An oil-, coal-, or electric-powered heater was needed for the first six to eight weeks to keep the chicks warm. Colony houses usually had temporary foundations, or were built on skids, so they could periodically be moved to fresh ground free of soil-harboring diseases. Location unknown, circa 1910. (MHS photo)



In 1951 the National Plan Service was offering plans for these two portable brooder houses with arched roofs. Footprints were 8′ x 12′, 10′ x 12′ and 12′ x 12′, with the 10′ x 12′ house capable of housing 250 chicks. The exterior walls were sheathed with wood siding and the roof may have been either rolled asphalt or galvanized metal. The University of Minnesota was offering a similar plan in 1953. Brooder houses were usually designed for storage or other purposes when not needed for chicks. From *Practical Structures for the Farm* (1951).

▪ BULL BARNS

- Typically a small structure where a single bull was kept
- Early examples probably date from around 1900
- Usually surrounded by a stockyard with a strong fence
- Minnesota dairy farmers started using artificial insemination in the late 1940s

Dairy expert Clarence H. Eckles in a 1911 dairy management guide repeats an old saying, "the sire is half the herd" when introducing his discussion of the importance of bull selection and care to the success and productivity of a dairy herd (Eckles 1911/rpt. 1921: 154). Minnesota farmers kept bulls to breed both dairy and beef cows.

Some farms housed their bull in a barn with other animals. The practice was not recommended for sanitary reasons (particularly in dairy barns) or for the health of the bull who was too often "confined in a dark, dirty stall without exercise" (Eckles 1911/rpt. 1921: 170). Creating separate facilities for the bull was advised for worker safety, to make handling easier, and to insure that he received adequate exercise. More than one bull could be kept together as long as the space was large enough and the bulls were dehorned.

Some farmers used a shed or other available building to house their bull, while many built a dedicated structure. Early examples probably date from around 1900.

A woodframe, drop-sided 12′ x 16′ building was recommended by the Midwest Plan Service in 1937. It had a concrete foundation and a shed roof. The building had two small windows, a door for the worker, and a door for the bull. Inside was a manger and a stanchion to restrain the bull during barn cleaning, veterinary procedures, etc. A similar 14′ x 14′ structure was recommended by the University of Minnesota in a 1953 plan book (Midwest Farm 1937; *Farm Building Plans* 1953).

It was recommended that an outside pen or yard be adjacent to the housing. Experts recommended that the pen be long and narrow to encourage exercise as bulls tended to stand in the middle of a square yard and move very little. A 1937 Midwest Plan Service plan for a bull barn had a 56′ x 21′ pen (Midwest Farm 1937, also printed in Carter and Foster 1941: 222). The pen needed to be made of substantial material with closely-spaced fence posts to keep the bull from breaking out. Strong metal post-and-rail fencing secured in concrete-filled post holes was recommended by *Successful Farming* magazine in 1940 (Fox 1940: 49).

Eckles noted in 1911, "Plenty of exercise is one of the factors in preventing a bull from becoming vicious." In addition to being strong and in good repair, the pen should be placed so that the bull can see the herd and the attendant since, according to Eckles, "Solitary confinement in an isolated box is not conducive toward the development of a quiet disposition in a bull" (Eckles 1911/rpt. 1921: 173).

See also

Beef Barns
Stockyards
Appendix: Focus on Biotech Agrichem

Successful Farming's advice in 1940 added that the bull pen should have a "well-drained location where bull can see the herd; shade; a stout keg or barrel for the bull to play with; [and] tanbark on the ground if possible" (Fox 1940: 49).

Safety for the hersdman when handling the bull was always a concern and experts warned that the "Doors between shelter and pen must be controllable from outside so the animal may be shut in or out of the stable without handling him" (Fox 1940: 49).

Farmers often included a breeding stall or chute at a corner of the pen. (Breeding the cows one-by-one facilitated the control and record-keeping important to herd management (Eckles 1950: 188).) The breeding stall also had to be carefully designed and strongly built to ensure worker safety. The cow entered and exited the stall via an exterior gate, while the bull entered the stall directly from the pen.

Artificial insemination reduced the need for farms to keep bulls. After several decades of experimentation in other countries, significant artificial insemination work began in the U.S. in the 1930s, particularly at Cornell University around 1936 and in Minnesota and Wisconsin in the late 1930s (Foote 2002: 3). Retired University of Minnesota animal scientist Harley Hanke believes that average Minnesota farmers began using artificial insemination for dairy cows around the late 1940s, and for beef cows about five years later (Hanke 2005).

Using artificial insemination for dairy herds was more common than for beef herds for several reasons. Dairy cows, who were accustomed to stanchions, were more tame than beef cows and easier to inseminate. Dairy farmers needed to breed several times a year, rather than once like many beef farmers, and dairy bulls tended to be more aggressive than beef bulls and therefore harder for the herdsman to safely handle. These factors favored artificial insemination on dairy farms (Hanke 2005).

Some Minnesota farmers rented a bull. This was more prevalent among beef producers and more prevalent among small farmers. Hanke estimated that about five to ten percent of Minnesota beef producers rented bulls in the 1950s and 1960s (Hanke 2005).

PREVALENCE

Keeping bulls was very common on Minnesota farms through 1960. After 1960, it was more common for beef producers than for dairy producers. Many Minnesota cattle farmers still keep bulls today.

Bull barns were likely vacated when farmers either began to use artificial insemination or phased out of cattle. Bull barns were then likely converted to other uses. Because they were strongly-built, many are likely to be standing.

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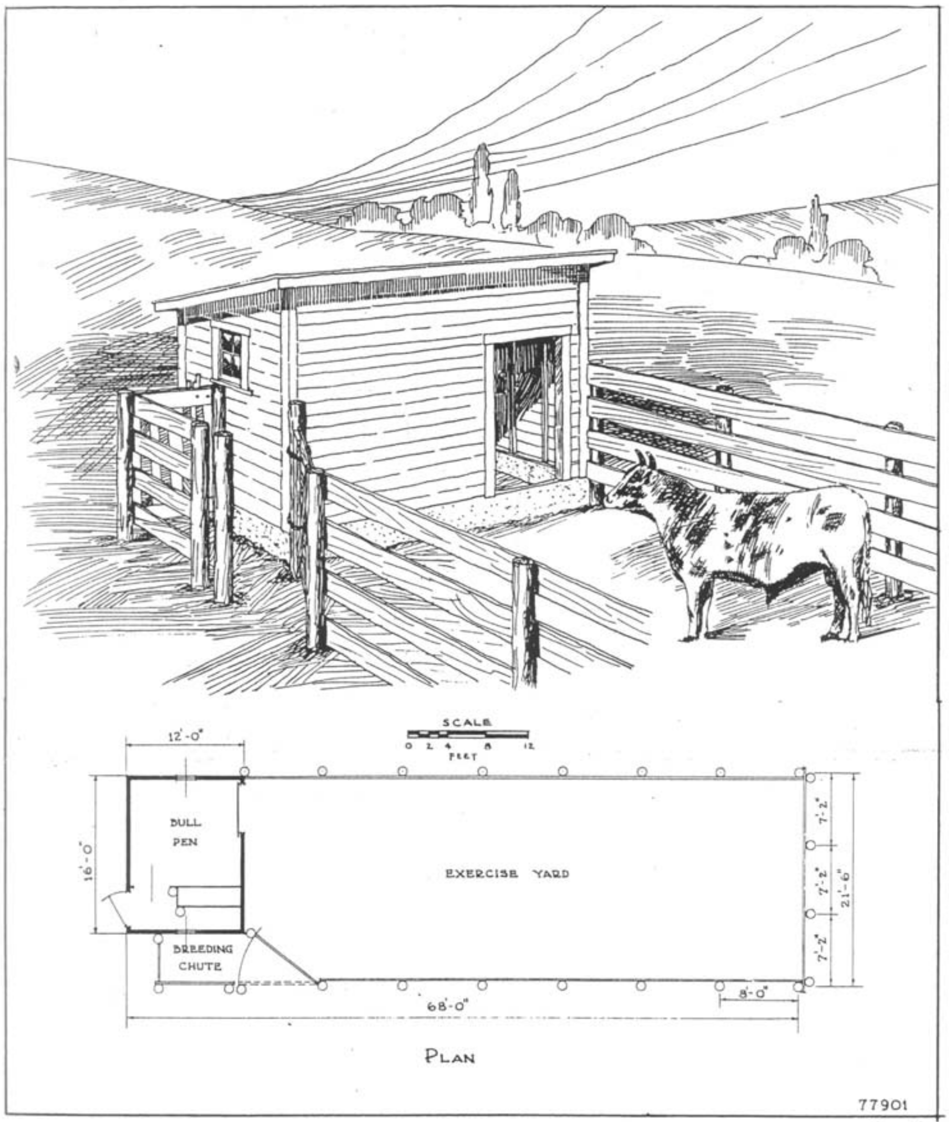

This 1937 design for a bull barn was typical. It had a 12′ x 16′ barn and a strong fence surrounding a yard. The gate to the yard was designed so that it could also serve the breeding chute at the corner of the building. From the Midwest Plan Service 1937 catalog of plans.

■ CATTLE GUARDS

- Structures that allowed vehicles to pass freely into pastures but prevented livestock from escaping
- Used beginning in the 1920s, but more guards were installed in the 1940s and 1950s

A cattle guard, or cattle grid, was an at-grade structure – usually built at the intersection of a farm lane and a fence line – that allowed vehicles to pass over it but discouraged livestock from escaping. Cattle guards often replaced gates that took time and trouble to open and close, especially when farm workers had to access a field or pasture frequently.

A cattle guard usually consisted of a set of parallel pipes or bars mounted over a shallow pit and set at right angles to the farm road or lane. The bars were mounted close enough together to support a vehicle, but too far apart to support the hooves of livestock.

Cattle guards were typically as wide as the roadbed (e.g., 12′) and measured 4′ to 8′ in the other direction. While a 4′ or 5′ distance might be sufficient to keep adult cows from wandering out of a field or pasture, energetic calves sometimes tried to jump the grid and therefore 8′ grids were sometimes used.

The pit could be built of materials such as earth, poured concrete, or concrete block. The pit was often at least 1′ deep and had to be cleared periodically of accumulated soil, debris, and weeds.

The bars or pipes were often about 4″ in diameter and were sometimes welded into a rectangular framework that was set over the pit. Some farmers preferred true-round pipes over flat-topped bars because the round pipes were more slippery to the animals' hooves. Some farmers made the bars from timbers (which were not long-lasting) or pieces of railroad track cut to length. In another variation, farmers filled the pit with short sections of concrete drain tile set on end. Modern cattle guards are generally built of precast concrete and/or steel.

PREVALENCE

Cattle guards were used throughout Minnesota, but especially in areas where livestock production was prevalent. The earliest probably date from the 1920s when cars and trucks became common on farms. Far more likely date from the 1940s-1950s when livestock feeding increased substantially.

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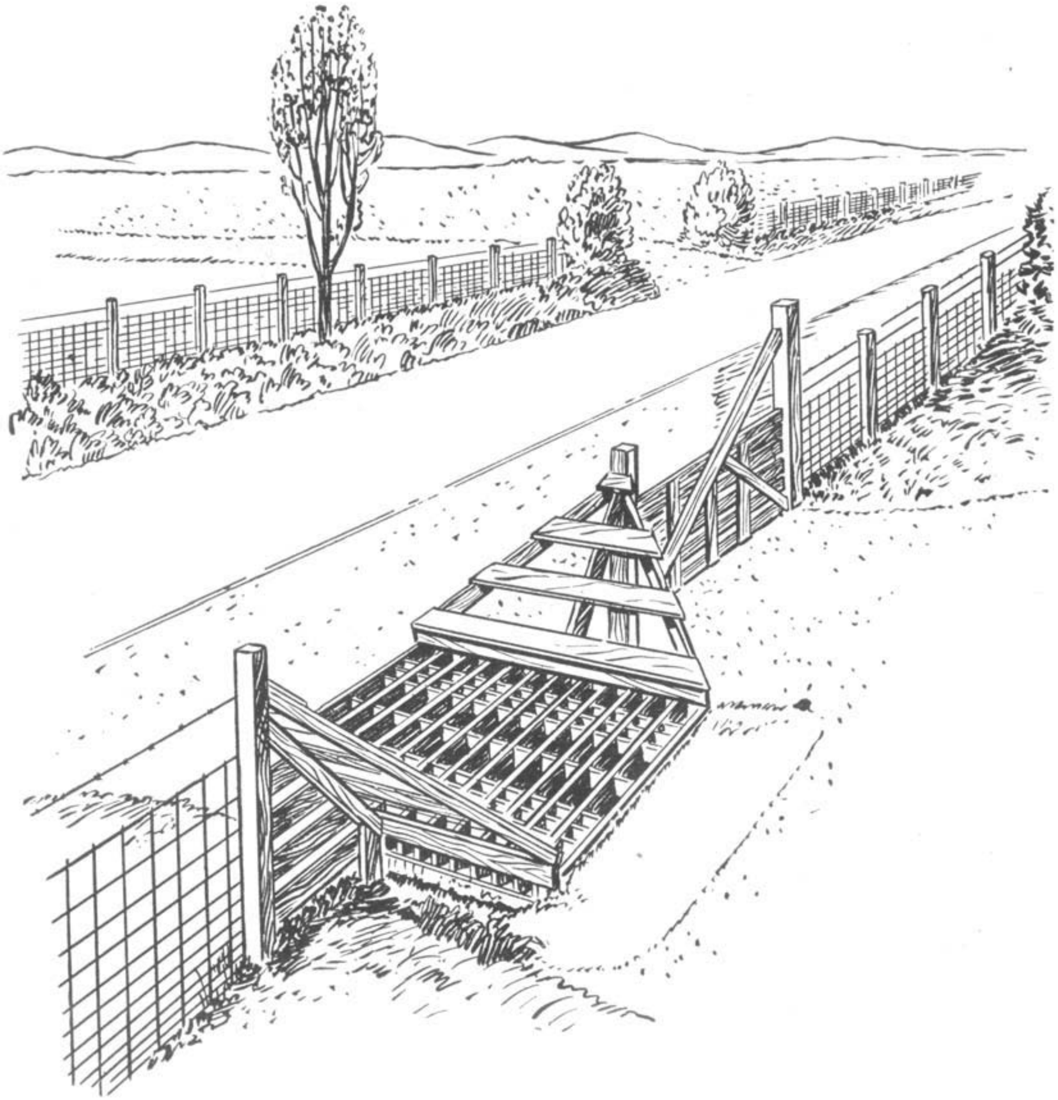
See also

Fences
Fields and Pastures
Roads, Lanes, Tracks, Sidewalks
Develop of Livestock, 1900-1940



A typical cattle guard of recommended design. Cattle guards could save valuable time otherwise spent opening and closing pasture gates. From Wooley's *Farm Buildings* (1946).

▪ CESSPOOLS AND SEPTIC TANKS

- Cesspools were an earlier, simpler way to handle sewage
- Septic tanks in familiar form date from the 1880s
- Septic tanks were generally made of brick or clay tile plastered with cement; monolithic versions were made of poured concrete
- Usually sited near the house

Farm septic tanks were underground sewage disposal tanks in which household waste was decomposed by anaerobic bacteria. Forms of septic tanks were used in the U.S. by at least the mid-19th century, but in familiar form were introduced to the U.S. around 1883.

Before septic tanks were adopted, many farms drained household waste into a cesspool near the house. The cesspool was a covered hole or pit lined with lumber or brick. In porous soil, liquid waste quickly drained out through the walls of the pool, leaving the solid matter behind. In heavier soils the cesspool often overflowed and a new pool had to be dug. Cesspools seldom worked well and were a health hazard, "saturating the surrounding ground, for a long distance, with disease germs, which in time may be carried into the house water-supply" (Stewart 1914: 73).

Septic tanks offered a sanitary method of sewage disposal. They consisted of a single- or double-chambered underground tank with a tight cover. The tank was often made of poured concrete, but clay tile and brick plastered with cement were also used. Concrete septic tanks were usually rectangular but other shapes were also used. Typical in 1914 was a jug-shaped septic tank with an arched neck and a cast iron manhole cover. The tank was especially useful for small spaces and for masonry construction (Stewart 1914: 79; Structural Clay 1941).

Septic tank size depended on family size and the amount of wastewater that had to be treated in a 24-hour period. In 1914 a minimum size recommended by one author was 6′ long, 3′ wide, and 3′ deep. In 1953, plans distributed to farmers by the University of Minnesota had common tank sizes of 3′ to 5′ deep, 2 1/2′ to 4′ wide, and 5′ to 10′ long (Stewart 1914: 74-85; *Farm Building Plans* 1953; Structural Clay 1941).

The septic tank was covered by a permanent lid that could be removed to clean or repair the tank. Covers were usually made of reinforced concrete or cast iron. Wood was also used – one 1914 source discussed a double layer of 2″ pine planking laid crossways, but reminded farmers that it would last only a few years. Heavy concrete covers were often divided into small sections for easier removal. The tank lid was covered with at least 2′ of earth to shut out light and prevent freezing. Experts offered several cost-saving tips for septic tank construction, such as using old horseshoes for the lid handles and worn-out hay-rake teeth or scrap fencing to reinforce the concrete (Stewart 1914: 79, 82; *Farm Building Plans* 1953).

See also
Privies
Farmhouses

Sewage entered the septic tank through an inlet pipe. Flow through the tank was regulated by baffles that prevented movement on the surface of the effluent, where the bacterial action took place. After decomposition, which took about 24 hours, the liquid effluent flowed out through a 4" pipe into an underground dispersal system (Stewart 1914: 74-85).

Several methods were used to disperse the liquid. Often it was simply carried a short distance through drain tile to an open ditch or waterway. Sometimes the effluent was discharged into a covered dry well where it seeped away into the ground (Midwest Farm 1937; Stewart 1914: 75-76).

Septic tanks were usually located quite close to the foundation of the house so that the sewage could be discharged into the tank directly from the household's cast iron soil pipe.

PREVALENCE

Septic tanks were used on farms throughout Minnesota, with their use increasing after World War II when many farm outhouses were replaced. It is likely that many are extant, but they may be difficult to detect on the ground surface unless evidence of a depression or cover is visible.

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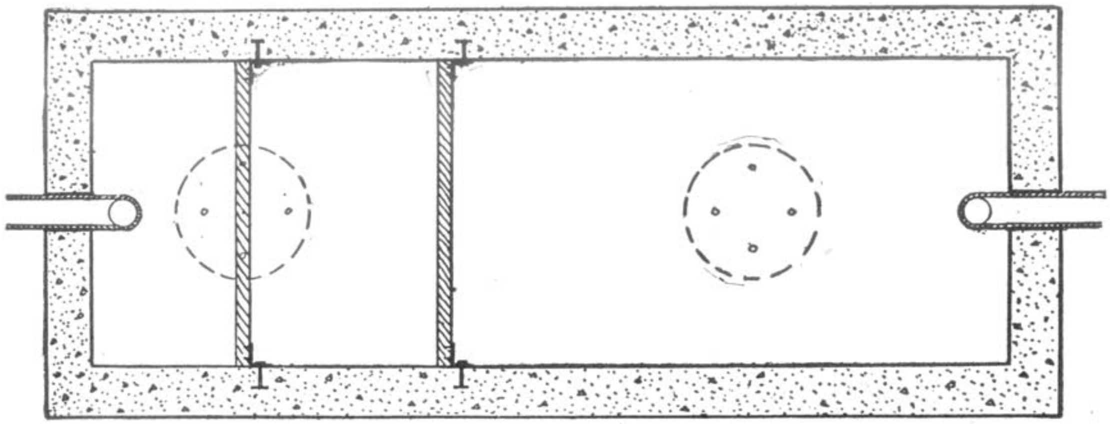

Fig. 35.—Top View of Septic Tank.

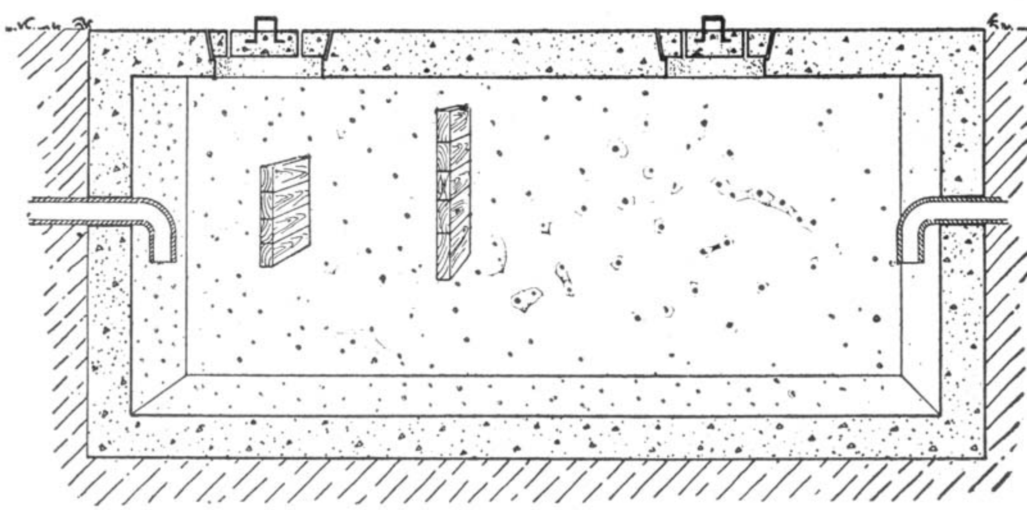

Fig. 36.—Lateral View of Septic Tank.

Top and lateral view of a septic tank from a 1920 farming manual whose audience included Minnesota farmers. From *Farm Economy* (Moore et al 1920).

■ CISTERNS

- Devices used to store rainwater for household use
- Found on farms by at least the late 19th century
- Usually located underground near the house
- Least durable were jug-shaped cavities with cement-covered earthen walls
- More durable were cylindrical or rectangular cisterns with walls lined with stone, brick, or clay tile – all covered with cement – or with walls of poured concrete

Cisterns were circular or rectangular reservoirs for storing water collected from building roofs or pumped from wells (Brooks and Jacon 1994: 58). They were in use by at least the late 19th century, and usually located underground within or near the farmhouse.

Farmstead cisterns generally stored soft rainwater, which was much better for household chores than hard, mineral-laden well water. A 1920 *Farmers' Institutes Annual* extolled the advantages of rain water for washing, explaining that "less soap and no chemicals are needed for softening rain water, and dishes, clothes and bodies are more easily cleansed with soft than hard water; hence, these operations are more likely to be thoroughly done, especially by children, when plenty of soft water is easily available" (Shepperd 1920: 139). However, experts discouraged farm families from consuming cistern water, warning that it was unsafe for drinking (Stewart 1922: 7).

A successful cistern needed a year-round supply of "water as nearly pure and as nearly colorless as it is possible to have roof water" (Shepperd 1920: 145). Cisterns were usually filled by collecting rain in eave troughs or gutters. To keep the cistern clean farm specialists recommended discarding the water from the first portion of each rainfall until the roof was well rinsed. A 1920 publication showed farmers how to install a simple cut-off valve between the eave down spout and the cistern pipe. The valve was operated by means of a long cord so that the water could begin filling the cistern once the roof was washed. A metal screen prevented leaves, twigs, and other foreign material from entering the cistern (Shepperd 1920: 140, 145).

Water flowed into the cistern through an inlet pipe – typically 1" galvanized pipe – that entered the cistern below ground. Most cisterns also had an overflow pipe to carry away surplus rain water. A pump in the kitchen – often hand-operated – drew water out of the cistern through a suction pipe. A tightly-fitting, removable lid made of wood, concrete, or cast iron allowed access to the cistern for cleaning and repairs.

Cisterns were built in several shapes. Simple forms were made by digging a jug-shaped hole in the ground and plastering cement mortar directly onto the earth to form walls. The neck of the cistern could be either poured concrete or 20"-diameter concrete or clay sewer pipe. Jug-shaped cisterns were inexpensive to build, but they were practical only in areas where the soil consisted of very firm clay. They also had to be protected from freezing or the walls would crack (Shepperd 1920: 143).

See also

Farmhouses
Wells
Pumps and Pump Houses
Water Tanks and Tank Houses

Cylindrical and rectangular cisterns could be built in any soil and were much more durable than earthen cisterns. The walls were made of poured concrete or stone, brick, or clay masonry plastered with thick cement to make them waterproof. A rectangular cistern was a little cheaper to build than a cylindrical one, but it was also "less sanitary, because it has more sharp angles and dark corners to catch and hold dirt" (Shepperd 1920: 143; Structural Clay 1941). The walls of the cistern often angled inward at the top to form a bottle-shaped neck.

The size of a cistern depended on the needs of the farm family. For example, a circular cistern 8' in diameter and 8' deep had a capacity of about 100 barrels of water – roughly 4,300 gallons (Structural Clay 1941). In 1922 the Minnesota Extension Service estimated that a "normal family of eight persons – will use generally from 200 to 225 gallons of water per week" (Shepperd and Stewart 1922).

Some cisterns had filters inside. A commonly-used filter consisted of two parallel brick walls with sand between them. Water seeped through the layers of sand and brick, leaving impurities behind. A variation of the wall filter consisted of a beehive-shaped brick dome built on the floor of the cistern. Separate underground filter beds of sand and charcoal were also used (Shepperd 1920: 147; Midwest Farm 1937).

Cisterns were commonly located both inside the farmhouse and outdoors. Basement cisterns were preferred because they didn't need special protection from frost and were less likely to be polluted by surface runoff (Stewart 1922: 7). Outdoor cisterns were generally placed near the house. If the farmstead had a hill, the cistern was sometimes cut into the hilltop to take advantage of the power of gravity in distributing water to the buildings below. An 1898 Minnesota publication shows a cistern located near the barn to supply water for the stock (Boss 1898: 159).

Cisterns were widely used for many decades. In 1930, only 12 percent of Minnesota farms had running water. Even as late as 1960, only eight out of ten Minnesota farmhouses had running water and indoor toilets (Jellison 1993: 55, 169).

PREVALENCE

Farm cisterns were commonly built throughout Minnesota, but early examples may be uncommon. Basement cisterns were often demolished when farmhouses were razed or replaced. It is possible that outdoor cisterns are more likely to have survived.

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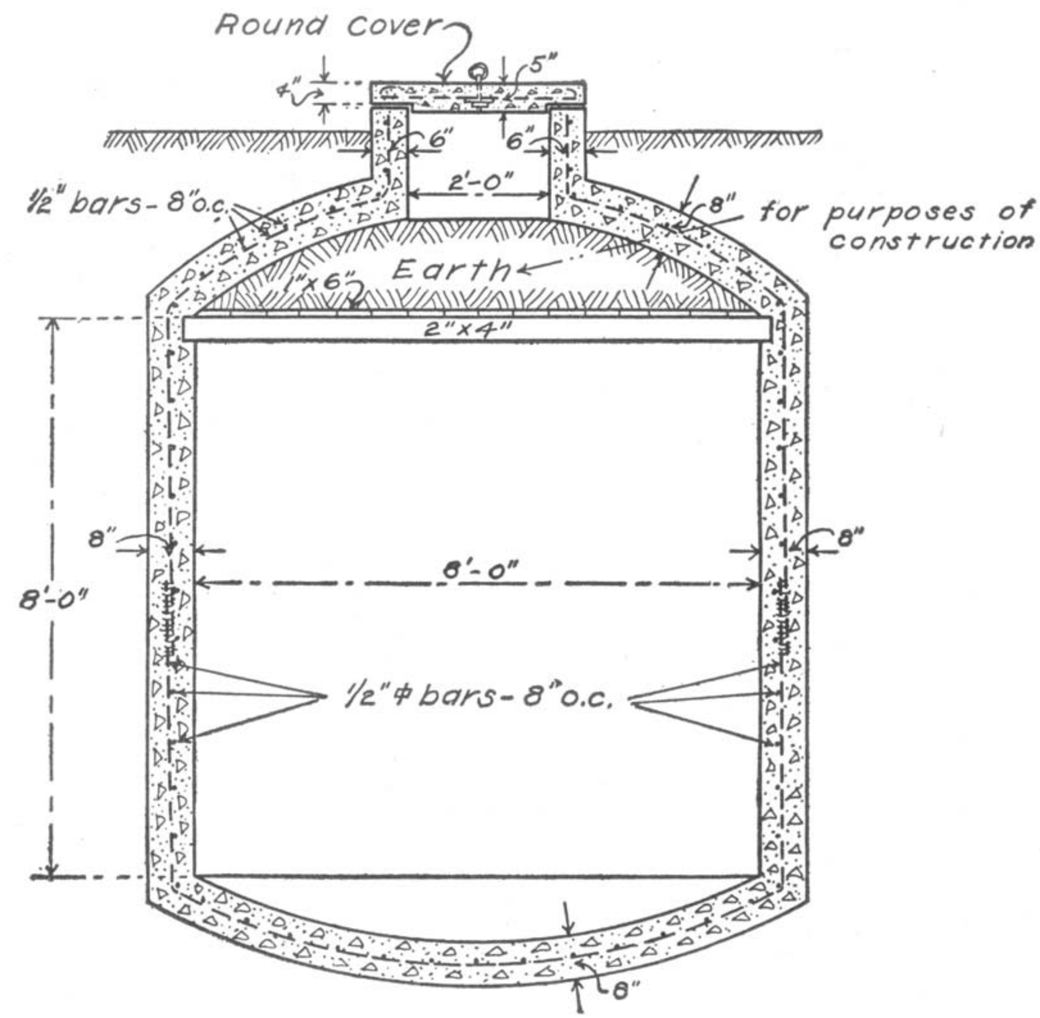

Cross-section of a poured concrete cistern from *Farm Economy*, a 1920 farming manual (Moore et al 1920).

Hand-operated pitcher pumps were commonly used in farm kitchens to pump water from a cistern. The water was used for bathing and washing clothes and dishes. Location unknown, circa 1910. (MHS photo)

■ COMBINATION BUILDINGS

- ▸ Common on Minnesota farms where it was often cost-effective to combine several structures under one roof
- ▸ Combination buildings often boosted efficiency, but could be a fire hazard

Combination buildings are structures built to serve several functions. They were sometimes built with a separate unit for each function. They often made use of a shared wall, but had no interior inter-connection.

Combination buildings were often built as a practical matter. They allowed farmers to save labor and materials by building one structure instead of two or three separate buildings, and let them build in phases, thereby spreading out capital costs. Combination buildings could also be efficient, reducing the distance farm workers had to walk to perform related functions. Combination buildings had many of the same advantages as building additions. Some farmers avoided combining buildings because of the risk of extra losses due to fire.

In Minnesota the use of combination buildings in the late 19th and early 20th centuries may have been more prevalent among particular immigrant groups such as Germans; this topic needs further research.

Combination buildings were constructed during all periods of Minnesota farming, from the early settlement era through the post-World War II period. Before and after World War II, in fact, there was a broad trend toward building multipurpose, rather than specialized structures, so that farmers could efficiently change operations to meet shifting markets and take advantage of evolving technology.

Many types of farm structures could be combined. Examples of common combinations included:

- implement shed, farm shop, and/or garage
- granary and corncrib
- granary and implement shed
- hay barn and livestock barn
- dairy barn and horse barn
- dairy barn and milk house
- icehouse and milk house

See the individual farm element section entitled "General Purpose or Combination Barns" for information on multi-use barns.

Housebarns, which were structures that combined the farm family and livestock under one roof, were rare in Minnesota but were built, particularly during the early settlement period (Jarchow 1949:

See also
Housebarns
Farm Shops
General Purpose or Combination Barns

83). They were generally conducted by specific ethnic groups such as Finns. At least one housebarn still stands in northern Minnesota's St. Louis County where it was built by Finnish farmers (Koop 1989).

PREVALENCE

Combination buildings were built throughout Minnesota during all farming periods. It is likely that many will still be standing, with early examples being more rare. Combination buildings with three or more separate units may be uncommon.

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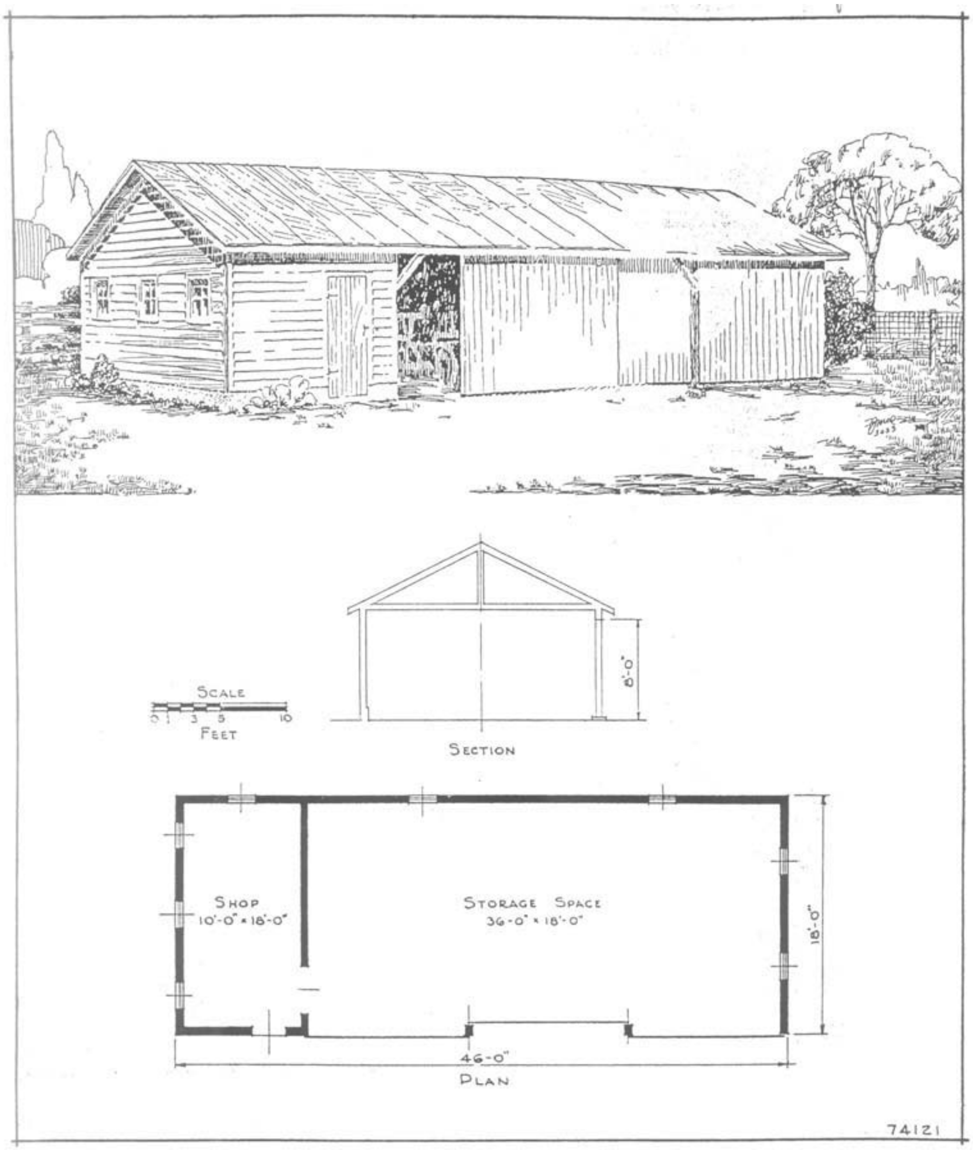
This farm near Pine River in north central Minnesota had a poultry house incorporated into a larger barn. This was an unusual combination – poultry houses were generally separate. Near Pine River, circa 1915. (MHS photo)



Farm shops and implement sheds were frequently combined under one roof. This 18′ x 46′ structure appeared in a Midwest Farm Building Plan Service catalog from 1933.

▪ CORNCRIBS

- Structures used to dry and store ear corn
- Sited for easy access to fields and livestock
- Associated with diversified farming and the rise of livestock farming
- Built in a variety of sizes and styles; carpenter-built or factory-made
- Sometimes combined with a grain bin
- Larger cribs and masonry cribs were more common in southern Minnesota
- Steel wire cribs became common in the 1940s
- Use began to decline in the mid-1950s with picker-shellers

Corncribs – or structures designed to store ear corn – were built in Minnesota beginning in the early settlement period. Corncribs were similar to granaries, except that the walls of corncribs were slatted or perforated to allow more air to circulate. (See "Granaries, Elevators, Bins, Dryers," a separate farm element section.) Corncribs were widely used throughout Minnesota, but especially in the southern half of the state where conditions were best for growing corn.

While corn was grown in Minnesota throughout the early settlement period, only the southern edge of the state had reasonable yields because most seed originated from Southern sources. In the mid-1890s, the Minnesota Agricultural Experiment Station developed 'Minnesota 13,' an open-pollinated variety more suited to cold regions. With 'Minnesota 13,' corn-growing crept northward. Cornfields, and the need for corncribs, increased in 1900-1920 as Minnesota farms continued to diversify. Corn production increased significantly after hybrids were introduced around 1930 and as the state's livestock industry grew. Double-hybrids, as the first hybrids were called, were used almost exclusively in Minnesota from the end of World War II until the early 1960s when single hybrids were introduced and yields increased again. Even with hybrid varieties, most corn-growing was concentrated south of a diagonal line drawn through Breckenridge, Little Falls, and Cambridge.

Before farm mechanization, Minnesota farmers used several methods to harvest and dry field corn. During the early settlement period, for example, corn stalks were cut, bundled into shocks, and left standing in the field to dry. They were sometimes left there all winter, with the farmer picking and husking the ears as needed for feed (Noble 1984: 105).

Some farmers harvested corn by walking the rows, picking the ears by hand, and throwing them into a wagon. By the late 1920s, harvesting equipment included tractor-drawn one-and two-row pickers. The corn was hauled to the barn where it was husked and then stored in a corncrib where it continued to slowly dry. Unlike wheat and hay which had to be harvested under time constraints to preserve quality, corn could be harvested very late. Many Minnesota farmers harvested through December (Lindor 2004).

See also

Granaries, Elevators, Bins, Dryers
Develop of Livestock, 1900-1940
Appendix: Focus on Minnesota Crops

Ear corn was removed from the corncrib in batches (e.g., 200 to 500 bushels) as needed for feed year-around. The batch was shelled and the shelled corn stored in a granary. Some farmers also ground ear corn and fed it to beef cattle, or ground ear corn and blew it into a silo. Beginning around the 1950s some livestock farmers also ensiled shelled corn for livestock feed (Lindor 2004).

GOVERNMENT STORAGE PROGRAMS

During the Depression there was an increase in corncribs built on Minnesota farms in response to USDA Commodity Credit Corporation loan programs authorized by the New Deal's Agricultural Adjustment Act of 1933. Beginning in 1934 farmers could borrow money on stored ear corn as part of a larger program to stabilize prices by reducing hog and corn production. According to Minnesota historian Jerome Tweton, "The corn had to be stored under seal; the farmer could pay off the loan and feed or sell the corn or let the Corporation take it over to satisfy the debt" (Tweton 1988: 117). Corn was also stored under another New Deal program, the "Ever-Normal Granary," also operated by the Commodity Credit Corporation. The Ever-Normal program, which began in 1938 and continued into the 1970s, sought to protect farmers' incomes, as well as consumer food prices, from market fluctuations. A secondary goal was to insure a reserve of grain against drought or other unforeseen events. Farmers were given loans on grain placed in storage with the idea that they could market the grain during years when supplies were down and prices high. The USDA also purchased corn directly from farmers to help control the market (Bridgman 1938; Tweton 1988: 121-123).

To participate in the government loan programs, farmers needed to store the corn in a substantial and permanent structure that would effectively protect the quality of the crop for a minimum of two years (Wooley 1946: 270). The Ever-Normal program "spawned a great wave of farm construction as farmers erected grain bins and other storage facilities on their farms" (Minnesota Institute 1939: 17).

POSTWAR PRODUCTION

After World War II there was another wave of corncrib construction as American farmers, still producing at high levels, faced bumper crops and too few storage facilities. The USDA collaborated with the Midwest Plan Service (based at Iowa State University in Ames) to quickly draw and issue plans for storage structures to handle the huge farm surpluses. In 1949 the Midwest Plan Service issued its response, a widely-distributed catalog called *Grain Storage Building Plans* that included a broad range of corncribs and granaries (Giese "Midwest" 1957; Midwest 1949).

OUTMODED

The use of corncribs began to decline in the 1950s as farmers began harvesting with combines that shelled as well as picked corn. The shelled corn was then stored in granaries rather than cribs. Writing in 1953 one agricultural engineer predicted, "The field shelling method of harvesting corn would make the present slatted corncrib as obsolete as the horse stable" (Kaiser 1953: 36).

In a farm memoir, retired southern Minnesota farmer Michael Cotter described the change:

> In the 1950s farmers started shelling the corn in the field with a new piece of equipment called a picker sheller. The ear corn that used to sit in cribs drying for six months, now

> as shelled corn, had to be dried immediately and grain dryers appeared. The grain dryers had to move a large volume of warm air through the wet shelled corn. The heat was provided by propane gas burners, and the fans were powered by either tractors or large electric motors. The fans would reduce corn moisture from 25 percent to 12 percent in a matter of a couple of hours. Corncribs and ear corn pickers gave way to combines that harvested every type of grain. And corn dryers enabled the corn to be stored in large round metal bins. . . . Six thousand bushels seemed like an enormous amount in 1949. By the 1960s we would have had 30,000 bushel stored in less space than the 6,000 (Cotter and Jackson 2001: 81).

Producers of hybrid seed corn were among the first to use artificial dryers for corn. The practice began in the late 1920s or early 1930s shortly after hybrids were first developed. In the 1950s mechanical driers became a necessity for farmers who shelled corn in the field, but were also used by farmers who continued to harvest ear corn. By 1960 mechanical drying was recommended for all ear corn harvested with more than a 20 percent moisture content. (Minnesota corn was often picked at 20 to 22 percent moisture.) With mechanical dryers, cribs for ear corn could be "any shape and size, and of various materials. . . . Sizes are unlimited except that tunnels, ducts, and perforated areas must be ample and close enough to provide air movement without high pressures" (Neubauer and Walker 1961: 229; Hukill 1957: 526).

Today some corncribs in Minnesota are still filled with ear corn each fall, but their use is increasingly rare. Most of these farmers are grinding the ear corn for cattle feed (Lindor 2004).

CORNCRIB DESIGN FEATURES

In 1921 agricultural engineers Kaiser and Foster described the evolution of corncrib design. They wrote:

> In the early days when grains [and ear corn] were shoveled by hand from wagons, the height of the bin or crib was naturally limited to the height a man could conveniently shovel. The old pioneer type of crib usually consisted of a simple shed roof structure standing by itself in some exposed position. When more storage room was required another crib was built alongside it with enough space between the two for a driveway and both were covered with the same roof. This driveway furnished the man who was unloading corn protection from the winds and storms which, in many cases, was badly needed as the farmer was often compelled to shovel off his load by lantern light after the evening chores were done and the evening meal was over. This sheltered driveway also provided a convenient place for housing vehicles and farm implements. With the advent of power-driven conveyors [in the 1920s] there occurred a radical change in the design of cribs and granaries. The height was no longer controlled by the height to which a man could shovel, therefore, cribs were built higher to obtain greater economy in construction. Bins for grain and cribs for corn were included under one roof so that one conveying system would serve to handle all of the farm grains, effecting further economy in construction (Kaiser and Foster 1921: 51).

Location. Corncribs needed a site that was well-drained, provided good air circulation, and was accessible for loading, unloading, and shelling. Cribs were often oriented north and south to catch maximum cross winds. They were frequently placed near fields for convenience at harvest. They were also sited near the hog house – which was often built on the southern edge of the farmstead – to ease the daily chore of feeding (Noble 1984: 106-107; Roe 1995: 172).

Size. Corncrib height was first determined by comfortable height for a worker standing in a wagon and filling the crib by hand. Later, mechanical elevators determined height. There was some debate among experts about whether tall cribs compressed the corn at the bottom of the crib to the point that air didn't sufficiently move through it (Noble 1984: 106; Barre and Sammet 1950: 337-338; Neubauer and Walker 1961: 227).

Cribs 5′ to 8′ wide were common. The width of a corncrib was limited by the ability of air to move through the corn, with narrower cribs allowing more air to reach the center. Local climate and winds helped determine the best width, and corncribs were narrower in Minnesota than they were in Kansas and Missouri. Agricultural engineers eventually determined that the optimal width in Minnesota was 6′ to 7′ for a rectangular crib, and a diameter of 9′ to 11′ for a round crib (Neubauer and Walker 1961: 227).

The length of a corncrib was determined by the amount of storage required. A typical length in 1930 was 16′ or 18′.

Ventilation. To supply the ventilation needed to cure and hold the corn, a corncrib needed generous air gaps in the walls. The uppermost part of the walls was usually solid so that rain and snow wouldn't reach the top of the crop as it settled.

Many early cribs had gaps that were quite narrow. In 1921, one source recommended that gaps comprise a minimum of 20 percent of the crib's wall surface (Kaiser and Foster 1921: 53). Slatted wooden cribs met this goal. Cribs of "snow" fencing had gaps comprising about 50 percent of the wall surface, and wire mesh cribs had gaps comprising about 90 percent (Neubauer and Walker 1961: 228).

Wooden cribs were often fitted with interior ventilators – that is, slatted frameworks – that created open air space in the center of the crib. Vertical ventilators and shorter A-frame ventilators were common forms (Carter and Foster 1941: 271-272; National Plan 1951: 27).

Materials. Early corncribs were built of logs, poles, or planks, sometimes laid vertically but most often horizontally. Brinkman and Morgan documented cribs of both pole and log construction in their 1982 study of settlement-era farms in central Minnesota (Brinkman and Morgan 1982).

Because ear corn weighed less than loose grain, corncrib walls did not need to support as much weight as granary walls (Barre and Sammet 1950: 337-338). Tie rods or extra bracing were common, however, and the crib's exterior siding or slats were sometimes installed diagonally for extra strength.

Most cribs were built of dimensional lumber or crib fencing (also called "snow" fencing). Lower crib walls often incorporated metal screening or skirts of sheet metal to deter rodents. Steel wire cribs were popular beginning in the 1940s. At about the same time perforated steel cribs appeared. They were made of perforated steel and resembled a grain bin with a pattern of holes punched in the sides. Cribs of masonry and asbestos cement were also built, especially in southern Minnesota.

In 1961 the most prevalent type of crib being used on American farms was woodframe with slatted sides. Also common in 1961 were cribs of structural clay tile, concrete block, cement stave, perforated metal, and wire mesh (Neubauer and Walker 1961: 226).

Doors. Corncribs were usually filled through a hatch door in an upper wall or roof. After portable elevators came into use in the 1920s-1930s, most cribs were filled through the roof rather than through side wall openings. Cribs were emptied using one or more small doors or removable gates in the lower walls.

Foundation and Floors. Corncrib floors were set high with gaps beneath them for air circulation and "where dogs may hunt the pesky rats" (Fox 1940: 56). Cribs were often placed on large rocks or concrete blocks. Floors of wood, metal, and concrete were common. Alleys were often dirt or gravel.

Many corncribs had a "shelling" or "drag" trench beneath each crib floor that could double as a ventilation channel. When it was time to shell a batch of corn, boards or grates in the crib floor were removed and the ears dropped down into the trench. The ears were pulled from the trench for shelling, often with a drag conveyor (either portable or built-in) (Lindor 2004).

Roofs. Most rectangular corncribs had shed, gabled, or rounded-arched roofs. Most circular cribs had domed or conical roofs. Some experts preferred shed over gabled roofs because they believed gabled roofs allowed snow to accumulate on the corn beneath the peak (Barre and Sammet 1950: 336).

Conveyors. Portable conveyors or elevators for filling corncribs were being used on average-sized Minnesota farms beginning in the 1920s and were prevalent by World War II (Kaiser 1953: 36). (See the individual farm elements section entitled "Granaries, Elevators, Bins, Dryers" for information on built-in elevators.)

COMMON TYPES OF CORNCRIBS

Single Wooden Corncribs. Rectangular, single wooden cribs were among the earliest forms built in Minnesota. During the early settlement period they were often built of logs, with the wooden floor raised above the ground on large stones. Single wooden corncribs were economical because they allowed farmers to build only what they needed and expand later with a second or third crib.

The side walls of single cribs often tapered from top to bottom in a "keystone" or "coffin" shape (also called "slant-sided) that helped the gabled roof shelter more of the corn, provided good air movement, and facilitated gravity unloading (Noble and Cleek 1995: 156). The coffin shape made the crib somewhat unsteady, however. One source in 1950 also explained that the coffin shape "makes them more difficult to build, the crib has a greater [and therefore more expensive] roof area for the same storage capacity, and the side walls become weakened sooner because of the added weight and pressure on them" (Barre and Sammet 1950: 336).

Single cribs were frequently mounted on treated wooden skids so they could be moved where needed. In the mid-20th century a portable crib might be 8' wide, 10' long, and hold 200 to 500 bushels of ear corn (Carter and Foster 1941: 270).

A typical crib from 1953 was built with dimensional lumber and was 7′ x 32′ with a shed roof (*Farm Buildings* 1953). An interesting crib from 1949 was an 8′-wide structure built of snow fencing over a pole frame (Midwest Plan 1949: 8).

Temporary Corncribs. Temporary or low-cost corncribs were sometimes built of crib or snow fencing with little, if any, framework. Crib, snow, or "combination" fencing, as it was called, was made of wooden slats and woven wire. This fencing was commercially available by at least 1894 (Woodburn 1894: 347). Two rolls of the 4′-tall fencing could create a corncrib 8′ tall and 8′ to 10′ in diameter. A concrete platform and a portable roof were sometimes added (National Plan 1951: 27).

Double Corncribs. Double cribs were similar to the single cribs described above, except that two cribs were ganged under a single roof. One advantage of the double crib design was that one unit of the structure could be a corncrib and the other a grain bin.

Double cribs were usually separated by a central alley or drive. The alley could be about 4′ wide to allow air circulation, or up to 13′ wide to accommodate a wagon or harvester. In 1940, a *Successful Farming* publication noted that double-crib structures with driveways were "fairly expensive" considering their storage capacity (Fox 1940: 56). The passage was usually used to house tools or implements.

Geographer Allen G. Noble wrote, "The drive-in crib may have originated in the Middle Atlantic states. It occurs frequently in the Shenandoah Valley and occasionally throughout Appalachia, but it is in the Midwest (and especially the Corn Belt) that this crib is most commonly encountered" (Noble 1984: 107).

While usually straight-walled, some double cribs had coffin- or keystone-style outer walls that narrowed near the bottom.

A typical double crib from the 1930s and 1940s might be a gable-roofed structure measuring 20′ x 32′ if it had a 4′ alley, or 27′ x 32′ if it had an 11′ alley. Eight-foot-wide cribs could each store about 1,000 bushels of ear corn (Midwest Farm 1933; Barre and Fenton 1933: 12; Midwest Plan 1949: 9; *Farm Buildings* 1953).

Continuous Corncribs. Some corncribs were long, narrow structures dubbed continuous corncribs. They often had partition walls at regular intervals (e.g, every 16′) to form separate compartments.

Round Masonry Corncribs. Beginning in the 1910s, some cribs were built of concrete blocks, cement staves, or structural clay tile. Most were cylindrical. In 1921 Kaiser and Foster wrote, "The circular form is especially suited to masonry structures as this shape makes it easy to reinforce. There is also an economy of materials as a circular structure will enclose a greater volume for a given amount of wall space than any other form. Circular storages are used singly, in twos, or in groups or batteries" (Kaiser and Foster 1921: 52). Round masonry cribs often had domed metal roofs similar to silo roofs.

According to Noble, masonry cribs were built in Iowa and other parts of the Corn Belt from the 1920s-1950s (Noble 1984: 109).

Cement stave cribs were fairly new in 1919, according to one expert (Kaiser 1919: 26-27). The staves were 10" x 30" units that were designed to create gaps for air circulation. The staves incorporated small metal grates across the gaps to keep out rodents. Steel hoops encircled the corncribs for added strength.

Clay tiles for corncribs, and corncrib designs that best used clay tiles, were developed as the result of studies conducted at Iowa State University circa 1908-1920 (Bridgman 1938). One such design from 1941 was a 24'-diameter, round clay tile corncrib. At its center was an optional 10'-diameter grain bin or, if no grain storage was needed, a narrow air shaft. Depending on the design, the structure could store 2,000 to 20,000 bushels of ear corn (Structural 1941: 16).

Combination Corncrib-Granaries. Combination corncrib-granaries were very common in the Midwest. Simple forms resembled the double-crib structures described above with one unit being a corncrib and the other a grain bin (White Pine ca. 1925; *Farm Buildings* 1953).

A more elaborate and very popular design had two corncribs flanking the central drive, and grain bins overhead (Fox 1940: 55; National Plan ca. 1950: 47). Some examples had built-in elevating equipment. A typical structure might be 27' x 32', with an 11'-wide driveway and storage for 3,600 bushels of ear corn and 2,800 bushels of grain. Shelling and grinding equipment could also be installed overhead, with chutes sending the shelled or ground corn to one location and the empty cobs to another (Midwest Farm 1933; Kaiser and Foster 1921: 52; Structural 1941: 17; Barre and Sammet 1950: 338; *Farm Buildings* 1953).

Combination Corncrib-Granaries of Masonry. Combination corncrib-granaries built of masonry were developed in the 1910s and were very popular in Iowa. They usually had two or four rounded corncribs, a central drive, and overhead grain storage (in an overall oval footprint). One version was built with drying racks at the "attic" level where ear corn could be dried for a few days before being dropped into the cribs (Kaiser and Foster 1921: 52-56). A 1938 example measured 31' x 42' and stored 8,000 bushels of ear corn and 5,000 bushels of grain. In 1941 the Structural Clay Products Institute was promoting a 28' x 41' clay tile version (Structural 1940: 17; Bridgman 1938: 116, 119; Carter and Foster 1941: 273; Noble and Cleek 1995: 157).

Steel Corncribs with Wire Walls. Corncribs built of wire mesh stretched over a metal frame became available in the 1930s and were widely used in Minnesota through the 1960s. On some farms they were purchased to replace aging wooden cribs. In Midwestern states, the wire crib became "extremely popular after World War II because of its low cost, ease of filling, and low maintenance" (Roe 1995: 179). Most were prefabricated. Some were oval in cross section and elevated on steel frames (Fox 1940: 57). Round wire cribs usually had conical or domed metal roofs, while rectangular wire cribs often had rounded-arched roofs. Floors were commonly metal or poured concrete.

Steel Corncribs with Perforated Walls. Round steel corncribs with walls of punched or perforated steel were in use by 1940, but much less common than steel wire cribs. Internal ventilation channels were important since the walls didn't have much open surface area. In 1942 agricultural engineers were testing new "down-draft" metal cribs that had rotating wind fins that turned the tops of central flues to make best use of the wind (Malcom 1942; Barre and Sammet 1950: 326). One steel crib recommended in 1949 was 18' in diameter with a ventilated floor. It could hold 500 bushels of ear corn or 1,000 bushels of shelled corn or grain (Midwest Plan 1949: 14). Perforated steel cribs were not as successful as wire cribs because the perforations did not always provide adequate ventilation (Roe 1995: 180).

Prefabricated Wooden Corncribs. Some companies made prefabricated wooden corncribs. Around 1940, for example, the Economy Portable Housing Company was advertising an octagonal corncrib that was factory-made and shipped to the farm in sections, ready to assemble with three hours' work. The woodframe wall panels were built with diagonally-laid "West Coast fir." The floor and roof were also wood and came in sections (Economy ca. 1940).

Steel and Aluminum Sheds. After World War II and the introduction of the picker-sheller, large grain storage sheds became popular in the Midwest. One version issued by the Midwest Plan Service in 1949 had a quonset-style roof, sheathing of corrugated sheet steel installed over shiplap siding, and a poured concrete floor. The 16' x 32' structure could accommodate a "4,000-bushel ear corn dryer" which used a ventilating tunnel that ran lengthwise through the center of the building. Another model was 28' x 40' with a gabled roof and corrugated aluminum siding. It accommodated an ear corn dryer but instead of a ventilation tunnel it had an elevated drying floor that could be removed so the building could also be used as an implement shed (Midwest Plan 1949: 13-14). Prefabricated steel sheds were widely marketed for farmers who chose not to build one from scratch.

PREVALENCE

Corncribs were prevalent throughout Minnesota, but less common in northern counties. Larger cribs and masonry cribs were more often built in the corn-rich southern counties. The two most common forms of corncribs in Minnesota were built of wooden slats and steel wire. The use of cribs declined after average-sized farms began using picker-sheller harvesters in the mid-1950s and storing shelled corn in granaries. Corn dryers became common when this change was made. Corncribs are still encountered throughout the state with the earliest cribs being quite rare. Early examples of prefabricated or factory-made cribs are likely uncommon.

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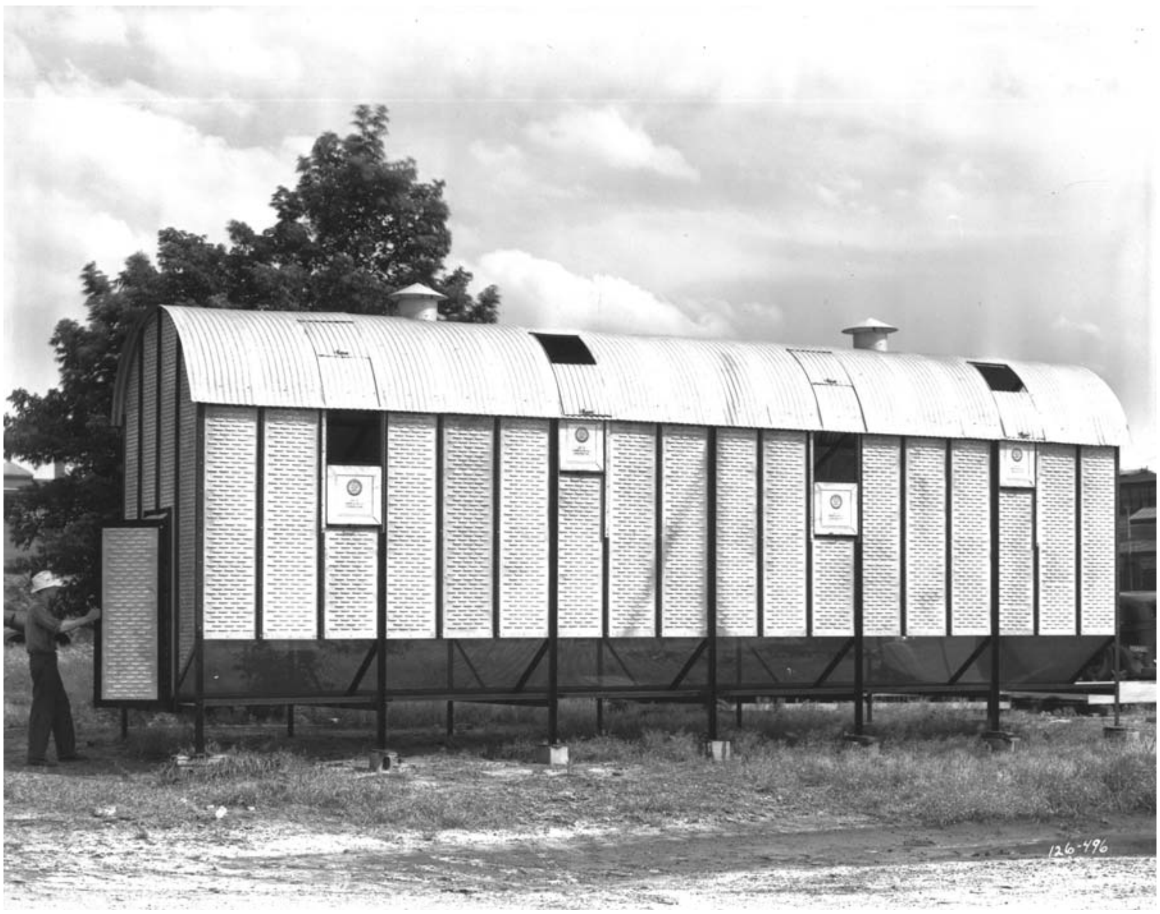
A single-pen, coffin- or keystone-style corncrib with walls and roof sheathed with planks. Location unknown, 1903. (MHS photo by Frank T. Wilson)

A single-pen corncrib of intricate pole construction. The man in the photo is shucking corn by hand. Location unknown, circa 1915. (MHS photo)

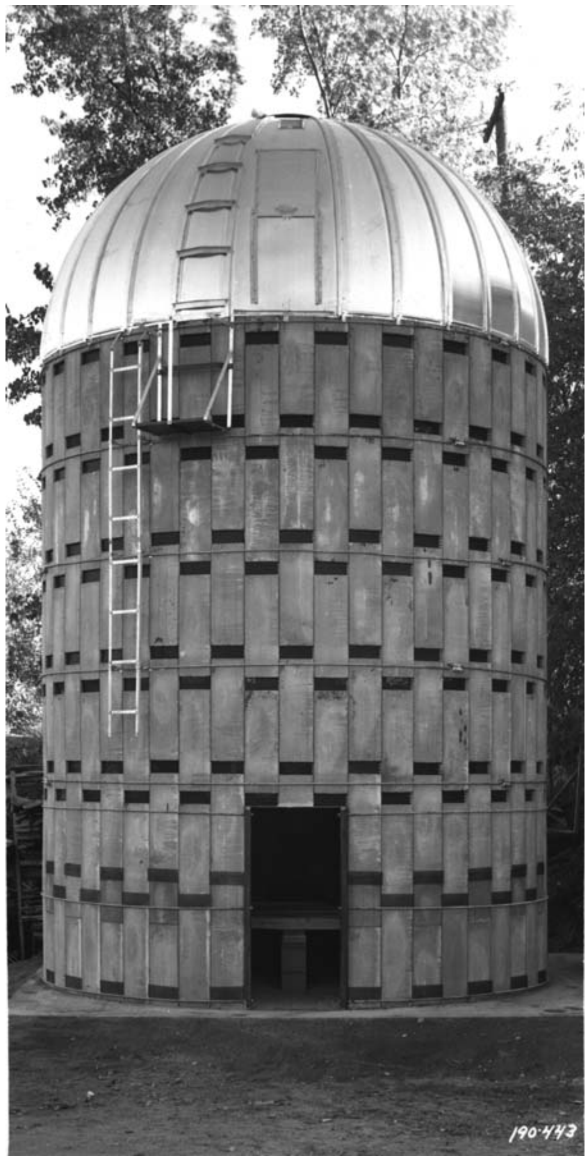
Farmers shelling corn using a sheller mounted on a flatbed. The shelled corn was placed in the wagon (right), and the ear corn into a simple corncrib (background) made of two rows of snow fencing. The two men on the left hold a banner that reads "Let the nation own the trusts," a socialist slogan. Location unknown, circa 1910. (MHS photo by Ole Mattiason Aarseth)

The optimal width for Minnesota corncribs was 6' to 7' but the length could vary. The height was determined first by comfortable hand-filling and then by the height of mechanical conveyors. This long, continuous crib probably had several interior partitions. Corncribs were often aligned north and south to catch cross-winds. Farm near LeCenter, 1998. (MHS photo by Chris Faust)

This style of combined corncrib-granary was very popular according to a 1940 publication from *Successful Farming* magazine (Fox 1940). There was a central drive between two cribs on the first level, and overhead grain bins on the second. Judging by the electric wires, there was probably an electric-powered elevator inside. This building was built with glue-laminated arches made by Rilco, a company founded in St. Paul in 1939. Location unknown, 1947. (MHS photo)



Prefabricated metal corncribs similar to this one were termed "experimental" in 1940 by *Successful Farming* magazine and the first models were just being marketed (Fox 1940). This version had perforated metal walls, which didn't ventilate as well as walls of wire mesh. Location unknown, photo 1938. (MHS photo by Norton and Peel)



Cement stave corncribs were first built in the 1910s. This brand new example was photographed in 1949. It had steel reinforcing hoops, a hatch in the roof for filling, and a lower door for unloading – all typical of the type. The staves incorporated small metal grates that kept rodents from passing through the air gaps. Location unknown, 1949. (MHS photo by Norton and Peel)

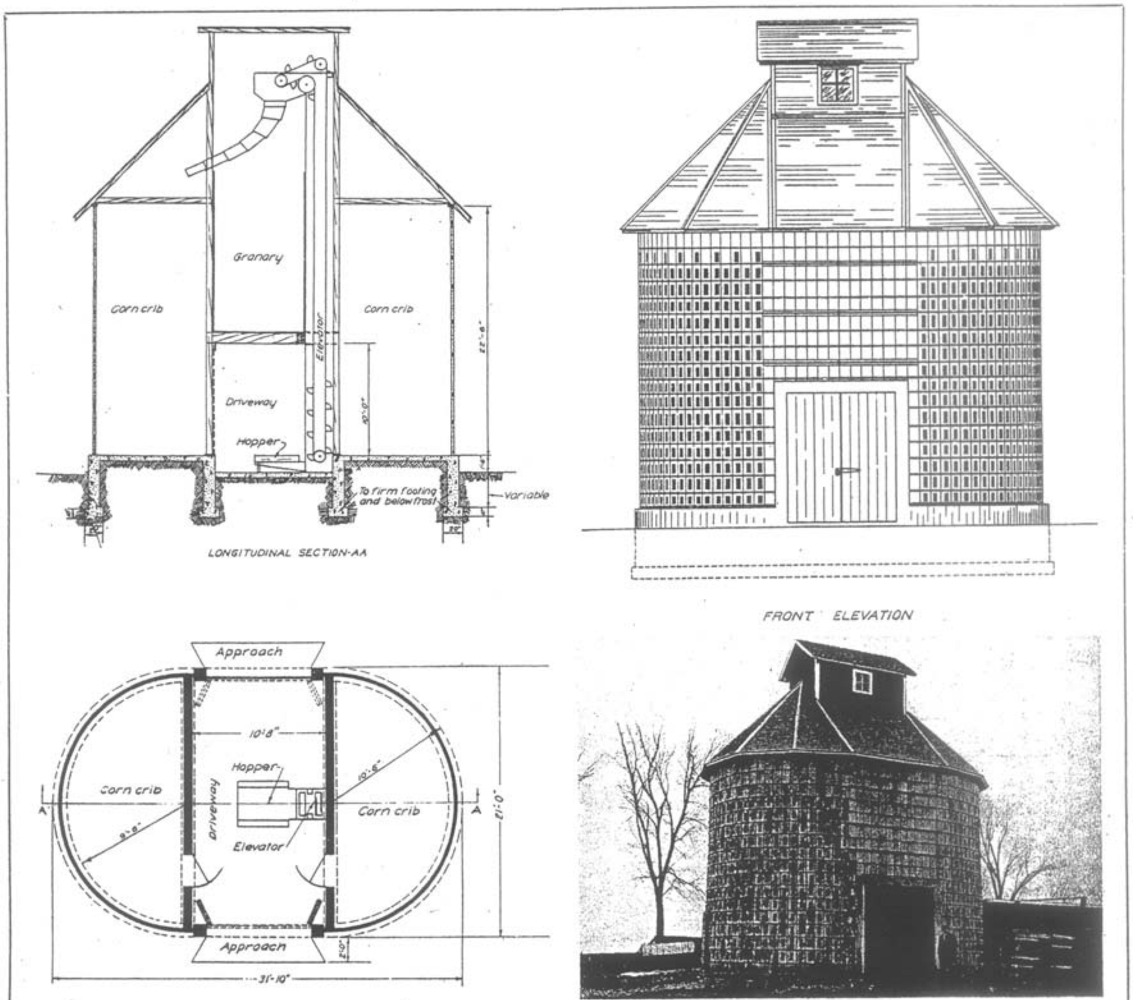
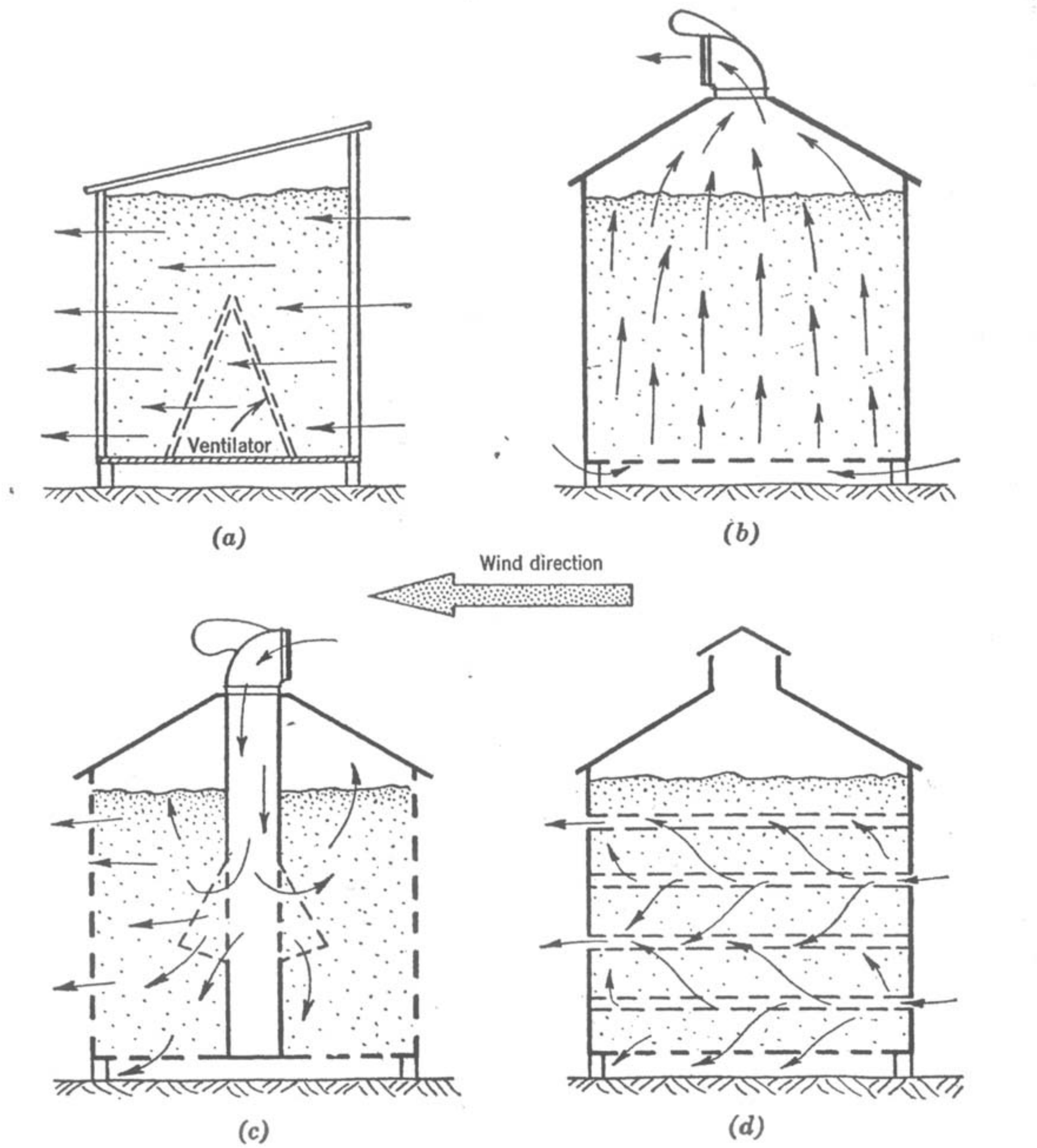


Fig. 5. A concrete stave farm elevator with semi-circular cribs and bins for small grain over driveway

Combination corncrib-granaries could also be built of masonry. This oval, cement stave model contained two semi-circular corncribs, upper-level grain storage, and a built-in elevator. This illustration appeared in a 1921 article in *Agricultural Engineering* that indicated this style was common in Iowa. They were also built in southern Minnesota. From Kaiser and Foster (1921).



Various types of bin ventilation are illustrated including (clockwise) an A-frame ventilator within a slatted wooden crib, a bin with tight sides and a perforated floor with air drawn upward, a bin with perforated sides and floor and a central flue with air flowing downward, and a bin with horizontal flues. From Barre and Sammet's *Farm Structures* (1950).

A steel wire corncrib now used for miscellaneous equipment storage. McLeod County, 2003. (Gemini Research photo)

Two versions of prefabricated steel wire corncribs. Both have poured concrete floors and standing-seam metal roofs. Some cribs filled with ear corn can still be encountered in Minnesota. Stearns County, 2004. (Gemini Research photo)