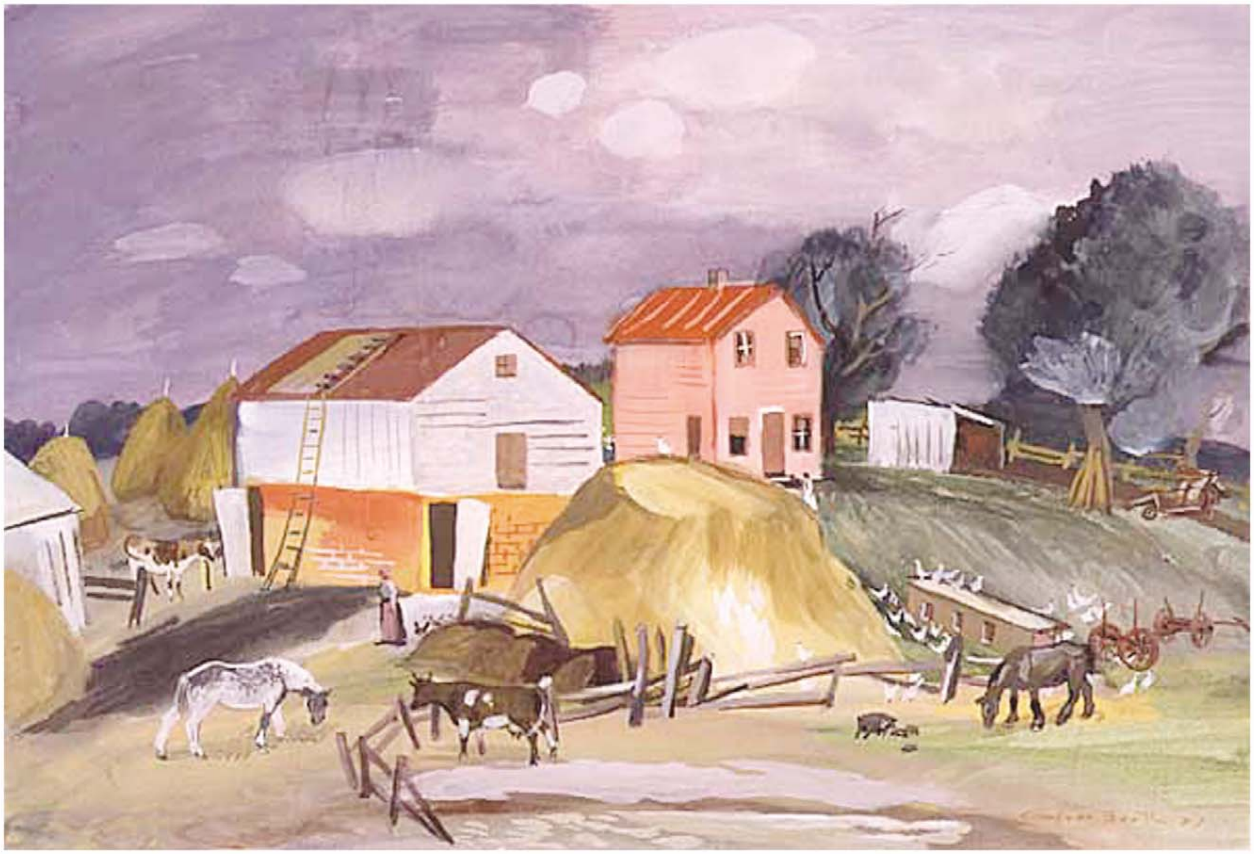
HISTORIC CONTEXT STUDY OF MINNESOTA FARMS, 1820-1960

Vol 2



prepared for the
Minnesota Dept of Transportation

Susan Granger and Scott Kelly
Gemini Research June 2005

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

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■ DAIRY BARNS

- A few dedicated dairy barns were built in Minnesota as early as the 1860s
- Most pre-1960 dairy barns were either stall barns or, less often, loose housing barns
- Two-story barns are characteristic of cold-climate dairying but were a fire hazard
- A few Minnesota dairy barns were one-story before World War II
- Most stall barns had two rows of stanchions; facing the cows in or out both had advantages
- Loose housing grew after a University of Wisconsin study began in 1941
- Round and polygonal barns were more popular in the Midwest than in other areas; an estimated 170-180 were built in Minnesota; about 70-75 were standing in 2001
- Field hay balers and choppers became affordable in the early 1940s, as did blowers and mechanical conveyors to move the hay up to the loft
- Feed and litter carriers were developed in the 1890s and paddle-type gutter cleaners date from about 1950
- Many farmers bought their first milking machines between 1915 and 1925, but they weren't widespread until after electrification

Dairying has historically been one of Minnesota's most important farm enterprises. The growth of dairying in the 1880s was closely linked to the diversification of Minnesota farms, and by 1940, some 90 percent of Minnesota farms had dairy cattle (Koller and Jesness 1940).

Women and older children worked in the dairy barn nearly as often as did male farmers. Marilyn Brinkman, in her study of Stearns County dairying, wrote that during both the early settlement period and at the turn of the 20th century, women often led the care of the dairy cows, including milking, churning butter, washing equipment, feeding and bedding the cows, and cleaning the barn. Brinkman found that, as dairy herds grew around the turn of the century, both women and men shared the dairying chores. She reported that on some farms, if the herd was six or seven cows, the women did the milking, but with a herd of 20 cows "everybody pitched in" (Brinkman 1988: 8-17). According to Mary Neth, a USDA survey in 1920 revealed that 45 percent of Midwestern farm women milked cows. In addition, 93 percent washed milk pails, 75 percent washed cream separators, and 66 percent made butter (Neth 1995: 19-20).

Dairy barns, or barns constructed for the housing of dairy cows, were one of the most common structures on Minnesota farms before 1960. In addition to barns, however, Minnesota dairy farms needed milk houses, milking barns, silos, manure pits, stockyards, bull barns, hay barns, etc., to produce and market dairy products. Many of these structures are described in individual farm elements sections in this context study, as are General Purpose or Combination Barns, which often combined dairy cows with other animals.

See also

General Purpose or Combination Barns
Barn Forms and Terminology
Milking Barns
Milk Houses
Silos
Diversification & Rise of Dairy, 1875-1900

Dairy barn design and construction were important for several reasons:

- dairy barns were prevalent – 90 percent of Minnesota farms had dairy cattle in 1939
- dairy barns were expensive – dairy farming required a greater investment in buildings than did cash grain farming
- milk cows were expensive and somewhat delicate; good dairy barns were necessary to protect this investment
- dairy barns were essential to storing enough feed to carry the herd through the long Minnesota winter
- milk was sold fresh and spoiled quickly; both public health and farm profits relied on proper barn conditions and the sanitary handling of cows, milking, and milk
- dairy structures were the most-regulated buildings on Minnesota farms and subject to stringent laws
- dairy barn design needed to support the efficient handling of 20 tons of milk, feed, bedding, and manure per cow per year
- barn design and dairy methods could make a significant difference in farm labor requirements; in 1960 labor differences among Minnesota dairy farmers ranged from 60 to 150 man-hours per cow per year depending on building, equipment, layout, and methods (Witzel 1960: 600)

TYPES OF DAIRY BARNS

Pre-1960 dairy barns were of two major types: the stall barn in which cows were confined in individual stalls (and a few horses shared the barn), and the pen barn that provided loose housing.

The pen barn had to be accompanied by a milking barn (also called a milking parlor) where the cows were secured while they were milked. Pen barns were much less common, perhaps because two buildings were needed. (See "Milking Barns," another individual farm elements section.)

Stall barns (also called tie-stall or stanchion barns) were more common, and their form changed very little between 1900 and the 1950s.

Although Minnesota statistics regarding the prevalence of stall versus pen barns have not yet been located, something may be learned from Wisconsin data: S. A. Witzel wrote in 1960 of a "recent" survey of dairy barns in Wisconsin that found only 600 loose housing systems on a total of about 101,000 farms with dairy cows (Witzel 1960: 601).

COMMON DAIRY BARN FORMS

Geographer Allen G. Noble in 1984 found that most dairy barns in Wisconsin and Michigan fell into five basic categories based on specific design characteristics. Vogeler in 1995 felt that the same five categories could also be applied to Minnesota (Vogeler 1995: 106-108; Noble 1984).

The five design groups described by Noble and Vogeler are listed below. Most were stall barns and included hay storage.

Three-bay or English Barn. Gabled roof, door on the sidewall, timber bents forming three equal-sized bays inside. Few windows. No basement. In its pure form apparently rare in Michigan, Wisconsin, and Minnesota, according to Noble and Vogeler. The Raised Three-Bay barn (see below) is more common, including in Minnesota.

Raised Three-Bay or Basement Barn. An English or Three-Bay barn raised on a basement. Animals housed in the basement with downslope access; feed and bedding stored on the floor above. A ramp is built to the main floor if no hillside available. Usually timber framed. Fairly common in central and southeastern Minnesota. Common in Michigan and Wisconsin, according to Vogeler.

German or Forebay Barn. Gable roofed forms generally built into a hillside with a first story forebay (usually the eave side) projecting over the basement level. Not found in Michigan but found in eastern, central, and northwestern Wisconsin, according to Vogeler. Very rare in Minnesota.

Wisconsin Barn. Narrow width to length ratio (e.g., 35' x 100'), often gambrel roof, large hay mow with gable end hay door, side walls with rows of closely-spaced windows, low main floor (stable) ceiling, two rows of stanchions. Common in Minnesota. Common in Michigan and Wisconsin, where one-half to three-quarters of barns in some counties are this type, according to Vogeler (Vogeler 1995: 106-108).

Round Roof Barn. Rounded arched (also called "rainbow" arched) or gothic arched roof with large hay mow. Most popular in the Midwest just after World War I. Fairly common in Minnesota. Apparently "scattered thinly" across Michigan and Wisconsin (Vogeler 1995: 106).

For more information on these and other barn forms, see this context's "Planning and Building Farm Structures: Barn Forms and Terminology."

LOCATION

Regardless of whether they were stall barns or pen barns, dairy barns needed to be placed on well-drained ground. A barn aligned north and south was preferred so that the sidewall windows would get maximum lighting (especially important before electricity) and so that roof shingles wouldn't curl during hot summers. The barn needed to be close enough to other structures for efficient operation, but far enough away to reduce the danger of spreading fire. To reduce odors at the farmhouse, barns were placed southeast of the house, or west or southwest of the house but at a greater distance away. Access to yards and pastures, to feed and bedding storage, to the milk house, and for the bulk milk truck were all important.

AGE

Before the 1880s, most dairy cows in Minnesota were housed in multipurpose structures. Very small herds were sometimes milked in the pasture where they were grazing.

Barns designed specifically for dairy cattle were built in Minnesota by the 1860s, but were not common until the 1880s. In explaining the evolution of dairy barns, Ingolf Vogeler wrote in 1995:

> As dairy farming spread into the northern Midwest during the late nineteenth century, most of the pioneer structures, which were often log, were replaced by new dairy barns, and older buildings were used for other activities, especially to house young stock, horses, and, later, tractors and mechanized equipment. Increasingly large dairy herds and more

> stringent sanitary requirements often meant that updating of older facilities was impractical. New barns were predominantly board-sided, plank-frame structures (Vogeler 1995: 102).

By the early 20th century, dimensional lumber, shipped by rail, became a common replacement for mortise-and-tenon timber frame construction, and new roof framing systems developed. According to Harper and Gordon, "By 1910 . . . a dramatic shift had taken place in the rural Midwest. The prototypical barn, although still two stories, was now a spacious, plank-frame structure built on a concrete or hollow tile foundation with an adjoining silo. Barn framing and interior plants had become more standardized. An optimum width of 36 feet provided the most economical use of lumber and allowed room in the basement for service alleys and a double-row arrangement of animal stalls" (Harper and Gordon 1995: 214-215).

Most of the barns described by Vogeler, Harper, and Gordon were stall barns. The earliest pen barns in the Midwest date from about 1890, but were rare until about 1950.

SIZE AND SHAPE

Stall barns in Minnesota tended to be long and narrow (e.g., no wider than 40′), like the "Wisconsin barn" identified by Noble. The narrow shape provided efficient use of space, good lighting, and heat conservation. On the other hand, barns were inefficient if they were too narrow and did not allow ample workspace for feeding and barn cleaning. Stall barns generally accommodated two rows of cows, a configuration that created the best balance between the amount of materials needed to build the barn and the distance the farmer needed to move during chores. Barns that were 36′ wide, for example, allowed light from the windows to reach all parts of the interior and were easier to keep warm. Many experts advised that barn width shouldn't exceed 32′ to 36′ in very cold climates. One wrote in 1923, for example, that a 36′ x 76′ barn "is larger than required on many farms and should be kept well filled with stock and warmly built or it will be cold under Minnesota conditions" (White 1923: 105).

The length of stall barns depended on the size of the herd and the length of hay carrier equipment mounted in the loft. As Minnesota farmers increased the number of cows they milked, they tended to either increase the length of the barn by adding onto an end, or add a perpendicular wing of the same width. The intersection of the wings then formed a stockyard sheltered from the wind.

Stall barn plans available to Minnesota farmers suggest typical dairy barn sizes. A Minnesota example described in 1907 was 36′ x 100′ and housed 30 milk cows, with feed alleys along the outer walls, five box stalls, a silo, and an attached milk house. The hay mow was accessed via a banked drive and had a feed room, feed bins, and was divided in half for straw and hay (Henry 1907). In 1937 the Midwest Plan Service was offering three plans for two-story dairy barns. The barns were 32′ x 80′, 34′ x 64′, and 36′ x 80′ and had stanchions for 20 to 28 cows (Midwest Farm 1937). In 1953 the University of Minnesota's plans for farmers included two-story dairy barns that were 32′, 34′, and 36′ wide (*Farm Building* 1953). In 1955 Rilco Laminated Products of St. Paul was offering two-story dairy barns that were 30′ to 40′ wide and 60′ to 80′ long, although the length was adjustable (Rilco 1955).

Pen barns tended to be wider than stall barns because they were not restricted by long, fixed rows of stalls. Pen barns often consisted of a large open space with perhaps a feed bunk, much more like a beef feeding barn or a sheep barn.

NUMBER OF STORIES

Two-Story Barns and Hay Mows. Both stall barns and pen barns could have either one or two stories. Two-story barns usually housed cows, feed, and bedding under one roof. It was usually cheaper to combine feed, bedding, and animals in one building than to build two separate structures. The hay and straw in the mow helped insulate the barn in harsh climates, and it was efficient for workers to drop hay and straw through chutes to the cows below. For these reasons, two-story dairy barns were much more common in Minnesota than those of one story.

The need to increase mow capacity to store more hay, thereby supporting a larger dairy herd, was one factor that led farmers to shift from gable-roofed timber frame barns to gambrel- and gothic-roofed styles. Framed with dimensional lumber, these self-supporting roof forms created larger interior spaces with fewer bents and crossbeams to obstruct the movement of equipment and workers inside. (Other factors influencing the shift away from timber framed barns included the increased availability of dimensional lumber and its lighter weight, and the fact that frames of dimensional lumber required less wood, less skilled carpentry, and less hand-work than timber frames.)

Farmers accessed the hay loft via wooden staircases or ladders inside the barn. In many cases, the ladders were nothing more than boards nailed to the sidewall studs.

On many farms, straw was stored in stacks outside because the barn only had sufficient capacity for the hay, which was more valuable and more fragile. Some hay mows were divided into two parts, one for hay and the other for straw. (These permanent partitions were more common in very early barns where the space was also shared with a threshing floor.) Mow floors, which also served as the ceiling above the cows, had to be built of tightly-fitting boards to prevent debris from sifting down and contaminating the milk.

The mow's hay chutes were usually located above the mangers, feed alley, or above the feed room. Chutes were sometimes simply holes cut in the mow floor, but were often vertical wooden boxes that extended some distance into the first floor to help control dust when the material was dropped. The chutes often had doors that could be closed to help the barn's ventilation system function properly.

The job of getting the hay out of the fields and into the mow was critical to the farm's survival over the winter, and was a back-breaking operation. (See Steven Hoffbeck's *The Haymakers* (2000) for excellent accounts.) One Minnesota farmer in 1914 advised his colleagues to take the hay into the north end of the barn which was shady and cooler on hot August days. If only one mow door was to be provided, he advised placing it on the north end for this reason (Henry 1914: 151).

Moving loose material into the hay mow was made somewhat easier by the invention of hay forks and the Louden hay carrier, patented in 1867 by William Louden of Fairfield, Iowa, which moved hay along a track mounted down the center of the mow ceiling. These devices gave farmers significant labor savings, although the hay still had to be hand-pitched from the center of the mow to evenly fill the space.

Ever-advancing hay-handling equipment led to the construction of barns with increasingly larger, stronger mows. The hay sling, which could hoist larger amounts of hay to the loft than the hay fork, also required stronger roof bracing, wider mow doors, and a stronger carrier track (Bassett 1914: 97; Wooley 1946: 265). Gambrel, gothic-, and rainbow-arched roofs increased capacity without increasing height, with the gambrel shape being the most popular (Vogeler 1995: 105). According to Iowa historian Lowell Soike:

> Louden's hay carrier encouraged farmers to think about building higher barns, longer barns, barns free of driveways for loading and unloading by hand, barns free of crossbeams, and barns with a hay door for outside access to the loft, especially at the gable end. The design of older eastern barns had been circumscribed by their own history, a past where heights and widths were suited to hand-pitching methods. This limited the size of storage bays and the practical height and length of working areas. Farmers had responded accordingly, building low and comparatively short barns, except on larger farms, where available hired hands made possible two- or three-story barns. Whether because of inconvenience or old farming habits, fewer people in the older farming areas would consequently upgrade their barns with hay carriers. As progressive farmers in the older eastern states struggled to accommodate the hay carrier to their low, big-beamed barns, the Midwesterners, most of whom had yet to build a barn, knew few such constraints (Soike 1995: 89-90).

Tractor-powered hay balers that could gather, bale, and tie hay were developed in the late 1930s and became affordable for some farmers in the early 1940s. Balers compressed hay and straw so that it took up considerably less volume than loose material. One result was that more material could be stored in the loft – but only if the mow floor could withstand the increased weight, or was reinforced to do so. For some farmers, the space-savings allowed them to store straw in the loft for the first time (previously all loft space had to be reserved for the more-valuable hay). The use of baled hay and straw led many Minnesota farms to evolve from two-story barns to one-story buildings where the extra weight wasn't a problem. Equipment that gathered hay into large round bales was developed in the 1940s.

Even with a baler, handling hay was a strenuous chore with bales weighing as much as 75 to 100 pounds. Mechanical elevators or conveyors were first used to move hay into barns in the 1920s. In southeastern Minnesota, virtually no farms used a portable elevator in 1920, 15 percent did in 1930, 33 percent in 1940, and 48 percent did in 1949 (McDaniel and Pond 1953: 5; Atkeson and Beresford 1935).

In the late 1930s and early 1940s, machines for chopping and blowing hay were developed. While chopped hay was often blown into silos, relatively few Minnesota farmers chopped hay for storage in a mow because chopped hay's advantages did not outweigh the extra labor involved (Lindor 2004). Advocates of chopping hay for mow storage argued that it was somewhat less fire-prone than loose or "long" hay. Like baled hay, chopped hay took up less room so barns with smaller mows could be built, or more hay could be stored in the same amount of space. Barns designed for loose hay sometimes needed modifications to accept baled or chopped hay including reinforcement to carry the greater weight, alteration of mow doors or other entry points, and alteration of the hay chutes (Wooley 1946: 265-266).

By the 1940s some farmers were installing mechanical systems in their mows to cool and dry long hay in the mow, rather than letting it dry in the field. The practice was fairly uncommon in Minnesota (Lindor 2004; Strait 1944). One method was to place loose hay in the mow in successive layers, drying each layer with fans and/or air that was drawn or forced through duct work. Some farmers in 1961 were using slatted floors in combination with fans and ducts. Others were using vertical flues to dry chopped hay that was blown into barns in piles up to 25' deep (Hukill 1957: 526; Neubauer and Walker 1961: 238-240; Lindor 2004).

The difficulty of getting hay and straw to the second story was sometimes solved by building a basement barn in which the ground level or a ramped driveway led directly into the storage area. While basement barns were built in many hilly areas, they had some disadvantages: they were often more expensive to construct, the lower level was often dark and damp, considerable storage space had to be sacrificed to the drive-in alley, and much of Minnesota's landscape was too flat to make the basement barn practical.

Despite their assets, hay mows were a great fire hazard and frequently ignited under hot, dry conditions. In a barn fire, the farmer could lose not only the whole barn but often the animals as well. Insurance – if the farmer had any – might replace the building but did not replace the loss of milking income while the barn was being reconstructed and the herd rebuilt. In the 1930s and 1940s farmers experimented with concrete mow floors to prevent the spread of fire, but they did not become widespread (Nelson 1947).

The second story on a Minnesota dairy barn, with its roof topped with caps and cupolas, dormers, and lightning rods, is part of what makes large dairy barns such a distinctive regional type. Ingolf Vogeler explained in 1995 that the large dairy barns of the upper Midwest are unique in the nation. He wrote: "Huge barns remain characteristic of the northern Midwest . . . . In the South, small outbuildings and simple shelters are adequate for domestic animals, and in the western plains, range cattle are protected near [hay] stacks or in open-ended sheds. Even in the heart of the corn-soybean belt, large barns are not the necessity they are in Minnesota, Wisconsin, Michigan, and the rest of the dairy belt" (Vogeler 1995: 100).

One-Story Barns. One-story dairy barns had been used in the Midwest and known to Minnesotans since at least the 1890s (Casselman 1895: 71). While they remained few in number before 1930, one-story barns were the subject of renewed interest in the 1930s and 1940s as farmers sought low-cost dairy housing during the Depression, and as they increased production during World War II. Loose housing and one-story designs drew increased attention after a Wisconsin research project began in 1941. (See "More Information on Pen Barns or Loose Housing" below.) After 1950 one-story dairy barns became more prevalent.

One-story barns had the advantage of separating the highly-flammable feed and bedding from the livestock. Wisconsin dairy expert S. A. Witzel noted that, by the 1930s, many farmers had spent decades slowly building up herds of prized dairy cows whose loss to fire would be devastating. Housing hay and livestock in separate structures could reduce the farm's insurance cost and, if the hay did burn, ensure that the farm still had a building from which to operate during recovery (Witzel 1939: 395). One-story barns were also less susceptible to wind damage than taller structures.

By the 1930s the growing costs of labor and lumber were making two-story barns increasingly expensive, and new methods and materials like pole frames and prefabricated construction – both conducive to one-story construction – were being developed.

One-story barns were also advantageous for farms using increasing amounts of machine-baled and -chopped hay, which took up less space than loose hay but were heavier. The extra weight strained both hay loft floors and workers' backs. With a one-story barn, hay and straw were often housed in an adjacent structure and moved into the barn by machine.

One-story buildings were also expandable with relative ease if the herd size grew.

Advances in the dairy industry and stringent dairy laws also favored one-story buildings. After World War II many dairy farmers were faced with the task of modernizing their operations if they wanted to participate in lucrative dairy markets. The dairy industry was increasingly regulated, labor costs had risen, operations were being mechanized, and larger herds were required to make a profit. Many farmers chose to replace older two-story barns with one-story buildings, often of pole-frame or prefabricated construction (Witzel 1939: 395). These one-story barns were built in both fixed stall and loose housing styles. By the 1950s, furnaces, offices, locker rooms, and toilets were also being incorporated. Some one-story barns were built as wings of older two-story barns, with the older structures still providing storage for feed and bedding (Eckles 1950: 512).

In a 1946 article entitled "Trends in Dairy Barn Design," the University of Minnesota described a one-story dairy barn with a moderately-pitched gabled roof that created a small storage loft. The building was sided with asbestos shingles. It had two rows of stalls with cows facing outward, and a central cleaning alley with an under-floor liquid manure collection system, among other modern features (Christopherson 1946).

Vogeler wrote in 1995, "Since the 1950s, low height, gable-roofed, pole structures have become the dominant types of [dairy] barns built" (Vogeler 1995: 105).

OTHER BARN COMPONENTS

Windows and Whitewash. In both stall and pen barns, windows provided ventilation and light, especially in the years before electrification. Good lighting reduced mold, helped farmers keep the barn clean, and made milking more sanitary. Some experts advocated four to six square feet of window area per cow. Others recommended a window for each cow. In summer, open barn windows were often covered with screens of muslin cloth or wire mesh to prevent flies from entering (White 1923: 102; White and Witzel 1934: 7).

Some dairy barns were whitewashed on the inside to brighten the interior, making them easier to keep clean (White and Witzel 1934). Some experts recommended painting the interior with aluminum paint for the same reason (Fox 1940).

Dairy cows generally needed more protection from the cold than did beef cattle or dual-purpose breeds. Hay and straw in the loft provided considerable insulation, but some dairy barns also had storm sash over the windows and insulation in the walls. An over-heated barn was not desirable, however, and by the mid-20th century studies were showing that cool temperatures were better for dairy herds (Witzel and Derber 1952; Stewart 1960). In 1961 Neubauer and Walker wrote, "Dairy animals can endure freezing temperatures without serious hardship for long periods, but barn temperatures should be maintained above 32 degrees F. at all times, in order to assure optimum milk production . . . At temperatures above 65 degrees F., there seems to be a gradual reduction in milk production, which becomes significant above 75 degrees, and critical at 85 degrees" (Neubauer and Walker 1961: 52).

Doors. Exterior barn doors were either hinged or hung on rollers. Roller doors had the advantage of taking up less space when open, of not blowing open or shut in the wind, and were less susceptible to being broken by livestock. Some large first-story doors had a smaller inset door so the big door didn't have to be used on a regular basis or opened during frigid weather.

Ventilation. Bovine tuberculosis was a disease that could spread from cows to humans and was a serious public health problem until 1950. To prevent the spread of tuberculosis and other diseases, it was important that dairy barns be properly ventilated. Before 1960 most dairy barns used a passive gravity ventilation system. The two most common methods, the King system and the Rutherford system, relied on the principle that warm air rises and cold air drops. The systems worked best when the barn doors were closed and there was a big difference between the inside and outside temperatures. Both systems were fairly straightforward to build in wooden barns and, with some extra work, could be installed in masonry barns.

The King system, developed around 1900 by Wisconsin professor F. H. King, became the most common. Outside air entered the barn via intake flues located at the base of the barn's sidewalls near the ground level. The air traveled upward through the walls to a point just below the hay mow floor where it escaped from the walls and dropped into the building. Outlet flues in the interior of the barn usually had openings near the floor. The warm foul air rose up the outlet flues and out of the building near the roof (Moore et al 1920).

The Rutherford system was used in colder regions of the U.S. and Canada but was less common overall. It used intake and outlet flues in opposite positions as the King system. The fresh air entered the barn through openings on outside walls near the top of the ground floor. The cold air dropped through the walls and entered the barn just above the floor. The outlet flue openings were usually located at the ceiling above the animals. The flues carried the warm air through the mow and out the roof.

In both systems, the outlet flues generally rose 2'-3' above the roof and ended with a cap or emptied into a cupola. Cupolas of wood were built as part of the barn's roof structure while metal cupolas were purchased from various manufacturers. Cowls that turned with the wind were sometimes placed on top of the flues. Some experts advised 8-10 gravity flues in a good-size barn, but recommendations varied.

Electric fans were first used for dairy barns in the late 1910s on a mostly experimental basis (Kelley 1921). They were discussed in technical literature in the 1930s and became widespread in the 1950s. While the cost of running fans could be high, some experts pointed out that the "long high flues and many intake openings of the gravity system are much more costly in material and labor" (Neubauer and Walker 1961: 48). It was recommended that one-story barns, in particular, use electric fans for ventilation, along with electrically-operated gutter cleaners and other equipment (Christopherson 1946: 15).

Stalls and Stanchions. In stall barns the milk cows were typically aligned in rows, with a two-row system most common because it used barn space and the farmers' labor most efficiently. It was more common for the cows to face outward toward the side walls of the barn. This gave farmers less distance to move the milking equipment and aligned the manure gutters along a central cleaning alley. Experts indicated, however, that it was equally useful to face the cows inward. With this arrangement, light from the windows illuminated the twice-daily milking process, and feeding was conveniently concentrated in the central alley. This style also allowed the barn's structural posts to serve as stanchion supports. The posts were in a more awkward location when the cows faced out (Eckles 1950: 521).

Individual stalls and/or stanchions were useful because they secured the cows for milking, confined the manure to specific locations and, experts believed, prevented the cows from stepping on one another. Stalls without stanchions were considered by many to be more comfortable for the cows, however, and dairy cows usually gave more milk when content and comfortable.

Often divided by partitions of wood or metal, stalls had to be wide enough to be comfortable but narrow enough so the cows couldn't turn around. Stalls that were too long could result in dirty cows because the manure didn't always land in one place. Stalls could have interior doors (sometimes split Dutch-door-style) or chains across the end. Once the size of stalls became standardized around the turn of the century, commercial stall partition assemblies were readily available (Bidwell 1890: 12; Macy 1925: 2; Giese 1943: 70). In 1946 the University of Minnesota discussed stall rows that angled slightly to provide some longer stalls for larger cows (Christopherson 1946: 15).

Stanchions, chains, straps, and halters were used to restrain the cows in a stall barn. The first stanchions were wooden and homemade. By 1902 there were numerous styles of commercial and homemade stanchions, each with advantages and disadvantages. Stanchions could be adjustable or fixed, made of wood and iron, and incorporate bars, ropes, and chains ("Cow Ties" 1902). Rigid stanchions, for example, kept the cows cleaner but were less comfortable than movable stanchions. Stanchions were eventually standardized in size. Some assemblies were mounted into the reinforced concrete barn floor at the time it was poured.

Providing adequate water was important to maintaining good milk production and by 1920 many stalls had individual water bowls and salt cups (Kelley and Edick 1923: 140). Water bowls were placed about 26"-30" from the floor, especially if automatic, so the cows wouldn't step on the levers and flood the barn. By the 1950s water cups (which came into use in the early 20th century) had electric heaters to maintain an optimal water temperature during cold months.

Calf and Bull Pens. Most dairy barns had separate pens where calves were born and nursed, or where a bull might be kept.

Feed Alleys and Mangers. In stall barns the dairy cows were usually fed in wooden, steel, or concrete mangers fixed at the head of the stalls. Mangers with rounded corners were easier to clean. While continuous mangers took less labor to clean than those with divisions, the cows tended to eat each other's food and diseases could spread. The mangers were aligned along a feed alley or feed passage that was either down the center of the barn or along the side walls, depending on which direction the cows faced. Feeding alleys needed to be at least 6' wide to accommodate a three- or four-wheeled cart or feed carrier. Well-designed feed alleys had a direct connection to the silo and to overhead hay chutes.

By the 1890s some farmers were equipping their stall barns with a mechanical feed carrier. Some models had feed containers suspended on an overhead track, somewhat similar to a manure carrier. (See "Beef Barns" for additional information on feeding.)

In 1946 the University of Minnesota described a trend toward placing food directly on the floor at the head of the stalls, instead of in an elevated manger. The article explained. "Dairymen using this arrangement have found it most satisfactory as it eliminates the lifting of hay from the floor to the manger. Any hay or grain pushed away from the curb by the cows can be quickly swept back [toward the cow] with a fiber push broom" (Christopherson 1946: 15).

Feed Rooms. Many dairy barns had feed rooms or "mix rooms" where feed was chopped, ground, mixed, and stored. The room could be located on the main level or – in a basement barn – in the hay mow. A feed room might contain a scale, mixing containers, fodder cutter, grinder, feed bins, and the outlet of a hay chute from the loft above. As dairy herds became larger and labor more expensive, farmers mechanized feed handling further and developed new ways to mix, store, and move cattle feed (Millier 1951).

Root Cellars. Many Midwestern farmers fed their dairy cattle root crops like turnips, mangels, and rutabagas, and stored the roots near the herd. Root cellars were often located under the central alley, under the silo, under the ramped driveway of a basement barn, or near the feed room. Root cellars appeared in some published barn plans as late as 1923 (Casselman 1895: 72; Louden 1923).

Floors. Early dairy barns had dirt floors, some with dirt manure gutters that were eventually lined with boards. Wooden barn floors were better, but were often slippery, dirty, and prone to decay. Poured concrete floors were considered a vast improvement. By the early 20th century concrete floors often incorporated alleys, mangers, stanchion bases, gutters, and proper drainage – all in a single monolithic pour. Concrete floors had to be scored or roughened when poured to help keep the animals from slipping. Sand could be scattered on floors to increase traction. Some concrete floors had an overlay of wood, especially under the animals, to relieve uncomfortable coldness that was thought to reduce milk production. Some barns had cork blocks, creosoted wood blocks, or short blocks of end-cut logs beneath the animals for warmth and comfort (White 1923: 99; Eckles 1950: 516-517).

In pen barns, the cows lounged on deep straw bedding that captured and absorbed the manure.

Gutters and Manure Handling. In New England in the early- to mid-19th century, some farmers allowed cow manure to drop into holes below the barn floor – a practice that Minnesota experts abhorred and was apparently rare in the state. Instead, most manure was removed from stall barns daily and hauled to a manure pile or pit ideally located about 50' away. Many felt the most practical way to clean a stall barn was to have a central alley, edged with gutters, with a door at each end, and of sufficient width (e.g., 8' or 9') so a manure spreader could be brought into the barn and directly filled. Stall barns were easier to keep clean with well-designed gutters, and various gutter shapes were developed. By the early 20th century, typical concrete gutters were about 10" wide and 16" deep.

Early manure handling equipment included the mechanical litter carrier, developed in the 1890s for stall barns. A typical carrier consisted of a metal tub suspended on a track that ran the length of the barn and out to the manure pile. These carriers were eventually electrified. Barn gutter cleaners with chains and paddles came into wide use in the 1950s. Gutters were sometimes altered to accommodate the equipment, or poured to its specifications. (See "Beef Barns" for additional information on manure handling.)

In a pen barn or loose housing system, manure was only removed from the barn once or twice a year. Instead, the farmer regularly added fresh bedding that absorbed the manure, capturing it for spreading on the fields. The straw-manure mix (or "manure pack") under the cows heated up as it decomposed, providing useful heat to the herd during cold winter months. Because the manure was stored within the barn, it remained sheltered from the weather and was not lost to rain or run-off.

Milking Machines. Milking the cows consumed more time than any other dairy farm chore. The first milking machines were developed in the mid-19th century but did not work well. In Scotland, William Murchland invented a vacuum milker in 1889, for which he was given a U.S. patent in 1892. Eventual improvements to the Murchland milker included a foot-operated pump. By the late 1890s several milking machines were commercially available and successfully operated. In 1916 dairy specialists Eckles and Warren characterized milking machines as not yet out of the experimental stage (Eckles and Warren 1916/rpt. 1921: 66). Many Minnesota farmers purchased their first milking machines between 1915 and 1925, but they weren't widespread until after farm electrification.

In 1931 agricultural engineers were suggesting that an electrical milking machine would pay for itself with a herd of eight or ten good quality cows, and would pay for itself with a herd of only five or six cows if the alternative was "[milking] irregularly or indifferently done by children or a hired man" (Prickett 1931: 151). Despite the fact that the equipment had to be washed after each use with both cold and scalding water, milking machines saved labor and were more sanitary than hand milking, although they could spread disease from cow to cow.

Two basic types of machines were used in 1931 and improved through the next decades. One was a portable model with a motor and vacuum pump mounted on a small milk tank that was moved throughout the barn. The container was usually emptied after each cow was milked. The second was a stationary system with pipe lines that pumped milk directly from the cows into milk cans or a refrigerated bulk tank. The latter system was expensive and difficult to keep clean, so many farmers continued to use portable milkers and milk cans into the 1960s (Prickett 1931: 151-152; Witzel 1960).

Milk Houses. All dairy barns had a dedicated space where the raw milk was handled. Often called the "milk room" or "milk house," this space could be incorporated into the barn's original design, be an addition, or be an entirely separate structure. Milk sanitation laws eventually required that the milk house be completely separated from the stable area – for example with a vestibule and self-closing door – although the milk house did not have to be a detached structure. For information on milk handling, see the separate individual farm elements section entitled "Milk Houses."

Electricity. Dairy farmers were among the first farmers to use electricity, and the farmhouse, farmyard, and dairy facilities were usually the first areas on a farm to get electric lights. Electric lighting was especially helpful because much of the work in dairy barns and milk houses took place before and after daylight hours.

In the dairy barn, electricity was "largely responsible for the rapid development of the milking machine" (Golding and Neff 1956: 305). In her study of Stearns County dairy farms, Marilyn Brinkman wrote that time spent on milking chores was cut 45 percent with electrification (Brinkman 1988: 20). In addition to lights and milking machines, electricity was widely used for cooling milk, heating water, and sterilizing dairy equipment. Electric fans, water cup heaters, manure conveyors, tail clippers, and other devices were also prevalent (Golding and Neff 1956: 305-306). A 1940 *Successful Farming* publication recommended that dairy barns have one outlet for every five cows. Barns also needed overhead lights with reflectors and separate electrical circuits for the cream separator and churn, refrigerator, cooler compressor, and other equipment (Fox 1940: 63-64).

Maternity Barns. Some dairy farms had a separate wing or building that served as a calf or maternity barn (National Plan 1951: 10). It is not known how prevalent they were in Minnesota.

MORE INFORMATION ON PEN BARNS OR LOOSE HOUSING

In a pen barn or loose housing system (also called a loafing barn), cows were milked in a separate milking barn or milking parlor. (See the separate individual farm elements section entitled "Milking Barns.") The need for two buildings, rather than one, was one reason that pen barns were less common among Minnesota farmers than were stall barns before 1960.

Pen barns could be either one or two stories tall. If no storage for feed and bedding was provided within the barn, another storage facility had to be located nearby. One-story pen barns were generally taller than one-story stall barns so that a winter's worth of manure-straw could accumulate on the floor and still leave sufficient headroom for manure-handling equipment (Christopher 1946: 5).

A few Midwestern farms were using pen barns or loose housing by the late-19th century. In 1905 a University of Illinois dairy specialist, Wilbur Fraser, published an analysis of the productivity of dairy cows kept in loose housing. He included in his report some farms in Illinois that had been using loose housing since 1891. The farms studied in 1905 had loose housing set up in buildings of various sizes. Fraser's findings were so favorable that the University of Illinois began using loose housing for part of its own herd in 1903 (Fraser 1905).

In a pen barn, cows spent most of their time in a loafing or resting area. At particular times of the day they were also given access to a feeding area where the feed bunk was located, to an exercise area, and to a holding area where they waited to enter the milking barn. Stanchions were only used in the milking barn.

Fraser's work anticipated a more generalized trend from stanchion to loose housing, the advent of the separate milking parlor, and the development of the one-story dairy barn, all of which came to eventually dominate the dairy industry, especially after the 1950s. Fraser and others found that unrestrained cows did not injure one another as had been previously believed. The cows were healthy, productive, and apparently more comfortable (and therefore gave equivalent or more milk) than restrained cows. Pen barns sometimes needed more floor space than conventional barns, but were easier and less expensive to build because they didn't need the complicated arrangement of stalls, mangers, gutters, and stanchions. Pen barns were not as advantageous for farmers who sold cows for breeding since the herd wasn't as well-displayed as they were in the fixed rows of a stall barn. Pen barns required less labor for barn-cleaning and feeding, and generally stayed cleaner than stall barns, although considerably more bedding was needed. In explaining some of the labor advantages of loose housing, Witzel wrote in 1960, "Cows confined to stalls cannot help themselves, select the feed they want, go out for sunshine, or obtain exercise without the dairyman being on hand to wait on them" (Witzel 1960: 600; Fraser 1905; Ashby 1916; Engene et al 1948; Neubauer and Walker 1961: 55; Christopherson 1946).

An experiment to test stall barns versus pen barns, as well as loose housing under both warm and cold barn temperatures, began in 1941 in a newly-built dairy research barn at the University of Wisconsin in Madison. (The Wisconsin Dairy Barn Research Project also tested steel's suitability as a building material for one-story dairy barns, granaries, and silos.) The experts found that cattle in pen barns usually had longer productive lives because of fewer injuries, less stiffness, and a better appetite. Cold housing with open doors was found to be just as suitable as warm housing (Witzel and Barrett 1944; Witzel and Heizer 1946; Engene et al 1948; Witzer and Derber 1952).

Pen barns were becoming somewhat common in 1936, although they were not widespread, according the University of Minnesota (White et al 1936: 3). In 1944, Wisconsin's S. A. Witzel included pen barns in a discussion of recent trends in agricultural engineering (Witzel 1944: 376). In a 1946 University of Minnesota publication discussing one-story dairy barns, both stall and loose housing were discussed (Christopherson 1946). In 1948, following World War II and the release of results from the Wisconsin study, the Minnesota Extension Service published a bulletin that indicated that "many" farmers in Minnesota were using loose housing (Engene et al 1948). The Minnesota Agricultural Experiment Station began a loose housing study in 1949. In 1952 it reported that the cows were producing as well or better in loose housing than in the University's stall barn (Peterson 1952).

In 1950 Minnesota's C. H. Eckles wrote that loose housing was "becoming increasingly popular" (Eckles 1950: 514). In 1960 Witzel wrote that as a general rule in Wisconsin, stall barns were being used for herds of less than 50 to 60 cows, while pen barns were being used for larger herds. Witzel indicated that in a "recent" survey of dairy barns in Wisconsin, only 600 loose housing systems were being used on about 101,000 dairy farms (Witzel 1960: 600-601).

Older stall barns could be remodeled into pen barns. In 1950 the University of Minnesota's C. H. Eckles wrote, "[Loose housing's] great advantage is to be found in remodeling old barns. They are generally of undesirable size or dimensions for standard barn equipment but may be gutted to form the open-shed part, and by the addition of a simple milking quarter, a modern and economical barn may be secured. In recent years much development has taken place in labor-saving design and convenience in milking parlors" (Eckles 1950: 514).

Because of their simple design, pen barns also favored prefabrication. By the late 1940s several companies were offering one-story pen barns that were all or partly prefabricated. They included Stan-Steel (Great Lakes Steel), which offered Quonset barns, and Reynolds Aluminum, which in 1953 was advertising a pole barn for dairy cattle with corrugated aluminum sides and roof. A 52' x 60' Reynolds barn could hold 30-40 cows in loose housing (Reynolds 1953).

CONFINEMENT HOUSING

In 1960 dairy expert S. A. Witzel reported that confinement housing, whereby dairy cows spent virtually no time in outdoor pastures, was a new concept in Midwestern dairying. Modern methods of intensive cropping and mechanical harvesting were producing higher yields per acre than pasturage, and farmers were finding their fields better-used for crops than for grazing. Herds were growing increasingly large and confinement systems were offering better control over all facets of production, better use of labor, and other lowered costs (Witzel 1960). Air conditioning for confinement barns, which held promise to alleviate the overheating inherent in confinement systems, was just beginning to be discussed in 1960 (Stewart 1960).

NONORTHOGONAL BARNS

Nonorthogonal barns, or those without right angles, were a special subtype of dairy barns and multipurpose barns. Most nonorthogonal dairy barns were stall barns.

In the Midwest the construction of nonorthogonal barns began as early as 1850, peaked around 1910, and ended during the 1930s (McMahan 1991: E2-E3).

Proponents of nonorthogonals explained that they provided more natural light to the interior, encompassed more interior space with fewer building materials, and increased the efficiency of farm labor through their unique spatial arrangement. They were, however, hard to expand. Many were built around a central silo, although this made the silo more difficult to fill.

Polygonal barns, most of which were built in 1850-1900, were the first popular form of nonorthogonal barns and were cheaper to build than true-round barns. Most polygonal barns had 6, 8, 9, 10, 12, 14, or 16 sides. Those with a greater number of sides were often built to more closely approach the true-round form and its presumed advantages (Meyer 2001). Some polygonal barns were built to escape patent restrictions that had been placed on some round barn designs.

One of the first octagonal barns that became widely known was built in 1874 in New York. It was owned by Elliot Stewart, a farmer and the editor of the *Livestock Journal*. Stewart replaced four rectangular barns (totaling 7,000 sq. ft.) with a 5,350 sq. ft. octagonal barn. Stewart claimed that octagonal barns were cheaper to build because fewer materials were needed, and that they were much more efficient for feeding animals because of their "shorter lines of travel." His articles on the octagonal barn were reprinted in several publications (McMahan 1991: E4-E5).

Most true-round barns were built during the years 1889-1936. Round barns were usually more expensive to construct than other nonorthogonal forms because they usually required curved lumber and special carpentry expertise. Despite this drawback, they became the most popular form of nonorthogonal after about 1900. Round barns were purported to resist strong winds better than other nonorthogonals and therefore to be more storm-proof. Minnesota dairy expert Clarence H. Eckles noted that round barns used between 34 and 58 percent fewer materials to build than comparable rectangular barns (Eckles 1950: 513).

Nonorthogonal barns were generally planned and built in several ways. Some were built by carpenters who traveled a wide area and specialized in nonorthogonals. Some were built by carpenters who worked only in a small, local area. Some were built with the help of companies that sold plans, materials, or entire kits, and sometimes offered to supply labor. Others were simply planned and built by farmers themselves (Sculle and Price 1995: 197). Traveling specialists included Jeremiah T. Shaffer who, along with his five brothers-in-law, owned Minnesota's Shaffer-Haas building company. This company is known to have built 25 round barns in Illinois, 14 in Wisconsin, and 3 near Albert Lea, Minnesota. Most date from circa 1901-1917. Another builder, Indiana-born Benton Steele, is known to have built 44 round barns in the Midwest (Sculle and Price 1995: 197-200).

Nonorthogonal kits could be ordered from companies such as the Radford Architectural Company of Chicago, Sears and Roebuck of Chicago, and the Gordon Van-Tine Company of Davenport, Iowa. One Minnesota example of kit construction was the A. C. Sherman Barn near Sleepy Eye, which was built from a kit in 1908-1909 (Sculle and Price 1995: 200-201).

Nonorthogonals were more prevalent in the Midwest's corn-growing and dairying regions than in any other parts of the country (Sculle and Price 1995: 188). Even in the Midwest, however, they were rare. Indiana and Wisconsin are believed to have had the most nonorthogonal barns, with about 220 built in each state (Meyer 2001). About 15 percent of Indiana's nonorthogonal barns were octagonal (McMahan 1991: F12). Iowa is believed to have ranked third in the number of nonorthogonal barns, and Minnesota fourth (Meyer 2001). Through many years of study, historian Roy W. Meyer had by 2001 identified, or found reference to, about 170-180 nonorthogonals known to have been built in Minnesota. Roughly 60 percent had been demolished by 2001, with only about 70-75 barns still standing in Minnesota at that time (Meyer 2001). Only about 44 nonorthogonal barns are believed to have been built in South Dakota. Most, or about 36 of the 44, were extant in 1995 (Ahrendt 1995). The world's largest round barn, built circa 1917 with a 150'-diameter, still stands in Marshfield, Wisconsin.

The collapse of the farm economy in the 1920s slowed the construction of nonorthogonal barns. At the same time, they had lost popularity among farm journalists (Sculle and Price 1995: 204-205). By the time the economy improved in the 1940s and farmers could again afford to build large barns, technology had changed drastically and nonorthogonals were considered obsolete. Large two-story barns, whether round, polygonal, or rectangular, were almost completely supplanted by modern one-story, steel-sided pole barns that, in the words of one historian, "were inexpensive, easy to build and completely devoid of character" (McMahan 1991: E11).

PREVALENCE

Dairy barns were widely built throughout Minnesota. Early barns built specifically for dairy operations are likely rare. Well-preserved examples of two-story, fixed-stall barns dating from the 1890s and later are likely to be fairly common. Basement barns are still found in hilly areas. Nonorthogonal barns are rare. Pre-1945 examples of pen barns or loose housing barns are probably rare.

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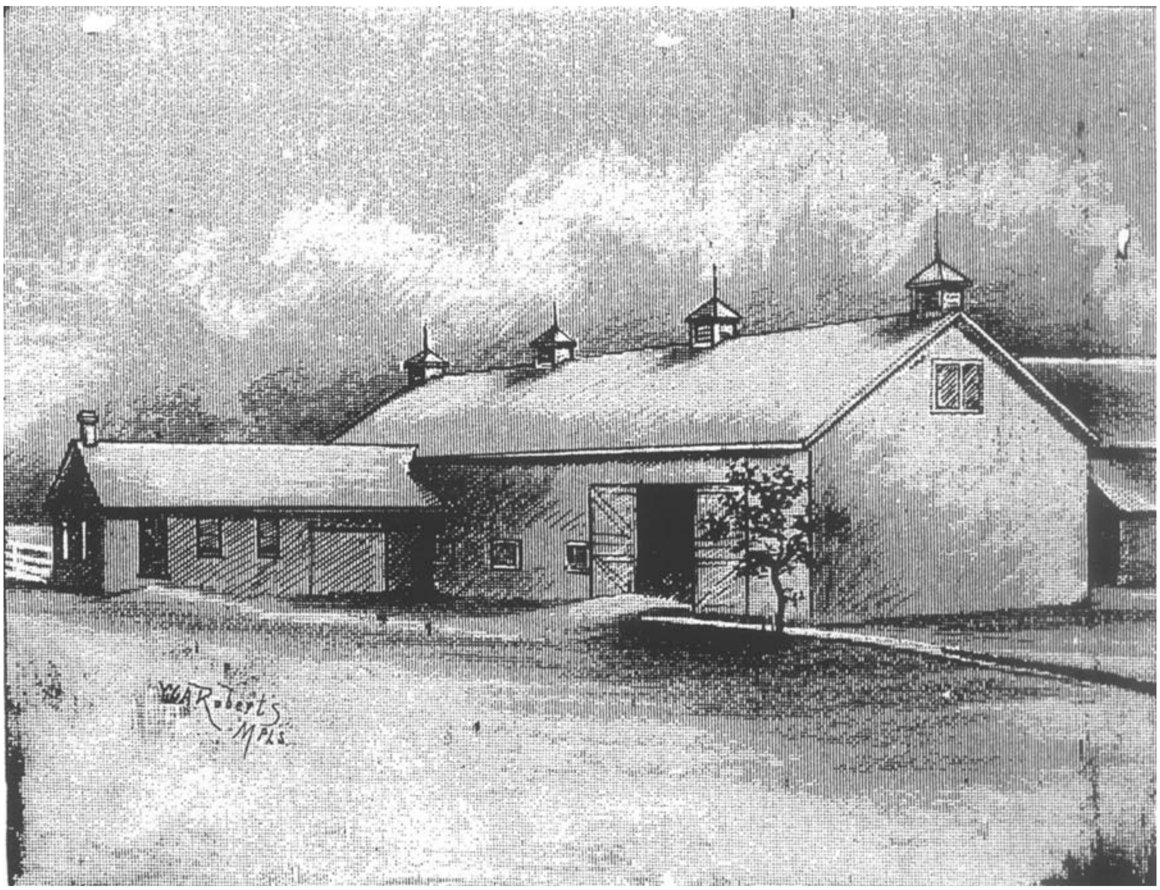
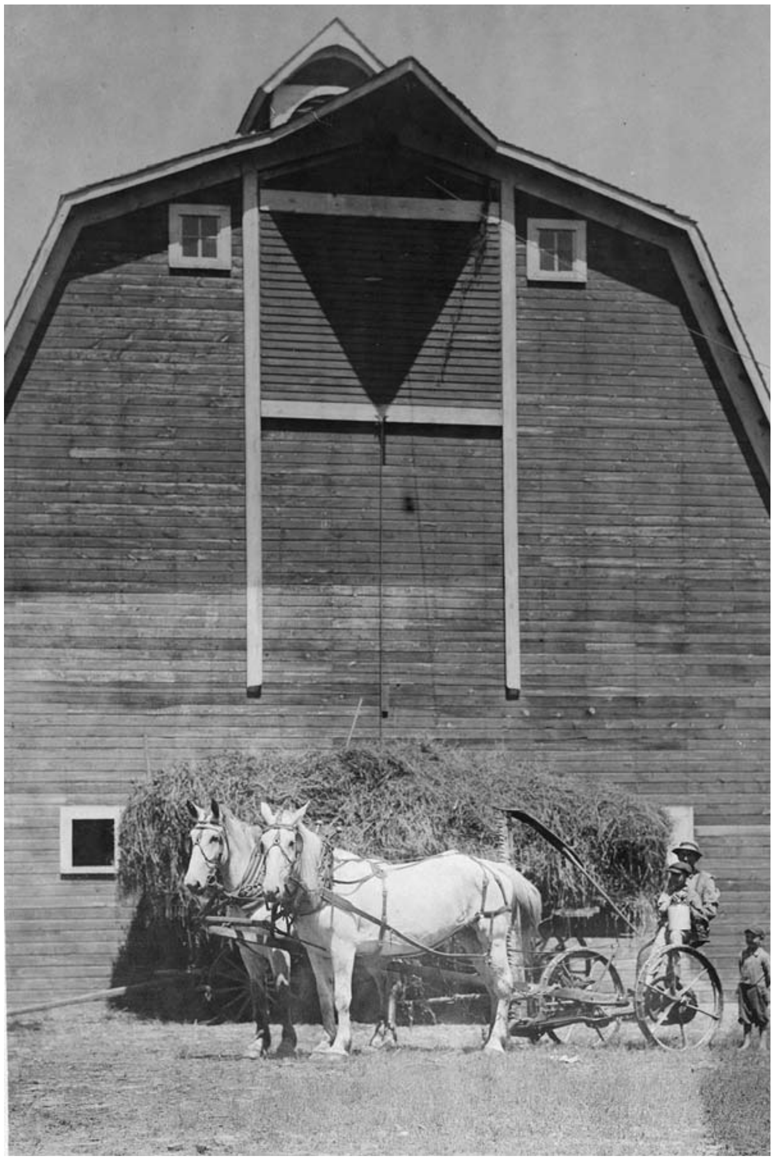
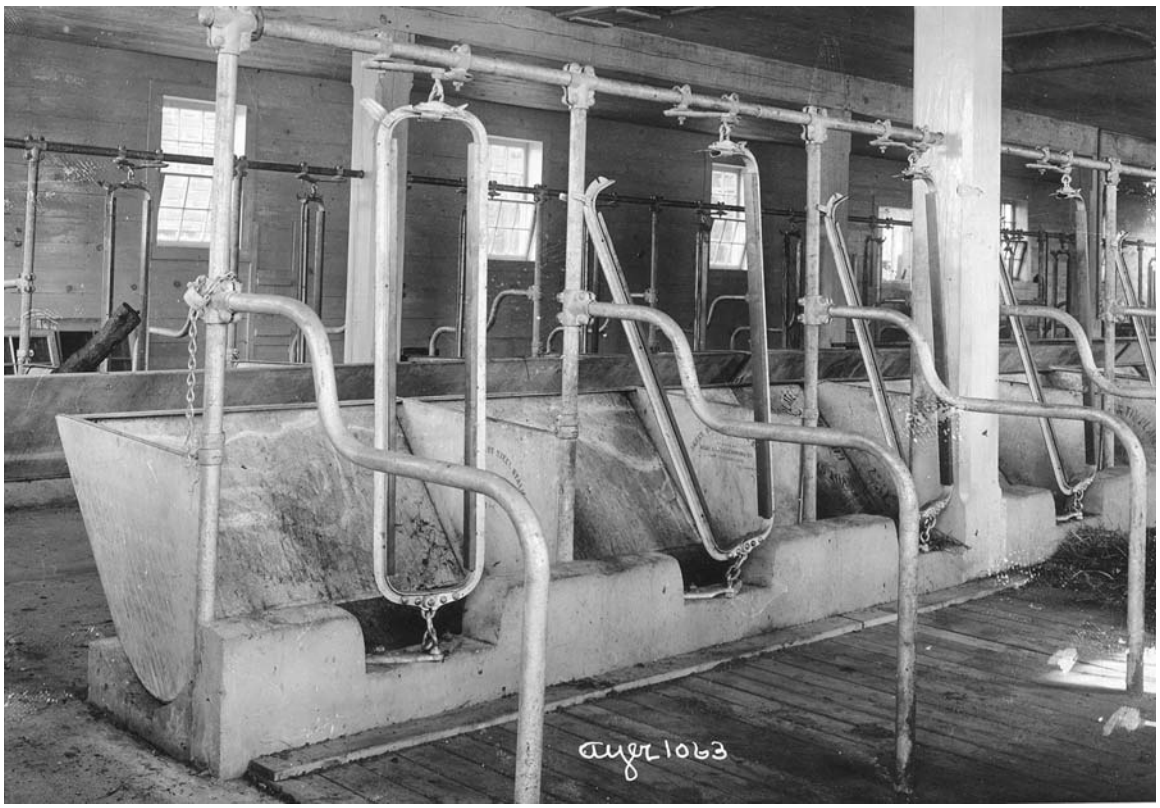


One-story dairy barns are not a modern invention. This illustration was published in an 1895 issue of the *Minnesota Farmers' Institutes Annual*. The 36′ x 112′ building had stalls in which 32 cows were chained, root cellars under the feed alley floor, five calving pens, and a milk house wing. From Casselman (1895).



A load of hay ready for the loft. One Minnesota farmer in 1914 advised that the hay door be placed on the northern end of the barn so that the hot dusty chore of loading the hay in August could be done in the shade (Henry 1914). While second story lofts saved labor at feeding time, the dry hay was highly flammable and barn fires were common. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

Loading the mow using a hay sling. In the field, the empty bed of a wagon was loaded with three layers, each consisting of a canvas or rope sling and then about 4' of hay. Back at the barn, each sling and its load was lifted off the wagon and hoisted into the loft. The load was raised with pulleys, with horses (later tractors) towing the ropes away from the barn. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)



The interior of a "Wisconsin" style barn, common in Minnesota. It had two rows of stalls, pipe stanchions, steel mangers, and wooden floors beneath the cows. The cows faced inward, which allowed light from the windows to illuminate the milking process. Hackney Farm near St. Paul, circa 1910. (MHS photo by Harry Darius Ayer)

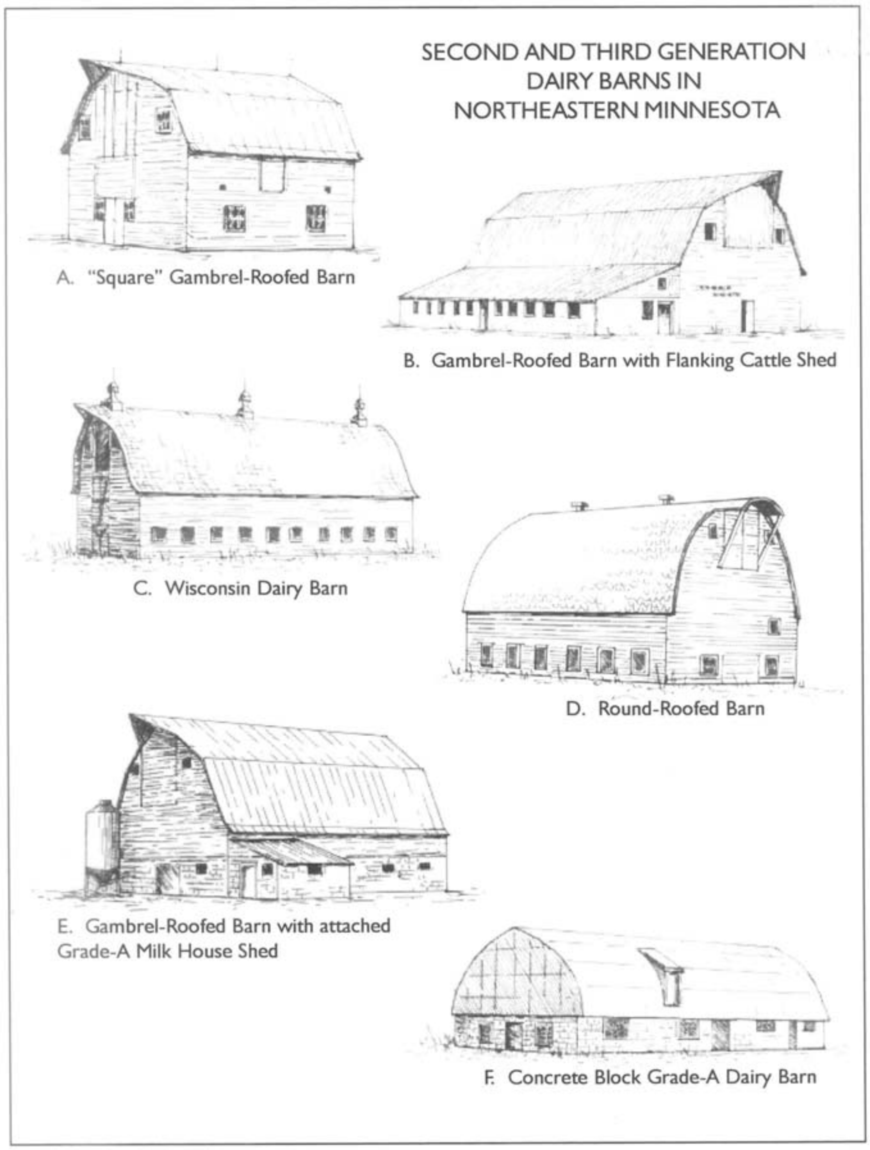
A barn sided with unpainted sawn lumber, probably in northern Minnesota. Location unknown, circa 1915. (MHS photo)

Most dairy barns had passive gravity ventilation systems with outlet flues topped with metal caps and/or wooden cupolas. The fresh air intakes were usually along the barn's sidewalls. This barn was covered with sheets of corrugated metal, a low-maintenance material that was in use by the early 20th century. Six milk cans stand near the door in this photo. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

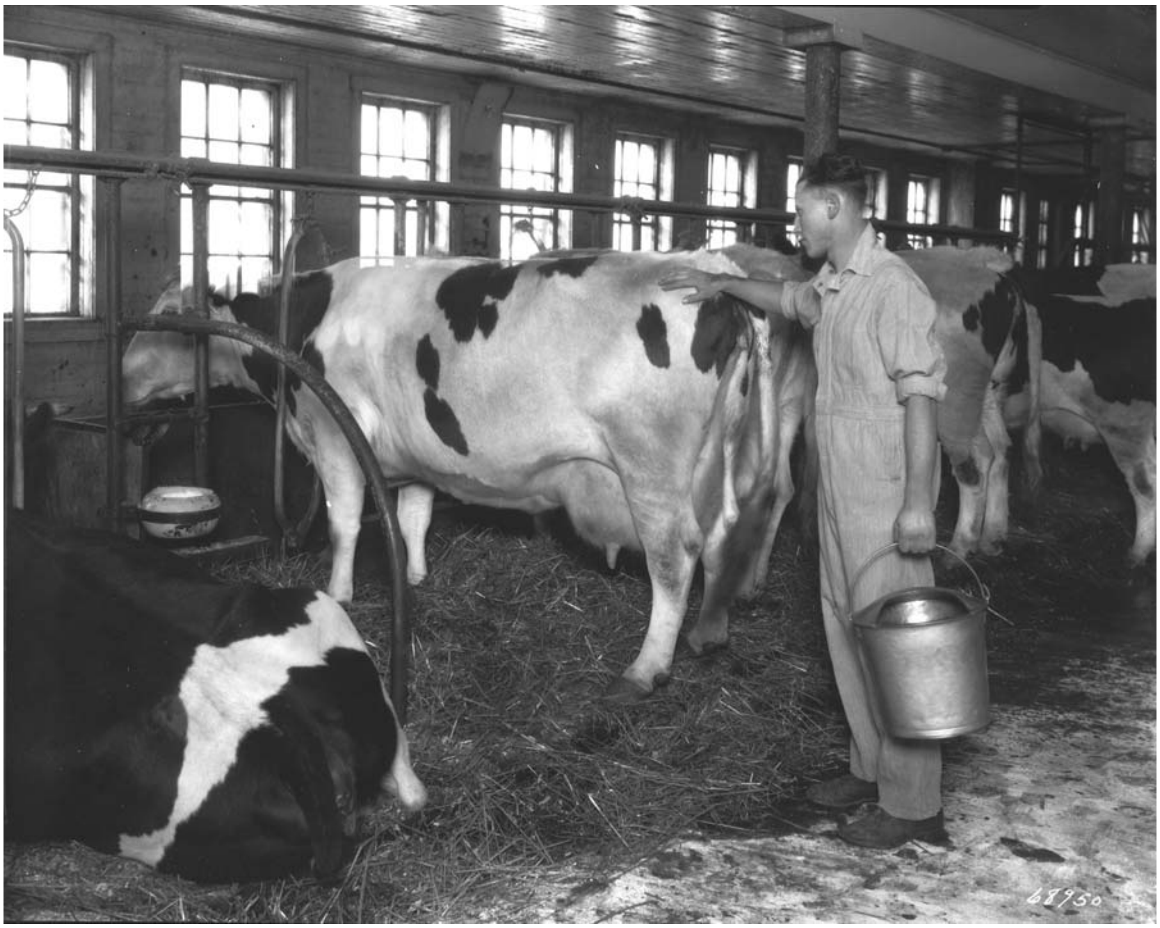
A dairy barn with stone basement and a concrete block milk house addition. The end walls feature decorative wood shingles, which is unusual. The painted lettering reads "Pleasant View Dairy Farm, Isidor A. Schwinghammer, prop., Albany, Minn., registered and high grade Holstein-Friesian cattle, Chester White swine, and Rhode Island Red poultry." Photo taken circa 1915. (MHS photo by Henry A. Briol)

Purebred Holsteins and a wooden silo on a Stearns County dairy farm. Many Minnesota dairy farms in the early 20th century had 12 to 20 cows. The number was determined by factors such as the number of workers available to milk, the capacity of the silo, and the amount of hay that could be cut and stored. Falkner Farm, near Albany, 1917. (MHS photo by Henry A. Briol)

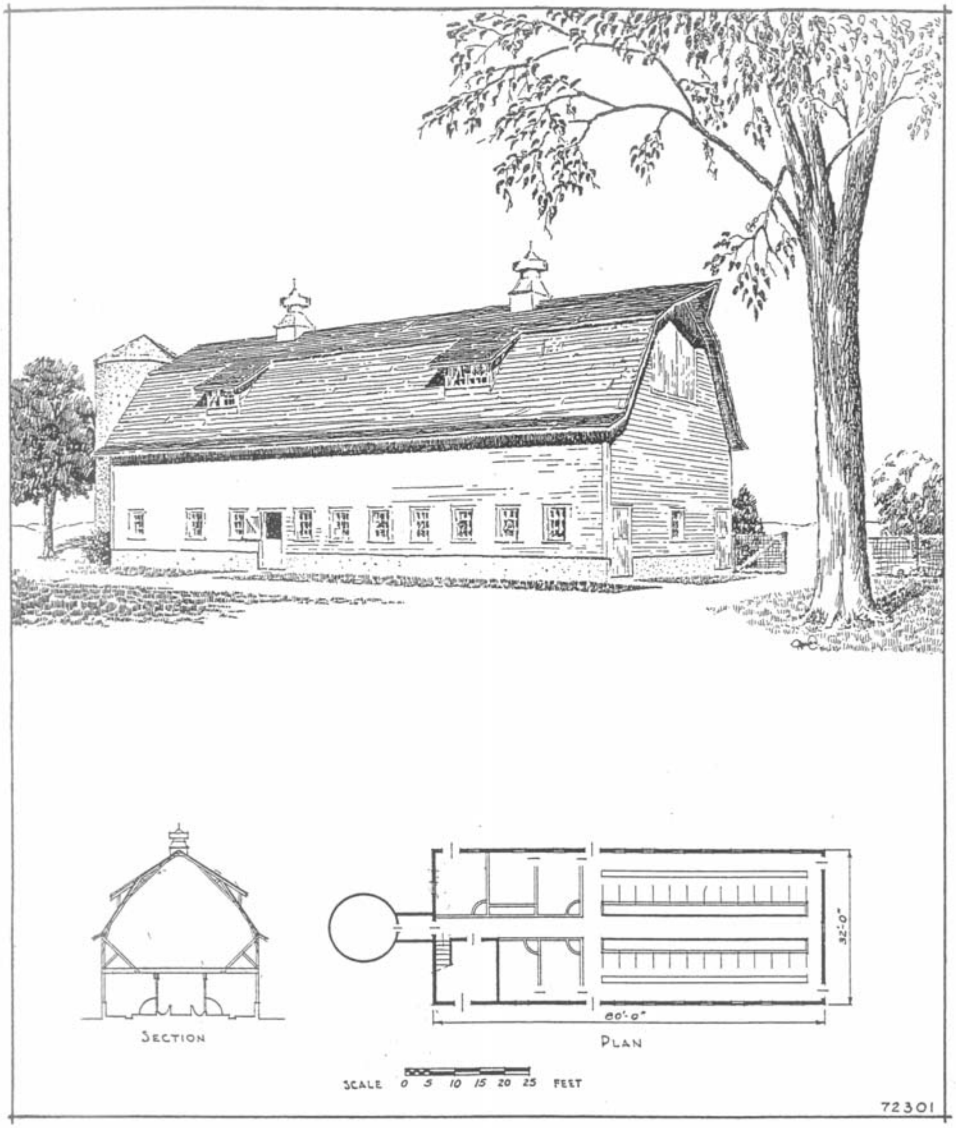
Basement barns often had lower-level animal stables and an upper storage area into which a feed wagon could be driven. This type of barn had a few drawbacks: it was usually more expensive to construct, it required hilly terrain or a large earthen ramp, the basement was often dark and damp, and the upper-level driveway stole storage space. Itasca County, circa 1920. (MHS photo)



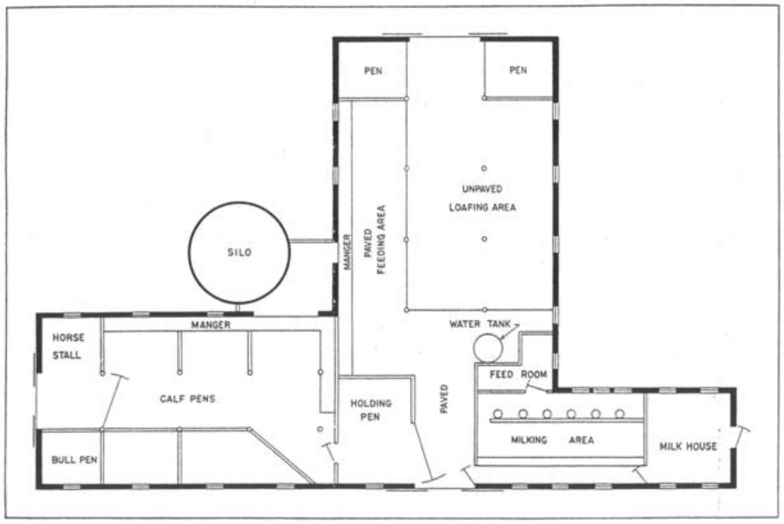
Types of dairy barns in northeastern Minnesota in 1999. Drawn by Debra Flanders based on photos by Arnold Alanen for Alanen's *A Field Guide to the Architecture and Landscapes of Northeastern Minnesota* (2000).

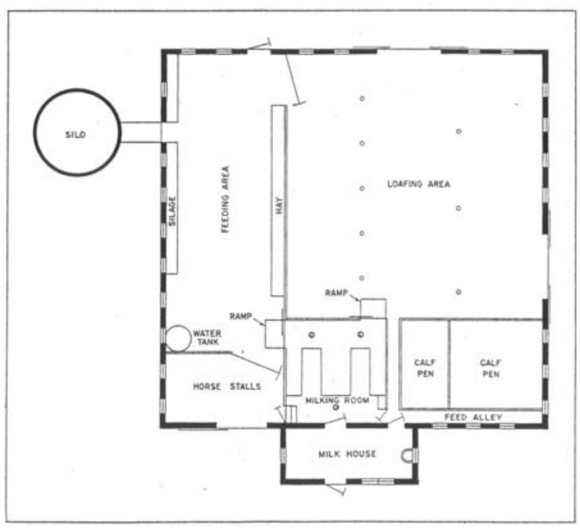


The interior of a well-lighted, Wisconsin-style stall barn. The pipe stanchions allowed the cattle to swivel their heads and lie down, and the cows could probably see out the many windows. The manger was concrete, and small salt cups were attached to the stanchions. The low ceiling helped conserve heat. Lake Elmo, 1927. (MHS photo by Hibbard Studio)



Two-story dairy barns were built in Minnesota from the late 19th century through the 1950s. In this 32′ x 80′ example, the cows faced inward. While either style worked, it was more common for cows to face outward, which gave farmers less distance to move the milking equipment. Facing the cows outward also made barn cleaning more efficient by placing the manure gutters along a central alley. From the Midwest Plan Service, 1933.

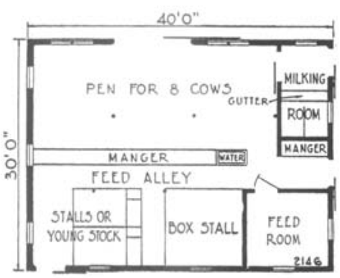




Both of these loose housing arrangements were created from older stall barns that were remodeled. The one with the square footprint was expanded toward the right. From a Minnesota Agricultural Extension Service bulletin published in 1948 and entitled "Loose Housing for Dairy Cattle."

PEN BARNS . . .

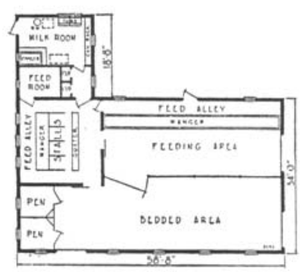
A small pen barn with a loafing area for eight cows. A two-stall milking room is included with other facilities. Outside lower walls are of tile construction. Gothic roof is bent rib type.



No. F-2146

Mow Capacity
21 Tons
Loose Hay
or
56 Tons
Baled Hay

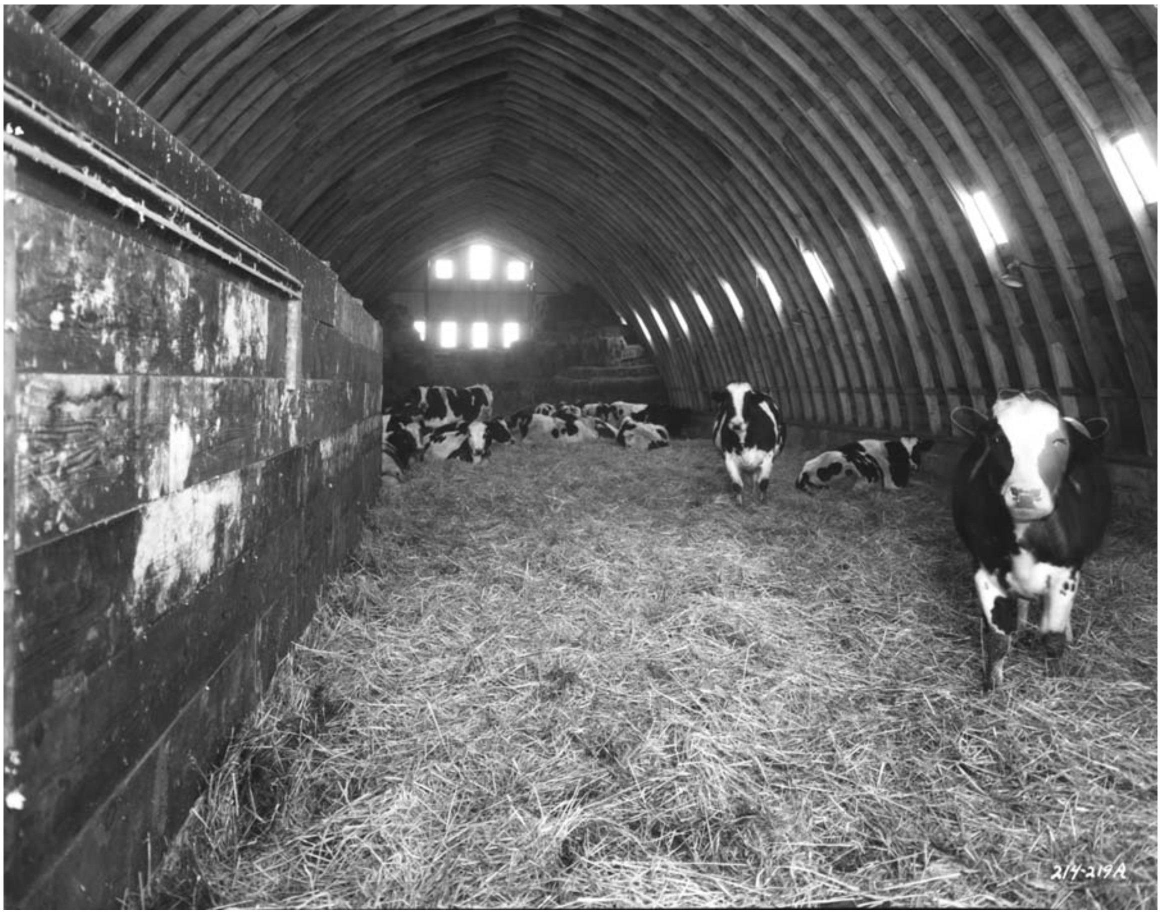
A one-story loafing barn with milking parlor. The plan also shows the milk room facilities attached and adjacent to the milking parlor. Exterior walls are of concrete blocks.



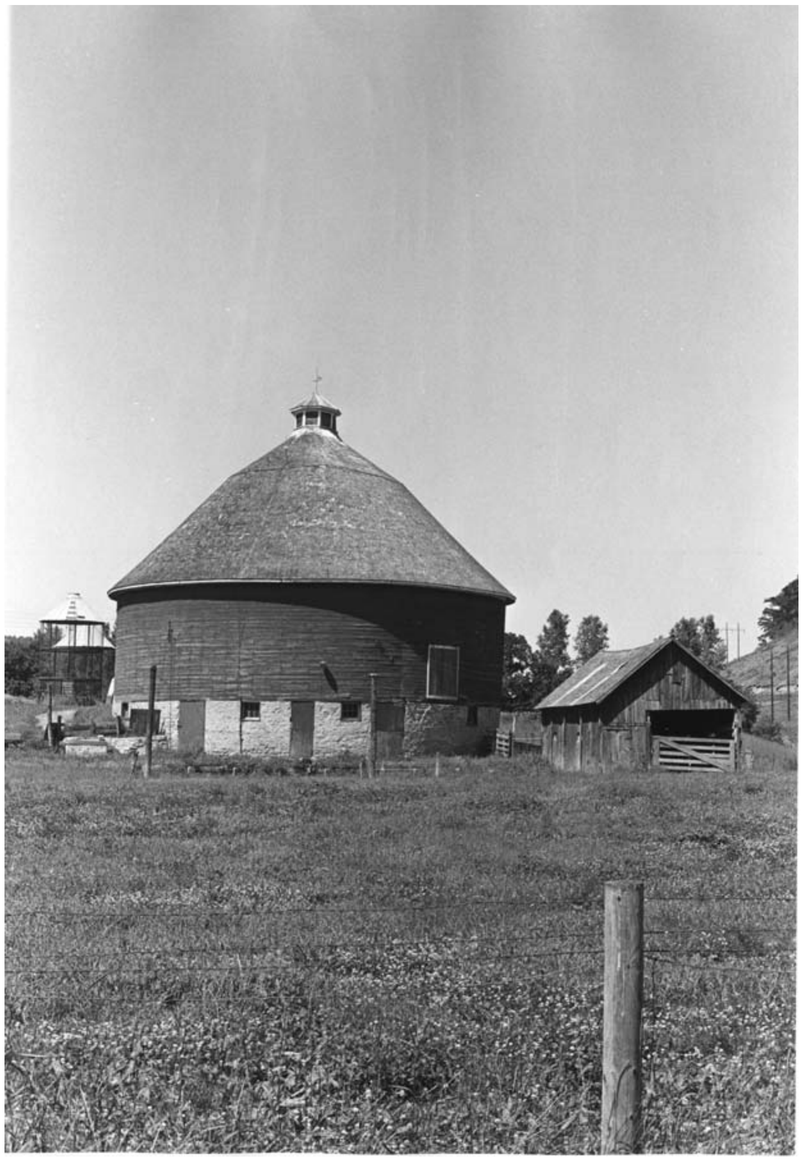
No. F-2151

Door on rear wall permits the addition of silage, hay and feed rooms if desired.

Two styles of loafing or pen barns, both built of hollow clay tile. The barn on the left had upper-level storage, while the barn on the right had separate feed and bedding areas. From the 1951 publication *Practical Farm Buildings* by the National Plan Service.



A few Midwestern farmers used loose housing as early as the turn of the century. By the 1940s studies were finding that loose housing saved labor and that cows housed this way enjoyed better health, fewer injuries, and longer productive lives. The cows lounged or "loafed" on a deep bed of straw. Milking was done in a separate milking parlor or barn. Location unknown, 1953. (MHS photo by Norton and Peel)



Round and other nonorthogonal barns were usually stall-type dairy barns. They sometimes had a central internal silo. Mount Vernon Township, Winona County, circa 1973. (MHS photo)

Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

▪ DRAINAGE STRUCTURES

- Drainage improved tillable acreage, crop yields, and farm profits, but altered the natural environment by removing wetlands
- Most of Minnesota's public drainage ditches were built between 1860 and 1920
- Drainage activity peaked in the 1910s
- Subsurface drains were the most effective method of farmland drainage
- Subsurface drain tiles were made of various materials: clay (first used in the U.S. in 1835), concrete (1862), plastic (1940), corrugated plastic (1964)

Minnesota has some of the richest cropland in the country. But much of the land – especially in the southern and western parts of the state, the Red River Valley, and the cutover peat regions – was excessively wet and poorly drained. Inadequately drained soils were slow to dry out and warm up in the spring, delaying field work and planting and resulting in a shorter growing season. Even a one-week delay in seeding could mean significant yield losses – in some cases as much as 50 percent. One source claimed that up to one-fourth of a farm's acreage could be too wet to till (Roe 1923: 70). Another source estimated that 45 percent of Minnesota's soils were originally wet (Herrick and Raup 1957: 1).

Beginning shortly after settlement, Minnesota farmers began to systematically drain the state's wet soils, "potholes," and sloughs. Drainage accelerated during the period 1900-1920 when farmers sought to expand acreage but the state's best cropland was already in production. Drainage considerably altered the state's ecology, as well as increasing its cropland (Cunfer and Guse 2001; Amato 2001; Timmerman 2001). Soil drainage also played a role in controlling erosion. (See also "Erosion Control Structures," a separate individual farm elements section.)

By the 1960s, drainage improvements had been made on about one-third of the state's cropland, and about one-half of the land in the Minnesota and Red River valleys. Widespread drainage increased the size of fields, and they became more regular in shape. Drainage increased productivity and profits, but also affected wildlife and flood-control efforts (Nass 1989: 130; Baerwald 1989: 30). Much of the historic system of ditches, subsurface tiles, culverts, headwalls, and other structures remains today.

OVERVIEW OF DRAINAGE

Unwanted water was removed from the upper 3' to 4' of agricultural lands by cutting channels into which water could seep, and linking the channels by gravity or a pump to an exit outlet. In some areas like pastures, the drainage channels were left open. But on cropland, where open channels would interfere with fieldwork, lengths of pipe – called tile – were laid at the bottom of the channels and then the trenches were filled in. Water percolated by gravity through the soil and into the drainage system.

See also

Erosion Control Structures
Fields and Pastures
Industrialization and Prosperity, 1900-1920
Developing the Cutover, 1900-1940

The location of the drainage structures, their depth, slope, and distance apart depended on topography, soil type, rainfall, watertable height, watershed area, and land use. Because of the number of variables, drainage systems were usually designed by engineers. As a general rule, more and shallower drainage channels were needed on heavy soils than on light or sandy soils. Ideally, channels were fairly straight and had a uniform slope. Branch, or lateral, channels flowed into a main channel which led to an outlet – usually a public ditch or surface waterway.

Public outlet channels were government enterprises. Sometimes satisfactory drainage outlets were secured by improving natural channels – for example, widening, deepening, or straightening a creek bed. But more often, new open ditches or large tile lines were built. These formed the backbone of Minnesota's public drainage system (Russell and Lewis 1956; Sutton 1957; Wilson 2000).

STATE AND FEDERAL GOVERNMENT

Construction of public drainage outlets was enabled and promoted in the 1850s-1950s by federal and state laws. Minnesota's first drainage law was passed in 1859 during the first year of statehood, "to regulate and encourage the drainage of lands." The law let farm neighbors form corporations to build drainage ditches, and spelled out requirements for pro rata assessments of costs and settlement of disputes. Subsequent laws in the 1870s gave township and county authorities a voice in drainage decisions and ditch governance (Wilson 2000: 4).

In 1893 the Red River Board of Audit was set up to oversee drainage in the Red River Valley, and in 1897 a State Drainage Commission was established. The State Commission, which had the authority to drain any land in the state, reflected the public consensus that "the wetland areas that have impeded the progress of development . . . should be transformed to productive lands as rapidly as possible" (Timmerman 2001: 126).

By 1907 the state had a large body of agricultural drainage law that allowed public ditches to be built by townships, counties, district courts, or the State Drainage Commission. Construction of new public ditches was usually initiated by a petition of landowners to one of the drainage authorities. If the governing body approved the petition, engineering surveys, designs, and cost and benefit estimates were made, and public hearings were held on construction, financing, and tax assessments for the project. Public drainage systems were financed through assessments to benefitting property owners ("Reclaiming" 1905: 74-76; Herrick and Raup 1957: 14; Russell and Lewis 1956: 572-4; Dickman 1977: 24-5; Wilson 2000: 4).

State organization of drainage ended in 1947 with a major revision of state drainage law, and authority to establish public ditches was thereafter limited to counties and judicial district courts.

In the 1950s Minnesota agricultural policies began to shift from drainage promotion to conservation. Water began to be seen not as a nuisance or an enemy but as a valuable resource. Policymakers and drainage engineers began to think about the effects of farmland drainage on rivers, lakes, wildlife, recreation, and flooding. Watershed districts were organized to oversee regional water management and conservation programs (Herrick and Raup 1957; Wilson 2000: 4-7).

In the early 1960s the role of wetlands in flood control and in environmental and water quality protection gained new recognition. New state laws in the early 1970s limited drainage activities and established stricter environmental requirements for new systems. In the 1980s the federal government began to restrict the draining of wetlands (Cunfer and Guse 2001: 144). These changes culminated in the 1991 Minnesota Wetland Protection Act – "one of the most sweeping wetlands protection laws in the country" – which aimed at no net loss of existing wetlands (Herrick and Raup 1957; Wilson 2000: 4-7).

The federal government also played an important role in drainage. The Army Corps of Engineers constructed drains, levees, dams, and flood control structures on Minnesota's navigable rivers and their tributaries. The USDA provided extensive technical assistance. The Soil Conservation Service advised individual farmers on their private farm drainage and conservation plans. The Agricultural Conservation Program paid farmers in some areas to install drainage and other water-control structures. During the 1930s, federal refinancing programs bailed out many bankrupt drainage districts, and Works Progress Administration and Civilian Conservation Corps relief workers built new ditches and cleaned and reconstructed existing drainage systems (Sutton 1957: 408).

DRAINAGE ACTIVITY IN MINNESOTA

Most of Minnesota's public drainage ditches were built between 1860 and 1920 during the so-called Era of Reclamation. The peak of ditch construction in Minnesota was during the prosperous decade of the 1910s. Drainage and road-building projects were often combined, and the soil removed in dredging was used to build adjacent roads. Minnesota's pattern was consistent with the rest of the Midwest, where drainage peaked in the 1910s and early 1920s (Cunfer and Guse 2001: 144-145).

There were few public drainage projects in Minnesota from 1920 to 1945 during the years of agricultural depression, drought, and war. Drainage activities picked up again after World War II when the farm economy improved, and when Minnesota experienced a series of wet summers (Nass 1989: 131; Wilson 2000: 7). In 1960 Minnesota ranked second among states in acreage drained (Cunfer and Guse 2001: 145).

Most public drainage ditches in Minnesota were built by counties or judicial districts. After the county ditches were built, many individual farmers installed private systems that emptied into the public outlets. By 1950 Minnesota had more than 16,000 miles of public surface ditches and 10,000 miles of public subsurface tile, draining more than 11 million acres of farmland. This did not include the much greater length of private ditches and tile built by landowners (Russell and Lewis 1956: 574-575; Sutton 1957: 406-407).

TYPES OF STRUCTURES

Experts advised farmers to invest in a complete drainage plan designed by a drainage engineer, even if they were only able to install the system a little at a time. The Minnesota Agricultural Experiment Station advised farmers in 1950, "A properly designed system normally requires the services of a trained drainage engineer. Very few farmers or tilers are competent to design a drainage system (Manson and Rost 1950: 13). The type of plan depended in part on expected land use: some crops such as potatoes, for example, needed more complete drainage than others like pasture grasses (Roe and Neal 1938: 3-4).

Farmers often installed drainage systems themselves. The University of Minnesota helped by publishing detailed construction guides. Through the 1930s farm ditches less than 4' deep, and early tile lines, were often dug by hand. Larger ditches were usually dug by a farmer with a team, plow, and slip or wheel scrapers, and finished by hand. By 1905 the first tile trenching machines were used to install shallow tile, and backhoes or dragline excavators were used to install deep tile (Roe 1924: 6; Roe and Neal 1938; Sutton 1957: 412; Wilson 2000: 7-12).

Shallow Farm Drains. The cheapest and simplest drainage system was the short surface drain that followed a natural swale or depression, or traveled the shortest line between sloughs. Farmers often worked out these field drains by themselves, marking the natural water flow after a heavy rain and later excavating a shallow channel. This type of ditch, which only needed to be deep enough to keep the water moving, was V-shaped but shallow so it could be farmed across. If the channel floor was too wet for crops, the farmer could sow grass and mow it periodically.

These simple surface drains could move abundant water a short distance to the nearest slough or outlet. They were especially important in the early years of Minnesota agriculture, before county ditches and tile drains were built. Even after tile drainage became common, many farmers maintained surface channels as auxiliary ditches to help remove surface floods quickly, especially in the spring (Stewart 1908: 100-105; Boss 1918: 177; Roe and Neal 1938: 11-12).

Open Farm Ditches. Farmers used open farm (or field) ditches, which were deeper than simple surface drains, as outlet channels or to control surface floods and avoid overloading tile drains. Soil type and slope dictated the depth and width of open farm ditches and the steepness of the ditch walls. Fibrous peat or hardpan clay ditch walls, for instance, would stand nearly vertical for years. Ordinary loam soils required side slopes of 1.5:1 or flatter. Ditch walls in sandy soil needed a ratio of 2:1 or 3:1 (Roe 1924: 11; Roe and Neal 1938: 10-11).

By the 1930s farm experts were discouraging the use of open farm ditches except where unavoidable. "Usually, open ditches as a permanent type of improvement have little place on the modern farm. Frequently, however, depth, grade and outlet conditions make necessary some open ditching in connection with tile" (Roe and Neal 1938: 10-11).

Intercepting Farm Ditches. This type of ditch was built at the foot of a hill to cut off the flow of water from a highland and prevent flooding of cultivated lowland. Intercepting ditches were wide and shallow and followed the contour of the hill. All the excavated material was thrown to the lower side of the ditch, thereby increasing the ditch capacity. The bank and sides were smoothed and sown with grass (Roe and Neal 1938: 11).

County and Judicial Ditches. One of the roles of public outlet ditches was to gather water from private systems. Public ditches varied in depth, width, and slope according to the topography, volume of water carried, watershed size, and other factors. Some of the first ditches in Freeborn County, for example, were 32′ wide at the top and 11.5′ deep. Early ditches in southern Minnesota had a slope of about 1′ per mile. In the Crookston area, early ditches ranged from 2′ to 16′ deep, and 6′ to 20′ wide, with a slope of 1′ to 10′ per mile. Ditches with greater slope had to be cleaned out less often than ditches with a flatter slope ("Reclaiming" 1905: 77-79).

County ditches were generally V-shaped, with the spoil, or excavated dirt, thrown on one or both sides. W-shaped ditches were also built, with the spoil placed in the middle between two separate trenches. They were typically designed to handle about 1.5" to 3" of runoff per 24 hours. But after 10 or 15 years, most ditches became clogged with sediment, grasses, young trees, and other debris, typically losing about one-third of their drainage capacity. Ditches were then cleaned out and repaired, with costs assessed to the benefitting property owners (Sutton 1957: 410-411). In the 1950s agricultural engineers began designing more environmentally-sensitive surface drainage systems, taking into account flood control and natural resource conservation (Sutton 1957: 410-411).

Culverts. When an open ditch had to cross a road or embankment, water was channeled through a culvert. Culverts were made from a variety of materials, including wood, corrugated metal, and concrete. Many had headwalls of stone rubble, brick, or poured concrete (Robertson and Stewart 1908: 24-30).

Controlled Drainage Structures. In some areas, check dams and other structures were installed in open ditches to control erosion and regulate water level and flow. Drain tile gates, for example, were used to control the water levels in outlet ditches (Sutton 1957: 413).

Subsurface or Tile Drainage. Subsurface drainage, also called tile drainage or under drainage, consisted of lengths of clay, concrete, or perforated plastic pipe buried at intervals in farm fields. Water percolated through the soil and into the tile, and then flowed by gravity through the underground network of lines and mains into a surface ditch or waterway. Tile drains were more expensive than open surface drains, but they were the most effective way to dispose of surplus and conserve productive cropland. Properly constructed tile drains were generally very durable, needed little or no attention after installation, and were considered a permanent improvement. Tiles were made by a number of local firms in cities like Hutchinson, Glencoe, Fertile, Lengby, and Mason City, Iowa (Stewart 1908: 100-101; Sutton 1957; Wilson 2000: 15; Robertson and Stewart 1908: 34).

Early subsurface drain tile was usually made of unglazed clay pipes laid end to end. Clay drain tiles came in many sizes and were round or horseshoe-shaped. First used in America in 1835, clay drain tiles were resistant to corrosion in both acid and alkaline conditions, although they were susceptible to damage from freezing and thawing. Clay tile lines were quite durable – often lasting 50 years – if installed with care and covered with at least 2′ of soil (Robb 1935; Structural Clay 1941: 11; Wilson 2000: 15).

In 1862 the first concrete drain pipe came into use. By 1919 concrete tiles were being used in many public drainage projects in Minnesota, especially in southern and southwestern counties. Many of these concrete tile drains failed in the alkali conditions of southern Minnesota. This prompted two decades of research by the University of Minnesota on improving the durability of concrete tile. Concrete tile was not recommended for high-acid peat soils or for strong alkali conditions (Roe and Neal 1938: 10; Wilson 2000: 15-18).

Bituminized fiber pipe was also used for drainage in some places. Corrugated metal pipe was used for special conditions such as quicksand or road crossings, and for drain outlets. Plastic tubes were first used in 1949. Corrugated plastic pipe, now the most widely used subsurface drainage material, was first used in 1964 (Sutton 1957: 412; Wilson 2000).

The size of tile drains depended mainly on soil, topography, and the attainable slope. Larger tile, perhaps 8″, was usually required when the grade was too flat, in an area with poor surface drainage, or when surface inlets were used. Because small tiles were hard to lay accurately and clogged easily, sizes under 5″ were not recommended. Tile larger than 24″ was not usually economical for farms. Main lines were usually larger than lateral or branch lines (Stewart 1908: 102-103; Roe 1924: 1; Roe and Neal 1938: 5-10; Russell and Lewis 1956: 573).

When the drain tiles exited into an open ditch, the end of the tile had to be supported and protected from breakage, frost, blockage, and washout. One early method was to build a wooden box around the tile end. Tile ends were often reinforced with iron culverts, iron rings, or cement tile. When needed, more elaborate headwalls were made of brick, stone, or concrete. The end of the tile was usually screened with poultry netting, iron grates, or removable metal or wood screens (Stewart 1908; Roe 1924; Roe and Neal 1938; Robertson and Stewart 1908; Russell and Lewis 1956).

Pumped Outlets. In some locations, such as swamps, or river and lake bottoms, topography did not allow for a gravity drainage outlet. In these areas, mechanical pumps were used if the farm had electricity. A "lift station" pumped the drainage water from a sump (which stored water from the tile line) into the receiving ditch or waterway. The electric pump was generally housed in a pump house or protective shelter (Sutton 1957: 412-413; Wilson 2000: 14-16; Sands n.d.).

Mole Drains. In stiff, heavy soils free from stones, mole drains were sometimes installed. Cheaper than tile drains, they were constructed using a special steel-bladed mole plow, which cut a 2″ or 3″ tunnel, or mole, about 2′ below the surface, for water to drain into. Mole drains had to be much closer together than tile drains – usually about 10′ or 12′ apart – and were typically not more than 200 yards long. In stiff soils, mole drains could last a decade or more (Russell and Lewis 1956: 573).

Vertical Surface Drains. Vertical surface drains, sometimes made of a vertical length of tile, improved drainage in glacial pockets and other low, wet areas. These structures were placed in the lowest point of a depression and dropped surface water down into a tile drain or into a layer of gravel that had a natural outlet. The opening was capped with an iron grate that remained visible at the surface.

Another type of surface inlet sent water down funnel-shaped layers of sand, gravel, and tile bats to the subsurface drain. The inverted funnel shape was about 2′ wide at the surface and about 6′ wide where it met the buried tile line. This inlet didn't interfere with plowing in fields (Wilson 2000: 23).

Vertical Catch Basins. Vertical catch basins improved drainage around farm buildings and stockyards where the ground was usually packed down, making it hard for surface water to filter down to tile drains. Catch basins could be made with broken clay tiles, corrugated culvert pipe, sewer pipe, iron grates, and even wooden boxes (Robertson and Stewart 1908: 76-81; Roe and Neal 1938: 7-8).

PREVALENCE

Drainage structures – including open ditches, subsurface tile lines, and outlet structures – were built throughout Minnesota by both individual landowners and public entities. It is expected that many are extant, with intact pre-1920 examples being less common.

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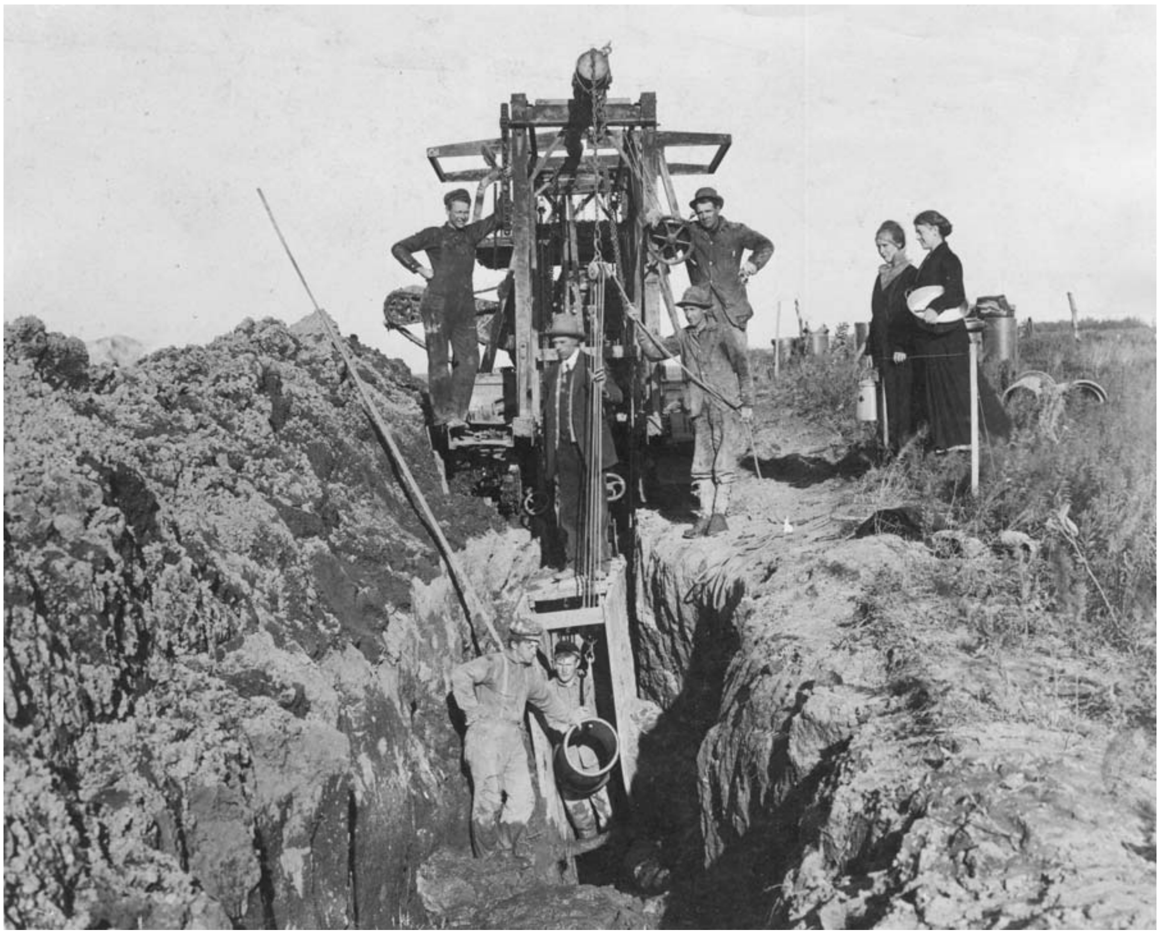

Laying subsurface drain tile with a machine. Shallow tiles and ditches were generally dug by hand. About four miles west of Dawson, Lac qui Parle County, circa 1905. (MHS photo)

This drain tile required structural support at its outlet to the ditch. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

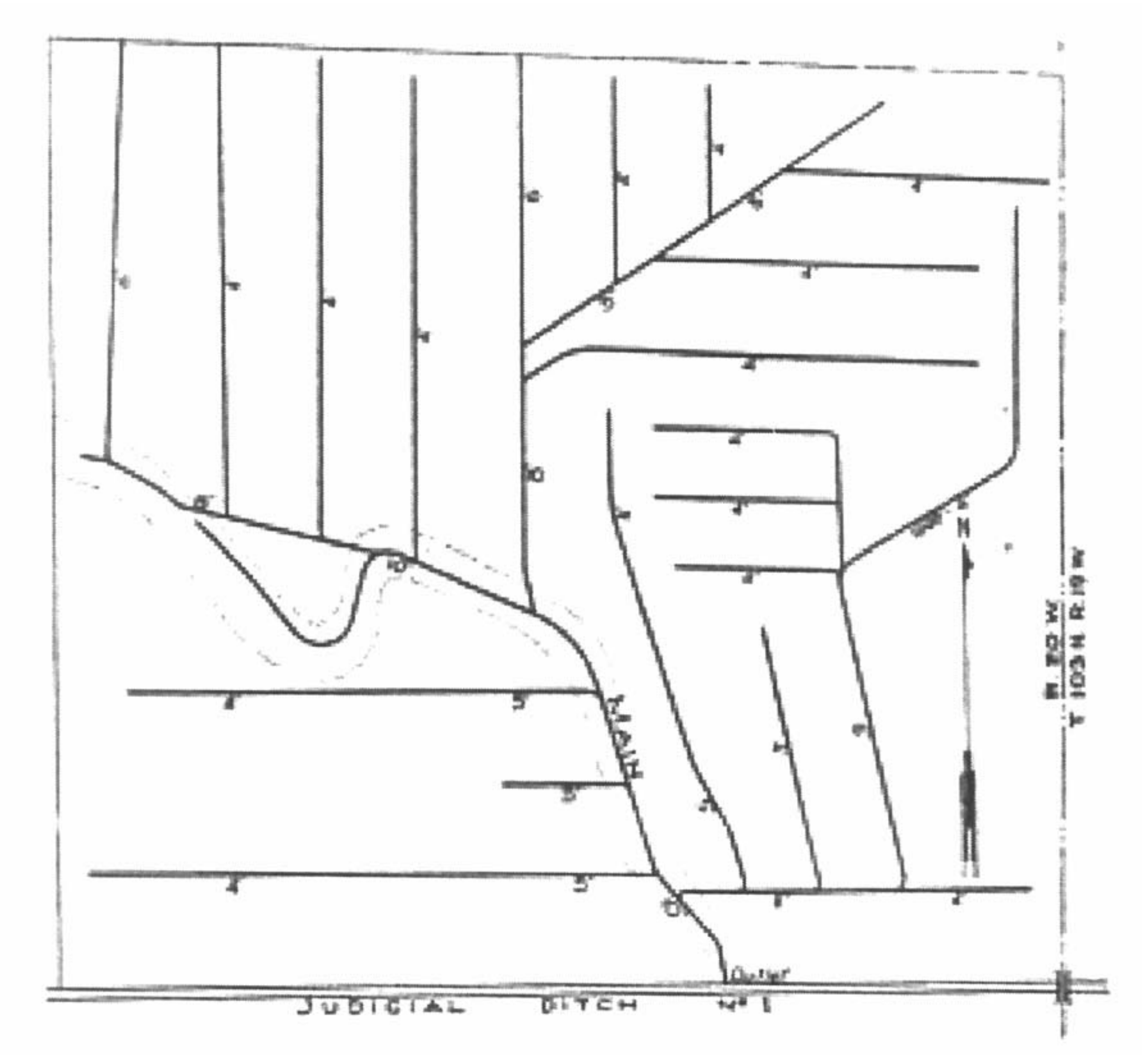

Diagram of a subsurface drainage system in Freeborn County. Tile drains were spaced closer together in heavy soils and farther apart in light soils. From a 1927 bulletin used by Bruce N. Wilson in his *History of Drainage Research at the University of Minnesota* (2000).

▪ EROSION CONTROL STRUCTURES

- Erosion control structures were often used in combination
- Elaborate stone or concrete water-control structures were built in areas with the steepest terrain
- Many structures date from New Deal conservation efforts

The roots of natural prairie grasses ran deep, holding the moisture and the soil. When farmers tilled the land, the soil was exposed to the erosive forces of water and wind.

Erosion from water was most serious in Minnesota's "driftless" area – the six southeastern counties where the terrain was steepest. In 1937 Roe and Neal cautioned that one-quarter-inch of soil could be washed away by water in a single year and, if unchecked, could result in the loss of nearly all original top soil over 40 years (Roe and Neal 1937: 2; Helms et al 1996: 378).

Early research on erosion control began nationwide soon after 1900. A leader in the field was Hugh H. Bennett of the United States Department of Agriculture (USDA). By the 1910s county agricultural agents were advising farmers to terrace vulnerable fields. The effort began in Southern states and spread next to the Midwest (Nichols and Smith 1957: 422).

While soil conservationists had been warning of the effects of erosion for years, it was not until the 1930s that a broad conservation effort began. The movement was a response to a combination of factors including recognition of widespread damage from years of poor farming practices, several years of drought and wind storms, and the availability of federal funds and federal relief labor. Bennett became director of a new federal Soil Erosion Service (SES) in 1933. In 1935 it became the Soil Conservation Service (SCS) within the USDA.

The SES and SCS collaborated with work programs like the Civilian Conservation Corps (CCC) and with state agencies and nonprofit groups to educate farmers and the public, secure funds, establish demonstration areas, and construct erosion control projects. In areas like southeastern Minnesota, professional engineers and federal relief workers built hundreds of erosion control structures on private and public land. The SCS also introduced strip-cropping and terracing to southeastern Minnesota in the 1930s (Helms et al 1996: 392).

In 1934-1935, Soil Conservation Associations were formed in Minnesota around 11 CCC camps and conservation projects. These led to a system of Soil and Water Conservation Districts (SWCDs), authorized by the Minnesota Legislature in 1937 following a federal enabling law. The state's first district, near Winona, was organized in 1938. (The most recent district, in Ramsey County, was organized in 1973. Minnesota now has 91 districts.) The SWCDs helped implement conservation efforts statewide and, at the local level, provided advocacy, technical expertise, plant materials, and equipment.

See also
Shelterbelts
Fields and Pastures
Drainage Structures
Depression & Interwar Period, 1920-1940

BASIC EROSION CONTROL METHODS

The most common methods to prevent and reduce wind and water erosion required no special structures. These practices included avoiding steep land when cultivating, planting a cover crop, planting a catch crop, deep tilling, improving soil tilth, strip cropping (i.e., alternating deeply-cultivated crops like corn with grains or grasses), and leaving field stubble or intermittent stubble rows. Running crop rows diagonally on slopes was not recommended. Methods to improve soil tilth included adding manure, crop rotation, turning under a green manure crop, and letting a field lie fallow for a year.

Research on so-called conservation tillage – a prominent modern erosion control practice – was well underway by 1957 (Nichols and Smith 1957: 425). Conservation tillage was made possible in part by the size and strength of modern machinery. Methods include "no-till," ridge tilling, strip tilling, and mulch tilling. In recent decades, farmers have also been encouraged to retire steep land from production, just as they were in the 1930s.

WIND EROSION

Fields were vulnerable to wind erosion when the soil was left open, especially during winters when snow cover was light or intermittent. In fact wind erosion was most serious when strong winds blew across tilled fields in the fall and early spring. Wind erosion both carried away the topsoil and stripped moisture from the fields. The topography and soil texture helped determine the extent of the damage.

Wind erosion was controlled through the basic field methods described above, as well as by planting shelterbelts. (See also an individual farm elements section called "Shelterbelts.")

WATER SHEET EROSION

Sheet erosion occurred when a thin layer of topsoil was removed by water running over an area of land. Sheet erosion could damage an entire field, and sometimes created gullies, a more serious form of erosion. Sheet erosion was encouraged by shallow tilling and failure to maintain a high organic content in the soil (Roe and Neal 1937: 5). Sheet erosion was mitigated through the field methods described above, as well as building terraces with water outlets.

WATER GULLIES

Gullies, which were often caused by unchecked sheet erosion, occurred when water cut a path into the land. Removing vegetation from slopes, cultivating steep slopes, over-grazing, and losing the organic content of the soil all promoted gullying (Roe and Neal 1937: 5). Arresting the gullying before it became deep was important. Shallow gullying could be alleviated by building diversion ditches to redirect the water; sodding waterways to hold down the soil; building low barriers of sod, wire, and straw to slow the water; and repairing gullied land.

Deeper or more acute gullies called for more drastic measures. According to Roe and Neal, the first step was to stop the head erosion, or advancement of the gully. They wrote in 1937, "It is usually necessary to construct [at the top of the gully] a plank or galvanized iron flume, a corrugated iron culvert, or a concrete or masonry dam provided with a vertical drop and some sort of apron with side or wing walls" (Roe and Neal 1937: 9). Once this had been accomplished, check dams and soil-saving dams were often constructed.

When the tractor-loader became a standard piece of farm equipment after World War II, many farmers were able to fill troublesome gullies and other small areas of erosion-prone terrain.

EXAMPLES OF EROSION CONTROL STRUCTURES

While the basic cropping and tillage methods described above could be implemented by all farmers, it was advised that farmers seek engineering expertise to design and build most of the structures listed below. Once built, all erosion control structures had to be inspected annually and maintained.

Barriers of Sod, Wire, or Straw. Low barriers of sod, wire, straw, and other materials were built within shallow gullies and in other areas to slow the flow of water. Trees such as willows could also be planted within gullies if soil moisture was sufficient (Roe and Neal 1937: 9).

Check Dams. Check dams were simple dam structures used to slow the flow of water in and near gullies. They were often made of loose rock, woven wire such as poultry netting, posts, creosote-treated timbers, brush, or – if warranted by the volume or speed of the water – mortared stone or concrete. Dams of concrete had a different design than those of stone because the concrete weighed less and was susceptible to slipping if not properly designed. Several check dams were often built along the length of a gully (Roe and Neal 1937: 10).

Culverts. Culverts were used to contain and direct the flow of water. They also carried water under roads, railroad trackbeds, and other structures. They were often built with corrugated iron pipes and stone rubble or concrete headwalls. Culverts generally had wing walls to help direct the water into the culvert if the flow was significant. Poured concrete box culverts were also common.

Diversion Ditches. Diversion ditches directed the flow of water and were constructed, for example, at the head of a gully to prevent gully erosion. Farmers could often drive over shallow ditches. Some ditches were lined with stone riprap in uncultivated areas. Fast-moving water generally required a flume, rather than a diversion ditch.

Drop Structures. Drop structures, like check dams, were used to stabilize steep waterways where damage from rushing water might be severe if left unchecked. Drop structures were often designed to create a straight vertical drop of 6′ to 8′ that would dissipate the energy of the flowing water. Drop structures were often built of poured concrete or mortared stone. Stone dams built near the heads of gullies with circular arc spillways were drop structures "used effectively by the ECW [a Civilian Conservation Corps precursor] engineering staff in southeastern Minnesota" (Roe and Neal 1935: 21).

Flumes. Flumes or chutes were channels designed to carry swiftly flowing water to help prevent gully erosion. They were usually built of timber, galvanized iron, concrete, or mortared stone. Some were very long and elaborate in design and were built in combination with other erosion control structures like culverts and drop structures.

Grass Waterways. Grass or sod waterways or swales, like diversion ditches, helped combat shallow gully erosion by directing the flow of water. Some grass waterways were created by filling gullies to the point that machinery could be driven over them. The waterways were generally lined with a buffer strip of untilled land or similar device to prevent soil from washing into the waterway and clogging it.

Riprap. Riprap consisted of stones or broken rocks placed along gullies, ditches, stream banks, and other waterways to stabilize the soil and prevent it from washing away. Riprap was also used on the slopes of earthen dams and other erosion control structures. Historically, stones of uniform size were hand-placed. Later, riprapping consisted of stones dumped with a tractor-loader and then evened out. This method required more rock, but less labor. Riprap was most often found where natural deposits of rock were readily available and therefore inexpensive.

Soil-saving Dams. Soil-saving dams, also known as sediment storage dams, were structures made of earth, stone, concrete, or other materials. They slowed the flow of water and allowed soil sediment to settle out rather than being washed away. A soil-saving dam might be built at the mouth or foot of a gully to keep the soil within it.

Terraces. Terraces or bench terraces were bench-like flattened areas that slowed the flow of water down the slope so the displaced soil could be redeposited. Terraces were generally used to combat sheet erosion. Roe and Neal wrote in 1935 that terraces were the most effective method of controlling water erosion in cultivated fields and that, if combined with contour plowing and strip cropping, the soil loss could be negligible and yields improved (Roe and Neal 1935: 3-4).

Terraces could be built with common field equipment. It was advised that they be built from the top of the hill down so that, if it should rain before the field was completely terraced, the finished terraces would offer some protection for the soil farther down the slope.

There were several types of terraces, and terraces for cropland and non-cultivated land could differ. The Mangum terrace, built with broad ridges of earth, was considered most effective for Minnesota in 1935.

Experts advised that cropland terraces should have grades no steeper than 1:250. The terrace interval was determined by the grade of the slope (with closer intervals on steeper grades) and by the speed at which local soils could absorb the water. Most terraces had water outlets that could be shallow sodded ditches, or steeper structures with check dams.

After World War II, terraces became broader as the size of farm equipment increased. One of the disadvantages of terraces – the fact that they could leave awkwardly-shaped areas or row patterns that were difficult to work – became even more troublesome as machines got larger. Engineers developed new configurations such as parallel terraces and push-up terraces to help mitigate this difficulty (Larson and Machmeier 1962; Larson and Swan 1965).

A 1965 University of Minnesota publication indicated that there were about 50,000 acres of crop land in Minnesota protected with terraces at that time. About 1.3 million acres were being protected with contour plowing and strip cropping (Larson and Swan 1965: 15).

PREVALENCE

Basic methods to control water and wind erosion were implemented throughout Minnesota by the 1930s. Engineered structures such as terraces and check dams were most often used on steep land, while less dramatic practices were used where erosion was not as severe. Many early 20th century field terraces have been altered to accommodate larger equipment and/or have been damaged by years of farming and erosion. Erosion control structures built of lightweight materials such as brush and wire are less likely to have survived than those of mortared stone and poured concrete. Extant examples of elaborate or well-developed systems of erosion control structures will likely be rare. Structures built by New Deal conservation efforts should also be evaluated under statewide federal relief historic contexts.

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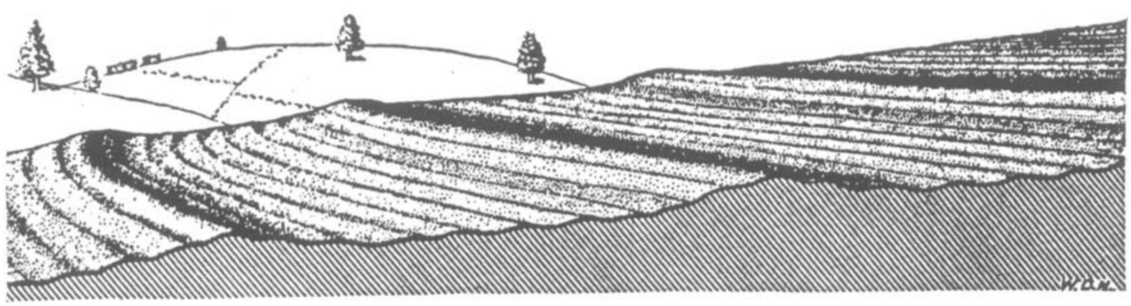
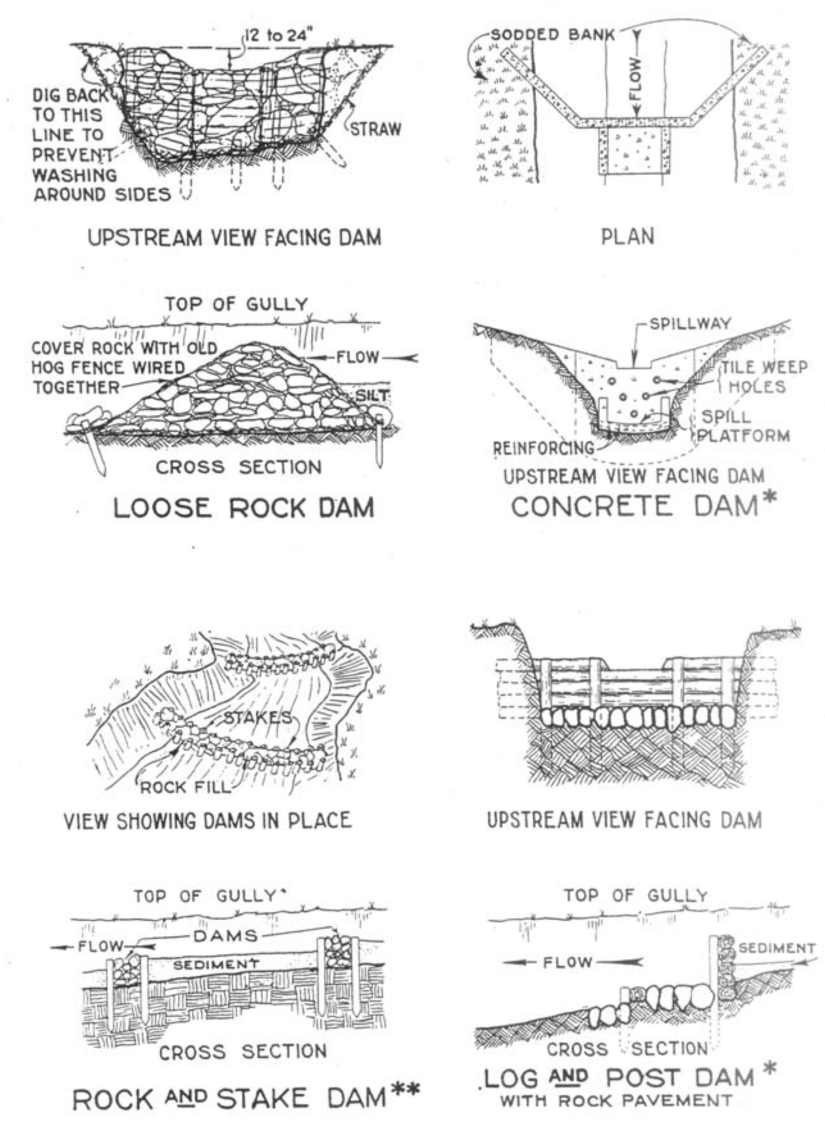


Mangum terraces, recommended for Minnesota, were made by excavating ridges of soil at intervals down the slope. This 1935 publication recommended that terraces have slopes of 1:250 or less. From Roe and Neal's "Soil Erosion Control by Engineering Methods" (1935).



A Minnesota Extension Service bulletin from 1937 illustrated effective check dams suitable for Minnesota farms. Check dams were placed along gullies to slow the flow of water. They were usually built of loose rock, woven wire, posts, creosote-treated timbers, brush, mortared stone, or concrete (Roe and Neal 1937).

■ FARM SHOPS

- Important for repairing equipment, storing tools, and maintaining the farmstead
- A well-equipped shop could save operating expenses
- The size of the shop depended on the size of farm implements

Most farmers were constantly repairing, maintaining, and upgrading the equipment needed to operate the farm. In addition to implements for fieldwork, farmers had chore motors, cream separators, milking machines, and cars and trucks to repair. All farms had systems for water, sewage, heating, and power that had to be maintained, and many farmers built or expanded their own houses, barns, and other outbuildings. Many were excellent mechanics and most were well-versed in carpentry, plumbing, electrical work, concrete work, small-engine repair, auto mechanics, and blacksmithing (and its successor, welding).

Barn historian Eric Sloane describes a "forge barn" as a small building or work shop with a forge, which was sometimes found on farms east of the Midwest (Sloane 1967: 83). In the late 19th century, the *Minnesota Farmers' Institutes Annual* was pointing out the advantages of having a dedicated farm shop in which to store tools and provide space for the construction, maintenance, and repair of farm equipment (Gregg 1898: 370).

In the mid-20th century, experts were still explaining that, in addition to providing essential work space, a shop could "prevent costly loss of time . . . reduce annual depreciation . . . [provide] emergency storage of farm products . . . [and serve as an] emergency animal shelter." They felt a shop would "more than pay its own way if properly managed" (Neubauer and Walker 1961: 246).

One of the farm's most important seasonal chores, maintaining machinery, occurred in the farm shop. This was no small job, as a 1937 Minnesota Extension Service Bulletin entitled "The Farm Shop" explained:

> A complete overhauling [of a piece of machinery] includes the cleaning of all parts; the application of heavy oil or grease to the bright parts so that they will not rust; the changing of oil and grease in all bearings; the tightening of nuts; straightening of bent rods; the replacing of broken or worn parts; the sharpening of sickles, discs, cultivator shovels, colters, and plow shares; and the repainting of both wooden and metal parts (Christopherson et al 1937: 3).

DESIGN CONSIDERATIONS

In 1940, *Successful Farming* magazine listed four goals for a complete farm shop: to "provide convenient storage for all shop tools and supplies . . . to provide a well-lighted, comfortable place to work . . . to provide sufficient space so almost any machine can be taken in for repairs or servicing . . . [and to accommodate] the need for power equipment" (Fox 1940: 60).

See also

Implement or Machine Sheds
Garages
Combination Buildings
Appendix: Focus on Mechan Techno

Labor efficiency, drainage concerns, the location of windbreaks, possible drifting snow, and planning for future additions needed to be considered when siting a shop building. Because shops typically housed a combustible mix of oil, wood shavings, heating stoves, and flames from the forge, the risk of fire was real and the possibility of flames spreading to other buildings was also a concern (Christopherson et al 1937: 5).

While a farm shop was often an independent building, it was equally common to combine the shop with the implement shed and/or the garage. A shared structure saved construction costs and reduced travel time between buildings. (See also "Implement or Machine Sheds" and "Garages", two individual farm elements sections.)

If the shop was combined with the garage, the building was usually located near the back door of the house. It was recommended that there be a fireproof wall between the shop and the garage.

If the shop was combined with the implement shed – also a typical combination – the building was sited with easy access to the fields. Some farmers placed the shop at one end of the implement shed – often the end nearest the house – while others placed the shop in the center of the building for easy access to machines at both ends.

Farm shops varied in size. A building measuring 12′ x 16′ or 12′ x 20′ was considered the smallest adequate size to provide both tool storage and work space. In a combination building, the shop's share of the space could be modest (e.g., 12′ x 18′ or 12′ x 24′) or quite large. And as farm equipment grew in size, so did the shop.

The farm shop was most often made of wood but fireproof materials such as brick, clay tile, concrete block, and metal were also employed.

Farmers were often advised to use poured concrete for shop floors and approach ramps. One 1920 manual disagreed with this advice, arguing that tools dropped on the floor would be dulled by the concrete and that wood or dirt made a better floor (Moore et al 1920: 594). One source wrote that if concrete was not affordable, "black-top, soil-cement, pumice, gravel, sand, and clay" could suffice (Neubauer and Walker 1961: 246).

Roofs were usually gabled, hipped, or shed, and covered with standard roofing materials. Beginning in the 1940s trussed rafters were used to maximize floor space without interior posts (Neubauer and Walker 1961: 246; Christopherson et al 1937: 8; Iowa State 1969: 425).

Doors could be hinged, sliding, or roll-up style, with the size of the opening determined by the size of the implements. In the 1930s, for example, double doors 8′ high and 8′ wide could be sufficient, but eventually openings 16′ wide and 9′ to 12′ high were necessary. A service or pedestrian door was usually located on the side of the building closest to the house (Christopherson et al 1937: 8; Iowa State 1969: 425).

It was important that a farm shop have several windows to provide light and cross ventilation. Windows were especially important before electric lights and ventilating fans were affordable.

Shops were frequently insulated and heated because farmers usually had more time for repairs and improvements during the winter. Shops were sometimes insulated with tar paper and materials found on the farm such as straw or sawdust. Shops were heated with wood stoves and later coal, gas, oil, and electric heaters. Many also had forges, and it was recommended that the chimney have a double flue to separately serve the forge and heater. An exhaust fan to remove smoke and gases was also recommended (Christopherson et al 1937: 7-8; Neubauer and Walker 1961: 249; Iowa State 1969: 425).

With the introduction of electricity, shops often needed to be rearranged to make the best use of electric power and tools. As electric "chore" motors came into use, additional wiring and well-placed switches and outlets were needed. One of the biggest concerns of agricultural engineers was designing structures that allowed safe use of electric power tools, especially by farmers working alone (White 1936: 19).

Because of their simple design, shops, like implement sheds, were good candidates for the new types of construction that emerged in the 1940s. Pre-built trusses, pole frames, and prefabricated panels were all useful options. For example, Stran-Steel's easy-assemble Quonset-brand buildings were popular for use as farm shops and combined shop-implement sheds (Stran-Steel 1948; Stran-Steel 1957; Flintkote 1946).

Common shop equipment included a forge and anvil, drill press, bench grinder, vise, and a full array of hand tools for carpentry and motor repair. One 1920 farming manual noted, "[the] better equipment a farmer has on his own farm the less he has to pay to the machinist, blacksmith, and carpenter. It pays for the farmer to turn machinist during the winter months" (Moore et al 1920: 594). Most shops had workbenches along the walls. Tool cases, bins, lockers or cabinets, and sufficient shelves for supplies were common (White 1921: 147; Wooley 1946: 263). By the 1950s, some farms were expanding their shop into "a management center" with an office complete with desk, manuals, catalogs, reference books, ledgers, and a telephone (Iowa State 1969: 425).

PREVALENCE

Provision for the repair of equipment and the storage of tools was found on virtually all Minnesota farms. It is not known how many farms had a separate, dedicated farm shop, but they were not uncommon. It is likely that well-preserved examples are still standing, especially those built after the 1920s when tractors and tractor-drawn implements became widespread.

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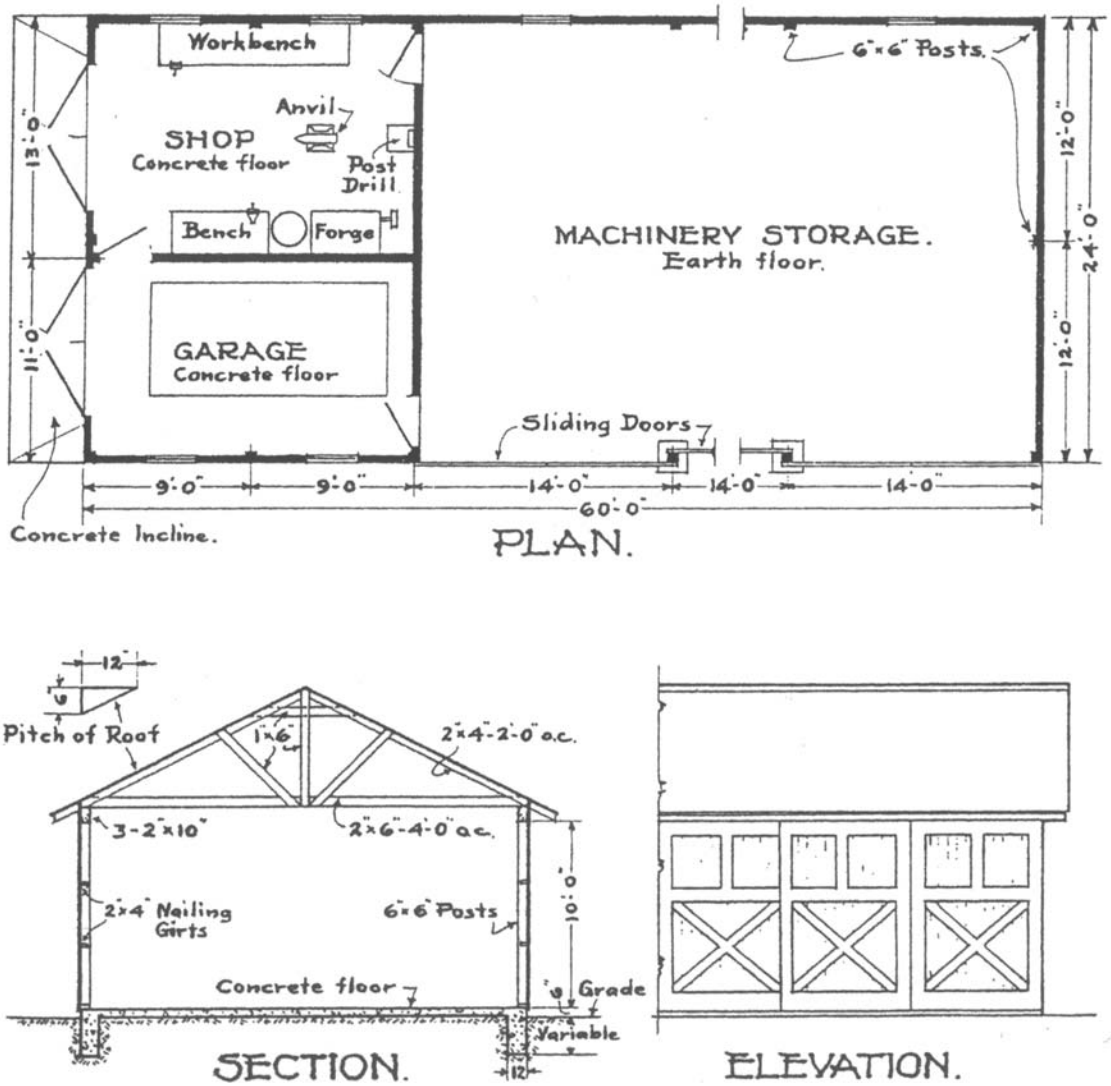

Combining a farm shop, implement shed, and garage into a single structure saved capital costs and could be very efficient since repairing and maintaining farm machinery was a constant task. Most farmers were also blacksmiths, draftsmen, carpenters, concrete-layers, electricians, plumbers, auto mechanics, and small-engine repairmen, and much of this work was supported by the shop. From “The Farm Shop,” a 1937 Minnesota Extension Service bulletin.

▪ FARMHOUSES

- Farmhouses were often by necessity modest buildings that were expanded as needed
- Farmhouses were vital work centers for the farm, but competed with barns, livestock, and machinery for farm resources
- In the early 20th century there was new interest in improving the comfort and functionality of farmhouses
- After 1900 some farmhouses were built with design details that distinguished them from many urban houses of the same period
- Farmhouses in both Minnesota and nationwide were substandard compared to their urban counterparts in 1940

Farmhouses in Minnesota and the Midwest have been the subject of considerable study. That information is not summarized here. The reader is referred to sources such as Jarchow (1949), Folwell (1956/rpt. 1921), and Hudson (1975) on settlement-era farmhouses, and Marilyn Brinkman and Bill Morgan (1982) on settlement-era farmhouses still standing in central Minnesota in the early 1980s. Studies of balloon frame farmhouses include those by Fred Peterson (1992; see also others by Peterson). The many studies of ethnic influences in farmhouse design include those on Germans (e.g., Peterson 1998, Martens 1988, Martens 1990, essays collected in Glasrud 1981, and Tishler 1986), Germans from Russia (e.g., Goertz 1976, Sluss 1983, and Koop and Ludwig 1984), Finns (e.g., Koop 1988 and Gudmundson with Winckler 1991), Norwegians (e.g., Peterson 1989 and others by Peterson), and Swedes (e.g., Ostergren 1979 and A:son-Palmquist 1983). A nationwide look at farmhouses in the 19th century is Sally McMurry's *Families and Farmhouses in 19th Century America* (1988).

In most ways Minnesota farmhouses were similar to the houses found in any city or small town in the state. But in some significant ways, both conceptual and physical, farmhouses were unique. Those unique characteristics are the focus of the discussion below.

ALLOCATION OF RESOURCES

Despite the fact that the farmhouse was usually one of the two most important buildings on a farm (the other being the principal barn), many Minnesota farmhouses were modest structures, especially before 1945. Farmhouses often received a different allocation of total family resources than did comparable houses in the city. At the same time that the farm family needed a house, they also needed to make constant investments in land, seed, equipment, livestock, fencing, and numerous other farm structures.

According to Fred Peterson, a student of Minnesota farmhouses, "Many pioneer families (and their heirs even today) never built the substantial houses they could well afford, either because of moral misgivings or because they preferred to plow their profits into land, animals, and machinery."

See also

Cisterns
Cesspools and Septic Tanks
Acetylene or Carbide Gas Structures
Summer Kitchens
Saunas
Hired Workers' Housing

Peterson also wrote, "The simple adage, 'The house doesn't pay for the barn,' communicates a belief that frames architectural ambition in the proper context of the farm as a working enterprise where one ought to accomplish 'first things first'" (Peterson "The Intuitive" 1983: 30; Peterson 1992: 80).

Agricultural engineers Neubauer and Walker wrote in 1961, "Very often an ambitious and hard-working farmer will spend most of his time and money on his crops, livestock, and service buildings, to the neglect of his residential comforts, but ultimately, when success is developing or assured, he will invest in a high-grade home on the farm, one which will last for several generations (Neubauer and Walker 1961: 97).

Frugality and necessity led many farmers to construct their houses in increments, building only what was needed at the time. As a result, many farmhouses grew piece-meal from frontier log cabin or frame and tar paper cores to larger houses with two or sometimes three additions. In 1914 a University of Minnesota author described one such situation: "For many years a dark, miserable, two-room shack, size 10' x 16', lighted by but two windows, was their home. The only attention it ever received was the addition of a couple of more rooms, and that addition was in harmony with the ideas of the pioneer homebuilders. However, if at any time more shelter was needed for the livestock or improved machinery in the farm operations, it was purchased, even though on borrowed money" (Wilson 1914: 35).

When farm families did elect to build a new house, the old house was often put to good use as a summer kitchen, workers' housing, barn, shed, or granary. By 1960, if the remnants of an early dugout or log cabin happen to survive, some farms contained evidence of three generations of housing standing on a single property, often built by a single extended family.

ISOLATED LOCATION AND LACK OF CONVENIENCES

Many of the state's first farmhouses were built of indigenous materials found on the farm, in part because they were constructed far from railroads and lumberyards – and sometimes predated them. This physical isolation also prevented farmhouses from getting electricity until the 1930s, 1940s, or 1950s, decades after urban houses received it. Because of their isolation, farms had to supply their own water and sanitary sewer systems, and farmhouses were far less likely than city houses to get indoor running water and bathrooms before 1950. Farmers also typically had cash incomes that were lower than urban residents, making manufactured goods harder to buy. Many farmers created their own, and often ingenious, utility systems with windmills, hydraulic rams, elevated water towers, acetylene plants, and basement generators.

In 1957, Wallace Ashby, a USDA agricultural engineer, described farmhouses of the early 20th century:

> The typical farmhouse was adequate in size, but poorly planned and lacking in facilities we now consider important. Many had 'grown' by addition of rooms without proper planning, so that a person had to pass through one bedroom to get to another. There were few clothes closets and those were small. Most houses were heated by stoves or fireplaces and in cold winter weather the entire family might move into two or three rooms. Very few houses had piped water supplies or plumbing. Since cooking was on a coal or wood range, the kitchen was the best-heated room in the house, and the most used by the

> family. However, it was not a satisfactory work center because of traffic paths and lack of sink, running water, refrigerator, or built-in cupboards. The man of the house coming in to meals was likely to hang his rather smelly coat by the kitchen door, dip water from the water bucket or the reservoir at the side of the range, and wash at the kitchen table, or on the back porch (Ashby 1957: 427).

Ashby also described his parents' farmhouse in Iowa, built around 1900, which was considered quite modern at the time:

> It was 30 ft. square, two story with 8 rooms and bath, full basement with attached storm cave for tornado protection and vegetable storage, and an attic and front and back porches. The walls were sheathed and weatherboarded and plastered inside. The attic was floored, but there was no insulation. Heating was by piped warm air furnace, cooking on a coal range. There was an ice refrigerator on the back porch, supplied with ice hauled from the river three miles away and stored under sawdust in our own icehouse. Water supply was from a storage tank in the attic, filled by hand pumping. Plumbing fixtures included sink, with piped cold water in the kitchen, tub and toilet in the bathroom. House sewage drained into a cesspool. To save pumping water, an outdoor privy was generally used in good weather. Kerosene lamps furnished light at night; later in the principal rooms we had mantle lamps burning gasoline stored in an outside tank and supplied through a hollow wire (Ashby 1957: 427).

A 1951 survey of farm women in the Upper Midwest found that only about 45 percent of farmhouses had basements, while about 95 percent of farm women expressed a desire for a basement – basements having nearly the same desirability as central heating (Schroeder and Otis 1951: 8).

THE FARMHOUSE WORK CENTER

In 1920 A. D. Wilson wrote in the *Minnesota Farmers' Institutes Annual*:

> A farm is not only an industry operated for the purpose of making profit but it is also a place where people have their homes and must live. No one in this country has developed a successful system of operating a farm except through having people live immediately on the farm, and since this is so, the development of the farm is not alone a matter of making the farm a profitable industry but it must include considerations for making the farm home a desirable place in which to live (Wilson 1920).

As Wilson suggested, a farmhouse's primary function was domestic. However, one of the significant differences between a farmhouse and its urban counterpart was the role each played in economic-family life, especially before 1960 (Neth 1995: 17).

Most farmhouses functioned not only as domestic refuges, but as work centers where essential and labor-intensive chores were performed every day. Preparing and preserving food, feeding family and work crews, washing cream separators, drying seed corn, hatching chicks, and feeding bottle lambs were just a few of the numerous farm tasks that took place in the house. In 1914 William Etherton of the USDA explained that not only are all members of the family "farmers and workers," but "the house is a part of their industrial equipment. It is the workshop for the women from dawn until dusk and the kitchen is the center of their activities. . . . The relative importance of living and service rooms is, therefore, reversed in city and country [homes]" (Etherton 1914: 123).

In 1939 Minnesota farmer William Benitt wrote, "The farm home and the farm buildings are a unit. The farm factory comes up to the kitchen door. Yes, we can even say it spills over into the kitchen, and a times envelops the entire home, merging the home and factory into one, and both become just a factory" (Benitt 1939: 303).

In 1941 farm experts Carter and Foster called the farmhouse "the business center of the farm." In 1947 the University of Minnesota's Vernon Davis explained that, on average, farmhouses needed to house several more people than city houses including extended families and hired help. And in 1951 the University of Minnesota's Andrew Boss and George Pond wrote, "In no other industry is the home so much a part of the business as in farming" (Carter and Foster 1941: 301; Davies 1947: 6; Boss and Pond 1951: 275).

The farmhouse's role in the industrial enterprise even held true for wealthier farmers. In 1914 the USDA's William Etherton explained that upper-middle-class urban men usually left their house to be at work all day. And upper-middle-class urban women often spent much time in the parlor, or away from the house at social activities. In contrast:

> The [well-to-do] family on the farm is seldom away from home and the men are in and out of doors during the day. All members of the family and the farm help must have their 'three square meals' a day, two of them in many instances while the sun is below the horizon. During harvest time, when the well-to-do city family may be in the mountains or at the beach, and little or no kitchen work is done at their home, the farm family is busiest and the kitchen and dining room are taxed to their greatest capacity (Etherton 1914: 123).

In her study of early 20th century farmers in nine Midwestern states, Mary Neth quoted a farm woman who wrote in 1923:

> You don't think of your home on a farm . . . as just a space inside four walls. The feeling of home spreads out all around, into the garden, the orchards, the henhouses, the barn, the springhouse, because you are all the time helping to produce live things in those places and they, or their products, are all the time coming back into your kitchen from garden, orchard, barn or henhouse, as a part of the things you handle to prepare for meals or market everyday (Neth 1995: 17).

POST-1900 FARMHOUSE IMPROVEMENT

Until 1900, most builders' journals and plan books made little distinction between designs for farmhouses and houses in the city. But around 1900, farmers, farm experts, and designers began to express the idea that farmers were not well served by either farmhouses that evolved from frontier cabins, or farmhouses built from plans designed for the city. A major criticism of houses designed for the city, for example, was that attention was focused on the front of the house near the street. These houses often worked poorly on a farm where the rear or side of the house – the elevation facing the farmyard – was usually the center of activity.

A nationwide effort to improve farmhouse design developed in association with the new academic field of home economics, and with the Country Life Movement of 1900-1920. The Country Life Movement was a series of Progressive Era reforms sought to improve the lives of rural families economically and socially, and reverse an exodus of young people from rural areas. One strategy was to provide farmers with the same basic services that urban families enjoyed including running water, central heating, and electricity. Reformers also worked for improving rural roads, mail service, education, technical support, and social networks.

Reconsidering farmhouse design was also aligned with reformers' efforts to improve conditions for rural women (which might in turn increase farm productivity). The Country Life Commission's final report of 1909 stated, "Whatever general hardships, such as poverty, isolation, lack of labor-saving devices, may exist on any given farm, the burden of these hardships falls more heavily on the farmer's wife than on the farmer himself. In general her life is more monotonous and more isolated, no matter what the wealth or poverty of the family may be" (quoted in Ashby 1957: 429).

In 1913 Secretary of Agriculture David Houston wrote:

> According to the testimony of many who are thoroughly familiar with conditions, the needs of the farm women have been largely overlooked by existing agricultural agencies. Endeavor has been largely focused on inducing the field workers to methods of crop production. The fact that the woman's work and time have a real monetary value and that her strength is not unlimited have not been given the consideration they deserve. As a result, on farms where there is always money enough to buy the latest agricultural appliances there is seldom surplus to provide the woman in her productive work with power machinery that will lighten her physical labor, running water that will relieve her of the burden of carrying from the pump all water used in the household, or kitchen equipment and household devices that will save her time, increase her efficiency, and enable her to make important monetary saving. The department [USDA] believes that intelligent help to women in matters of home management will contribute directly to the agricultural successes of the farm (quoted in Etherton 1914: 135).

The message of farmhouse improvement was carried by farm experts, the farm press, government agencies, and University researchers. For example, the nation's force of "nearly 2,500" county extension agents "made more than half a million presentations on farmhouse improvements to rural groups by 1930" (Beecher 1999: 255). Beginning around 1900 – and especially after 1910 – building plans for both new construction and farmhouse remodeling contained features designed to facilitate the role that farmhouses played in farm operations, as well as increase its comfort for the family (Beecher 1999: 256-257). In 1945 University of Minnesota staff indicated that demands for "better working conditions in the farmhouse" had been "strengthened" by "the important part farm women have played in food production during the war years" (Schwantes and White 1945: 14).

Plans for farmhouse improvements were disseminated by land-grant colleges, by publications like *Successful Farming* magazine, by building materials trade groups, and by a host of other interests.

In 1913 Minnesota became "the first state in the union to institute a model farmhouse competition" when a state agency called the Minnesota State Arts Society sponsored a model farmhouse design contest (Flagg 1914: 2). The house was to cost $3,500 ($64,700 in 2003 dollars), and meet a set of requirements developed by experts and ordinary farm families. The Minneapolis firm of Hewitt and Brown won the competition with a Craftsman style design. Plans for all entries – the work of more than two dozen architects – were made available to farmers by the State Arts Society and the University of Minnesota (see the designs in Flagg 1914).

The Farmer's Wife, a popular national magazine published in St. Paul from 1906-1939, hosted its own model farm home contest in the spring of 1926. The winning entry, designed by Minneapolis' Small House Service Bureau, was published in April 1927. In 1930 the magazine also established a farmhouse plan service that offered designs for both new farmhouses and remodeling (Dean 1994). Improvements in farmhouse design were also spurred by a President's Conference on Home Building and Home Ownership, established by President Hoover in 1930. The group convened in 1931 and published findings in 1932 and 1933.

While the American Foursquare or "corn belt cube" is often linked by modern scholars with the farmhouse design movement of the early 20th century, "improved" farmhouse designs employed a wide range of styles including Craftsman, Colonial Revival, Cape Cod, Cottage Revival, Moderne, and simple vernacular forms (Neubauer and Walker 1961: 99).

FARMHOUSE FEATURES

Described below are some of the major features that designers, farmers, and farm experts identified as being important for good farmhouse design. Some later became standard for many American homes.

Grade Door and Landing. This improvement redesigned the rear (or side) entrance to a farmhouse, which was its most often used entrance. The exterior door was situated a few feet above ground level. Just inside the door was a landing with two sets of steps: about four steps that descended to the first floor rooms, and a longer set that led down into the basement. This arrangement allowed farm workers to walk directly into the basement to remove snowy coats and muddy barn clothes before entering the rest of the house. It also gave good access to the basement for removing ashes from the furnace, servicing the basement electrical plant, and hauling canning supplies from the basement to the summer kitchen. In some plans, a special door at the landing gave direct access to the kitchen wood box (White and Neubauer 1936: 3-8).

Central Rear Hall. Most 19th century houses – whether on a farm or in a city – had rear doors that opened directly into the kitchen. But as Foster and Ward wrote circa 1934, "Too many farm kitchens are passageways through which practically all traffic enters and leaves the house" (Foster and Ward ca. 1934: 5). The central rear hall guided traffic into the kitchen, as well as into the washroom, stairway, and farm office. It was one of the three design changes that *Successful Farming* magazine in 1940 believed would most improve farmhouses. The magazine's editors explained: "'The central rear hall gets rid of the pre-dinner confusion', one woman told us. 'Just about the time when Mother is busiest in the kitchen, the men come in from the field and take over the room'" (Fox 1940: 9). A central rear hall was also one of the "Big Three in Farmhouse Design" cited by experts in 1951 and 1961 (Neubauer and Walker 1961: 105, 122n; Foster and Ward ca. 1934: 3; Carter and Foster 1941: 305; Kaiser 1953: 35).

Washroom. The washroom, located near the rear entrance, was a place where farmers and help could wash up before coming into the rest of the house. Based on farm women's recommendations, a washroom was required in the Minnesota State Arts Society's model farmhouse of 1913. In many pre-1940 plans, which probably presumed that farm workers would use an outdoor privy, the washroom contained just a sink, but in later plans it sometimes had a toilet. Most washrooms also had hooks or lockers for coats, as well as places for boots (Midwest Farm 1933; Midwest Farm 1937; Flagg 1914; Foster and Ward ca. 1934: 2; Carter and Foster 1941: 305, 310; Kaiser 1953: 35; Dean 1994; Beecher 1999: 258).

Large Well-Placed Kitchen. In 1914 a University of Minnesota author wrote, "practically the housewife's entire lifetime is spent in and around the kitchen," and advised that the kitchen should be planned first and the other rooms designed around it (Wilson 1914: 36). The kitchen needed to be separated from traffic and needed to be big enough to support intensive activities, including preparing and serving large dinners for work crews during harvest and on other occasions. Some plans included kitchens that were 10′ x 16′, 12′ x 18′, or 15′ x 15′. The need for a large kitchen was sometimes reduced when labor-saving devices were purchased, or when heating, plumbing, and cooking were modernized so that firewood, water pails, and similar items didn't have to be stored in the kitchen.

Workroom. The workroom was a supplement to the kitchen and provided a second work space for heavy chores like canning, meat cutting, other food processing, and laundry, as well as complex chores like sewing. If the farm lacked a milk house, the cream separator, milk pails, and cream cans could be used and stored in the workroom. In some plans, the workroom was explicitly combined with the kitchen to form one large room (Carter and Foster 1941: 305, 310). Some experts recommended that the workroom could contain the shelves necessary to store the farm's large amount of canned fruits and vegetables. The workroom, central rear hall, and public side entrance were the improvements with the greatest potential to transform farmhouses, according to *Successful Farming* magazine in 1940, and other experts in 1951 and 1961 (Fox 1940: 7-9; Neubauer and Walker 1961: 105, 122n). A 1945 University of Minnesota source indicated that, after World War II's intensive years of food production, "Many homemakers now want a workroom . . . . The workroom is generally on the main floor but it may be in the basement if well lighted, heated, and equipped with running water and adequate kitchen facilities (Schwantes and White 1945: 14). A 1951 survey of farm women in the Upper Midwest found that nearly 70 percent expressed a desire for a first floor work room. Just over 40 percent of women characterized a first floor work room as a feature that "should be included by all means" in a farmhouse (Schroeder and Otis 1951: 8-9). Some experts recommended that an enclosed rear service porch or vestibule could serve this function and be used for laundry, canning, butchering, food storage, etc., as long the porch was easy to clean, had a water-resistant floor, and could stand up to hard use (Neubauer and Walker 1961:107).

Stairs to the Second Floor Located at the Rear. Foster and Ward wrote during the 1930s, "In town the stairway [to the second floor] is commonly situated close to the front door, or perhaps near the center of the house. Since members of the farm family naturally approach the house most often from the rear, the stairs will be most convenient if easily reached from the rear entrance." It was advised that the stairs be accessed from the central rear hall so that people could go upstairs without passing through other rooms in the house (Foster and Ward ca. 1934: 5; Kaiser 1953: 35).

Public Side Entrance. According to a 1951 University of Minnesota article, 65 percent of Upper Midwest farms reported that most callers came to the back door (Schroeder and Otis 1951: 9). Farmhouses were often set deeply back from the public road, rather than being close to the street and sidewalk as on a typical urban lot. This made the front door of the farmhouse virtually unused and often inaccessible from the driveway. Because of this, "almost every guest comes to the back door because that is the easiest way, and often enough, there is not even a walk leading from the driveway around to the front entrance" (Fox 1940: 7). Callers coming to the kitchen door was sometimes inconvenient and interfered with work in progress. Remodeling the house so that the main entrance was on the side, facing the driveway, improved the situation greatly. Guests could easily find the entrance, and the entrance was convenient to the kitchen where someone was likely working, yet segregated from it. The public side entrance, the workroom, and the central rear were the leading three farmhouse improvements named in 1940 by *Successful Farming* (Fox 1940: 7-9). The same features were called the "Big Three in Farmhouse Design" by experts in 1951 and 1961 most important improvements in farm house design (Neubauer and Walker 1961: 105, 122n; Foster and Ward ca. 1934: 4).

Sleeping Rooms for Hired Hands. Segregated bedrooms for hired workers – ideally (but rarely) accessed by their own back stairs – were included in some farmhouse plans, including those drawn for the State of Minnesota's model farmhouse competition of 1913. The desire for segregated sleeping rooms arose in part from social discomfort expressed by some farm families over the need to house unrelated men or "strangers" within the family quarters, especially around women, girls, and young children (Lundquist 1923: 4-5). Despite recommendations for segregated rooms, they were not common, and on most Minnesota farms the workers slept in a regular farmhouse bedroom or in a barn loft, summer kitchen, or separate bunkhouse structure (Scharf 2004).

Farm Office. A farm office was included in many recommended farm house plans, and coincided with the advice of experts who urged farmers to apply modern farm management principals and record-keeping to their operations (Carter and Foster 1941: 305; Kaiser 1953: 35). In 1914, however, the USDA's William Etherton suggested that the farm office's "practical importance to the average farmer has probably been overestimated" and that farmers should carefully evaluate the need for an office before going to the expense of building one (Etherton 1914: 122). In a 1951 survey of farm women in the Upper Midwest, only about 15 percent expressed a desire for a separate office in the farmhouse, compared, for example, to 85 percent who expressed a desire for a spare bedroom (Schroeder and Otis 1951: 8). It is not known how many offices were built in Minnesota farmhouses, but they are believed to have been less common than workrooms and washrooms (Scharf 2004).

CHARACTERISTICS OF FARMHOUSES IN 1940

Data from the 1940 census revealed that, nationwide, only about ten percent of farmhouses had central heating, only about 18 percent had "piped cold water," only 28 percent had kitchen sinks, less than 12 percent had "minimum bathroom facilities," and more than one-third needed "major structural repairs." Farmhouses were worst in the South and in the "Great Plains area of the West" (Barre and Sammet 1950: 342-343).

In 1940 the average farmhouse in the U.S. was "less than 1200 square feet." Nationwide, the average size of farmhouses declined between 1920 and 1950 (Neubauer and Walker 1961: 101).

In 1947 Vernon Davies of the University of Minnesota summarized 1940 census data on the 218,580 farmhouses then standing in Minnesota. He reported, for example, that about 30 percent of the state's farmhouses predated 1900, about 40 percent had been built between 1900 and 1919, and about 27 percent had been built between 1920 and 1940 (the age of 3 percent was unreported) (Davies 1947: 4).

The average number of people living in Minnesota farmhouses had decreased from 4.97 people in 1920 to 4.33 people in 1940. These occupants included hired workers, lodgers, and extended family members.

In 1940 more than 17 percent of Minnesota farmhouses had three or fewer rooms. About 26.6 percent of the farmhouses were classified as needing major repairs (Davies 1947: 6-9, 12).

In 1920 Minnesota ranked 26th among states in the number of farmhouses with electricity. In 1940 Minnesota had dropped to 27th among states.

Davies wrote in 1947, "Minnesota does not make a favorable showing in comparison with other states with respect to water and bathroom facilities and mechanical refrigeration. There was a higher proportion of flush toilets in farm homes in 32 other states, running water and private baths in 33 other states, and mechanical refrigeration in 37 other states according to 1940 census data. Only North Dakota, South Dakota, and Missouri in the Midwest show a lower ranking" (Davies 1947: 10). In 1940 about 92 percent of Minnesota's urban houses had running water, while only 12 percent of farmhouses did. About 98 percent of urban houses had electricity in 1940, while only about 30 percent of farmhouses were electrified. In 1940, 75 percent of Minnesota's urban houses had central heating, while 19 percent of farmhouses did (Davies 1947: 6-11).

Davies also reported an increase in vacant farmhouses that was occurring in the 1940s as farms consolidated, and as farms in the northern cutover counties were being abandoned. He expected a brief increase in the farm population immediately after World War II, but then expected the trend toward farm depopulation to resume (Davies 1947: 5, 19).

PREVALENCE

In 1940 there were 218,580 farmhouses standing in Minnesota according to the federal census. Today, it is expected that Minnesota farmhouses display a wide variation in age, style, size, and degree of integrity. In many cases, their design significance can be judged in comparison to urban houses within the state. Farms with two generations of houses are not uncommon, and a few may retain evidence of three generations. Farmhouses that display ethnic influences in design may be increasingly rare. It is not known how many Minnesota farmhouses have features directly linked to early 20th century reforms in farmhouse design.

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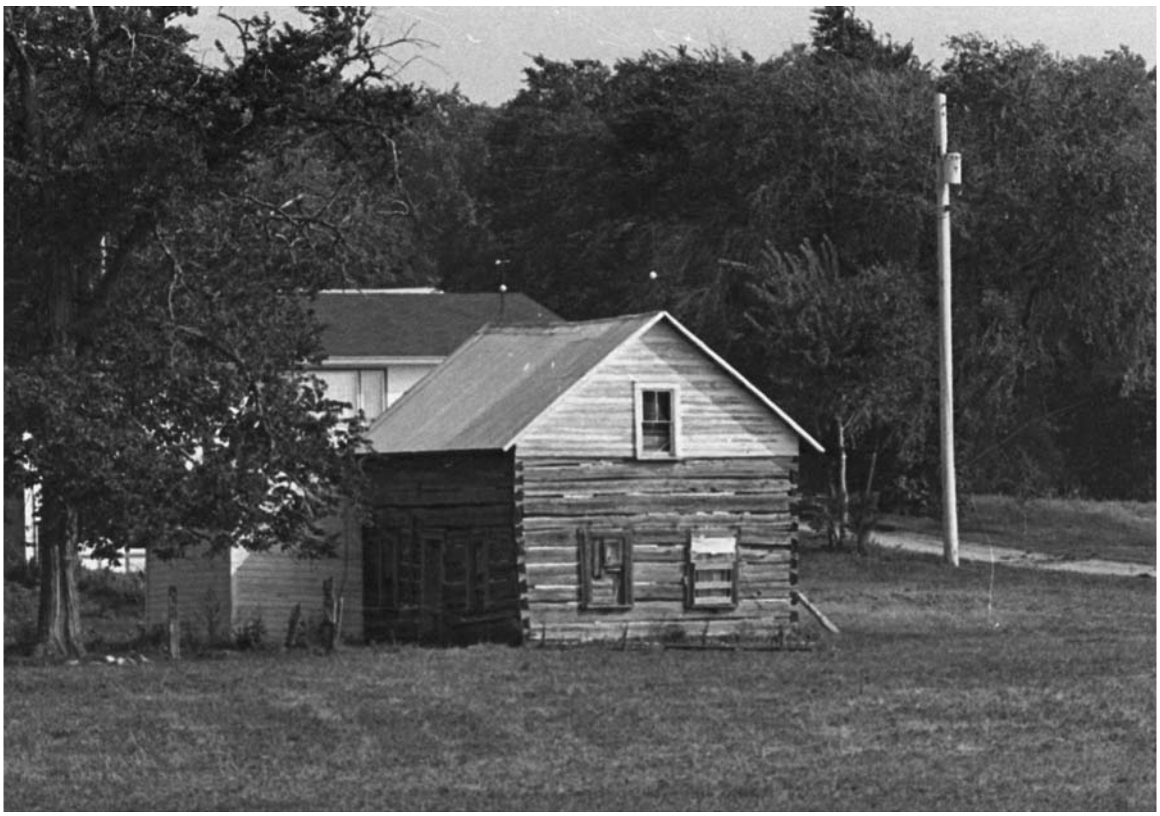


A settlement-era farmhouse in wooded Wright County, with a second-generation house nearby. Westphal Farm, Buffalo Township, circa 1973. (MHS photo)

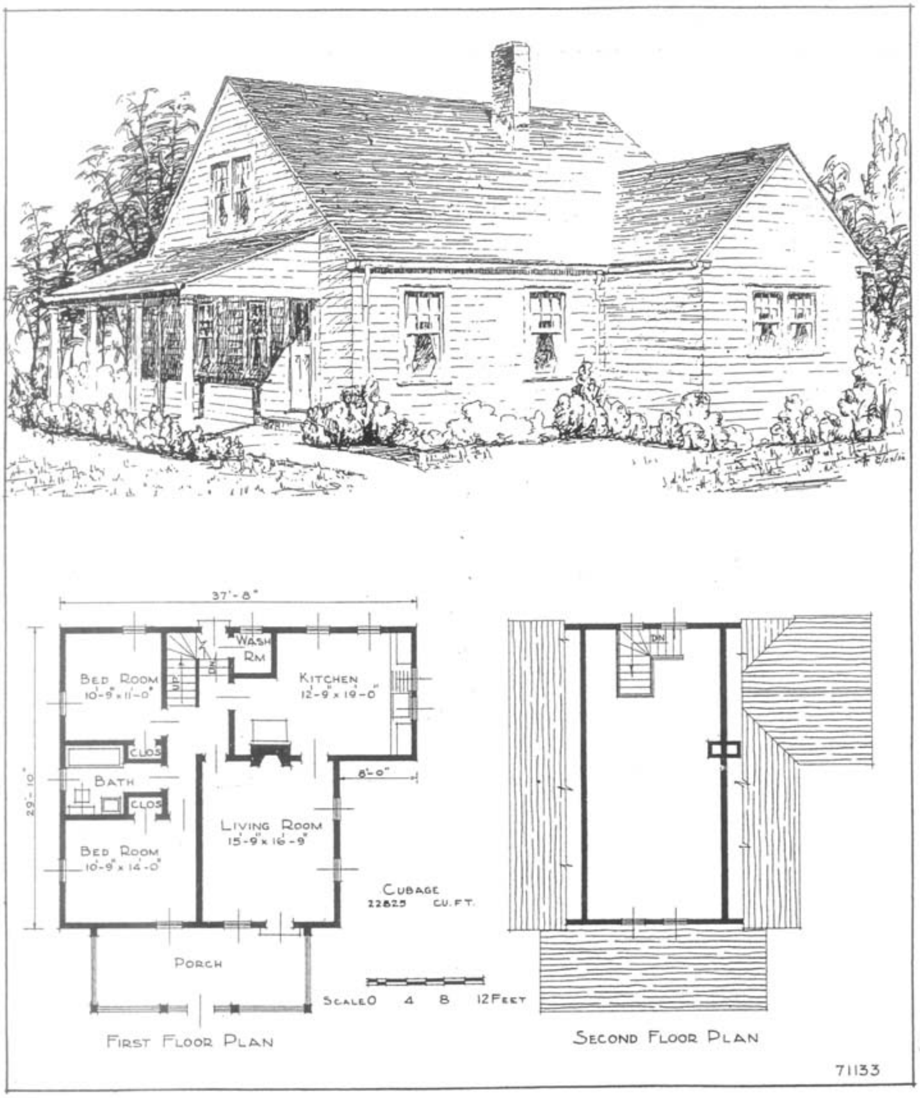
A windmill and orchard are sited on the slope behind this large farmhouse. Swanson Farm near Welch, Dakota County, ca. 1915. (MHS photo)

A woodframe farmhouse of moderate size. Location unknown, possibly near Glencoe, circa 1900. (MHS photo by Joseph Jay Brechet)

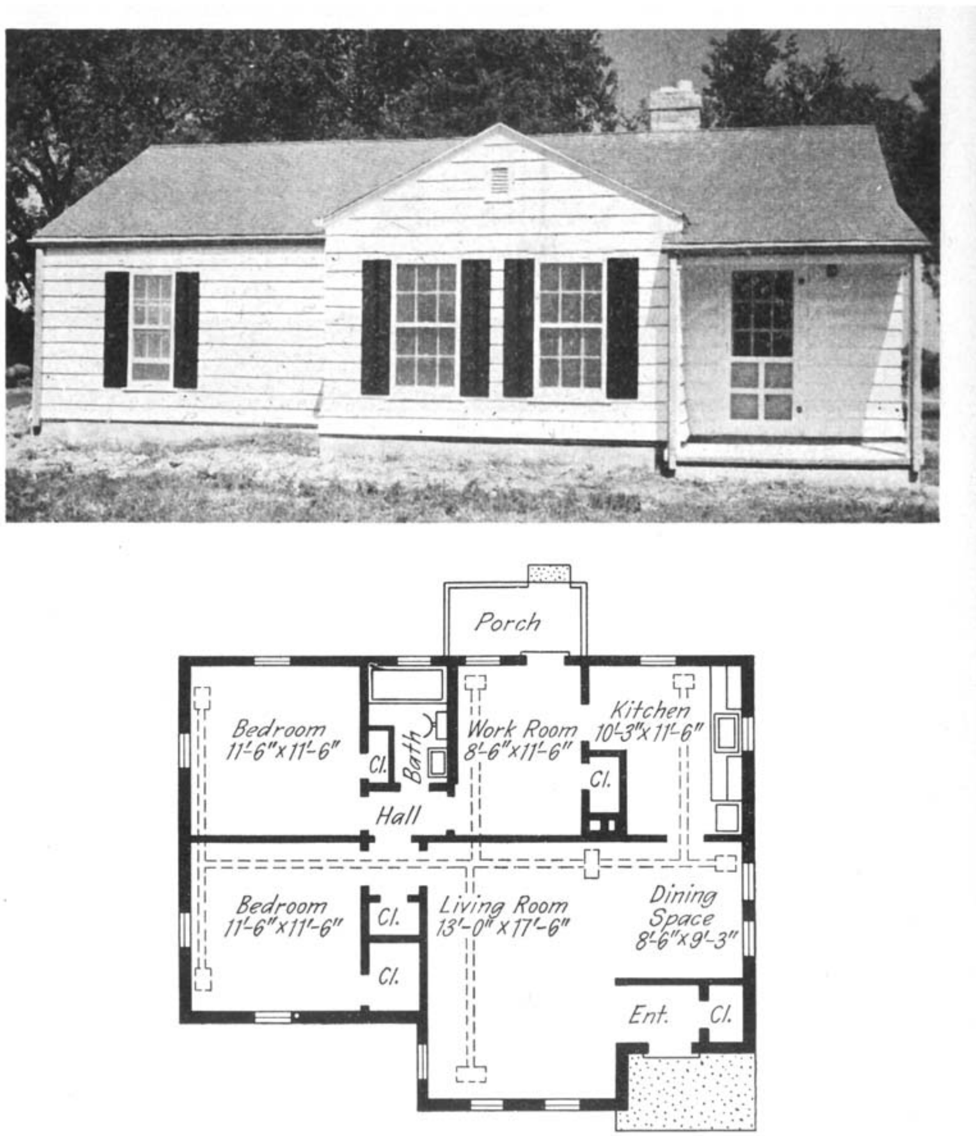
After a larger farmhouse was built, the earlier, smaller house was commonly reused as a summer kitchen, bunkhouse, granary, shop, or shed. In this photo, the earlier house stands behind its replacement. Crow Wing County, circa 1910. (MHS photo by Harry Darius Ayer)

This brick farmhouse was large and elaborate compared with many in the state. Photo taken near Princeton in Mille Lacs County, circa 1919. (MHS photo)

Many early 20th century farmhouses were built in the Craftsman style. E. E. Price farmhouse, near Onamia, Mille Lacs County, circa 1919. (MHS photo)



This Midwest Plan Service design illustrates several of the special features recommended for farmhouses. At the back door was a grade door and landing designed to allow easy access to both the first floor and the basement. A washroom for workers (with a sink but no toilet) was located inside the back door. A central rear hall kept the traffic out of the kitchen where intensive cooking or big, messy chores were often in progress. And the stairway to the second floor was at the rear of the house – the place where family members invariably entered – rather than in the front like in many urban homes (Midwest Farm Building Plan Service 1937).



This "low cost farmhouse" had a workroom measuring 8′6″ x 11′6″ located directly inside the back door. From Wooley's *Farm Buildings* (1946).

McDougall Farmstead, Dover Township, Olmsted County, 1979. (MHS photo)

▪ FARMS

- Minnesota farm numbers peaked around 1935 and have been declining ever since
- From 1925 onward farms have grown in size
- Minnesota farms averaged 145 acres in 1880, 160 acres in 1925, and 235 acres in 1964

For the purposes of this context study, a farm is a parcel of land comprised of a headquarters complex (the farmstead) and surrounding acreage, usually owned and operated by a single entity such as a family.

Each farm is comprised of a collection of built structures and landscape features (or characteristics) including:

- topography and natural features
- spatial organization
- circulation networks
- boundary demarcations
- vegetation
- buildings, structures, and permanent objects
- sites
- a setting

This context study found that, based on use, most features fall into one or more of the four categories listed below:

- crop husbandry elements
- animal husbandry elements
- domestic elements
- service and utility elements

Most Minnesota farms historically contained elements from all four categories.

For a good 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).

For planning and management purposes, farms were generally divided into untillable and tillable land. Untillable land was comprised of areas too steep, rocky, wet, or wooded to till, including woodlots and wetlands. Many untillable areas were used as permanent pasture. Tillable land included land that could be worked with machinery and planted. Tillable land was usually planted with crops to be harvested annually, or planted with forage crops to create rotational pasture areas.

See also

Farmsteads
Fields and Pastures
Woodlots
Wetlands
Drainage Structures
Boundary Markers
Appendix: Focus on Gov Land Programs
Snapshot of Farming Regions

In 1900, 82 percent of Minnesota farms were operated by the owner, while 17 percent were operated by tenants.

NUMBER AND SIZE OF MINNESOTA FARMS

The boundary lines of Minnesota farms tended to be straight and aligned with cardinal points – following the orientation of the Public Land Survey – except where rivers, lakes, railroads, or other major geographic features were followed or bypassed. (See also "Boundary Markers," an individual farm elements section.)

In the early-to-mid 20th century, many Minnesota farms were 160 acres, which was the parcel size used by important federal land allocation programs including the Preemption Act of 1841, the Homestead Act of 1862, various military warrants, and the Timber Culture Act of 1873. A parcel of 160 acres "was thought to be the maximum amount of land a family could realistically farm," given mid-to-late late 19th century technology, according to the National Park Service which operates Homestead National Monument in Nebraska (National Park 2005). (See also "Focus on Government Land Programs" in this study's appendices.)

Number and Size of Minnesota Farms

	1880	1890	1900	1910	1920	1925	1930	1935
Number of farms in Minnesota	92,386	116,851	154,659	156,137	178,478	188,231	185,255	203,302
Average size of Minnesota farms (in acres)	145.1	159.7	169.7	177.3	169.3	159.7	166.9	161.4
Average size of farms nationwide (in acres)	134	137	147	138	147	143	151	155
Total number of farm acres in Minnesota (in millions)	13.4	18.7	26.2	27.7	30.2	30.1	30.9	32.8
Percent of total Minnesota land area in farms	25.9	36.2	50.7	53.5	58.4	58.1	59.7	63.4

	1940	1945	1950	1954	1959	1964	1975
Number of farms in Minnesota	197,351	188,952	179,000	165,225	146,000	131,163	104,000
Average size of Minnesota farms (in acres)	165.2	175.4	183.6	195.4	211	235	291
Average size of farms nationwide (in acres)	167	191	213	251	288	333	388
Total number of farm acres in Minnesota (in millions)	32.6	33.1	32.9	32.3	30.8	30.8	30
Percent of total Minnesota land area in farms	63.1	64.1	59.6	59.6	59.6	59.6	58.0

Source: *Statistical Abstracts*, various years.

As railroads were built, as population increased, and as technology improved, the number of farms in Minnesota grew from about 92,000 in 1880 to about 154,600 in 1900. The number increased by only about one percent between 1900 and 1910. Between 1910 and 1920, the number of farms in Minnesota increased by about 14 percent.

The number of farms in Minnesota peaked around 1935 and then began to decline. The introduction of electricity, gasoline-powered implements, and other new technology helped reduce the number of workers needed to run a farm, increase the number of acres a farm family could operate, and shrink the total number of farms. These changes eventually compelled farmers to specialize to remain profitable, and helped increase the amount of capital and machinery necessary to farm, thereby causing farmers to buy or rent more acres.

In 1945, there were approximately the same number of farms in Minnesota as there were in 1925. The state's total number of farms fell from nearly 189,000 in 1945 to about 165,000 in 1954. In 1964 the number of farms in Minnesota was 85 percent the 1900 level, or about 131,000 farms. (In 1997 there were 73,367 farms in the state.) Nationwide, U.S. farm numbers also peaked around 1935 at about 6.8 million and then began to decline. In 1964 there were 3.4 million farms nationwide.

While total farm numbers were rising in the late 19th and early 20th centuries, the number of "improved" acres within each farm was also increasing as farmers cleared land of trees, broke prairie sod, and drained wet areas. About 54 percent of total Minnesota farmland was improved by 1880. The percent of farmland improved rose to 59 percent in 1890, 70 percent in 1900, and 71 percent in 1910 and 1920.

Minnesota farms averaged about 145 acres in 1880. In both 1890 and 1925, the average Minnesota farm was about 160 acres. After 1925 farms began to steadily grow in size. As mechanization accelerated around World War II, average Minnesota farm size jumped 11 percent, rising from 165 acres in 1940 to 184 acres in 1950. By 1964, average Minnesota farm size had jumped another 28 percent, to 235 acres. It was 354 acres in 1997.

Historically there was considerable regional variation in farm size. In 1910, for example, farms ranged from an average of 57 acres in Ramsey County to an average of 305 acres in Wilkin County in the Red River Valley, while the overall state average was 177 acres. In 1935 farms in western Minnesota were larger than the state average of 161 acres, but in northern Minnesota they were only 103 acres, with less than 36 of those acres cleared. In some cutover counties in 1935, the average number of improved acres was as low as 16.5 (Schwantes and Thompson 1940). (See "Snapshot of Farming Regions in 1940" for some additional information on farm size.)

In 1939 average Minnesota farm size was 165 acres with the following variations seen throughout the state:

- Farms in the Red River Valley, averaging 246 acres, were the largest in the state and well above the 1939 state average.
- Farms surrounding the Twin Cities, averaging 57 acres, were the smallest in the state and considerably smaller than the 1939 state average.
- Farms in southeastern Minnesota were about the same as the state average at 161 acres.

- Farms in west central Minnesota, southwestern Minnesota, and northwestern Minnesota were larger than the state average with averages of 233 acres, 204 acres, and 199 acres, respectively.
- Farms in south central Minnesota, east central Minnesota, and the northern cutover counties were smaller than the state average with averages of 143 acres, 130 acres, and 103 acres, respectively (Engene and Pond 1944).

Farm size also differed by the type of farm, with truck farms tending to be very small and livestock and cash grain farms being much larger.

In 1930 dairy farms (defined by the University of Minnesota as those receiving at least 40 percent of income from dairying) averaged 92 acres near the Twin Cities, 131 acres north of the Twin Cities, 134 acres in the northern Minnesota cutover, and 239 acres in the Red River Valley (Engene and Pond 1940).

In 1925, about 53 percent of Minnesota farms were between 100 and 259 acres. In 1954, about 57 percent of farms were in that size range.

Minnesota Farms by Size in 1925 and 1954

Farm Size	1925 number of MN farms	1925 percent of MN farms	1954 number of MN farms	1954 percent of MN farms
less than 50	26,880	14.3	17,742	10.7
50-99 acres	35,167	18.7	21,488	13.0
100-179 acres*	67,949	36.1	55,675	33.7
180-259 acres*	31,396	16.7	38,669	23.4
260-499 acres	24,064	12.8	30,842	18.7
500-999 acres	2,577	1.4	5,084	3.1
more than 999	198	0.1	725	0.4

*In the 1925 data, farm size divisions are 100-174 acres and 175-259 acres; in the 1954 data the divisions are 100-179 acres and 180-259 acres.

Source: *Statistical Abstracts*, various years.

In 1957 the University of Minnesota's Engene and Nodland recommended that farmers seeking an annual income of $5,000 gross or $2,000 net (which translates to a gross of $35,000 and a net of $14,000 in 2004 dollars), "have a very slim chance of meeting this goal if they have less than 100 acres of cropland. This is equivalent to a farm with 120 to 160 acres of total land. With 100 to 199 acres of cropland, the prospects for a $2,000 net income are much higher" (Engene and Nodland 1957: 6).

Regarding small farm size in the mid-century, Engene and Nodland reported, "In 1945 [Minnesota] had 104,000 farmers with less than 100 acres of cropland harvested; by 1954 this had fallen to

71,000. This is a decrease of 33,000 or about one-third. These farmers had acreages so small that prospects for satisfactory earnings were very slight." The authors predicted that farms under 100 acres would become part-time or residential-only unless their owners bought or rented more acres or supplemented their family income with off-farm employment (Engene and Nodland 1957: 7, 19).

Farms accounted for about 50 percent of the state's total land area in 1900. By 1920 the total land in farms had reached 30 million, or about 60 percent of the state's total land area. The total amount of land in farms was approximately the same in 1965 as it was in 1920.

PREVALENCE

Farms are located throughout Minnesota, with the fewest number in northeastern Minnesota's forested cutover. Through time, farms have grown larger in size and fewer in number. The average Minnesota farm was 145 acres in 1880 and 235 acres in 1964. The number of farms in the state has been declining since about 1935.

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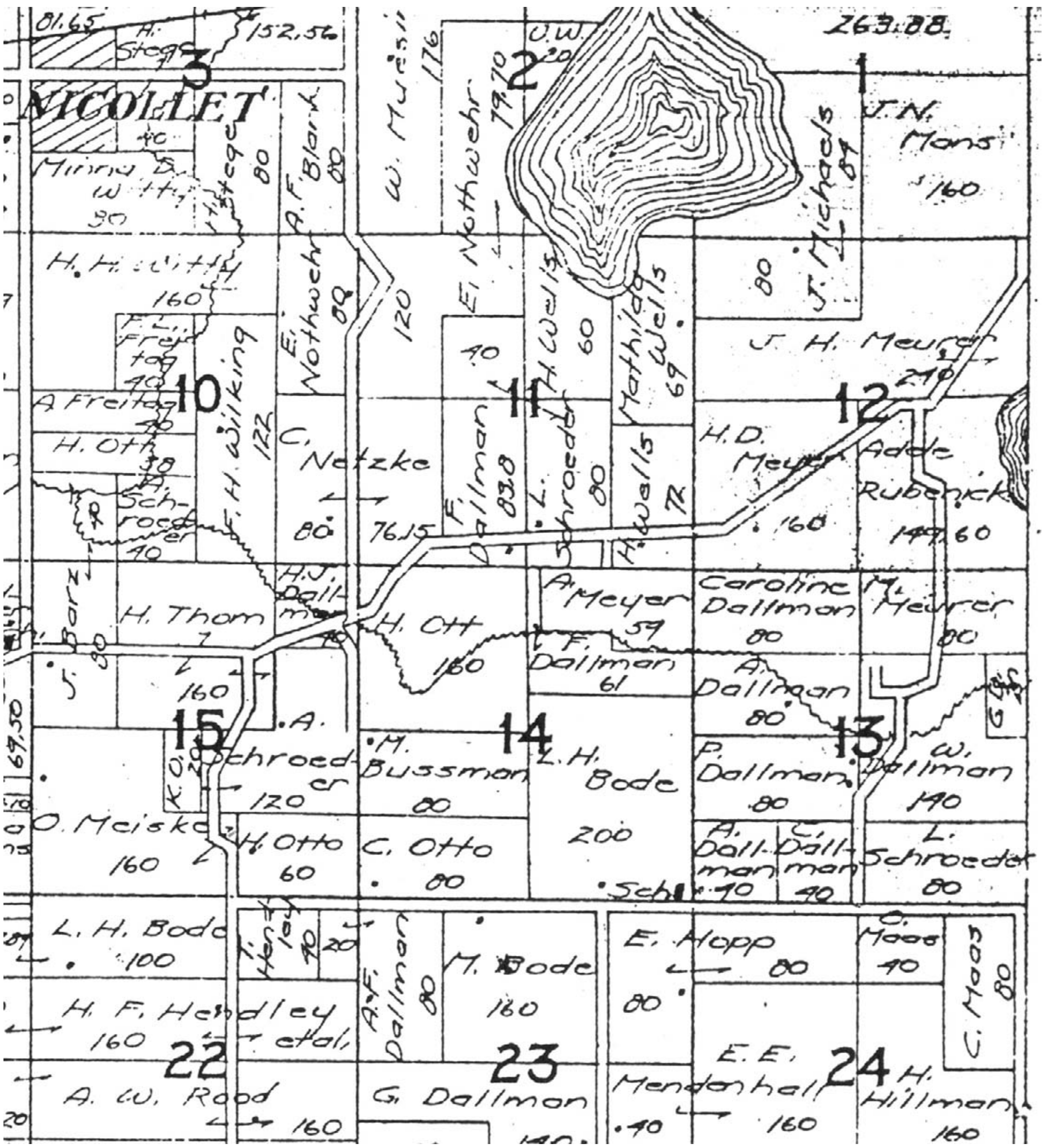
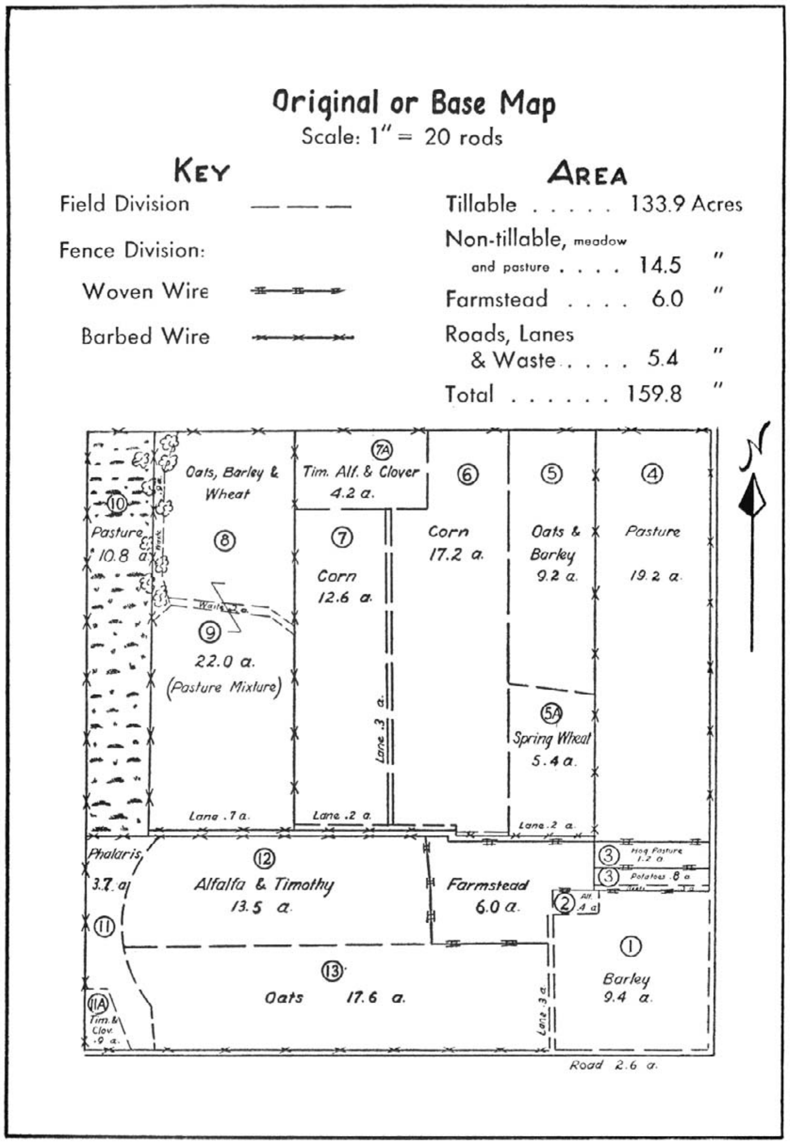
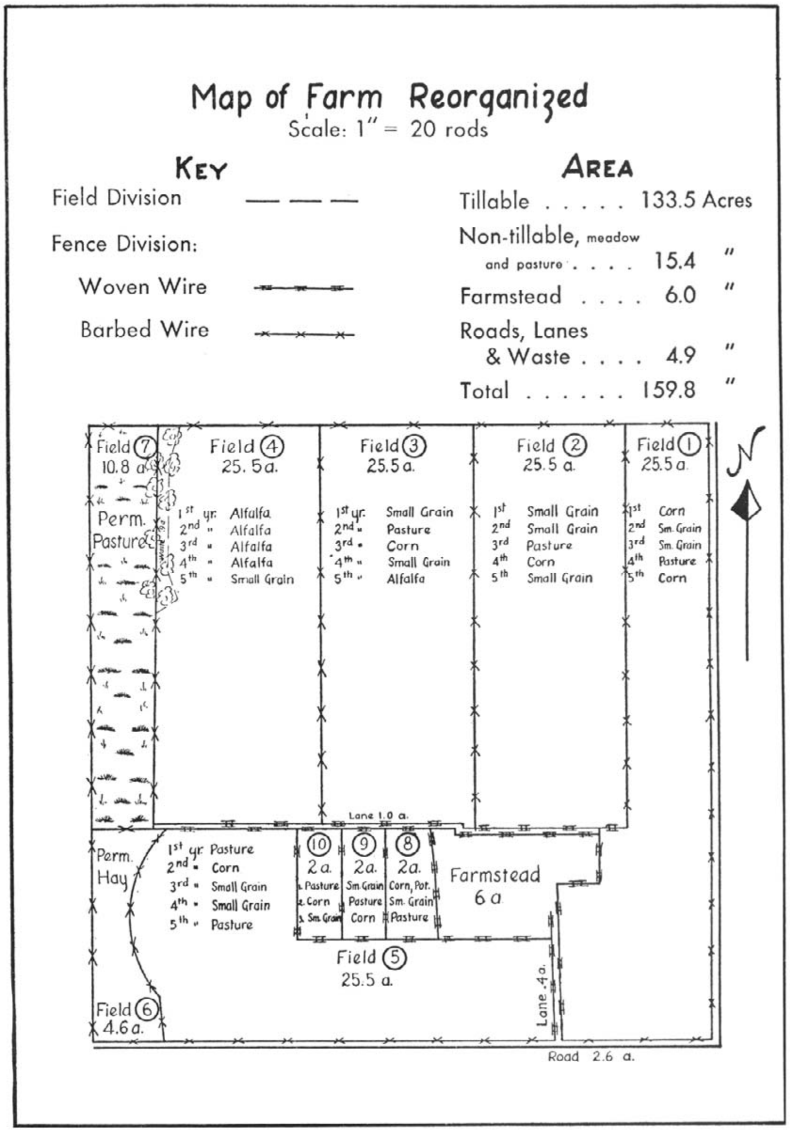


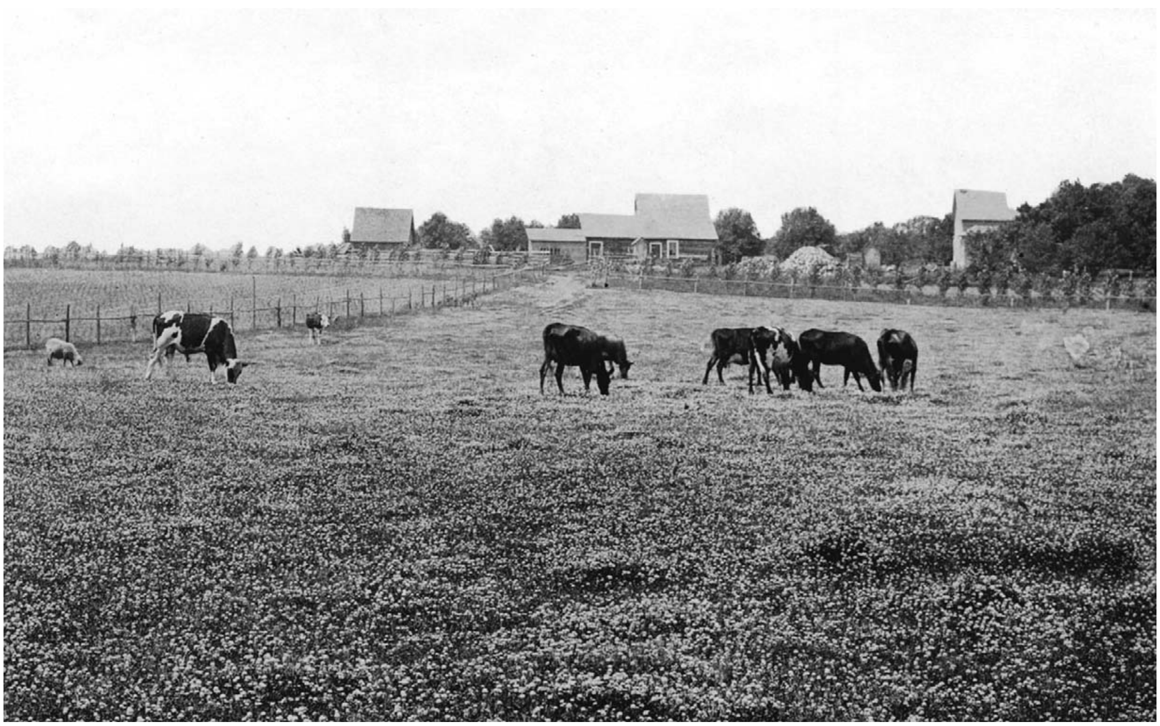
Farms in Nicollet County in 1916. The farms depicted on this atlas range in size from about 80 to 240 acres (Hixson 1916). Judging by the surnames of land owners, extended family members (perhaps siblings) were farming adjacent land.



Layout of a "southeastern Minnesota dairy farm" circa 1950. The farm's 134 acres are comprised of tillable land, nontillable land, a six-acre farmstead, and roads and lanes. From Boss and Pond's *Modern Farm Management* (1951).



Recommendations for reorganization of the circa 1950 southeastern Minnesota dairy farm depicted in the previous illustration. Fields are divided into larger and more even parcel sizes for more effective crop rotation and use of larger machinery. From Boss and Pond's *Modern Farm Management* (1951).



Cows (and one sheep) grazing in a clover field. The fences are made with simple poles, there are young ornamental plantings along the driveway, and there is a big stack of what looks like firewood in the yard. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

▪ FARMSTEADS

- Farm buildings and work areas were usually protected by a windbreak or woodlot
- Farm buildings were usually grouped around a farmyard accessed via the main driveway
- Livestock buildings were usually sited away from the house, often to the southeast
- In the most efficient farmstead layouts, buildings were grouped according to function
- South-facing farmsteads were preferred

"The farm headquarters serves as a home for the family, a business center, and an industrial establishment for the production and handling of crops and livestock," wrote University of Illinois faculty Carter and Foster in 1941 (Carter and Foster 1941: 158).

Two years before in 1939, Minnesota farmer William Benitt had called the farmstead "a virtual miniature city" of structures to house livestock, store forage crops and grain, shelter machinery, etc. (Benitt 1939). And in 1951 Minnesota's Boss and Pond wrote:

> The farmstead is the center of farm operations. It includes the home, the farm buildings, and the yards, paddocks, garden, orchard, windbreak, and other service areas. Its location and arrangement are important factors from both a personal and a business standpoint. An attractive farmstead adds much to the enjoyment of farm life. A well-located and arranged farmstead may help greatly in using labor most advantageously (Boss and Pond 1951: 160).

Minnesota farmsteads exhibited a wide variety of spatial and building arrangements. In general, however, the buildings were sheltered by a windbreak or woodlot, and clustered around a farmyard or work area that was accessible via the main driveway. Usually most farm structures are located within the farmstead. (Exceptions may include an occasional hay barn, stock tank, set of hog cots, straw cattle shed, etc., that might be located in pastures or at the edge of fields.) In rolling or hilly areas, topography often dictated the arrangement of elements, while arrangements in flat areas tended to be orthogonal.

Most farms developed with a fairly tight clustering of buildings and structures that were spaced far enough apart to prevent the spread of fire, but close enough to reduce travel time when moving between them. In Minnesota's extreme climate, siting buildings close together was advantageous for doing work in sub-zero weather and during blizzards. A tight grouping was also useful to deter animals like wolves that might prey on pigs, sheep, and chickens, or raid the hen house for eggs.

Noble and Wilhelm indicated in 1995 that the spatial arrangement of Midwestern farmsteads had not been extensively studied. In their brief discussion they named five factors influencing farmstead arrangement: topography, weather (including snow accumulation), convenience or labor efficiency, the land survey system, and "tradition" (Noble and Wilhelm 1995: 9).

See also

Farms
Farmyards
Roads, Lanes, Tracks, Sidewalks
Landscaping and Ornamental Plantings
Windbreaks
Woodlots
Appendix: Focus on Farm Electrification

The authors attributed the orthogonal arrangement of many Midwestern farmsteads to geometry and the cardinal alignment of the Public Land Survey. They wrote, "Barns and other farm buildings often line up in rigid conformity with survey lines, and the farmstead has an order imposed by the land division system" (Noble and Wilhelm 1995: 9). They cited a study from the mid-1980s that found that Midwestern farms in flat areas "obeyed just two general rules: They were square to the road (e.g., the survey lines), and, because of the prevailing westerly winds, hogs were housed to the east of the [rest of the] farmstead" (Noble and Wilhelm 1995: 9). Noble and Wilhelm also explained that traditional influences – for example, an ethnic German "courtyard plan" – were sometimes seen in the Midwest, but such phenomena had not been well studied (Noble and Wilhelm 1995: 9-10).

Noble and Wilhelm also wrote:

> Midwestern farmers usually laid out their farmsteads in one of three patterns. Most common are the farmsteads where all buildings have exactly the same orientation, usually to compass directions. A second pattern can be termed the courtyard arrangement. In these cases, the house and barn form two sides of an open square. Smaller outbuildings define the remaining two sides. The third pattern is a more free-form arrangement, in which buildings vary in alignment, but generally follow the contour of a slope. Further study may reveal additional farmstead patterns (Noble and Wilhelm 1995: 9-10).

Brinkman and Morgan, in their study of settlement-era farms in central Minnesota, described the layout of one farmstead as "circular, allowing for relatively simple access to the garden, pump, and outbuildings. To the east are Anna's garden, a small storage shed, and the privy. Running clockwise from the house in a north-to-south direction are the barn, storage shed, woodshed, garage, and granary-tractor shed. The major avenues of use are mainly for water and wood. The pump is located in the middle of the farmyard" (Brinkman and Morgan 1982: 95).

Many farmers grouped their buildings according to function to reduce labor – placing the corncrib by the hog barn, for example. Brinkman and Morgan reported that the Gogala farmstead, which had a group of log buildings built beginning in the 1860s, was arranged with triangular groupings consisting of a farmhouse, blacksmith shop, horse barn cluster; a horse barn, hog barn, corncrib cluster; a farmhouse, pump, smokehouse cluster; and a storage shed, pump, temporary corncrib cluster (Brinkman and Morgan 1982: 78).

ADVICE TO FARMERS

By the late 19th century, the farm press, university experts, extension agents, and others were trying to improve farm conditions and profitability by providing advice and plans for farmstead layout. Smart farmstead layout could save farmers significant time and labor, making them more productive. Because many farmers inherited an existing farmstead layout rather than building anew, farm specialists encouraged farmers to devise 5-year, 10-year, or even 20-year plans for improving their arrangement, including relocating buildings if necessary (Hays 1894; Hamilton 1908; Wilson 1914; White 1932: 217-218; Howe 1940: 20; Schwantes and White 1945: 8).

Farmstead Size. The size of the farmstead varied according to the total farm acreage, the type of farming, and anticipated expansion. In general small farms had small farmsteads, larger farms had bigger farmsteads. A common guideline for a suitable farmstead size was about five percent of the farm. According to that standard, a 160-acre crop and livestock farm (a quarter section) required a farmstead of about eight acres (Wilson 1914: 58; White 1932: 217). A 1951 source suggested that a livestock farm required a larger farmstead than a cash crop farm: a four- to six-acre farmstead for a 160-acre livestock farm, compared to a six- to ten-acre farmstead for a 240- to 320-acre cash grain farm (Boss and Pond 1951: 160-161).

Farmstead Location. Elevation and good drainage were among the most important factors in farmstead location, and farmers often built on the highest available ground. Farmstead location was also influenced by the location of timber and water, and by soil type, field access, location of roads, and proximity to neighbors and village services (Hamilton 1908: 95; Wilson 1914: 57; White 1932: 217; Howe 1940: 2, 14).

In deciding where to build, farmers also had to consider economic and social factors. Placing the farmstead near the center of the farm had operational advantages: the fields were closer to the farm buildings and stockyards, and all four sides of the farmstead were adjacent to fields. This was especially important when relatively slow draft horses were used to make multiple trips to fields each day. However, a central location, far from the public road, increased the farm family's isolation, especially before automobiles became common. Building the farmstead at the end of a long driveway also made it less convenient for children to get to school, placed the farm farther from markets and country grain elevators, and made it hard to get to town when snow blocked the driveway (Wilson 1909: 24-25; Wilson 1914: 56; Howe 1940: 3).

In 1914 the University of Minnesota's Andrew Boss favored placing the farmstead close to the public road. He explained,

> The objection to a central location is that it results in the isolation of the farmer's family, which is a serious phase of farm life. Families of farmers enjoy seeing passing teams and should be near enough to the road to encourage social calls from their neighbors. Convenience in getting to school and to market should also receive due consideration. The economic advantage of being near the center of the farm is . . . [apparent], but it is doubtful whether this advantage is sufficient to outweigh the social advantages of living near the main road in the center of one side of the farm (Boss 1914: 65-66).

Boss's advice of 1914 is consistent with the recommendations of the Country Life Movement, a series of Progressive Era reforms (circa 1900-1920) that sought to improve the harsh physical, social, and economic conditions facing American farm families. The movement's recommendations included improving rural roads, increasing rural mail delivery, bringing electricity to farms, improving the status of farm women, improving rural education, and establishing an agricultural extension service.

Nearly 40 years later Andrew Boss had not changed his recommendations regarding farmstead placement. He and colleague George Pond counseled in 1951:

> A location on the highway in the center of one side of the farm is generally the most satisfactory compromise. This avoids the necessity of maintaining an all-weather road [driveway] from the public road to the farmstead. In northern climates it may require considerable effort to keep a long lane free from snow in winter. In the days of horse travel this was not so important [because sleighs were used] but with practically all road

> travel motorized it is important to keep a road open and passable at all times. The extra time spent in reaching the fields from the farmstead is not so serious a handicap under present conditions. Modern tractors travel more rapidly than horses, and labor-saving machinery coupled with larger power units reduces the number of hours required to produce an acre of crops (Boss and Pond 1951: 161).

Boss and Pond also pointed out that "passing travel will create interest and break the monotony of daily routine in the household" and that telephone and electrical lines are more accessible if the farmstead is sited near the highway or public road (Boss and Pond 1951: 161).

Orientation. The orientation of farm buildings depended on which direction the farmstead and house faced. The south or southeast-facing farmstead was probably the most common, with a good windbreak on the north and west sides. The main barn and hog house could be placed to the east of the house so that the prevailing winds blew odors and grain dust away (Hamilton 1908: 95; White et al 1936: 6; *Farm Building Plans* 1953).

A north-facing farmstead was least preferred because the house was exposed to the prevailing wind and the windbreak had to go across the front yard, disrupting the view between the house and the road. However, the rest of the farm buildings were easily sited in a north-facing farmstead. The livestock yards could be placed south and east of the barns, where they were protected from the wind and got full sun (White et al 1936: 5-6; *Farm Building Plans* 1953).

A west-facing farm was also exposed to the wind, making the front yard likely to drift in the winter and forcing the windbreak to pass in front of the house. Some farmers solved this problem by facing the house south. A west-facing farmstead made it easy to place the barns and livestock yards to the east of the house and left plenty of room to enlarge them (White et al 1936: 5-6; *Farm Building Plans* 1953).

The east-facing farmstead was the most difficult to arrange well. The barns and stockyards had to be placed to the north and west, next to the shelterbelt, and were generally farther from the house because the prevailing winds carried granary dust and livestock odors to the living area (White et al 1936: 5-6; *Farm Building Plans* 1953).

Principles of Good Farmstead Arrangement. The test of efficient arrangement of farm buildings, University experts explained, "is the accomplishment of their specific purposes under sanitary conditions with a minimum of time and effort" (Hamilton 1908: 98). For example, because most farm animals had to be fed 500 to 1,000 times a year, "the stables, granaries, yards, lanes and well should be so arranged as to economize labor in caring for the livestock" (Wilson 1909: 24). According to agricultural engineers Barre and Sammet, in 1943 farmers spent about one-third of their labor hours in and around the farm buildings. This suggested that the arrangement of entire farmsteads and individual buildings could have a real effect on worker fatigue and safety, power requirements, equipment wear and tear, and total labor hours (Barre and Sammet 1950: 414; Schwantes and White 1945: 8).

To help farmers evaluate and improve their farmstead layouts, farm experts from 1894 to 1951 outlined a consistent set of basic principles for good farmstead arrangement (see Sources below):

House
- House located near one side or corner of the farmstead (this recommendation varied), set back 80′ to 200′ from the public road to avoid dust and traffic, and separated from the other farm buildings
- House sited with view of the service area or fields from the kitchen windows
- Garden, orchard, and hen house close to the farmhouse so chores could be done and eggs and produce gathered without extra steps

Service and Utility Infrastructure
- Convenient access to public roads and fields
- Convenient driveways
- Plenty of space for yard, garden, orchard, lanes, buildings, and stockyards within the windbreak
- Well and windmill built on ground that was higher than the barn and farm buildings, and at least 150′ to 200′ from privies, cesspools, manure piles, and other sources of contamination
- Low spots in the yard filled
- Open, level runways or tile to carry away surface water and reduce mud, preventing yards and roads from becoming impassable from rain and spring thaws
- Windbreaks on the north and west

Outbuildings
- Principal farm buildings grouped around a farmyard or work area accessible from the main driveway
- Buildings placed on high, well-drained ground
- Outbuildings far enough from the house to minimize odors, flies, noise, and fire danger, yet not so far that chore routes are needlessly long; outbuildings at least 150′ to 200′ from the house recommended
- Machinery buildings, shop, and fuel storage situated for good fire safety and easy access

Livestock
- Barns and stockyards located east of the house
- No livestock barns or yards southwest of the house
- Feedlots and stockyards south or east of the barns for wind protection and maximum sun
- No animal yards in front of the house or between the house and the barns
- Cattle yards adjoin main fields and hog yards adjoin smaller fields so livestock can be conveniently turned into fields
- Open-front barns facing south or east
- Facilities grouped according to function
- Horse barns near implement sheds
- Dairy barn, silo, hay and feed storage, and milk house grouped together
- Beef cattle barns, stockyards, and feed storage grouped together
- Corncribs near hog houses
- Hog houses located farthest from the house to reduce odors

The distance between buildings varied with the type of farm. A 1932 survey of Minnesota farms, for example, showed that dairy farmsteads tended to be more compact than cattle farmsteads (White 1932: 217-218).

The number of buildings also varied. One group of farm experts recommended in 1936, ". . . the fewer structures there are, the more economical the labor and the lower the shelter cost" (White et al 1936: 8).

In 1941 manufacturers of fireproof brick and tile promoted a "closed court" arrangement of farmstead buildings, in which related functions were grouped into a few long buildings with common walls. The structures were set in a tight ring around a central courtyard, which was entered from the main driveway or the service lanes (Structural Clay 1941). However, few Minnesota farms followed this plan (White et al1936: 8). More common in Minnesota was an "open court" arrangement in which the main farm buildings were loosely grouped around a central farmyard and the buildings did not share common walls (Structural Clay 1941).

Farmstead arrangements changed as tractors replaced horses in the 1920s and 1930s. A 1929 article in *Agricultural Engineering* illustrated how the coming mechanization would affect the entire farm setup and suggested that shifting a large farm to "power farming" with tractors might require alterations in field divisions and pastures, fences, grain storage buildings, stockyards, and housing for farm laborers (Doane 1929: 27-30).

It is interesting to note that, by the early 1950s, planners were advising that the farmhouse, "while part of the farmstead group, should be distinctly [and more fully] separated from other buildings." This suggestion reflected, in part, the success of technology in reducing some of the most intensive labor of farming and allowing farm families to begin to consider their home more like a domestic refuge (an ideal more common to urban culture) and less like an industrial work center. Early 1950s recommendations also show the influence of modernism in architectural design. A 1951 ideal, for example, shows an almost factory-like collection of matching, low rise structures with "buildings having some uniformity in color, roof coverings, rooflines, and foundation" (National Plan Service 1951).

PREVALENCE

Elements on Minnesota farmsteads changed through time as particular farming practices were adopted, later to be succeeded by others. While large buildings are likely to retain their historic locations, smaller buildings and structures may have been moved around as farm technology, methods, and products changed. Spatial arrangement is likely to be the most intact on farmsteads where the largest number of historic elements remain. As small buildings, windmills, fences, orchards, and other elements are increasingly removed, the integrity of farmstead spatial arrangements is also being lost.

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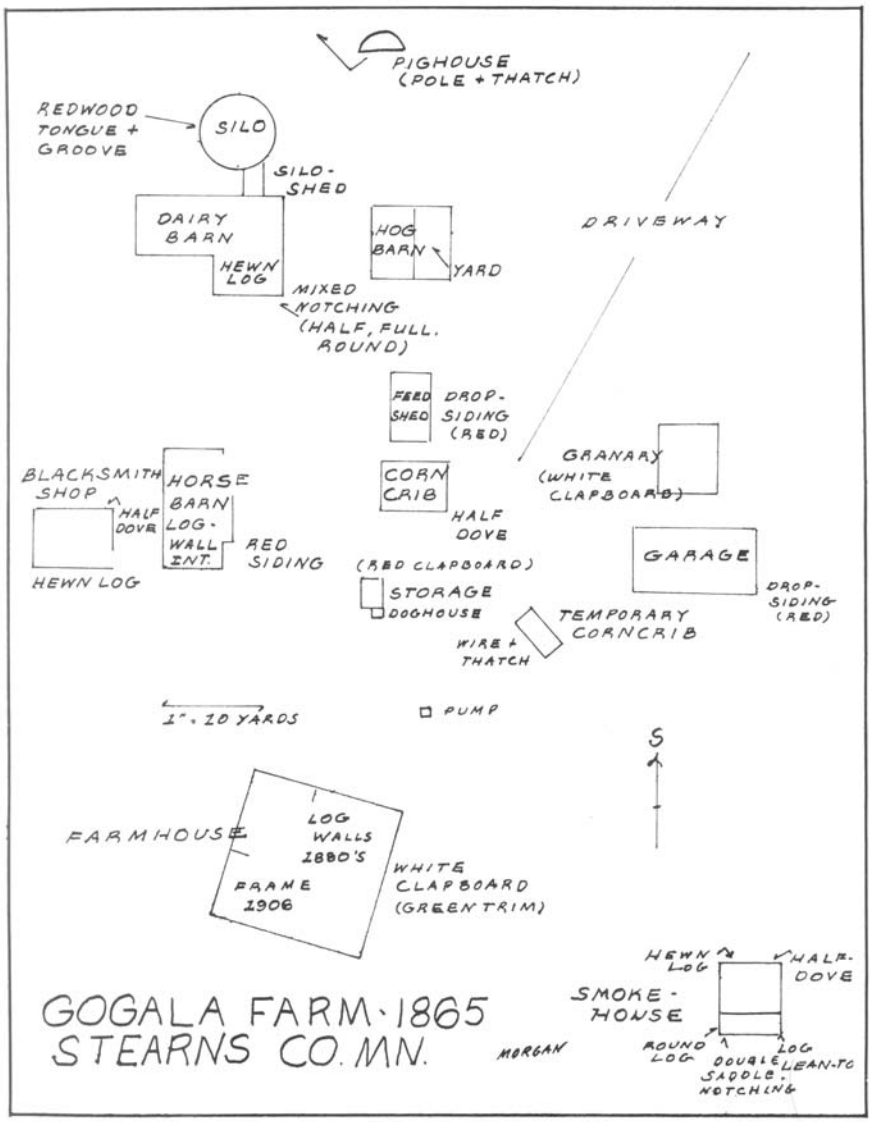
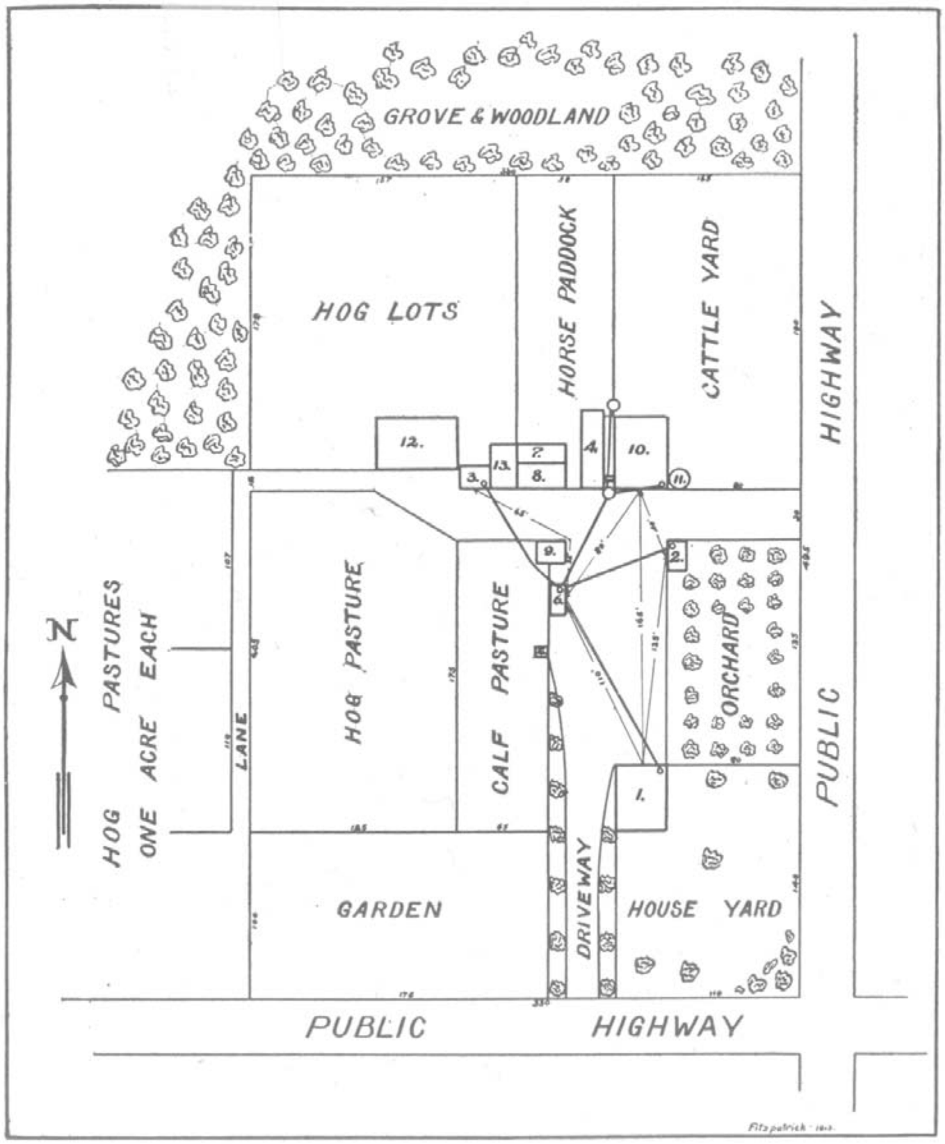
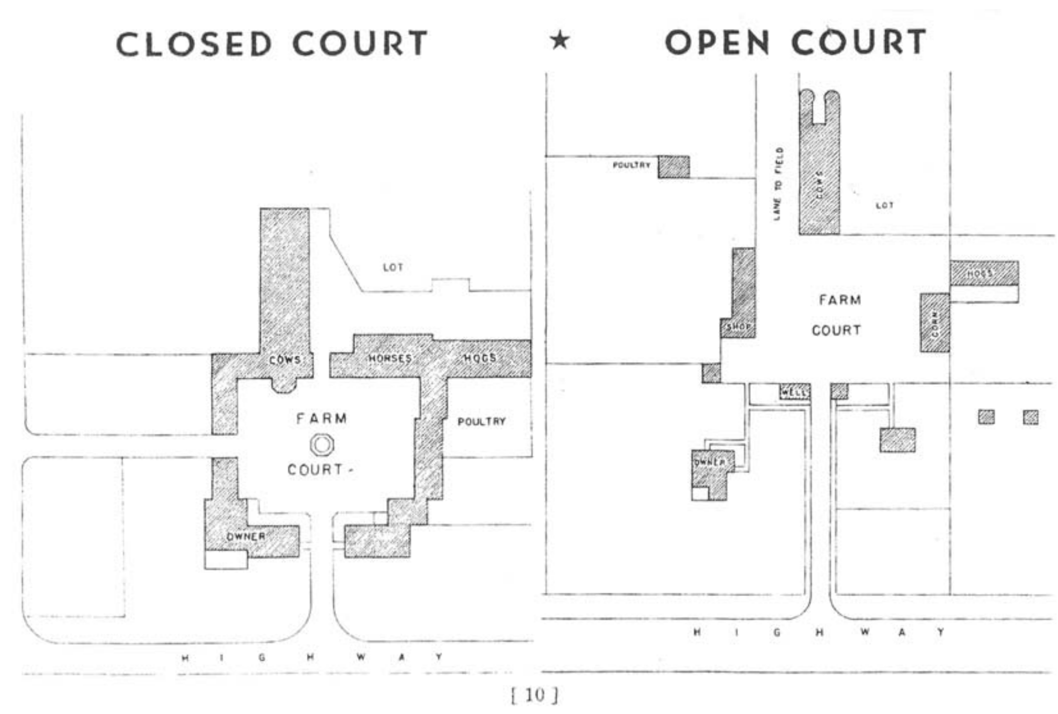


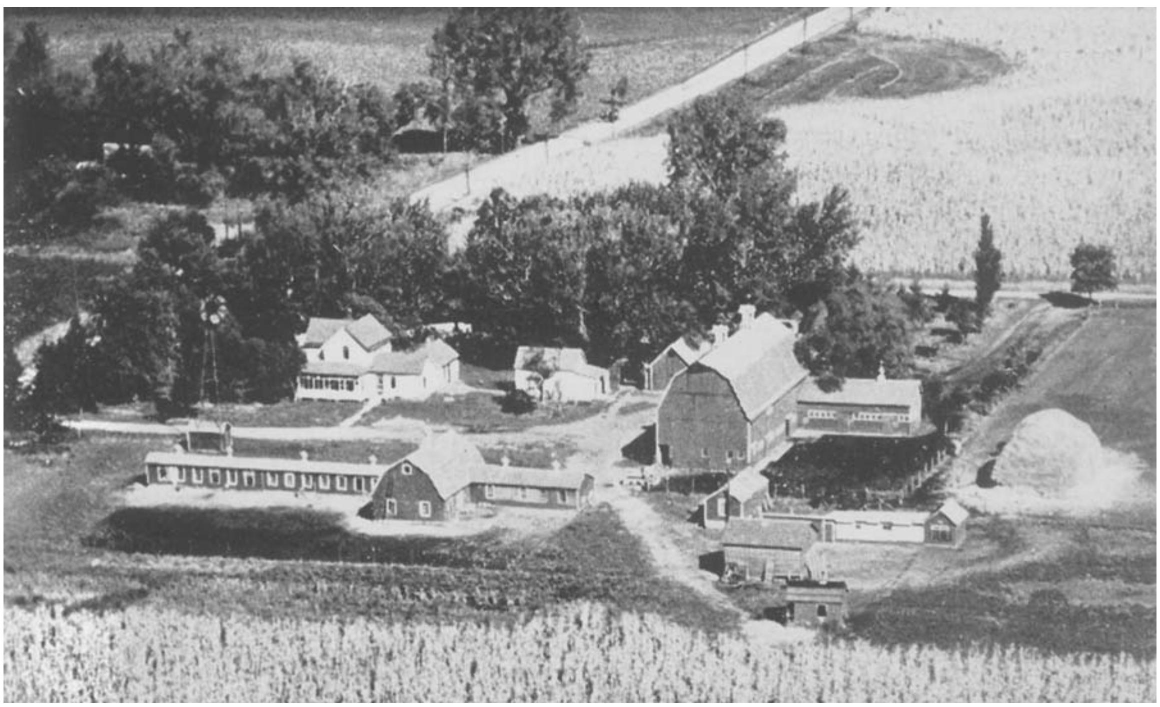
In their 1982 study of settlement-era farmsteads in central Minnesota, Marilyn Brinkman and Bill Morgan studied the Anton Gogala farmstead, established in the 1860s, which had tight clusters of buildings. From Brinkman and Morgan (1982).



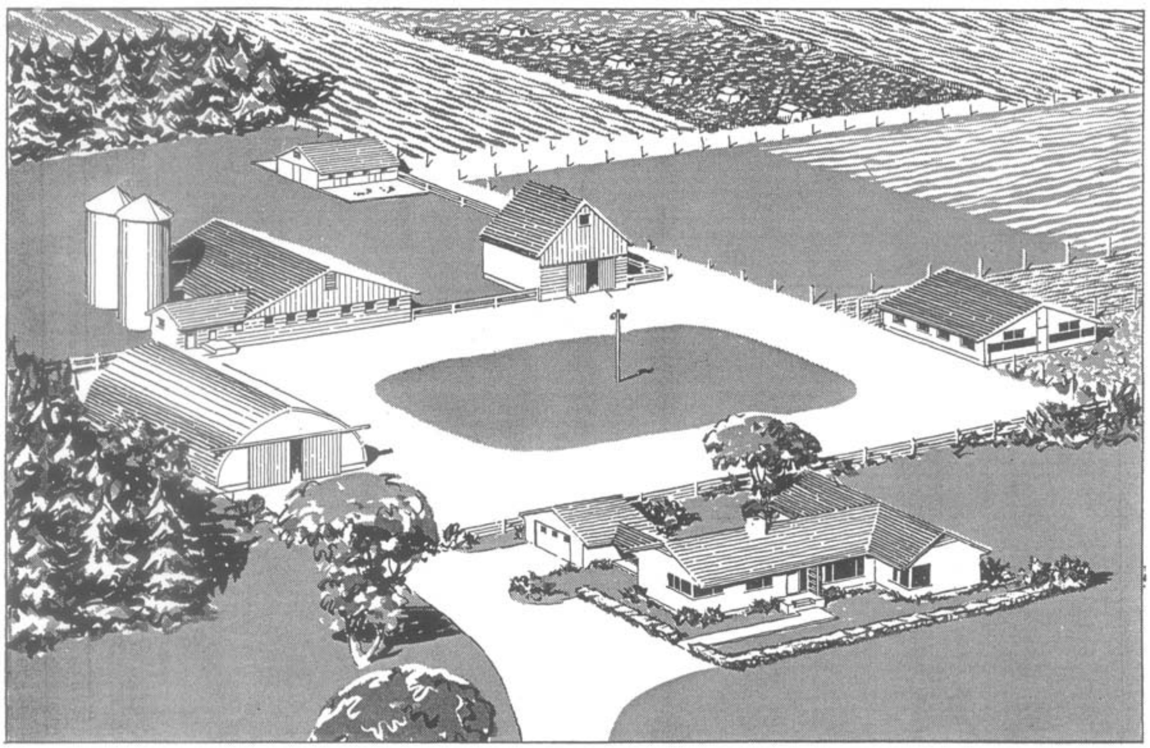
This illustration from *Farm Management* (1914) by the University of Minnesota's Andrew Boss shows buildings well-located, considering the farmer will need to travel three times per day between the corncrib and the hog barn, between the well and the hog barn, and between the farmhouse and the poultry house, according to Boss.



Closed court and open court plans from a 1941 publication, *Brick and Tile on the Farm*, published by the Structural Clay Products Institute. This trade group advocated the closed court, which was predicated on their fireproof building materials.



This University of Minnesota photo illustrates "A well-developed farmstead. The farmstead is the center from which a farm is operated. One that is well-proportioned, with buildings conveniently placed and arranged, contributes much to the economy of operation." The caption for a similar photo in the book indicates that "A well-established and orderly farm unit should be the objective of every farm operator." From Boss and Pond's *Modern Farm Management* (1951: plates 1 and 17).



This illustration of good farmstead planning appeared in a 1951 National Plan Service catalog called *Practical Structures for the Farm*. Among the recommendations accompanying this drawing was that the buildings have "some degree of uniformity in color, roof coverings, rooflines, and foundations."

▪ FARMYARDS

- The central common area enclosed by barns, implement sheds, and farmhouse
- Often the site of the windmill, electrical distribution pole, and fuel tanks
- The area near the back door of the house was often an intensive outdoor work area

The farmyard (sometimes called the court or barnyard) was a central common area into which the main driveway usually led. The yard was usually surfaced with dirt or gravel and patches of grass. The ornamental lawns of the farmhouse were nearby but generally not part of the "farmyard," which was typically a work area.

Buildings for crop storage, animal husbandry, and implement storage were generally grouped on one side of the farmyard, with the domestic service area and farmhouse located on the opposite side. The windmill, electrical distribution pole, and elevated fuel tanks were often located at the edges of the yard, and the vegetable garden, orchard, and poultry house were often nearby. Brinkman and Morgan describe the yard of the Gogala farmstead as a "hub around which the wheel of farm activity moves" (Brinkman and Morgan 1982: 74). Farmhouses, farmyards, and dairy barns were usually the first areas of a farmstead to be electrified.

Part of the farmyard – the domestic service area – usually extended outward from the back entrance of the house. In all but the coldest weather, this was an outdoor work center for innumerable chores like beating rugs, filling lamps, washing clothes, churning butter, and cutting meat. This was the area where threshing crews washed for dinner at outdoor plank "tables", where youngest children played, and through which family members made constant trips carrying water, firewood, ashes, eggs, and garden produce. The area contained the clothesline, which was placed in full sun, and often the water pump, trash burner, woodpile, and other utilitarian objects. The service area also needed to be large enough to allow a delivery wagon or truck to enter (Hunt 1937: 6-8; Snyder 1950: 4; Scharf 2004).

In 1961 agricultural engineers Neubauer and Walker wrote, "The kitchen is the farm woman's workshop, and should have access to the back yard, laundry, supplies, and equipment. It should overlook the farm court [farmyard], yards, and service buildings, as well as the children's play area. It may also view the farm driveway and road, when possible (Neubauer and Walker 1961: 104).

PREVALENCE

Farmyards were found on virtually all Minnesota farms. If the surrounding buildings remain, the spatial organization of the yard may be intact. Typical post-1960 alterations include removing windmills and other elements, paving portions of the farmyard with bituminous, removing historic circulation routes (such as gravel lanes) and converting them to lawn, and adding new structures.

See also

Farmsteads
Power Houses
Utility Poles and Equipment
Stockyards
Propane Gas Structures

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The farmyard was a convenient work area around which buildings were arranged. It was often surfaced with dirt and patchy grass. The windmill, electrical distribution pole, clothesline, trash burner, fuel tanks, hand water pump, and other pieces of equipment were often placed near the edges. The stacks of hay or unthreshed grain in this photo are covered with lightweight tarps to shed water. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

The service area near the back door was an outdoor workroom for washing clothes, filling lamps, churning butter, and countless other chores. To reduce the amount of water hauled, clothes were washed in reverse order of need, with the barn clothes washed last. Peterson Farm, Hamlin Township, Lac qui Parle County, circa 1910. (MHS photo)

■ FENCES

- Farms used fences to contain livestock; the type of fence depended on the type of livestock
- In the early settlement era, fences were made with materials available on the farm; later, farmers installed barbed wire and woven wire fences
- Barbed wire became common in the 1880s, woven wire in the 1890s, steel posts in the 1920s, and electric fences in the 1940s

Fences in Minnesota are especially linked to the diversification of agriculture in the late 19th century when farms replaced a wheat-only cropping system with a more sustainable mix of livestock and crops.

Fences were a major capital investment that could create new economic opportunity, just like a barn or other outbuilding. As early as the 1890s farmers were urged to see fences not as an expense, but rather as a means of increasing profits (Story 1897: 307).

Farmers put up fences to mark the boundaries of their property and subdivide their land, but especially to manage livestock by keeping them out of gardens and cultivated fields, off railroad tracks, within stockyards, and within pastures and harvested fields where they could forage.

Livestock were allowed to run at large in rural Minnesota until the 1870s. If farmers wanted to protect their crops, they needed to erect fences to keep animals out. Eventually in 1878 Minnesota law gave farmers damages for crop losses from livestock depredations, whether the field was fenced or not, making it expensive for stockmen to let livestock roam. Fencing-in of livestock then became standard (Jarchow 1949: 206).

Because crops were fenced, cattle farmers could drive their cattle along public roads to market. According to one historian, "This was possible as all roadsides were fenced. Someone, often on horseback, went ahead to see that all gates to fields were closed and to guide the cattle at crossroads" (Wayne 1977: 19).

In 1917 Minnesota law specified four types of legal wire fences for enclosing livestock. The law also recognized fences of "rails, timbers, wires, boards, stone walls or any combination thereof, or of streams, lakes, ditches, or hedges" (Jarchow 1949: 7, 205-206; Hart 1998: 170-171; "Legal Fence" 1918: 246-247).

TYPES OF FENCING

Stump and Brush Fences. In the early settlement period, pioneers made fences from materials at hand such as brush and trees cleared from their land. These were sometimes called brush, stump, or deadwood fences. In cutover regions settlers pulled up pine stumps that had wide, shallow roots,

See also
Fields and Pastures
Stockyards
Cattle Guards
Farmsteads

dragged them to the edge of the field, "tipped them over onto their sides, and lined them up to make fences that were quite effective" (Hart 1998: 166-171, 182; Noble 1984: 118-119).

Stone Fences. In areas where field stones were plentiful, farmers piled rocks along the edges of fields to get them out of the way of the plow, forming stone-pile fences that grew over the years. They were most often built in glaciated New England, New York, Ontario, Michigan, Wisconsin, and Minnesota (Noble 1984: 119). A few farmers built more elaborate stone walls, either laid dry or with mortar. Because wood was plentiful in much of Minnesota, however, stone was an uncommon fence material (Hart 1998: 182, 185-186).

Zigzag or Worm Fences. In newly-cleared areas frontier settlers often built zigzag fences (also called worm or rail fences) from wood the farmer chopped himself or obtained from a sawmill. Tree trunks were split into 10' rails and interleaved at angles to form a zigzag or "worm." The fences were often six or eight rails high. Zigzag fences consumed a considerable amount of wood and land, required hours of labor to build, and were subject to falling over (Jarchow 1949: 7).

Post-and-rail Fences. Post-and-rail fences – that is, fences with rails mortised into posts – used less wood and land than zigzag fences but required more labor to build. In the 1870s in Minnesota, a fence needed to have at least three rails and be 4' high to qualify as a legal fence (Jarchow 1949: 206; Noble 1984: 122-123).

Board Fences. Wooden fences made with three or four horizontal boards nailed to (rather than inserted into) wooden posts were also common on Minnesota farms, particularly after dimensional lumber became widely available. Sometimes a flat board was nailed across the top to protect the lower boards from the weather. A board fence made a secure livestock pen and it could be painted to give a neat appearance. Board fences, however, were not used in large quantity because they required many posts, were expensive to build and repair, and, according to one author, "the excessive winds of the Western [Minnesota] country [could] soon prove too much" (Story 1897: 310; Jarchow 1949: 98; Noble 1984: 124-125).

Hedgerows. On the treeless prairie some farmers experimented with living hedge fences. Hedgerows could both confine livestock and protect the animals from wind and driven snow. In 1894 one Minnesota writer praised the value of white willow for fences: "There ought to be a half-mile of white willow growing on every quarter section, for it will furnish a farmer with all his fuel, besides making a good fence and windbreak" (Ludlow 1894: 279). Another popular hedge fence planted in the Midwest, including southern Minnesota, was made of Osage orange trees. Osage orange enjoyed a decade-long boom that began in 1845 and lasted until the severe winters of 1856 and 1857 when many hedgerows died. Hart wrote in 1998, "Some prairie areas still have a few long derelict strips of overgrown Osage orange hedgerow that begin nowhere and end nowhere, but most of the old hedgerows have been grubbed out or bulldozed" (Hart 1998: 172; Noble 1984: 126).

Barbed Wire Fences. Before barbed wire became available in the 1870s, farmers made fences from 8-gauge round or oval wire, or flat wire with serrated edges. This kind of wire fence was easily broken, however, because it could not stand the pressure of cattle leaning against it. Expansion and contraction of the wire in temperature extremes also caused it to break (Schueler 1956: 675).

Although somewhat slow to catch on, barbed wire was mass produced in a wide variety of styles. It was made from two twisted strands of galvanized steel with about five twists per foot, a design that permitted contraction and expansion of the cable. Barbs were placed at intervals of 4"-5" and were diagonally cut in order to provide sharp points (Schueler 1956: 675; Story 1897: 310).

Barbed wire fences were cheap, effective, took up little room, did not harbor invasive weeds or damaging rodents, did not shade crops, and were easy to build (Noble 1984: 128). Barbed wire worked well for keeping cattle and horses fenced, but these valuable animals could be badly cut on the barbs. Barbed wire would not hold hogs, sheep, or goats, all of which required woven wire fencing (Hart 1998: 174).

In 1918 legal barbed wire fences in Minnesota needed posts not more than one rod (16.5' apart). The top wire could not be more than 48" high and the bottom wire had to be 12"-16" from the ground ("Legal Fence" 1918: 246-247).

Woven Wire Fences. Woven wire, also called hog wire, was first developed in the 1850s, but the early version was made of ungalvanized wire that rusted and broke in the cold. Woven wire fencing became practical in the late 1890s following advances in steel manufacturing and improvements in looms (Horton 1915: 135). It was expensive, but effective, and by 1907 experts were urging Minnesota farmers to replace their barbed wire fences with woven wire as soon as they could afford it:

> Most of us are glad that the barbed wire fence has had its day. To be sure, it served its purpose, and in most cases, paid for itself, but it must go and none too soon. The woven fence is far its superior in every way. It makes feasible upon the farm many features that otherwise would not be possible, such as the keeping of sheep or the 'hogging off' of corn. Still more than that, it makes desirable the use of permanent fences about the larger fields and the farm, whereby stock of all kinds can be turned out to glean the fields of grain and to gather weeds before going to seed (Olson 1907: 56).

Woven wire fence consisted of horizontal wires called line wires, and vertical wires called stay wires. Many variations were produced, and the fences generally stood 20" to 58" high. The vertical and horizontal wires were held together at each intersection by joints (called ties or knots) or by welds or twists. The wire was usually galvanized (coated with zinc), although lead, aluminum, enamel, and plastic coating was also used (Schueler 1956: 674). To prevent the stock from being electrocuted if the fence were struck by lightning, wire fences had to be grounded (Horton 1915: 136-148; Schueler 1956: 674-675).

Fences for hogs or sheep usually had rectangular mesh, which also kept out preying wolves and dogs. When topped with a strand or two of barbed wire, an all-purpose fence was created that could enclose hogs, sheep, cattle, and horses. Poultry fences, which also kept out predators, generally had woven diamond or hexagonal mesh. They were first made about 1865 (Horton 1915: 146-156; Schueler 1956: 674; Noble 1984: 131).

Wood Fence Posts. Posts were usually wood or steel; some fences used both. Minnesota's first farmers often cut wood posts from their own trees. They were cheaper than steel but didn't last as long and had to be set in hand-dug holes. The best were oak or cedar posts, which resisted rotting and could last 20 years or more. Posts of cottonwood, willow, jack pine, and tamarack were usually good for only a few years unless they were "barked" and treated against decay by smoking, charring, tarring, water seasoning, painting, or by applying a chemical preservative (Hart 1998: 177; Bassett 1918: 248; Aune 1908: 234; Horton 1915: 157).

The size of wood posts varied depending on the height, weight, and expected life of the fence. Temporary fence posts were generally 4″ wide or less and simply driven a short distance into the ground. Permanent wood posts were usually 5″ or 6″ wide and set about 3′ into the ground and about 16′ apart. End and corner posts, which bore most of the weight of the fence, were usually about 8″ wide and were installed in pairs set 10′ to 12′ apart They were usually anchored or braced with timber or wire (Wilson 1912: 322; Bassett 1918: 248-249).

Wire fencing was attached to wood posts with 1-1/2″ fencing staples. The staples were driven loosely into the wood, allowing the wire to play freely through the staples as the wire fence expanded and contracted and as cattle pushed on the fence (Bassett 1918: 251).

Sometimes field rocks were used to support fence posts. For example, wooden posts could be held in place by rocks contained within cylinders of woven wire fencing, wooden cribs, stacked tires, or other devices.

Steel Fence Posts. Used as early as the 1910s and common by the 1930s, steel fence posts were more expensive than wood but lasted longer and could be driven into the ground rather than being set into pre-dug holes. Steel posts were manufactured in many styles including flats, angles, channels, tees, trusses, and tubes. They were protected from rusting by painting or galvanizing.

By the early 20th century, steel posts fostered the use of temporary and portable farm fences and made it possible for one man to erect "80 rods of good fence in less than a day's time." Portable fences were especially useful for "hogging down corn, fencing small grain fields to utilize sweet clover after threshing, the fencing of temporary pastures, pasture rotation, and livestock sanitation methods [that required moving animals to fresh ground]" (Lyman 1930: 332). The University of Minnesota recommended a combination of permanent and temporary fences that allowed a farmer to quickly divide long fields into smaller sections. Permanent fencing mounted on anchored posts was installed on the long sides of the field, and then temporary posts and wire were stretched across the short side of the field "to make lots of any size desired" (Aune 1908: 232).

Concrete Fence Posts. In some parts of the Midwest farmers built permanent concrete fence posts. However, "there have been many cases of failure when using the cement post," said one agricultural engineer. This was primarily due, he believed, "to the lack of skill on the part of the maker of the post" (Horton 1915: 157).

Electric Fences. Electric fences became available in the early 1930s and were widely adopted after World War II, especially for rotational grazing. They were made of lightweight steel wire attached to plastic or porcelain insulators mounted on thin wood or steel posts. Fence posts were spaced at intervals ranging from 20′ to 80′. A fence charger or controller generated an intermittent electrical pulse that gave animals a painful but harmless shock when they touched the wire. Livestock quickly learned to respect the fence and remain within the enclosure (Kable 1936: 471; Hart 1998: 174). According to geographers Noble and Cleek, "Highly visible white porcelain insulators mark older fences" (Noble and Cleek 1995: 177).

Electric fences were cheap and easy to install and move, making them ideal for temporary fences. Farmers also found electric fences useful for protecting ditches from livestock, surrounding the hay stack to keep the stock out, pasture rotation, hogging down corn, confining the obstreperous farm bull, and dividing fields (Kable 1936: 471).

Electric fences did not work well for sheep, whose thick wool insulated them from electric shocks. Farmers trained the animals, however, by hanging shiny tin can lids from the charged wires. The curious sheep would put their unprotected noses against the can lids, receiving a shock that soon taught them to stay away (Hanke 2004).

Electric fences could be unreliable. Power failure was possible, and deer and other animals could disrupt the electric charge, permitting livestock to stray onto the road or into another farmer's field. For that reason, farmers often avoided using electric fencing along their property lines or next to a public highway (Hanke 2004).

Snow Fences. Snow fencing (also called crib or combination fencing) was made of wooden pickets or slats wired loosely together. It was commercially available by at least 1894 and was used by farmers to build low-cost corncribs and silos (Woodburn 1894: 347). Farmers also erected snow fences to force wind-driven snow to drift behind the fence instead of blocking roads or stockyards. Until the mid-1970s snow fences of this material were used frequently along Minnesota roads.

Ornamental Fences. Ornamental or lawn fences were used to enclose the farmhouse lawn or garden, accent landscaping features, or separate the domestic and work areas of the farmstead. They were usually made of wood, stone, iron, or wire. Ornamental wire lawn fences were not in widespread use until after 1920 (Schueler 1956: 675; Snyder 1950: 2-9; Hunt 1937: 2-12).

Gates. Farmers used a variety of structures to get in and out of fenced fields and pastures and, in planning fields, they had to consider the number of gates that had to be repeatedly opened and closed. Common methods to access fields included gaps, stiles, gates, and cattle guards. Gaps were made by attaching the fence strands to a loose, upright pole and slipping the pole into wire loops at the top and bottom of the next post. A stile was a set of steps or a ladder that allowed people to climb over the fence without damaging it. Gates came in all sizes, shapes, and materials. A Y-shaped "kissing" gate, for example, let people through but blocked animals (Hart 1998: 179-180).

PREVALENCE

Fences were found on virtually all Minnesota farmsteads before 1960. During the last 20 years, fences along fields have been steadily removed as farm machinery and fields have grown larger and as livestock farmers have moved to confinement operations and no longer put animals in pastures. Within farmsteads, fencing is also being removed as animal enclosures are no longer needed. A farm or farmstead with intact or extensive historic fencing is likely to be rare.

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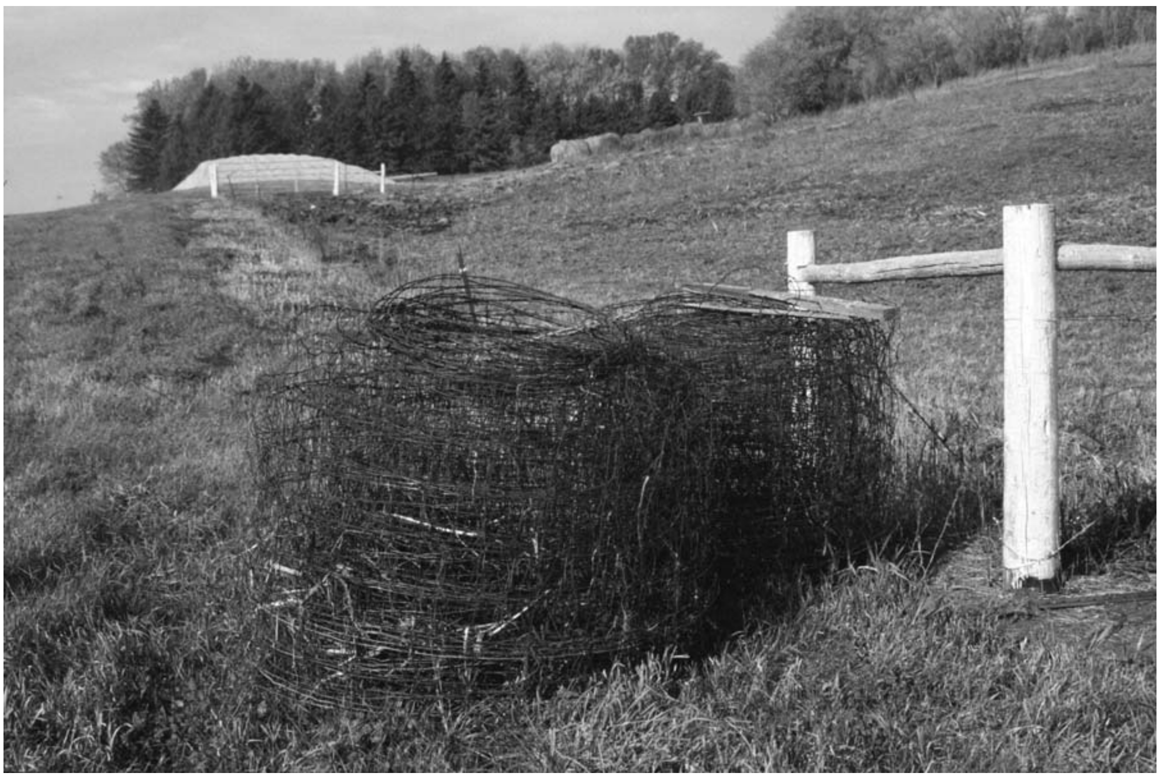
A barbed wire fence with a braced corner post and a simple gate consisting of two removable log rails. Farmers tried to plan their fields so they didn't have to open and close too many gates as they moved machines or livestock from field to field. Location unknown, circa 1910. (MHS photo)

Two whitewashed wooden gates marked openings in a woven wire fence that had round wooden posts. One gate was the width of a wagon and the other was more narrow. Many farmers preferred woven wire fences because they held sheep and hogs, which barbed wire couldn't contain, and because they didn't have sharp barbs that injured valuable horses and dairy cows. Location unknown, 1914. (MHS photo by Charles J. Hibbard)

A barbed wire fence with homemade wooden posts. Location unknown, circa 1940. (MHS photo)

One of many styles of woven wire fence that were commercially available. This fence had steel posts, which were common on Minnesota farms by the 1930s. Miller Farm, Lac qui Parle County, circa 1950. (MHS photo)

This woven wire fence had wooden posts and a steel gate. Location unknown, 1952. (MHS photo by Norton and Peel)



As farms phased out their livestock and as machinery increased in size, scenes like this became increasingly common as fences were removed. Stevens County, 2004. (Gemini Research photo)

▪ FIELD ROCK PILES

- Rocks pushed to the surface by frost heave had to be removed from farm fields to protect equipment
- Farmers usually heaped field stones along the edges of fields
- Rock piles are found on farms in all parts of Minnesota

Nearly all of Minnesota, except for a small area in the southeastern part of the state, was once covered by glaciers. Embedded in the glacial drift that forms Minnesota's soils were stones and rocks that are pushed up to the surface each winter like an unwelcome crop. These frost-heaved stones had to be collected every spring and moved out of the fields so that farm equipment wouldn't be damaged.

Historically, rock picking was a job farm children helped with, and today farmers still hire school-age children to pick rocks. The workers walked alongside a four-wheeled wagon driven slowly through the field picking up rocks and tossing them into the wagon bed. When the load was full, the farmer drove to the rock pile and the rocks were thrown onto the pile one by one. Larger rocks were removed from the fields with crowbars, shovels, and log chains, with horses and later tractors supplying the power.

Eventually machines like front-end tractor-loaders with rock buckets and mechanical rock-pickers made the job somewhat easier, but rock picking was still an annual ritual.

Many farmers simply piled the stones in heaps near the edges of fields or at the base of utility poles.

Sometimes the piles could serve a second purpose. For example, rocks were often piled along the edges of lanes or streams to serve as riprapping to prevent erosion. Less common was to form rough boundary walls by stacking rocks along the edges of fields, pastures, or lawns. Field rocks were also used to support fence posts. The posts – usually wooden – were held in place by rocks contained within cylinders of woven wire fencing, wooden cribs, stacked tires, or other devices.

Rocks could also serve an ornamental purpose when placed along the edges of a driveway, sidewalk, or garden. Some farmers built elaborate lawn art, statuary, rock gardens, gate posts, or walls with field rock, usually mortared. Field rock was also used as a construction material for foundations or entire buildings.

PREVALENCE

Simple field rock piles are expected to be found on nearly all farms throughout Minnesota. More innovative or complex uses for field stones are expected to be more rare. Rock piles are likely to be more prevalent in areas where soils are particularly stony.

See also
Fields and Pastures

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Each spring, a new crop of frost-heaved rocks had to be picked from the fields. Some farmers built dry-laid boundary walls with the stones, but more often they were left in simple piles at the edges of fields or at the base of utility poles. On this farm the rocks are corralled in woven wire fencing. Buh Township, Morrison County, 2004. (Gemini Research photo)

It was common to pile field rocks at the edges of roads or streams to serve as riprapping. Retzlaff Farm, Framnas Township, Stevens County, 2004. (Gemini Research photo)

■ FIELDS AND PASTURES

- Field sizes and shapes were influenced by factors like topography, drainage, soil type, and farming methods
- Untillable land often served as permanent pasture
- Historically nearly all fields and pastures were fenced for livestock
- Field divisions changed considerably beginning in the 1950s when farmers shifted from mixed crop and livestock farming to cash crop operations

Farms were not divided into perfect sets of square fields. On the contrary, field divisions on most farms were complex, with sizes and shapes dependent on several factors. Factors influencing the size and location of fields and pastures included pre-existing conditions such as topography, soil type, and location of native streams and woodlots, and man-made and operational factors such as accessibility to the farmstead and to roads, the type of crops planted and livestock raised, drainage structures installed, and machinery use.

See also individual farm elements sections such as "Farms," "Farmsteads," "Drainage Structures," "Erosion Control Structures," "Fences," and "Irrigation Structures."

Field patterns were apparently fairly persistent through time. Geographer John Fraser Hart wrote in 1975, "the layout of fields, as a general rule, is even more conservative, and changes even more slowly, than agricultural practices. The field pattern of an area often reflects past agricultural practices better than it reflects those of today" (Hart 1975: 74; Hart 1998: 153, 278).

The term field generally refers to a plot of land, often (but not always) tilled. The term pasture generally refers to grazed land. Pastures, also called meadows, could either be permanent, which could make good use of untillable land, or impermanent, sometimes called rotational. Impermanent or rotational pastures were planted with grasses, legumes, and other forage crops. Some pasture plants were perennials and some reseeded themselves, so a planted pasture could remain productive for several years, especially if enriched with manure.

Cropland had to be well-drained to be productive, and topography was a major factor in field size and layout. Farmers had to work around hills, ravines, streams, sloughs, timber stands, and roads, and try to use these features to best advantage. An 1898 example of a field layout for an 80-acre Minnesota farm created three, nearly-square, fenced fields arranged around a central permanent pasture that was cut by a deep ravine. The plan allowed a three-crop rotation, made full use of the farm's untillable land, and minimized the distance needed for manure hauling (Gregg 1898: 154-155; Howe 1940: 2-20; Hays et al 1912).

Soil type was another important factor in field and pasture division. Fields of mixed soil type dried out unevenly in the spring which impeded tilling and planting. Experts recommended, "Where the

See also

Farms
Field Rock Piles
Erosion Control Structures
Drainage Structures
Fences
Shelterbelts

soil varies considerably, each type should be segregated into separate fields so that all the land in each field will be ready to work at the same time and will receive the proper fertilizer treatment and cropping sequence" (Howe 1940: 4).

Whenever possible farmers tried to arrange fields that touched the farmstead rather than being located a long distance away. According to one Minnesota expert, in 1912 a 30-acre cornfield could easily require 240 annual trips between farmstead and field just to transport manure, plus 9 trips for harrowing, 8 for disking, 6 for planting, 40 for cultivating, and 60 for husking the standing corn. At a time when most farming was done with horses, the time saved with an efficient arrangement was considerable (Wilson 1912: 116).

Supporting the farm's livestock was an important factor in field and pasture layout. Having fields approximately the same size helped ensure a predictable supply of livestock feed as fields were rotated. Pastures had to be accessible to drinking water for the stock.

After 1900, the number and size of fields and pastures was often dictated by the farm's crop rotation. To work well in rotation, fields (or sets of fields) had to be about the same number of acres. A model plan from the 1910s, for example, divided a 160-acre farm into five fields – about 20 acres each – for the rotation of major crops, plus approximately seven smaller fields closer to the farmstead for the rotation of pasture crops and for supplemental space for the main crops. A plan from 1951 divided a 160-acre farm into six 26-acre fields – four of them long and narrow – for crop rotation (Boss and Pond 1951: 165). By 1940 many Minnesota farmers had settled on a standard rotation of corn, small grains, and a forage crop such as sweet clover or alfalfa, and divided their fields accordingly (Howe 1940: 4; Wilson 1912: 115-117; Boss 1914: 83-85; Boss and Pond 1951: 164-167).

Fields and pastures needed to be fenced to allow livestock to eat crop residue and forage plants. Fields grazed by hogs and sheep were generally small because they needed to be fenced with woven wire which was expensive. Fields grazed by cattle could be larger because they were fenced with barbed wire and, later, electric fencing (Lyman 1930: 330; Hanke 2004).

Field layout had to strike a balance between the expense of fencing and efficient machine operation: longer and narrower fields were more efficient for machinery, but square fields used less fencing. Fields two to three times as long as they were wide were considered a workable compromise. When portable electric fencing became available in the 1930s, the cost of fencing became less of a factor in field dimensions, "thus favoring the narrow field" (Howe 1940: 4).

Fields and pastures were often improved with drainage systems, and less commonly with erosion control structures and irrigation structures. Minnesota farmers began to build ditches and other structures to drain fields as early as 1860. As wet spots were drained, farm fields generally grew and became more regular in shape. Drainage was especially intense in 1900-1915, but continues today. Erosion control structures such as terraces and flumes were built beginning around 1900, but increased considerably in the 1930s. Some isolated fields were irrigated beginning in the 1920s, and irrigation became more widespread beginning in the 1950s.

Field divisions changed with mechanization and with other advances in agricultural technology. Fields were enlarged and lengthened, for example, as draft horses were replaced with tractors and farmers were able to till more land with less labor (Doane 1929: 28).

Beginning in the late 1950s many Minnesota farmers changed from mixed crop and livestock farming into crop-only systems, and began to use larger implements. They removed unneeded fences, enlarged their fields, and lengthened them to reduce the time wasted in turning the larger machinery (Hart 1998: 187; Howe 1940: 18).

After 1960, machines grew still larger, farm size increased, livestock raising became concentrated on fewer farms, livestock were less frequently put out to pasture, and farmers used fertilizer and pesticides instead of rotating crops. All of these factors favor larger fields and fewer field divisions.

Demonstration Plots. Some fields included demonstration plots, which were small areas planted along busy roads and identified with signs so passing farmers could see the results. The plots were used to demonstrate new crop varieties, hybrids, weed control, fertilization methods, drainage, and other new technologies. Railroads and other land developers used demonstration plots effectively in Minnesota in the late 19th century, and the Minnesota Extension Service began using them as a teaching tool around 1920 (McNelly 1960: 84).

PREVALENCE

The earliest field and pasture divisions may remain on farms where topography and other conditions have discouraged farmers from adopting cash grain systems with their very large equipment and expansive fields. Historic field patterns can sometimes be discerned through the location of existing fence lines along which volunteer trees and shrubs may grow, and preserved by the location of farm lanes, woodlots, streams, and other natural landscape elements. Farms with full sets of fields in pre-1960 patterns may be rare.

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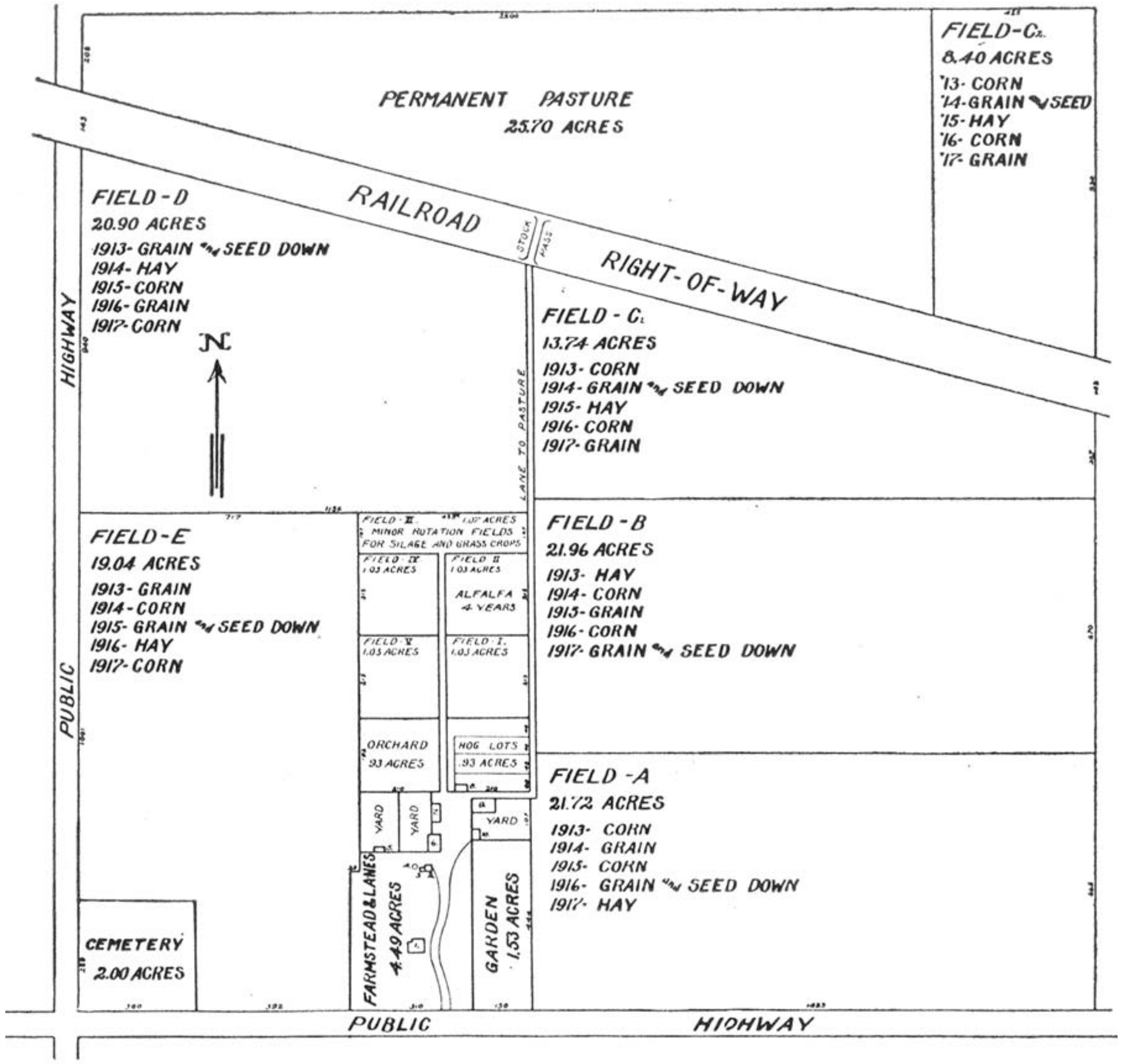

This 160-acre farm from the 1910s had five 20-acre fields for rotating major crops, and several smaller fields for rotating pasture, forage crops, and extra amounts of the major crops. The smaller parcels were located close to the livestock yards. Note the farm lanes and an underpass to move livestock under the railroad to the north pasture (Boss 1914).

A wheat field, location unknown, circa 1920. (MHS photo by Henry A. Briol)

Field divisions are responses to topography, the square divisions of the Public Land Survey, ownership patterns, drainage, and farm operations. By 1938, when this photo was taken, tractor use was increasing and fields were being lengthened to reduce the time wasted in turning machines. A closer look at this high-resolution photo revealed neat rows of grain shocks standing in several of these fields. (ASCS photo, Borchert Map Library, U of M)

A cornfield with shocks. Location unknown, circa 1940. (MHS photo by Kenneth Melvin Wright)

■ GARAGES

- Farmers were very early buyers of automobiles
- 87 percent of Minnesota farms had an automobile in 1939
- Garages on farms were similar to urban garages, unless combined with a farm shop or implement shed

Minnesota farmers began using automobiles as soon as they could afford them. Automobiles made farm operations easier and reduced farmers' isolation. A trip to town to buy parts or hardware or to deliver eggs might only take a few hours in an auto, rather than all day.

In the 1910s, some farmers used their automobiles not only for transportation, but as a source of farm power. The Ford Motor Company and others sold conversion kits, which turned the family car, in the words of one author, "into a powerful farm tractor" (Barlow 2003: 122). For as little as $195, farmers could turn their Model T loose in the fields, towing a plow. Also available were kits that ran a belt from the Model T's rear wheel to power pumps, churns, feed mills, saws, washing machines, and electric generators (Barlow 2003: 122).

By 1939, 87 percent of Minnesota farms had an automobile, compared with only 18 percent of farms that had a truck. The fewest farms with automobiles in 1939 were located in the low-income northeastern Minnesota counties where only 73 percent of farms had a car that year. Cars were more prevalent in southern Minnesota counties where 93 to 95 percent of farms had cars in 1939 (Engene and Pond 1944: 28).

Most automobile garages on farms were similar to urban garages unless they were combined with an implement shed or farm workshop.

Most garages were woodframe and covered with wood siding, although concrete block, clay tile, and even fieldstone garages were built. Most garages were placed on concrete foundations and had floors of concrete, cinder, or dirt. The first garages had swinging hinged doors although, by the 1930s, garages with vertically-opening doors were common. Windows provided natural light, especially in years before electrification.

The garage could include a small workbench. An elevated fuel tank was sometimes installed outdoors nearby.

PREVALENCE

Garages were built on nearly all Minnesota farms, except where automobiles were stored in another building. It is expected that many well-preserved garages are still standing, with examples from the 1920s and earlier being more rare.

See also
Farm Shops
Implement or Machine Sheds
Roads, Lanes, Tracks, Sidewalks
Appendix: Focus on Mechan Techno

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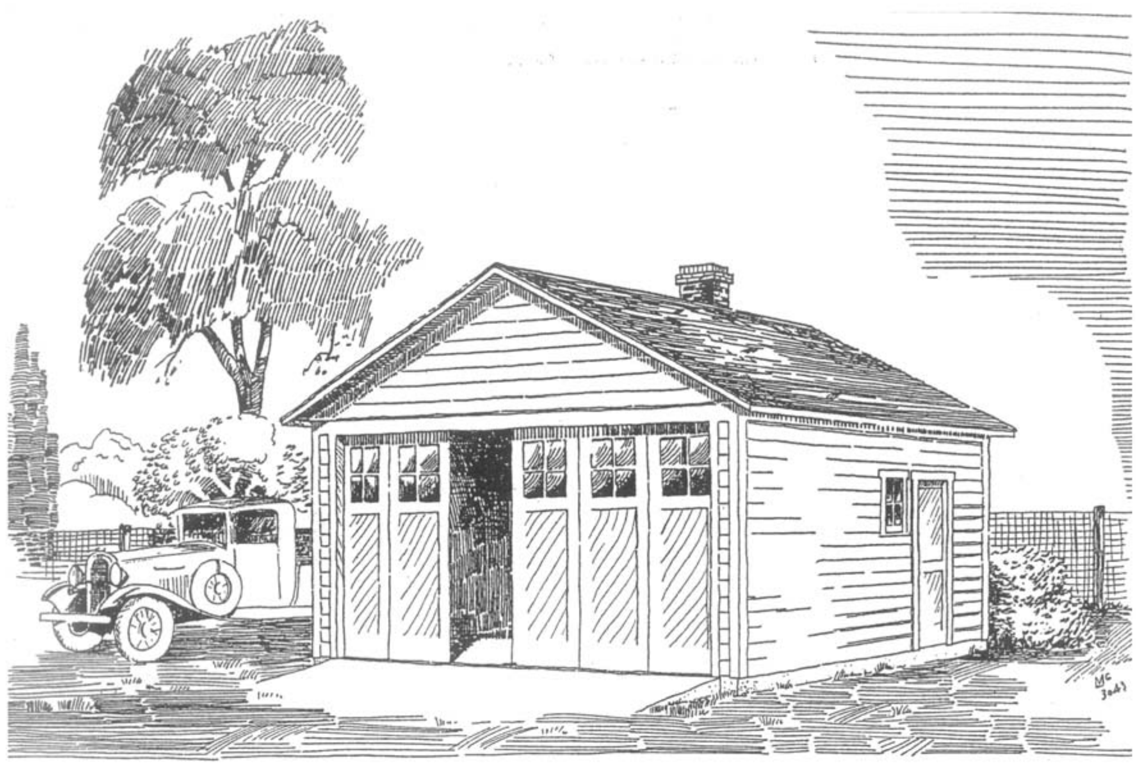

Minnesota farmers could order plans for this 20′ x 24′ garage with hinged doors and drop siding from the Midwest Plan Service. Note the chimney, which could vent a heating stove or forge near the back wall's workbench. From Midwest Farm Building Plan Service (1933).

■ GARDENS (VEGETABLE)

- A home vegetable garden was considered essential to nearly all farms
- Gardens were usually placed near the house in the shelter of the windbreak
- Poultry were kept near gardens to help control insects

Vegetable gardens and orchards provided essential food for farm families beginning in the early settlement era. Some families derived extra income from their home garden – for example, by selling vegetables and fruits in roadside stands or growing cucumbers to be made into Gedney pickles. (See "Roadside Markets," another individual farm elements section.)

An 1894 publication noted that "no farmer can afford to fail to spend the time to read and learn how to grow vegetables and small fruits, the money for seeds and plants, or the labor of raising all of these that the family wants" (Hays 1894: 278). In a 1921 survey of Minnesota farm women, 60 percent said their gardens were important, and many called them "positively necessary to our very existence" (Lundquist 1923: 14, 24). Reflecting this need, University of Minnesota farmstead plans from the 1890s to the 1950s consistently show a garden and orchard on every farm (Hays 1894: 272-278; Kirkpatrick 1910: 273; *Farm Building Plans* 1953).

Traditionally, the garden, orchard, and poultry care were women's responsibilities. For convenience "the orchard, garden and poultry are placed near the house, because the housekeeper often cares for the poultry and makes many more trips to the garden and poultry house than anyone else" (Wilson 1909: 26). The vegetable garden was usually to the rear or side of the house between the house and the windbreak, with orchards and berry bushes nearby. The hen house was normally placed near the garden to allow the chickens to forage for insects and help control garden pests. The garden was often fenced, however, to keep chickens away from the plants (Lundquist 1923: 14; Wilson 1914: 58; *Farm Building Plans* 1953; Hays 1894: 272-278; Kirkpatrick 1910: 273).

Big gardens were the rule on Minnesota farms. A University of Minnesota publication advised in 1931, "Particular attention should be given to having a farm garden of generous size, not only as a means of saving cash, but plenty of vegetables go a good way toward making certain that the family has a well balanced diet. If the garden is laid out in long rows about three feet apart, much of the work can be done with the horse cultivator" (Cavert and Pond 1931: 15). One 1956 source suggested that a farm garden of 100' x 150' would feed a family of five, but that a spot twice as large should be reserved so that crops could be rotated to preserve soil fertility (Roberts et al 1956: 214).

University of Minnesota building plans from 1953 show sample farmsteads with gardens ranging from 7,500 square feet to 30,000 square feet. Every summer and fall farm women typically raised and preserved an entire year's worth of vegetables and fruits such as strawberries and raspberries for the family table (*Farm Building Plans* 1953; Lundquist 1923: 14). Some Minnesota farmers also

See also

Roadside Markets
Landscaping and Ornamental Plantings
Greenhouses, Hotbeds, Coldframes
Orchards
Root Cellars

planted grapevines for making jelly or wine. The vines were trained on wire trellises strung between posts, which were usually set in rows on hillsides. Some varieties of vines had to be buried in the winter to protect them from freezing.

The necessity for large gardens and orchards on Minnesota farms declined as roads and transportation improved so that farmers could buy more things at stores, and as mechanical refrigeration and increasing amounts of pre-made, prepackaged, and frozen foods became available, particularly after World War II.

PREVALENCE

Vegetable gardens were found on nearly every Minnesota farm. It is expected that farms that retained gardens after the 1960s will have gradually made them smaller, and that large gardens will be uncommon. Like all vegetative features, garden plants, berry bushes, and similar elements are subject to change by natural processes.

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This photo appears in the 1951 book *Modern Farm Management* by the University of Minnesota's Andrew Boss and George Pond. The caption reads, "A good farm garden, suited to the size and needs of the home, will save expense for foods and add to the health and enjoyment of the family" (plate 21).

Big vegetable gardens were the rule on Minnesota farms. They were often fenced to keep out the chickens. Blonigen Farm, near St. Martin, Stearns County, circa 1960. From Marilyn Brinkman's *Bringing Home the Cows* (1988).

▪ GENERAL PURPOSE OR COMBINATION BARNS

- The most common type of barn historically built on Minnesota farms
- Almost always included, at a minimum, housing for dairy cows and horses
- Especially associated with the diversification of Minnesota farms, 1880-1960
- Sizes ranged from very small two-horse, two-cow buildings to large L-shaped barns

The most common type of barn on Minnesota farms was the "general purpose" or "combination" barn. General purpose or combination barns were associated with diversified or "general" farming, the most prevalent farming system in Minnesota between 1880 and about 1950.

Building a single all-purpose barn made economic sense for the general farmer, and most barns during Minnesota's early settlement era were of this type. During the early period, combination barns were often built of indigenous materials such as logs, stone, poles, mud, and straw. Dimensional lumber became the favored material for combination barns after local lumberyards were established and as farm income improved.

General purpose or combination barns shared many characteristics with Minnesota's dairy barns including size and shape, use of hay mows, and provision for ventilation, feeding, milking, and handling manure (Moore et al 1920: 546; Keith 1944).

Farm specialists remained consistent through the decades on the basic requirements of a general purpose barn. These were articulated by Neubauer and Walker in 1961:

Convenience – efficient arrangement of animals, alleys, and doors to minimize labor in feeding, milking, and cleaning the barn;

Sanitation – cleanliness, adequate lighting, drainage, storage, and proper ventilation to protect the health of animals and the quality of milk;

Economy – cost-effective, functional design; adherence to the requirements of dairy inspectors;

Appearance – both for aesthetic reasons and resale value. The authors noted that the barn "should be designed to harmonize with its general environment – adjacent buildings, surrounding vegetation, and countryside" (Neubauer and Walker 1961: 31-32).

Like all barns, combination barns were best sited on well-drained land, preferably southeast of the house. Adjacent manure piles or manure pits needed to be far from drinking water supplies. Many combination barns had a silo attached. Minnesota experts recommended that barns be aligned north and south to allow maximum light to shine into the windows (White et al 1936: 4).

See also

Barn Forms and Terminology
Dairy Barns
Beef Barns
Silos
Stockyards
Diversification & Rise of Dairy, 1875-1900

FORMS

Combination barns were built in a wide variety of shapes and types. See, for example, Dairy Barns and Beef Barns, two other individual farm elements sections, for information on forms and uses. See also this context's "Planning and Building Farm Structures: Barn Forms and Terminology."

SIZE

The typical width of general purpose barns in Minnesota ranged from about 20′ to 36′. Many experts considered 34′ the maximum desirable width in northern climates where the animals' body heat was needed to provide warmth in the coldest weather. (Hay in the mow and storm windows were also recommended for Minnesota barns.) Barn length was often limited by the size of the herd and by the length of hay carrier equipment. L-shaped barns were used to add capacity without over-extending length, to segregate dairy cows from other animals, and to provide a sheltered stockyard at the intersection of the wings (White et al 1936).

Combination barns could be very small. One plan offered for many years by the University of Minnesota created a 16′ x 18′ gable-roofed barn for two horses and two dairy cows. It had a small mow and a Dutch door that could double as a window. Slightly larger options were 16′ x 32′ and 16′ x 36′ (*Farm Building Plans* 1953).

A moderately-sized combination barn plan was featured in the *Minnesota Farmers' Institutes Annual* in 1903. Labeled a "good cheap barn for the small farmer," the 48′ x 48′ building was deemed sufficient for all stock, feed, and tools for a 40- to 80-acre farm. The ground floor was devoted 25 percent each to machinery, hay, horses, and other livestock. The hay mow had a hay carrier and hay door ("'This is the Barn'" 1903: 63).

In 1950 the National Plan Service was offering plans for 1 1/2-story general purpose barns in about 10 different widths between 20′ and 40′ and about 20 different lengths between 20′ and 80′. The smallest barn was about 20′ x 20′ and the largest 40′ x 80′. Roofs were gabled, jerkinhead, gambrel, gothic, and rainbow-arched, with or without details like hay hoods, flared eaves, bracketed eaves, dormers, cupolas, and circular metal ventilators (National Plan circa 1950; National Plan 1951).

In 1950 the National Plan Service also offered plans for one-story general purpose barns that were 18′, 32′, 34′, and 36′ wide. Their roofs were nearly-flat, gabled, and shed (National Plan circa 1950; National Plan 1951).

Moderately-sized multipurpose barn plans offered by the University of Minnesota in 1953 included footprints of 32′ x 56′, 34′ x 60′, and 36′ x 76′ (*Farm Building Plans* 1953).

In 1961 Neubauer and Walker indicated that most general purpose barns in the U.S. at that time ranged from 30′ to 40′ wide and 36′ to 80′ long. They reported that the most common widths were 34′ to 36′ with the length varying according to the number of animals. Feed alleys were generally 4′ to 6′ wide when carts were used and 8′ to 10′ wide for trucks and manure spreaders (Neubauer and Walker 1961: 39-41).

MATERIALS

Dimensional lumber was the most common material, but structural clay tile, concrete block, and brick were also used for combination barns. Dirt and wood were common floor materials. Because it was durable and could be easily washed, poured concrete was eventually favored for floors, although it could be cold and slippery for the animals. The concrete was sometimes overlaid with wood within the stalls (Cleland 1941; Hanke 2004).

As early as 1910 some farmers were re-siding their older combination barns with sheets of low-maintenance corrugated iron or steel. In the 1930s and 1940s changes occurred as innovations such as glued laminated trusses, metal framing, pole frames, and prefabrication were applied to the general purpose barn.

FUNCTION

While combination barns primarily housed dairy cows, calves, and horses, they could also shelter beef cattle, sheep, hogs, chickens, and turkeys, as well as store hay, straw, grain, corn, root crops, and machinery. (For the special requirements of each, see various individual farm elements sections in this context study.) Hogs, beef cattle, sheep, and bulls were kept in pens, and poultry were housed in a special poultry area with nesting boxes. Various animals were sometimes housed in an addition to the general purpose barn, rather than within it (Louden 1923: 95).

Some experts strongly discouraged sheltering dairy cattle with horses, despite the economic advantages of a shared facility. Milk easily absorbed barn odors and was contaminated by debris, and the constant noise, activity, flies, and dust of the horse area was incompatible with contented dairy cows and a sanitary barn. If the barn contained both, it was recommended that horses and dairy be clearly segregated by a wall or in separate wings of an L-shaped footprint. The gradual replacement of horses with tractors alleviated the situation as housing 5 to 10 horses on every farm was no longer necessary (Moore et al 1920: 540; White 1923).

Dairy cow areas generally had milking stalls and pens for maternity, calves, sick animals, young stock, or a bull. Whether the milk cows faced in toward the center or out toward the side walls was generally a matter of personal preference.

Areas for horses and mules usually had large doors for easy access to the outside and storage for harnesses and tools. Horse stalls were larger than those for dairy cows and had a different style of manger. The horse area usually had one or more box stalls for a sick horse, a "prized animal," or a team that was housed together – which was a common practice (Neubauer and Walker 1961: 39).

Some multipurpose barns had feed rooms in which feed was ground, chopped, and mixed. Feed rooms usually contained bins, scales, mixing containers, and a hay chute from the loft. Some basement barns had a trap door in the driveway that opened into a lower-level feed room. Some feed rooms had a root cellar nearby. Feed rooms were less important after commercial, fortified feed mixes became cost-effective and cylindrical bulk feed bins were installed. The latter were common by 1960.

Grain could also be stored in a combination barn. A 1933 plan from Midwest Plan Service described a 32′ x 32′ gambrel-roofed barn for a small farm. It contained four horse stalls, a box stall, two cow stalls, and four grain bins (Midwest Farm 1933).

Hay and straw were frequently stored in a combination barn. If feed and bedding storage wasn't included, the farm needed a separate storage area nearby. Minnesota farmers preferred to store feed and bedding with the animals because it reduced labor during the long indoor season dictated by Minnesota's winter.

When barns were electrified, agricultural engineers recommended that the new wiring include divided circuits, rows of overhead lights with reflectors to shed light for cleaning, double outlets for milking equipment, a heavy-duty 230-volt outlet for silo equipment, wall switches, and a master cut-out switch (White 1936: 19; Stewart et al 1928: 14).

PREVALENCE

General purpose barns were the most common type of barn built in Minnesota and are found throughout the state. Early examples will be less common.

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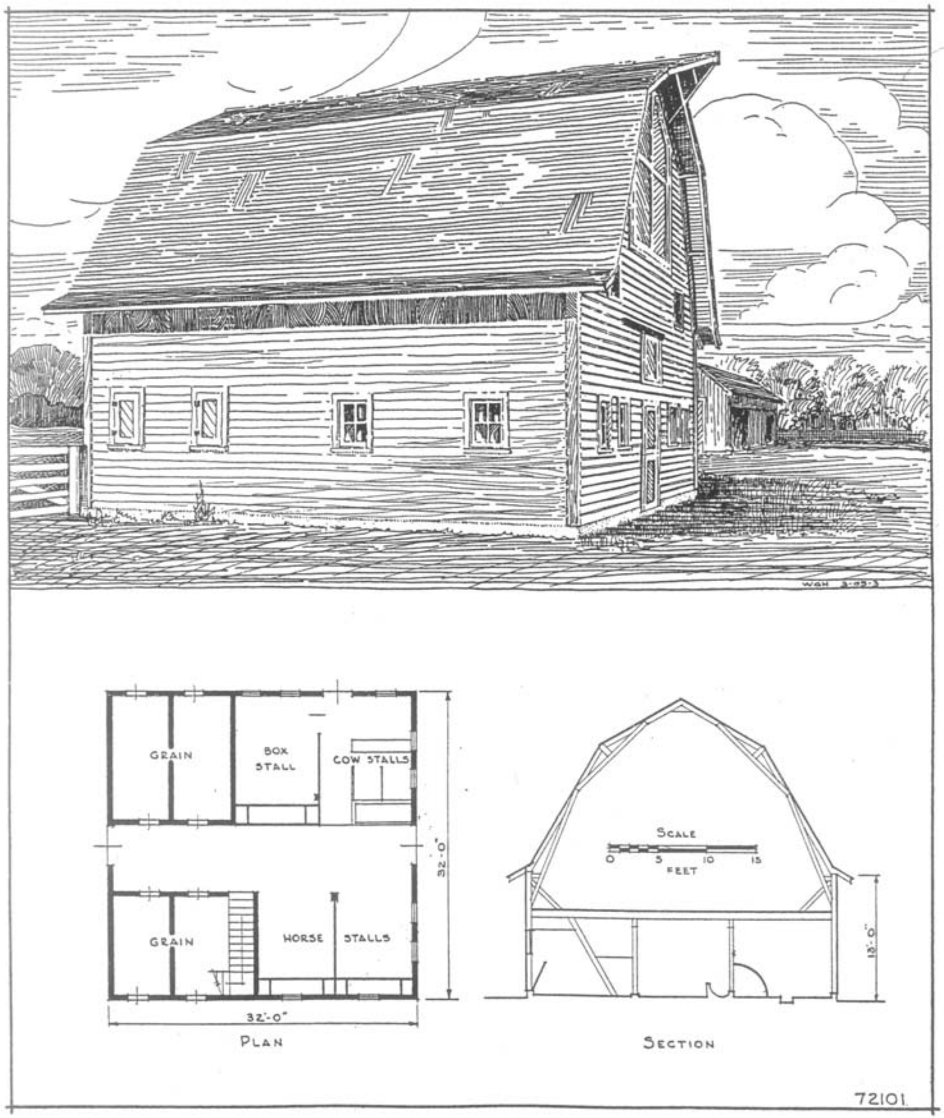
A settlement-era general purpose barn in wooded Douglas County. It was enlarged on one end, and eventually electrified. Note the tool grinder. Such grinders were used on most farms to sharpen mower sickles – twice a day during hay cutting. According to Steven Hoffbeck in *The Haymakers*, the grinder sat in the shade of a tree and children were pressed into service turning the handle while someone more skilled did the sharpening. Alexandria Township, Douglas County, 1983. (MHS photo)

This moderately-sized general purpose barn had vertical siding and three lightening rods on the roof. Location unknown, circa 1900. (MHS photo by John T. Austinson)

A relatively small general purpose or combination barn in Lac qui Parle County. In this photo the barn doors are painted with several names and "Madison, Minnesota 1902." Photo taken circa 1905. (MHS photo)

This barn was covered with corrugated metal panels. There are horses, cows, sheep, and hogs in the adjacent yards. Trygeseth Farm, Yellow Medicine County, circa 1915. (MHS photo by Ole Mattiason Aarseth)



In 1933 the Midwest Plan Service offered a 32′ x 32′ barn for four horses, two dairy cows, mow storage, and a granary with four bins. Storing grain with hay was discouraged by many experts because, if the hay caught fire, all feed would be lost (Midwest Farm 1933).

■ GRANARIES, ELEVATORS, BINS, DRYERS

- Essential for preserving crops for feeding livestock and timing market sales
- Sited for easy access to fields and stockyards
- Usually built of wood, metal, cement stave, or structural clay tile
- "Elevators" were granaries with built-in mechanical elevating equipment
- Cylindrical metal grain bins first became popular circa 1910-1914
- Portable elevating equipment was used by average farmers beginning in the 1920s
- Grain dryers were used in the 1940s and became more common in the 1950s
- Shelled corn was stored in granaries beginning in the 1950s

A granary was a structure built specifically for the storage of field crops – usually small grains, shelled corn, or soybeans. Metal grain bins and grain-drying structures are also included in this discussion. (See also "Corncribs," another individual farm elements section.)

Granaries allowed farmers to store crops outside of the barn. In addition to providing more ideal storage conditions, granaries separate from the barn reduced the danger that the entire crop would be lost if the barn caught fire, which was a common occurrence.

Granaries were used to store crops before they were fed to livestock or taken to market. Being able to store grain without spoilage and sell it when market prices were favorable freed farmers from being tied to immediate market prices.

In general, a farm's need for storage grew with improved seed varieties, crop rotation, fertilizer use, and mechanization, all of which increased production. New Deal farm programs and wartime output also increased storage needs. According to H. M. Bainer, an agricultural engineer writing in 1930:

> The 'combine' [first used in Minnesota in the 1920s] has revolutionized wheat harvesting and is compelling the farmer to make radical changes in his storage and marketing methods. The present plan, that of delivering a large part of the crop direct from the field to the market, results in a mad rush for space to unload and makes it impossible for local elevators and railroads to get the grain out of the way fast enough. As a result the farmer who does not have storage space is forced to dump at least part of his wheat on the ground. This rush plan has the temporary effect of overloading the market (Bainer 1930: 249).

One source explained that by the mid-20th century, "Nearly all grains produced on farms are stored before they are finally processed or consumed. The storage period may consist of a few weeks' holding on the farm or in transit or may extend to a year or more. Inadequate storage and conditioning facilities, or their complete absence, contribute to an enormous annual loss in the

See also

Corncribs
Threshing Barns
Scale Houses
Develop of Wheat Mono, 1860-1885
Appendix: Focus on Minnesota Crops

United States in the income from grains and to a loss of quality for consumption or processing" (Barre and Sammet (1950: 312).

DEPRESSION AND WARTIME

During the Depression there was an increase in grain storage structures in response to the Ever-Normal Granary, a New Deal farm program that began in 1938 and was administered by the USDA's Commodity Credit Corporation. Developed by agriculture secretary Henry A. Wallace of Iowa, the Ever-Normal program sought to protect farmers' incomes and consumer prices from market fluctuations. 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 with the idea that they could market the grain during years when supplies were down and prices high. One source wrote in 1938, "The federal government isn't interested in buying or taking delivery on any corn [or other grain]. It is interested, leaders say, in providing the means to enable the individual farmer to store his grain on the farm, and by so doing to establish orderly marketing to support the price and carry over a reserve from years of good crop production to years of less favorable yields" (Bridgman 1938; Tweton 1988: 121-123).

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). Participating farmers needed to store their grain in a substantial and permanent structure that would be weatherproof and protect against loss of crop quality, theft, rodents, birds, insects, and fire. Because participating granaries were sealed to discourage fraud, the granary also needed to "require forcible breaking in order to be entered when sealed" (Wooley 1946: 269).

As part of the subsidy program, the Commodity Credit Corporation purchased tens of thousands of prefabricated bins to sell to farmers and to install in large "bin sites" in locations where sufficient commercial and private storage was unavailable. In 1939, for example, the Butler Manufacturing Company won a contract to supply the Corporation with more than 30,000 steel grain bins. A recent history of the Butler company noted, "This order was one and a half times more bins than had been produced the previous year by the entire [steel grain bin] industry" (Butler 2004).

In 1942, after the U.S. had entered World War II, the Commodity Credit Corporation purchased another large group of prefabricated grain bins – this time wooden bins. Farmers were being urged to increase production during the war but storage space was lacking. One author explained that the prefabricated bins were needed in part because "There was not enough lumber and nails in local lumberyards to provide even an appreciable part of the storage needed in many of the localities" (Barre 1943: 290). The Corporation looked for prefabricated bins that were low-cost, easy to assemble, and convertible to other uses on the farm. Because of wartime shortages of steel and other materials, a variety of alternative materials and technologies were tested through the program. Among the prefabricated bins purchased by the Commodity Credit Corporation in 1942 were:

- rectangular wooden bins ranging from 8′ x 16′ to 14′ x 24′ with shed and gabled roofs. Some had shiplap siding, and some were built of tongue-and groove planks joined at the corners with notches.
- 12-sided structures built of wooden staves. The 12-sided design made use of short pieces of wood.
- 12-sided bins of vertical siding over wood sheathing

- circular bins built of plywood
- circular bins built of two layers of insulation board reinforced with circular steel bands
- circular bins built of vertical wood siding reinforced with steel bands (Barre 1943; Long 1943: 8; Fenton 1942).

The government storage program operated until circa 1972.

After World War II there was another wave of granary 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 draw and issue plans for grain storage structures to help take care of an estimated storage shortfall of one billion bushels. The Midwest Plan Service's resulting catalog, *Grain Storage Building Plans* (1949), was distributed through county extension agents, lumberyards, and other venues. It included a range of structures including some that could both store grain and double as garages, farrowing houses, etc. (Giese "Midwest" 1957; Midwest 1949).

By 1950 the storing of shelled corn in grain bins was on the horizon, as was increased use of mechanical drying. Writing in 1953, one agricultural engineer predicted, "Field shelling of corn, another probable development, would most certainly necessitate providing means for artificial drying of corn to reduce its moisture content to a point safe for bin storage. The field shelling method of harvesting corn would make the present slatted corncrib as obsolete as the horse stable" (Kaiser 1953: 36).

GRANARY DESIGN FEATURES

Centralized Versus Dispersed Storage; Permanent Versus Portable. Some farms used a centralized grain storage building for all crops. These were sometimes fairly large structures with built-in elevating equipment. Centralized structures were convenient because one piece of mechanical equipment could be used to convey all of the grain. This was especially useful in the years before portable conveyors became widespread. Centralized structures had some disadvantages including a high initial cost and the risk that the entire harvest could be lost to a single fire (Wooley 1946: 268-269).

Dispersed structures were advantageous because they could be placed near the field or stockyard, thereby reducing labor at harvest time or when feeding livestock (Wooley 1946: 268-269). The storage units could also be built one by one as needed.

Some farms used portable structures for maximum convenience. Some tenant farmers owned portable structures that they could move from farm to farm. Portable granaries were built on treated-wood skids and were light enough to be pulled by a team of horses or an average tractor. While low-cost, they did not usually last as long as fixed structures.

Location. Granaries were usually sited in locations that were well drained, were easily accessible by wagons and other equipment, were not too far from fields, and/or were near livestock feeding areas.

Size. The size of the granary depended on the size and type of farm. One author in 1912 recommended a 20′ x 32′ granary for a 160- or 320-acre Minnesota farm (Bassett 1912: 145). Small granaries held about 500 bushels of grain. Large structures could hold about 10,000 bushels.

Ventilators. Most granaries were windowless to keep out vermin. However, no matter what their size and style, granaries needed to provide adequate ventilation to keep the grain dry. This was critical, especially after farms adopted field combines. According to one agricultural engineer, "Before the days of the combine, when all wheat was cut with a binder or header and was shocked or stacked [outside], the grain had time to cure before it was threshed. The combine has eliminated this curing process and any excess moisture in the grain at the time it is harvested goes with it to the bin or market" (Bainer 1930: 249-250). To provide ventilation, many granaries had rooftop cupolas, monitors, or ventilators to draw air upward through the grain. Louvers in gable end walls were also common. Many granaries had vent shafts or flues within the bins to encourage air flow. Floors were raised above the ground for ventilation.

Drives. Many granaries and elevators had an interior drive for easier access. The drive could also be used to store implements and vehicles. If a built-in lift was present, the lift pit was often located beneath the drive. A grain cleaner (also called a fanning mill), which cleaned the grain so it could be used for seed, was sometimes operated from the central alley.

Doors. Granaries had small hatch doors in the upper walls and/or roof for filling. Man-sized doors at lower levels were used for unloading. Before mechanical elevators, granaries were filled by a worker with a shovel who usually stood in a wagon box.

Materials and Strength. Regardless of their size and materials, it was important that granaries be strong, well-braced, and balanced to provide stability against the weight of the crops. Wheat was the heaviest grain, exerting the most pressure on the walls and floor. Barley, oats, shelled corn, soybeans, peas, and flaxseed weighed successively less than wheat (Kaiser and Foster 1921: 54).

Woodframe granaries with ordinary stud walls were not usually strong enough and needed special bracing and internal cross-ties. Wood siding was sometimes installed on a diagonal for greater strength, or two layers of siding were used. If even more strength was needed in a wooden structure, it could be made with cribbed construction, often employed in commercial grain elevators. Cribbed walls were built of stacked boards laid flat with the broad surface down. The boards were overlapped on the ends and secured with spikes.

Round granaries were generally stronger than rectangular shapes. Round granaries were usually made of cement staves, concrete blocks, structural clay tiles, or metal, although wood and poured concrete were also used. While they were strong, masonry granaries were expensive to build and sometimes did not keep crops as dry as wooden or metal structures.

Foundations. Most experts recommended that granary foundations be made of poured concrete for strength. Setting the building up on large stones or concrete blocks was also common. According to geographers Noble and Cleek, "The most distinctive feature [of the granary nationwide] is the elevation of the building on several short piers of wood, stone, or cement block (Noble and Cleek 1995: 154).

Marauders. It was important that granaries keep birds, insects, and especially rodents from reaching the grain. Tall foundations helped deter animals, and it was recommended that bin floors be made of poured concrete or a combination of concrete and hollow clay tile to deter digging. Driveways often had gravel floors, and portable granaries had wood or metal floors. Some granaries had foundations that flared outward, or included skirts of sheet metal at the base of the walls, to keep out rodents.

COMMON TYPES OF GRANARIES

Common types of grain storage structures included the following:

Single Bins. Single-bin granaries were simple rectangular structures, usually with shed or gabled roofs. The smallest were about 8′ x 8′ or 10′ x 10′ and held about 500 bushels. Midwest Plan Service's 1949 postwar granary plans included several single-bin structures. They ranged from an 8′ x 12′ bin to a 22′ x 24′ single-bin structure that stored 3,400 bushels. Some were fixed on poured concrete, some were on skids, and some rested on concrete blocks. Siding materials included plywood, rolled asphalt, bricktex, or, for extra strength, a layer of drop siding over a layer of shiplap siding. Roofs were shed, gabled, and saltbox and were sheathed with corrugated aluminum, rolled asphalt, wood shingles, and plywood. Several of the Midwest Plan Service buildings could double as farrowing houses, brooder houses, or auto garages. By 1960, plywood, hardboard, and some plastics were also being used for single-bin structures (Midwest Plan 1949: 3-5; *Farm Building* 1953; Neubauer and Walker 1961: 210).

Double Bins. Double-bin granaries were rectangular structures with two grain bins separated by a single partition wall. Double bins could be built in phases with the second bin added as the farm's harvest grew. (One of the bins could also be a corncrib.) In 1933 the Midwest Plan Service offered a 12′ x 24′ woodframe, gable-roofed structure whose capacity was 2,000 bushels. The partition separating the bins was located mid-way along the 24′ wall, and there was a metal rooftop ventilator above each bin. The walls and roof were covered with galvanized sheet iron over shiplap siding. In 1949 the Midwest Plan Service offered two larger options, 20′ x 20′ (2,500 bushels) and 24′ x 24′ (4,500 bushels), with the partition aligned with the roof ridge. The Plan Service noted that these buildings could also serve as double garages for cars or trucks when not storing grain (Midwest Farm 1933; Midwest Plan 1949: 6, 13).

Double Bins with an Alley or Drive. A popular version of the double-bin granary had a central alley or a driveway, aligned with the roof ridge, that separated the two bins. The alley could range from a few feet wide to about 13′ wide and was often used to store machinery or vehicles, as well as provide air flow. A 1933 example was 31′ x 32′, with two 2,500-bushel bins separated by a 10′ drive (Midwest Farm 1933). The University of Minnesota offered plans for a version with an 8′-wide drive that was perpendicular to the roof ridge. The drive could also be used to store surplus grain (*Farm Building* 1953). The double bin with driveway model was the most common farm elevator design in 1921, according to one source (Kaiser and Foster 1921: 51).

Triple Bins with Drives. This structure had three bins and two driveways. The bins were located along the two side walls and in the center under the roof ridge.

Cross Driveways. Some farms used a cross-shaped granary with two intersecting driveways and four L-shaped bins, one at each corner. However, one 1921 source advised, "This type of crib has little to commend it" and indicated that the driveways "occupy an excessive amount of space in proportion to storage capacity" (Kaiser and Foster 1921: 51-52).

Multiple Bins. A rectangular, gable-roofed granary sometimes had four or more bins. A typical form had a central alley or storage room approximately 6'- 8'-wide, surrounded by four bins. Total capacity was about 2,000 bushels (Midwest Plan 1949: 5; National Plan ca. 1950: 45; *Farm Building* 1953).

Plans for a 31' x 40' structure were offered by Midwest Plan Service in 1949. It had six bins – two above the 11'-wide driveway and four flanking the drive. Capacity was about 8,000 bushels. The building was to be covered with corrugated steel over shiplap siding (Midwest Plan 1949: 6; National Plan 1951: 27).

Continuous Multiple Bins. Some granaries had multiple bins built side-to-side, forming a long, shallow structure somewhat like a continuous poultry house. The granary could be built to any length and bins could be added as needed.

Multiple Bins with Built-in Elevator. Larger-capacity structures (e.g., 8,000 to 10,000 bushels) often had multiple bins and built-in elevators. These structures were more likely than smaller structures to have cribbed construction. In 1933, for example, the Midwest Plan Service was offering plans for a 30' x 30' elevator with built-in equipment and storage for 10,000 bushels. It had a gambrel roof and a rooftop monitor. The ground floor had six equal-sized spaces – five bins and a power room – that flanked a central drive. There were four additional bins overhead. Plans for two similar buildings were offered by Midwest in 1949 (Midwest Farm 1933; Midwest Plan 1949: 7; National Plan ca. 1950: 47; National Plan 1951: 27).

Combination Granaries and Corncribs. Combination granaries and corncribs were very popular. They are described under Corncribs, another individual farm elements section.

Round Masonry Granaries. In 1916 round grain bins made of structural clay tile were in "common use" in some states like Iowa (King 1916: 62). In 1941, round grain bins built of tile were being promoted by the Structural Clay Products Institute. The bins ranged from 10' to 20' in diameter and had domed roofs (Structural 1941: 16). In 1948 the Portland Cement Association was promoting circular granaries of concrete block (Portland 1948). Circular granaries of reinforced poured concrete were also built (Neubauer and Walker 1961: 209).

Round Metal Grain Bins. Cylindrical steel granaries or "grain bins" were one of the first agricultural uses for steel framing (also called "light-load" steel framing). Most were prefabricated, and many had central ventilation flues. They first became popular around 1910-1914 and by 1926 one steel manufacturer wrote, "The great fields of the Middle West are dotted with steel grain bins" (Sheet Steel 1926). The Butler Manufacturing Company of Kansas City sold its first steel bins in 1907, and during the New Deal supplied tens of thousands of bins to the USDA's Commodity Credit Corporation (Butler 2004). After World War II, metal grain bins were widely built. They could be steel or aluminum, with either smooth or corrugated walls. The corrugation could run horizontally or vertically (Neubauer and Walker 1961: 210). Among the many popular brands of metal bins sold in Minnesota were Behlen (company established 1935 in Nebraska), Brock (est. 1952 in Indiana), Butler (est. 1901 in Kansas City), Chief (est. 1950s in Nebraska), and Sioux (est. 1918 in Sioux Falls).

Round Wooden Granaries. During World War II, circular plywood bins became popular, and they were still being built in 1961. Examples included structures that were 14′ and 19′ in diameter. Some had rolled asphalt or coats of linseed oil and varnish on the exterior walls. Roofs were often coated with hot asphalt, or with linseed oil and then aluminum paint (Fenton 1942: 217-218, 222; Neubauer and Walker 1961: 210). The bins were also made of double-layered insulation board or vertical wood siding, both reinforced with steel bands (Barre 1943).

Polygonal Wooden Granaries. Some grain bins were polygonal wooden structures that were shipped in pre-built sections to be assembled on the farm (Brooks and Jacon 1994: 63). In 1942, for example, the Ever-Normal Granary program was distributing prefabricated 12-sided bins of at least two styles: built of wooden staves and built of vertical siding over 1″-thick wood sheathing (Barre 1943).

Large Shed Granaries. By 1930 a few farmers in states like Kansas were using round-roofed "hangar-type" sheds in which to store wheat. The sheds had corrugated iron walls and concrete foundations (Bainer 1930: 251). After World War II, these large grain storage sheds became much more popular. Stran-Steel, which sold many Quonset buildings for grain storage, referenced the Ever-Normal program in a 1948 advertising appeal: "The current government wheat loan to farmers approximates $2.00 per bushel plus 7 cents per bushel for stored wheat. In the face of current elevator storage costs of 13 5/8 cents per bushel, plus haulage and dockage for ground-stored wheat, farmers cannot afford *not* to have their own storage facilities. Quonset buildings, immediately available for this purpose, give their owners these profit-making advantages" (Stran-Steel 1948).

In 1949 the Midwest Plan Service was providing plans for two buildings that could be used as combined implement sheds and granaries. (They could also accommodate built-in grain-drying equipment.) One was a 32′ x 36′ structure whose Quonset-style roof was supported by laminated wooden arches. The walls were built of corrugated steel over shiplap siding. The second was a 28′ x 40′ structure with a gabled roof. It was built of corrugated aluminum over shiplap siding. Both had large sliding doors (Midwest Plan 1949: 13, 14).

Combination Granary-Self-feeders. Some portable single-pen granaries were designed to also serve as self-feeders for beef cattle, hogs, and other livestock. In 1949, for example, the Midwest Plan Service was offering plans for a 16′ x 16′ granary-self-feeder with a 1,500 bushel capacity. It had a gabled roof and "coffin"-style stud walls that tapered inward at the base. The walls were sheathed with a layer of drop siding over a layer of shiplap siding. Openings at the base of the walls dispensed grain such as shelled corn to the livestock (Midwest Plan 1949: 16).

Grain Bunkers. Grain bunkers – large three-sided structures used to contain and store grain – were in use by 1960. Bunker walls were usually 6′ to 8′ tall and needed to be well-braced. Walls of braced plywood, treated timbers, poured concrete, and prefabricated concrete were used. The grain was usually covered with a tarp (Neubauer and Walker 1961: 210).

ELEVATING EQUIPMENT

Granaries were filled and emptied by hand until the development of mechanical equipment that could elevate crops. If a mechanical lift (also called a "leg") was permanently installed in the granary, the building was sometimes called an elevator. (The presence of this built-in equipment was sometimes the only difference between a "granary" and an "elevator.")

In most farm elevators, a wagon deposited the grain into a pit within the driveway. A drag or conveyor carried the grain to an upright elevator, which lifted it to the top of the granary. The rooftop monitor allowed the equipment to raise the grain high enough that it could be deposited into one of several interior bins or cribs. The farmer usually directed the chute to the correct bin using a wheel at ground level.

Portable elevating equipment, which could be wheeled up to granaries or grain bins, appeared on the market around 1904 (Kaiser 1953: 36). They were used on average Minnesota farms beginning in the 1920s. The machines were first powered by horses and later by tractors and gasoline motors. As portable equipment became more affordable, buildings with permanent lifts were built less often except on very large farms.

GRAIN-DRYING EQUIPMENT AND STRUCTURES

There was little mechanical grain drying on Minnesota farms before World War II and the use of the combine harvester. "The nearest approach to it was perhaps the practice of hanging in the attic those ears of corn selected for next year's seed" (Hukill 1957: 526).

Simple mechanical ventilators consisted of fans that blew air over and through the grain to speed drying. Dryers could also be run periodically to maintain storage conditions. Mechanical ventilators could be added to existing bins and cribs by, for example, adding a second, perforated floor above an original metal bin floor and using the space between the floors as the chamber into which the air was blown (Barre and Sammet 1950: 330-331).

Supplemental heat was often added to mechanical ventilation to dry the grain more quickly. One engineer explained:

> Grain drying on the farm before World War II was limited to a relatively few isolated installations. . . . [It] was following the war that grain drying equipment began to be readily available. Soon after the war manufacturers began making and selling driers which usually consisted of heaters and fans combined into single drying units with suitable controls. . . . At the same time, buildings and materials manufacturers have developed drying buildings, duct systems and various combinations for 'package' [marketing] distribution. About 1951 the Crop Dryer Manufacturers Association was formed (Hukill 1957: 526).

He added, "The only thing that stands in the way of [crop drying's] more universal use is the cost" (Hukill 1957: 527).

The use of artificial ventilators and dryers increased when farmers began using machinery that shelled corn in the field in the 1950s. The shelled corn was stored in grain bins rather than in corncribs and, because it was wetter than ear corn, it usually required mechanical drying before storage.

By the late 1950s, two methods of grain drying were being used on Minnesota farms: fast drying with heated air and slow drying with unheated air. Slow drying systems forced air through grain layers about 10′ deep. The grain-drying structure was usually a modified storage bin with a raised, perforated floor, or a system of ducts on the floor for distributing air. Slow drying usually took several days to several weeks per batch. That generally made it impractical to use the same drying structure for repeated batches. Some farmers supplemented slow drying with an intermediate system in which air was heated 5 to 15 degrees above the outside air temperature. This speeded up drying slightly and ensured that drying continued even in humid conditions (Hukill 1957: 526-527).

Fast drying systems forced heated air through shallow layers of grain. Drying typically took from a few hours to a few days. Regular grain storage bins could be used for fast drying if the depth of grain was no more than 3′. However, special drying structures were more common. These came in a variety of forms, but all were easy to empty and refill. One type of drying structure held grain in two parallel, vertical layers from 6″ to 18″ thick. Heated air was forced into the space between the two layers and moved horizontally through the grain, passing through screens or perforated metal walls. This structure often included an overhead hopper that fed undried grain into the bin. This type of structure could be used for either batch or continuous-flow drying. In a continuous-flow set-up, there was often a portion of the drying bin where grain was cooled with unheated air before being discharged. A variation of this type of drying structure was the diamond-shaped bin with sloping grain compartments. Another type of drying bin was a rectangular box-like compartment with inverted "V" ducts, open at the bottom, that extended across the bin at several levels. Half the ducts supplied heated air and half vented the exhaust (Hukill 1957: 526-527).

Farmers in the 1950s also used wagon-bed dryers for fast drying. A layer of grain was spread on a wagon bed with a perforated floor and the drying air was forced upward through the bed. Some farmers had several drying wagons, and moved the mechanical dryer from one to another. Some wagon-bed dryers had movable beds, so that grain could be dried in a continuous-flow operation (Hukill 1957: 526-527).

PREVALENCE

Granaries were widely built on farms across Minnesota. Because they were often strong and well-built, it is likely that many are still standing, possibly converted to storage and other uses. Large, elaborate elevators were less commonly built and extant examples are probably uncommon. Small lightweight portable granaries and those built of materials such as plywood may not have survived. Early examples of prefabricated steel grain bins are likely to be extant.

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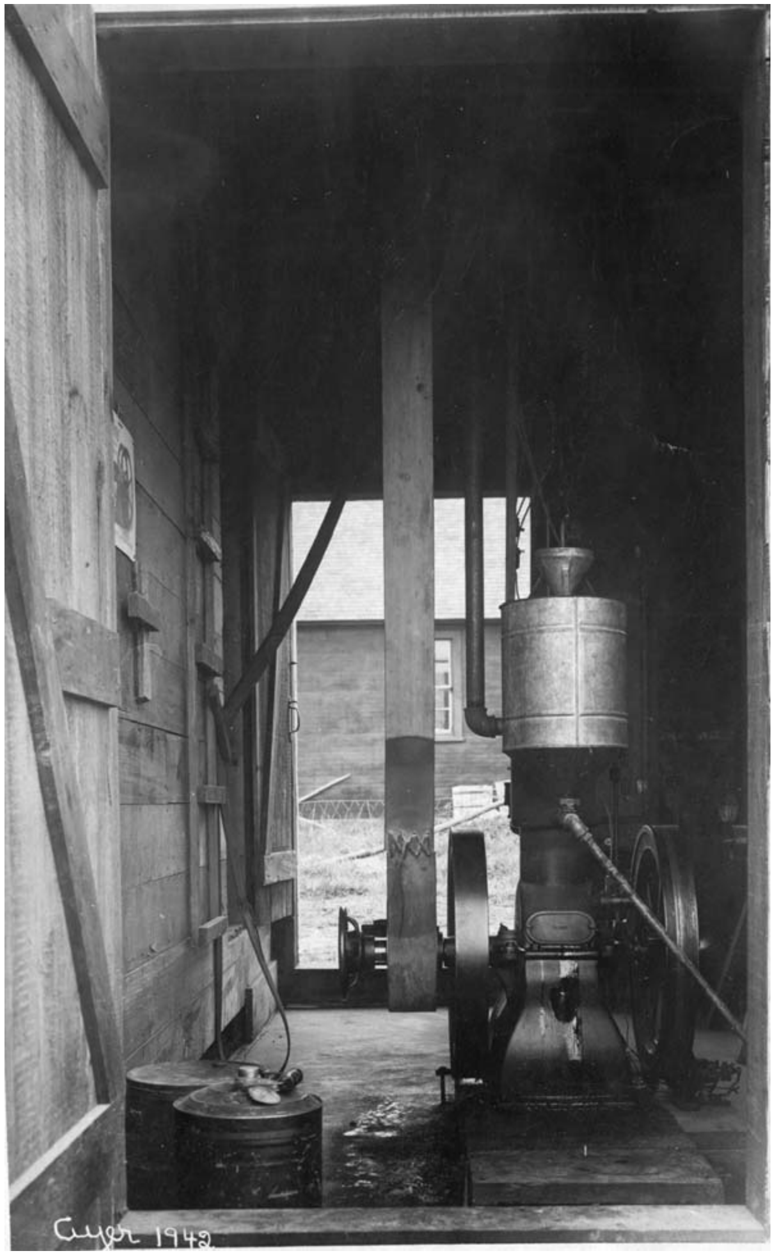
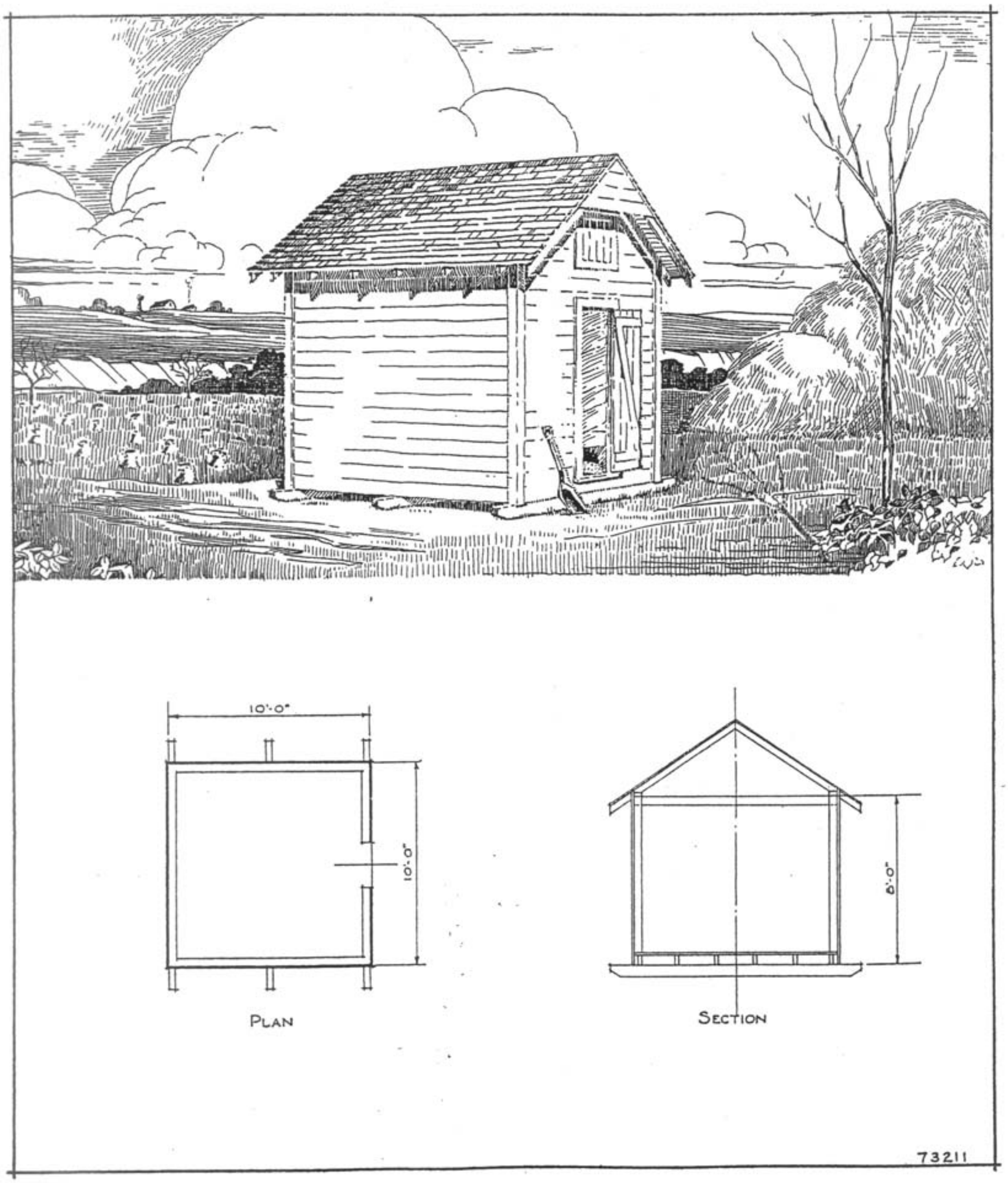


Farm granaries were built to taller heights once elevating equipment became available. The engine for this lift or "leg" was gasoline-powered. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

Built circa 1885, this farm elevator had woodframe construction, clapboard siding, a scale for weighing, and elevating equipment that filled at least seven overhead bins. The elevator was also used for machinery storage. Twente Farm, Brown County, 1979. (MHS photo by Gimmestad)

Elevator on the Jean Duluth Farm, near Duluth, circa 1910. (MHS photo by Harry Darius Ayer)



A simple 10′ x 10′ portable granary on skids. It was built with braced wood studs and clapboard siding. From Midwest Plan Service's 1933 catalog of plans.

A metal grain bin located near the edge of a field, rather than within the farmstead. It has two hinged, oval hatch doors – a small door on the roof for filling and a larger door near the base for unloading. Framnas Township, Stevens County, 2004. (Gemini Research photo)

Portable elevators or conveyors became available around 1904 and were widely used throughout Minnesota. Granaries were filled through hatches located in the roof or upper walls. This granary probably has two bins. Fillmore County, 2001. (Gemini Research photo)

■ GREENHOUSES, HOTBEDS, COLDFRAMES

- Built on Minnesota farms as early as the 1890s
- Used for starting vegetables in late winter or early spring

Hotbeds and coldframes – both a form of greenhouse – were apparently built on Minnesota farms as early as the 1890s. They were used to extend the growing season by starting vegetable crops early "for either home or market" (Mackintosh 1896). For example, plants could be started in a hotbed, whose heat was usually generated by composting manure, and then moved to a coldframe, heated only by the sun, to be hardened off, and then planted into a field or garden (Moore et al 1920: 213-215).

In 1896 the *Minnesota Farmers' Institutes Annual* published a plan for a hotbed greenhouse for Minnesota farmers. A hotbed (like the published plan) could be viewed at the University of Minnesota's farm in St. Paul. The hotbed depicted was a small 12' x 24' building that could be constructed of log, planks, or stone, and could be expanded at either end. It had a gabled roof whose ridge ran north and south. Both the roof and the southern gable end were glazed to allow sunlight to penetrate. The structure was built into a hillside and entered via a narrow door on the southern end. Inside was a narrow central path flanked by two boxed planting beds. The beds were filled with a 30"-deep mixture of horse manure and leaves or straw, topped by 5" of soil, which brought the upper surface of the beds about waist-high. Plants or seeds could be set out in the hotbed about February first, but shutters or other coverings had to be placed over the glass during the cold nights.

Such structures were still in use several decades later: University of Minnesota plans for farmers from 1953 included a low, 6' x 6' coldframe or hotbed. To be used as a coldframe, the structure was simply set on the ground. It could be used as a hotbed by placing it over 22" of buried manure topped by 5" of straw, and then packing additional straw around the outer walls. An electric soil bed heater could also be used *(Farm Building Plans* 1953).

While most greenhouses were framed with wood, by 1960 some farmers were using steel and aluminum frames because of their light weight and durability.

PREVALENCE

On-farm greenhouses and similar structures were likely built on farms near large metropolitan areas where fresh vegetables were sold to urban residents, and built on specialty farms that grew for the floral and nursery industry. Many of these farms have been lost to suburban growth, and it is possible that pre-1960 examples of such structures may be rare.

See also
Gardens (Vegetable)
Roadside Markets
Orchards

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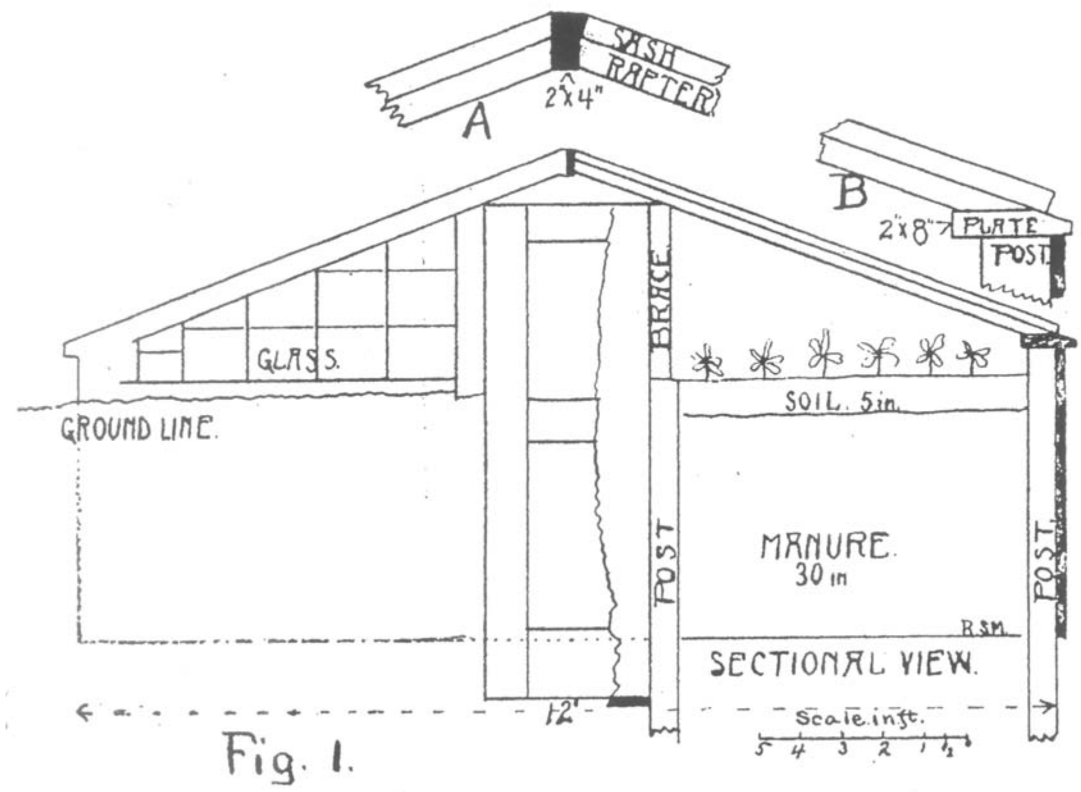

Plans for this hotbed were published for Minnesota farmers in 1896, and a demonstration model was built at the University of Minnesota. The 30" of composting manure under the 5" layer of soil provided enough heat to enable seeds and plants to be started as early as February 1st. From Mackintosh's "Hot Bed Greenhouse" (1896).

A hotbed being planted. The framework was set over several feet of manure and straw that generated heat as it decomposed. Note the window sash on top, which was typical for both hotbeds and coldframes. (Coldframes were similar to hotbeds but without the heat.) Location unknown, ca. 1910. (MHS photo by Harry Darius Ayer)

▪ HAY BARNS OR SHEDS

Key Points

- An alternative to storing hay in a haystack or livestock barn
- In use by the late 19th century
- Threat of fire was a significant reason to build a separate hay barn
- Hay barns or sheds could be open, partly-open, or fully-enclosed
- Field hay barns were one of few major structures located outside of the farmstead cluster
- Field pickup balers were first used in the late 1930s and became widespread in the 1940s

Hay barns in Minnesota are primarily associated with the state's livestock and dairy industries. The need to build hay barns emerged in the late 19th century as the number of livestock – especially dairy cows – increased steadily, as did the number of acres planted in hay.

Note: In addition to hay, which was fed to livestock, Minnesota farmers also need large quantities of straw, which used for livestock bedding. Straw's nutritional value did not to be preserved, and straw was able to withstand weathering better than hay did. Because it wasn't critical to protect straw, many farmers stored straw in large stacks outside, reserving their inside space for hay.

The term "hay" refers to grasses and legumes that are cut, dried, and stored for winter livestock feed. Wild hay was harvested by Minnesota farmers as early as the 1850s, but "tame" or planted hay was not grown in large quantities before about 1880. Alfalfa, a legume that made excellent hay, became one of Minnesota's leading hay crops beginning in the 1910s. The amount of hay harvested in Minnesota grew along with the diversification of farms and the rise of the dairy industry.

Minnesota farmers could usually harvest three, and sometimes four, cuttings of hay from a single field per season. Hay had to be properly harvested, dried, and stored to retain its food value all winter. The ability of a farm to carry livestock over the winter, and the number of wintered animals it could support, depended in large part on the farm's stores of hay.

Hay had to be dried, usually in the field, to minimize mold and bacteria growth once it was stored. Drying also prevented overly-moist hay from heating up to combustible temperatures in the barn (Neubauer and Walker 1961: 238). Harvesting and field-drying hay relied on good timing and cooperative weather to ensure that the crop was cut at the right time, dried to optimal condition, and then quickly moved into storage before it was re-wet through rain. (See Hoffbeck's *The Haymakers*, 2000, for vivid accounts.)

In Minnesota, hay was stored in three ways: within livestock barns, piled in outdoor haystacks, and stored in hay barns or hay sheds. It is believed that the circular "hay keeper" structures built in other states were not used in Minnesota (Lindor 2004).

See also

Dairy Barns
Beef Barns
Appendix: Focus on Minnesota Crops

Barns that housed both hay and livestock were built in many forms. Two of the most common were barns with hay storage on a floor above the livestock (e.g., hay mows), and barns with hay storage in the center (usually in a tall space extending from the ground level to roof ridge). This central area was often surrounded by livestock pens on two or three sides. Barns with hay storage above the livestock were more convenient but generally more expensive to build. See the "Dairy Barns" individual farm elements section for information on hay storage in barn mows, and the "Beef Barns" farm elements section for information on barns with hay storage in the center.

HAYMAKING TECHNOLOGY

The back-breaking job of putting up hay – originally hand-cut with scythes, raked into rows, and pitched into wagons – was eventually made easier by new technology. Devices such as hay carriers, forks, hoists, and buck rakes helped work crews pick up hay in the field and lift it into storage more rapidly. Hay storage barns, whether dedicated for hay or combined with a livestock barn, often had large doors in the gable or gambrel end and projecting hay hoods to accommodate the equipment. When hay slings supplanted hay forks, still larger hay doors and a stronger carrier track were necessary (Wooley 1946: 265).

Tractor-powered hay balers that gathered, baled, and tied hay were first used in the late 1930s and became widespread in the 1940s. Equipment to make round bales was introduced in the 1940s. At the same time, Minnesota farmers began using mechanical elevators or conveyors to move hay into the barn. In the early 1940s hay choppers and blowers were used to chop hay and blow it into a barn or silo (Wooley 1946: 267-268; Lindor 2004).

In 1942 a group of agricultural engineers looked at the future of hay handling technology and seem to presage the massive hay bales of recent decades. They wrote:

> If a successful pickup baler could be devised that was as simple to operate as present-day grain binders, then hay baling might have such sweeping advantages from the labor standpoint that, regardless of other considerations, it would be widely adopted and in fact become the almost universal hay-making practice. From the storage standpoint this would probably mean a sharp trend toward one-story hay storages where a great weight of baled hay could be directly supported on the ground (Shier et al 1942: 350).

In the 1940s farmers began to make "haylage" or "grass silage." The hay for haylage did not have to be dried carefully in the field (as hay needed for barn storage) and its nutritious qualities were well-preserved. Haylage was made in airtight glass-lined silos such as the Harvestore, and could also be made in trench or bunker silos.

By 1961 most farms that needed large amounts of hay used automated methods for harvesting, baling, and handling. Despite new techniques, however, the older methods of moving loose hay with a fork and tackle, and stacking baled hay by hand, were "still in common use" in 1961, especially when relatively small quantities of hay were needed (Neubauer and Walker 1961: 236).

An even newer technology – compressing chopped hay into pellets and wafers – was seeing a "rapid increase" in 1961 (Neubauer and Walker 1961: 236-237).

HAY STACKS

Before about 1950, loose hay was frequently stored in carefully-built outside hay stacks that shed water and preserved the quality of the hay within. The hand-pitched, dome-shaped stacks were 15'- or 20'-high and built so that the center remained loose and tall while the outer edges settled. Sometimes swamp hay or another type of grass that shed water was used for the stack's uppermost layer. Alfalfa, a common Minnesota hay crop, was not water-resistant enough to be stored outside unless covered by a tarp or roof.

After farmers bought balers in the 1940s and 1950s, outside hay stacks were commonly made of interlocking rectangular bales rather than loose hay.

HAY BARNS OR SHEDS

Stores of hay were a great fire hazard and frequently ignited under hot, dry conditions. Fire threat motivated many farmers to build a separate hay barn rather than risk a catastrophe if the livestock were also lost.

Separate, dedicated hay barns increased in number in the late 1920s and early 1930s as dairying and other livestock husbandry increased and as more farmers grew legume hay.

Dedicated hay barns were used to store both loose hay (long or chopped) and baled hay. They had to meet several design goals. They had to ensure that the hay crop stayed well-preserved and that the fire threat was minimized. Filling and emptying the barn had to be efficient using available equipment and labor, and the barn also needed to be adaptable to future technology. Finally, hay barns needed to be made of affordable materials and be uncomplicated to construct (Shier et al 1942: 351).

Whether open, partly-open, or enclosed, hay barns usually had gabled roofs. Hipped, shed, gambrel, or arched roofs were less common.

Hay storage barns were generally limited in width by "the distribution that can be secured easily from a single hay carrier track," according to agricultural engineers writing in 1941. They explained further: "A typical width is 24 feet, and from 32 to 34 feet is the practical maximum width. The maximum economy is obtained in the height; however, the total height should not greatly exceed the width, because of the heavier construction necessary, and the danger of storm damage to higher structures. The length of the building is determined by the capacity requirements" (Carter and Foster 1941: 279).

If they were built within the farmstead, hay barns were often located many feet from other structures so fire wouldn't spread.

Some hay barns were constructed out in the hay field and, in fact, field hay barns were one of few large structures on Minnesota farms that were not located within the farmstead building cluster. Field barns were convenient because less labor was required at harvest when extra hours were especially scarce. Instead, farmers moved the hay to the livestock barn later in the winter when they had more time. Some farmers hauled hay from the hay barn to the livestock barn about every two weeks in winter months (Wooley 1946: 267; Neubauer and Walker 1961: 234).

The Midwest Plan Service wrote in 1933 that it was experiencing a "demand for inexpensive hay shelters which may be erected in the field" (Midwest Farm 1933).

Some hay barns such as those built by Minnesota's Finnish immigrants had air gaps in the walls to provide ventilation. Some had side walls that were tapered slightly toward the bottom, somewhat like a corn crib. Some hay barns had battered walls that were wider at the bottom to help resist the lateral pressure of the hay. Hay bales were often interlocked to reduce lateral pressure (Neubauer and Walker 1961: 237).

TYPES OF HAY BARNS: ENCLOSED

Some of the state's most unique hay barns were built on the northeastern Minnesota farms of Finnish immigrants. These barns were similar to northern European designs that dated back to the early 15th century. The hay barn was one of "the classic quartet of the rural Finnish farmstead," which included the house, sauna, and dairy barn. Most of Minnesota's Finnish hay barns were built of logs (both hewn and unhewn) and had gabled roofs (Gudmundson 1991: 14, 16, 23; Koop 1988; Alanen 2000: 2.112-2.127).

In St. Louis County, intact Finnish hay barns were still standing in the late 1980s. On the Hill farm, for example, was a 19' x 23' hay barn, built circa 1897-1903. It was built into a steep hillside with a concrete foundation. It had wide spaces between the logs for air circulation (Koop "Hill" 1989). There were two hay barns on the Matson farm, both gable-roofed log structures built circa 1900. One was a dedicated hay barn, 19' square, with a 7'-wide opening in one gable end. The other was a 25' x 28' combination hay and cattle barn (Koop "Matson" 1989; Alanen 2000: 2.112-2.127).

The Hanka farm in St. Louis County had a one-story log field barn, built circa 1915, which was located 500' from the house. Measuring about 20' x 24', the barn had a gabled roof, an 8' x 5' wagon opening, gaps between the logs, and side walls that tapered inward slightly from top to bottom, which was "a characteristic common to many Finnish field hay barns." The Hanka farm also had a combination hay and cattle barn, built circa 1915, that was 23' x 58' (Koop "Hanka" 1989).

Enclosed hay barns of timber frame and dimensional lumber construction were also built in Minnesota.

TYPES OF HAY BARNS: OPEN OR PARTLY-OPEN

It was more common for hay barns to be open or partly-open than to be fully enclosed. In fact the most common type of free-standing, dedicated hay barn in the Midwest was a gable-roofed structure with open or partly-open walls (Neubauer and Walker 1961: 234). Having open sides facilitated the drying process and was cost-effective since the hay didn't need to be fully enclosed to be preserved. Open or partly-open structures were also efficient to load and unload.

According to barn historian Lowell Soike, a late 19th century hay barn that he considers a precursor to the modern pole barn was described in the May 31, 1889, issue of *Iowa Homestead*. The 40' x 26' hay barn had a 20'-tall central section that could be framed with either massive, upright, square timber columns or with full-length telephone poles. The pole frame eliminated the need for interior posts. The barn could hold 35 to 40 tons of hay. The article suggested that open-sided livestock sheds could be added around three sides (Soike 1995: 90-91).

An early Minnesota example of an open-sided hay barn was pictured in a 1909 issue of the *Minnesota Farmers' Institutes Annual.* It was a tall structure whose gabled roof was supported by braced poles. The barn appears to have measured about 20′ x 40′. It had fully-open sides and a hay hood over hay loading equipment. A very similar structure was illustrated in a 1944 issue of *Agricultural Engineering*, suggesting that the design was both widely built and long-lived (Witzel 1944: 375).

In 1933 and 1937 the Midwest Plan Service was offering plans for a 24′ x 60′ hay barn that was similar to the fully-open barn just described except that the upper 12′ of the walls were sheathed with siding. The barn was framed by braced poles and roof trusses spaced 12′ on center. The gabled roof had a hay hood that protected a large hay door. There was an open driveway through the side wall. The side walls were 20′ high with the lower 8′ left open. Either vertical wood or galvanized sheet metal siding were recommended (Midwest Farm 1933; Midwest Farm 1937). The University of Illinois' Carter and Foster wrote that this design was "widely used" in 1941 (Carter and Foster 1941: 281).

A rare form of the open-sided hay shed was the "hay barrack", often built by Dutch, German, and Ukrainian immigrants. Hay barracks were usually 12′- or 16′-square but occasionally 20′-square. They had hipped or sometimes gabled roofs that could be adjusted in height to shelter the hay. Geographer Allen G. Noble explained, "the roof rested on four movable wooden or metal pegs placed in a series of holes in the four posts. By using a ratcheting jack, the entire roof could be raised or lowered by moving each roof corner, one peg at a time" (Noble 1984: 109). Hay barracks were built in eastern Iowa and in Wisconsin. It is not known if any were built in Minnesota, where rectangular sheds with fixed roofs were much more common (Noble 1984: 110; Witzel 1944: 375).

By the 1930s and 1940s new building materials and methods such as pole frames, prefabricated trusses, sectional buildings, and steel and aluminum siding were entering the market and increasing in popularity. Many of the simple, rectangular multipurpose buildings sold to farmers as implement sheds, beef cattle barns, or grain storage sheds could also serve as hay barns. In 1953, for example, Reynolds Aluminum was advertising a 52′ x 60′ pole barn that could be lengthened by adding 15′ sections. The 18′-high roof could shelter approximately 180 tons of chopped or baled hay, according to Reynolds. It was built with pressure-treated pole supports and corrugated aluminum roofing and siding. There was a 12′ x 12′ door at each end to accommodate machinery (Reynolds 1953; Anderson 1937: 164).

PREVALENCE

Minnesota farmers apparently built more open and partly-open hay barns than fully-enclosed structures. It is not known how many hay barns are still standing in the state. Those that date from the earliest years of dairying and diversification are likely to be rare.

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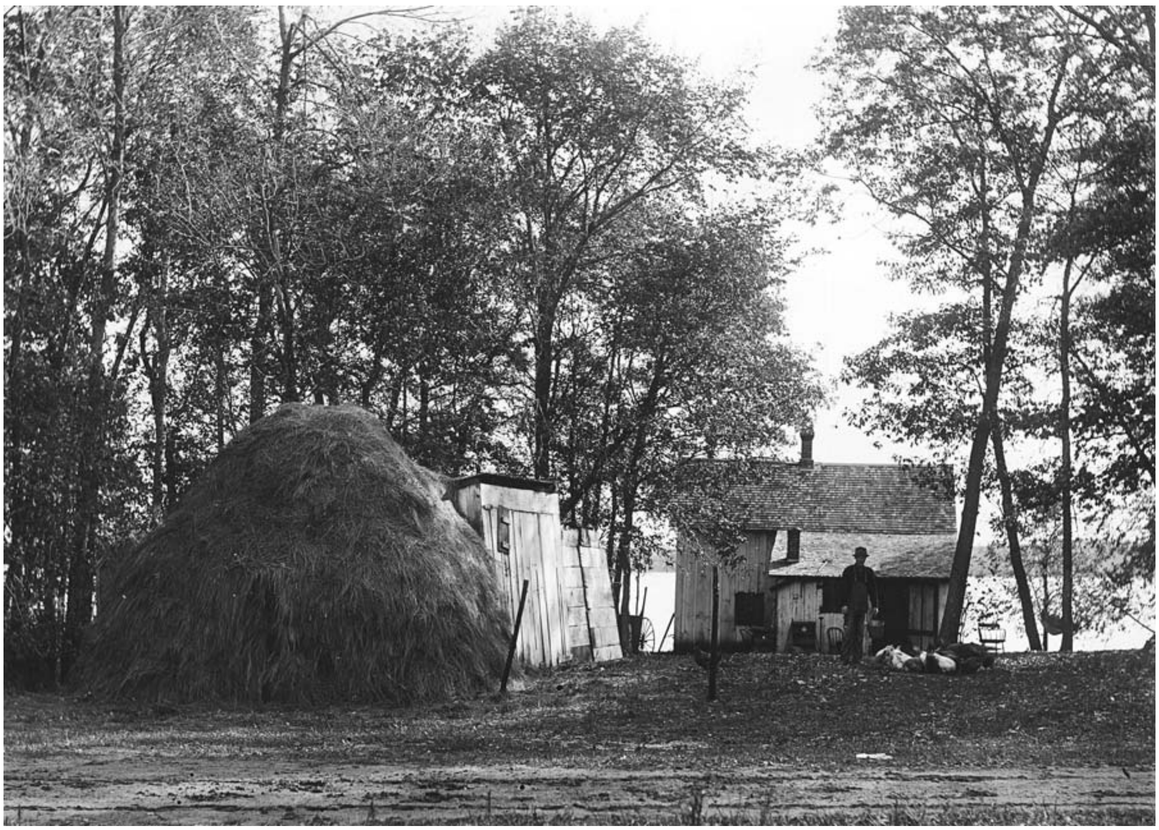
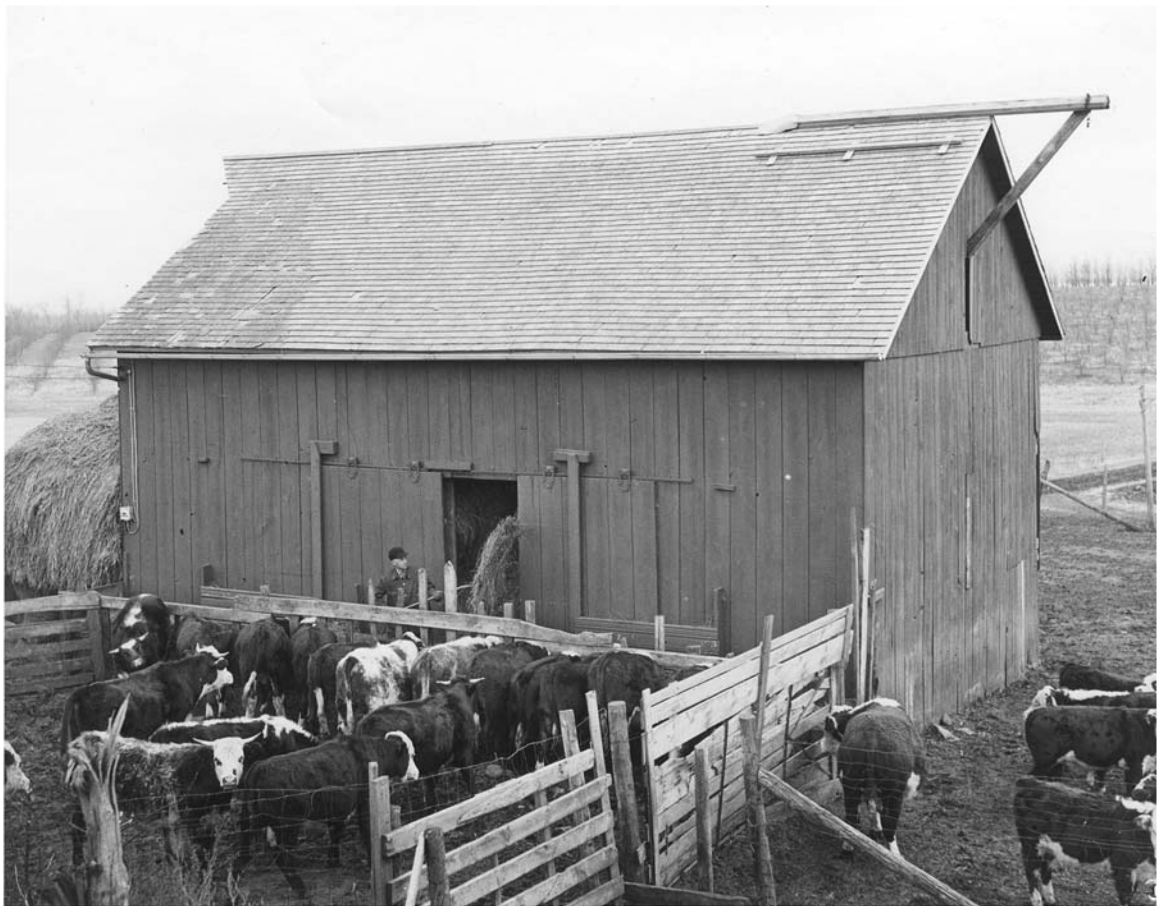
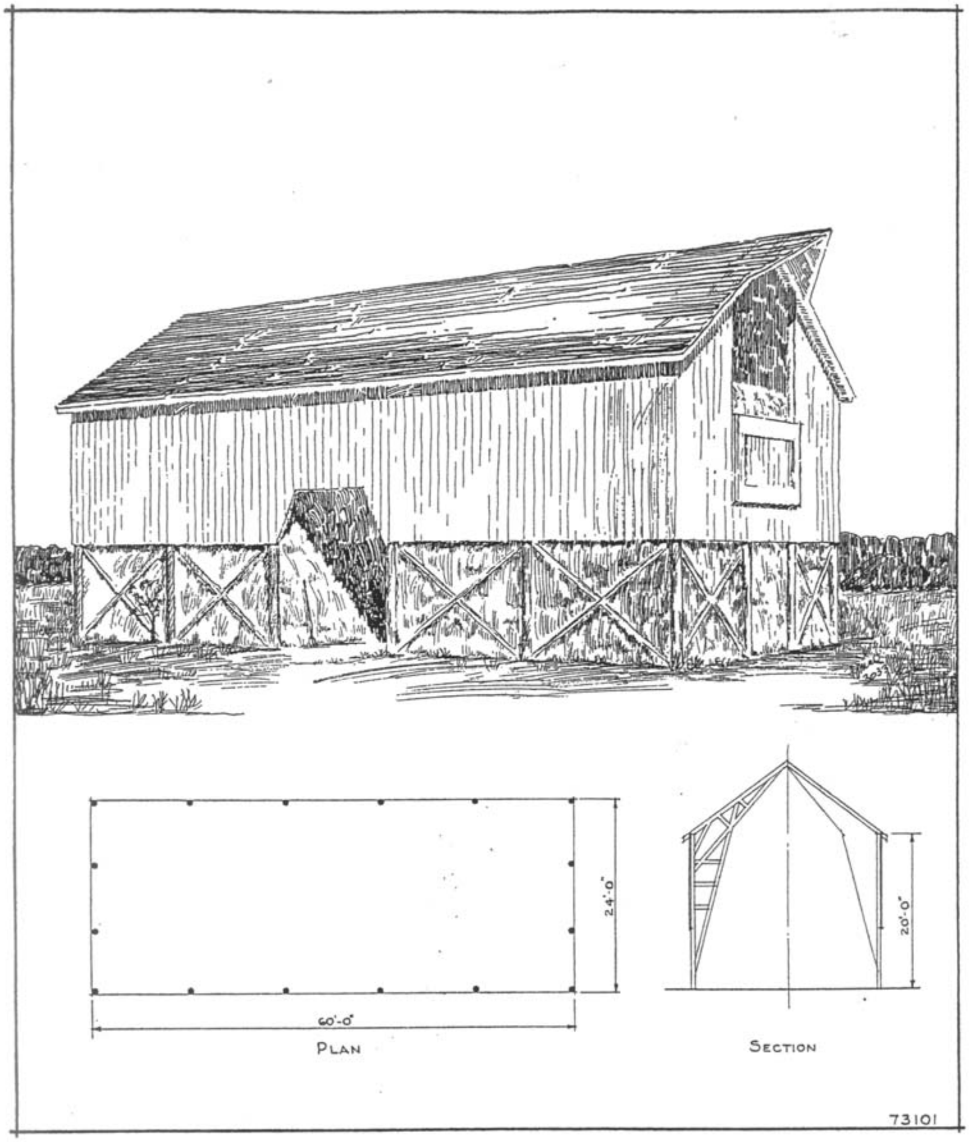


The builder of a haystack had to be skillful, according to Steven Hoffbeck in his account of Minnesota farming called *The Haymakers* (2000). To ensure preservation of the hay, the center of the stack had to remain uncompressed while the outer edges settled so that the entire 15'- to 20'-high mound shed water. Often a layer of swamp hay or another water-resistant grass was placed on the very top. Hoffbeck also notes that children were sternly forbidden to climb on the haystack. Location unknown, circa 1910. (MHS photo)



A fully-enclosed hay barn, photographed in 1932, that had typical sliding doors in the side wall, a brace and pulley on one end, and a hay hood on the other end. The photo shows additional hay stacked outside. It is interesting that the barn had electric wires leading to it. Benitt Farm, location unknown, 1932. (MHS photo by Nasvik)

Partly- or fully-open hay barns were more popular in Minnesota than those that were enclosed. This photo appeared in a 1909 issue of the *Minnesota Farmers' Institutes Annual* (v.22: 350). The caption indicated "such a shed can be built at a small cost and will pay for itself in a few years by the hay it will save over stacking in the open." The barn appears to be about 20' x 40', with a hay hood and hay loading equipment. The same photo is also in the Minnesota Historical Society's photo collection. Location unknown, circa 1909. (MHS photo by Harry Darius Ayer)



This 24′ x 60′ hay barn is very similar to the photograph on the previous page except that the upper 12′ of the walls are enclosed. The Midwest Plan Service, which published this particular plan in 1933, recommended vertical wood or galvanized metal siding. Very similar partly-open hay barns were illustrated in other technical sources in the early- and mid-20th century. From Midwest Farm Building Plan Service, 1933.

■ HIRED WORKERS' HOUSING

- Most hired workers' housing was not built for this purpose, but was adapted from other uses
- Mexican farm worker housing was generally substandard

FAMILY LABOR

Historically, farms in Minnesota were family-run enterprises in which it was necessary for all members of the family to work to ensure survival and prosperity. In most cases farm families lacked the cash with which to capitalize or create a cushion against hardship, and instead used their own labor – often intensively – to help counterbalance more unpredictable factors like weather and the markets. According to historian Mary Neth, family members received, instead of wages, "a share of the living the farm provided and an assurance that the farm would be a resource for the family's future." Neth wrote, "Farm people viewed their labor not as an individual effort but as part of a group effort, related to the work of the entire family." Families "expected that everyone would help out in whatever venue was most critical at a given moment" (Neth 1995: 18-19). In 1923 the University of Minnesota reported that both men and women were averaging more than 11 hours per day working on the farm (Lundquist 1923: 7, 13).

The University of Minnesota's Andrew Boss discussed labor in a farm management text published in 1914. He advised farmers, for example, to add livestock to their farms because it made use of cheap labor. Boss wrote that children can "often be profitably employed in caring for the poultry, sheep, and other livestock. In many cases most of the milking is done by the farmer's wife and children. They are not paid wages for doing the work and the product secured . . . is nearly clear gain, as they must be fed and clothed whether they work or not." Boss continued, "Livestock raisers who have children old enough to work are thus placed at an advantage over livestock raisers who must hire all labor used" (Boss 1914: 131-132).

In a later book on farm management published in 1951, Boss and George A. Pond (also of the University of Minnesota) indicated that data from studies in Minnesota and Indiana had shown that farms with hired labor and fewer children were more profitable than those with more children, refuting the "commonly held" opinion "that farmers with large families have a decided financial advantage" over those with fewer children who have to hire outside labor. Boss and Pond went on to describe some of the inefficiencies in having children help with farm work (Boss and Pond 1951: 272).

In a 1944 article on rural students and education, the Agricultural Experiment Station reported, "Only slightly more than half of the 38,000 farm boys and girls in Minnesota, 16 and 17 years of age, were attending school as of 1940. With a percentage attendance of only 52.7, Minnesota ranked 40th among the 48 states. To most Minnesota citizens this is a shocking revelation, even though a checkback proves that the situation has actually improved since 1930 when Minnesota ranked

See also
Farmhouses

47th." More than 83 percent of urban 16 and 17 year olds were attending school in 1940 (Nelson 1944: 5).

HIRED LABOR

A large percentage of Minnesota farms hired outside labor. On some farms this was confined to short-season "harvest hands," but in many cases the help was one or more workers who lived on the farm much of the year (Boss and Pond 1951: 182). According to Hart, hired hands on family farms were especially important "at those stages of the demographic cycle when the son is too young to be of much help or when the father is too old" (Hart 1998: 286). Many accounts of Minnesota farming include descriptions of hired help. (Some recent examples are *Mapping the Farm* (Hildebrand 1995) and *Growing up on a Minnesota Farm* (Cotter and Jackson 2001).)

According to Merrill Jarchow, seasonal laborers worked in Minnesota as early as the 1850s helping to hand-cut the wheat crop. Jarchow wrote:

> Wheat began to ripen in early and mid-August – a signal for the whole countryside to spring to life. Incoming trains at St. Charles, Winona, and other stations brought with them sets of rough-looking fellows, each carrying a bundle or valise. These men, looking like a detachment of Goths, were harvest hands, who began the season in the vicinity of St. Louis and worked northward through Iowa as the grain ripened. . . . Farmers drove into town and argued with the workers over wages, sometimes for several days, while the wheat was getting riper and riper. . . . At last the farmers would grow anxious, promise three dollars a day in wages, and drive off to their fields with a gang of laborers. They were generally good workers, but they demanded meals fit for a 'New York alderman.' The preparation of such meals was a real task for the farm women, as often a dozen men had to be fed three times a day for as many weeks" (Jarchow 1948: 21).

In the 1930s some migrant workers were still following the wheat harvest from Texas through the Red River Valley and into Canada, or moving from farm to farm within the spring wheat region of the Dakotas, Minnesota, and Canada (Taylor 1937).

The use of hired labor on Minnesota farms accelerated around World War I. During this period of relative prosperity, farm yields were increasing but farm labor was declining as industrial jobs and the social and cultural attractions of the city were drawing young people away from rural areas. Military service and other defense jobs also depleted farm labor.

In 1914, the University of Minnesota's Andrew Boss advised farmers that the best help they could hire was a young man who had grown up on a farm in the area. It was better if the young man lived in an adjoining county so that he would be familiar with local growing conditions, "but will be free from the interruptions which a large acquaintance in the neighborhood may bring." Boss explained, however, that such young men did not often stay long because they were frequently saving to buy farms of their own (Boss 1914: 145). In some rural Midwestern areas, working for wages was a natural stage for farm youth as they grew to adulthood (Neth 1995: 79-90).

Boss' second choice for hired farm labor was a "professional" farmhand. Boss wrote that such men had perhaps not risen to "doing anything higher than farm labor for the simple reason that they are not able to plan work themselves. These men often will be failures as farmers but where properly directed and where not required to do too much thinking, they give reasonably satisfactory service" (Boss 1914: 145).

According to Boss, "The third class of help and the least desirable of all, is the transient or 'hobo' class. These people can be depended upon to work only a few days at a time and must be watched or supervised closely if satisfactory service is to be obtained. This is the class of help that usually drift from grain harvesting in the summer to logging in the winter, thus migrating from one end of the country to the other yearly. . . . Such help must be directed by a competent superintendent to give satisfactory service" (Boss 1914: 145).

Boss also advised farmers to add winter dairying or winter cattle-, hog-, or sheep-feeding to their operations to help generate enough income to make year-around help cost-effective (Boss 1914: 146).

A 1932 University of Minnesota study reported a considerable variation in the use of labor on farms in southeastern Minnesota. The authors wrote, "In most agricultural communities the natural and economic forces are such that they permit a rather wide range of variation in the organization of the farms and the amount of emphasis" placed on different operations. They also noted, "The relative advantages of hired and family help is a common subject of discussion among farmers. From 1918 to 1931 it was difficult to obtain efficient hired help at wages that farmers could afford to pay" (Wilcox et al 1932: 26, 5).

In a 1951 farm management study, Boss and Pond wrote, "Where fair comparisons have been made it was found . . . that farmers using the largest amount of hired help made the largest operators' labor income. The data available indicates that men who have to hire help to do the work they cannot do themselves may not be handicapped by that necessity." The analysis was made with data from Minnesota and Indiana (Boss and Pond 1951: 272-273).

Social Relationships. In her study of early 20th century Midwestern farms, Mary Neth learned that a hired man often "ate at the same table, had his own place to sleep in the house, and could go to town or church with the family." However, he was sometimes considered a social class "below" his employers, particularly if he were of a different ethnicity. When hired help was a relative, the child of a neighbor, or a worker of the same ethnicity as the owner, however, the worker usually enjoyed better status (Neth 1995: 79-90).

A 1921 survey of farm women's attitudes (sponsored by *The Farmer's Wife* magazine of St. Paul) revealed that the hired man was often considered part of the family, but that these relationships changed as farm labor became more transient around the time of World War I. A number of women who answered the survey expressed opinions similar to this one: "'When the boys of some neighboring farmer can be hired, I have no objection, but when a stranger comes into the house of whom we know nothing, I never feel at ease, and often he is not a desirable companion for my boys.'" A number of women in the survey also resented washing hired men's clothes (given the fact that washing was one of their hardest jobs) and indicated that separate sleeping quarters for hired men would make the women feel more comfortable (Lundquist 1923: 4-5). In the 1910s and 1920s, the farmhouse reform movement recommended that workers' sleeping quarters be segregated from the families', ideally with their own back stairs. Few farmhouses were built this way, however (Scharf 2004).

SUGAR BEET FARMING

Mechanization reduced the need for extra labor in many cropping systems. But some crops such as asparagus, potatoes, and, especially, sugar beets, required extra manual labor.

Sugar beets were more labor-intensive than most crops and had to be cultivated several times both by machine and by hoe. They had to be "blocked" by hoe in preparation for thinning, and then thinned by workers on hands and knees. When mature, the beets were lifted (by tractor-drawn plows beginning around 1923), and then pulled from the field by hand, knocked together to remove the dirt, and then tossed in piles about 15' apart. Workers then topped the beets by cutting off the leaves with a knife and hand-loaded them into wagons so they could be hauled to a processor's collection station (Rasmussen 1967: 33, 35).

Minnesota's first sugar beet fields were located in southeastern Minnesota, southwest of Minneapolis. Many of the first laborers in these fields were European immigrants, including Russians, Poles, and Germans. In 1912 Andrew Boss wrote:

> A few farmers who are in the beet growing district have solved the problem of securing labor by importing families of Germans or Hollanders who perform the necessary hand labor under contract. Those who have tried this method find it very satisfactory. The foreign family is moved on to the farm and usually given a small house in which to live. They take the contract of performing all hand labor on the beets at so much [money] per acre. Men, women, and children all work whenever there is work to do. Aside from taking care of the beets it is often possible for some member of the [hired] family to help at other farm work when the pressure is strongest, being paid, of course, for the extra labor. In many cases this practice also helps to solve the problem of how to get help for the housewife, as there are, frequently, girls in the family who are capable of doing house work (Boss 1912: 298).

According to Diebold, "World War I and the quota laws enacted by the United States in the 1920s effectively cut off that labor supply. . . . The Mexicans provided a satisfactory alternative" (Diebold 1981: 92). African Americans and Puerto Ricans also began working on Minnesota farms.

Mexican workers were first recruited to Minnesota by the Minnesota Sugar Company (later American Crystal Sugar), which set up offices around 1907 in Texas and nearby states to hire Mexican and Mexican-American workers. The sugar company then put the workers in contact with Minnesota beet farmers who needed them. There were about 200 farm workers of Mexican ethnicity in Minnesota in 1912. Both the number of sugar beet fields and the number of field workers increased substantially in the 1920s. Mexican workers were also employed in vegetable canning factories in rural Minnesota, as railroad track-layers, and in other industries. St. Paul's West Side Mexican-American community grew as many Mexican laborers decided to move permanently to Minnesota (Diebold 1981: 92, 97).

A 1924 Minnesota Extension bulletin on sugar beets indicated that most workers at that time were Mexican. The bulletin suggested to farmers that, if the acreage was large enough, the sugar beet processing plant could help secure the foreign laborers needed. The Extension Service advised that, if farm laborers were to be used, the acreage needed to be large enough to justify the labor expense: for example, "From 20 to 30 acres should be planted in order to employ a fair-sized colony of experienced Mexican beet workers." The 1924 bulletin also suggested that if the labor was to be done instead by local school children, then the farmer should plant a maximum of 10 acres and supervise the children (McGinnis 1924: 3-4, 11).

According to historian Jim Norris, the sugar beet work force in the Red River Valley was fairly diversified through the 1930s and included local youth, German-Russians, Filipinos, as well as Mexicans. Norris explained, "A 1930 American Sugar document described the Valley beet work force as 60 percent 'local white,' 35 percent 'Mexican,' and the remainder 'drift-in whites' (Norris *Betabeleros* 2002).

Beet farming's hand labor was reduced somewhat during World War II by mechanical harvesters that could lift, top, and load the beets, but the machines were not always satisfactory. In 1945, only 12 percent of the U.S. crop was harvested mechanically. Over the next 20 years, labor needs declined as technology improved the field machinery and developed beet varieties that needed less thinning. By 1958 it took 2.7 man-hours to grow one ton of sugar beets, compared to 11.2 man-hours in the 1910s (Rasmussen 1967: 33, 35).

GENERAL WORKERS' HOUSING

Specialized structures for Euro-American hired hands were not common on Minnesota farms. Most hired hands slept in the farmhouse with the farm family. Others slept in the barn loft, in a previous farmhouse, or in a bunkhouse that might be a shed, summer kitchen, or other building converted temporarily or permanently for this use (Scharf 2004).

During the farm labor shortages in the 1910s, farms had to work harder to attract and retain labor. Farmers could no longer expect hired help to work for little and sleep in the loft of the barn. Boss wrote in 1914, "Good board and comfortable living quarters must be provided if the men are to be interested in the work and remain contented. Reading rooms, bathrooms, and time for social privileges are provided by the progressive farmers who wish to keep first-class help. While such accommodations add to the expense, they ease decidedly the problem of getting good farm help" (Boss 1914: 140).

Boss recommended that if farmers could provide a suitable house on the farm and offer full-time work, they might be able to attract a married couple. The hired man's wife and children could also be employed on the farm, or could work on neighboring farms (Boss 1914: 146).

In 1937 the Midwest Plan Service was offering farmers a plan for a small tenant or hired worker's house. It was a one-story, 20' by 20' house with three rooms: a kitchen, living room, and bedroom. An outdoor privy was assumed, but the plans also offered an optional expansion to add a bathroom and another bedroom.

SUGAR BEET WORKERS' HOUSING

Housing for Mexican migrant workers was often substandard. According to historian Susan Diebold:

> The Minnesota Sugar Company's treatment of migrants was apparently better than that of many firms, a fact which helps to account for the frequent return year after year of Mexican migrant families to Minnesota. Nevertheless, living conditions were still appalling by any objective standard. A former migrant worker recalled 'one specific case in

> Hollandale [Minnesota] where this farmer gave us two chicken coops to live in and we had to clean all the excrement out of it. . . . A total of twelve people had to live in two chicken coops.' As late as 1957 a state agency found chicken coop housing in 'flagrant violation' of state codes, but it reported that 'the occupants refused to . . . protest for fear they would lose their jobs as 'trouble-makers.' One migrant described 'The nicest place we had . . . an abandoned farm which had a two story dwelling that was to be ours. . . . But again, the building didn't have any plumbing, no wiring, nor screens' (Diebold 1981: 94).

A 1924 Minnesota Extension bulletin advised, "The [beet] grower must furnish a suitable dwelling place for the beet workers and it must be ready to occupy by April 15. An agreement for the hand workers usually specifies that the workers and their household goods shall be transported to and from the railroad station by the grower. All implements and tools necessary for the hand work are furnished by the grower" (McGinnis 1924: 9).

The first migrant housing in Minnesota appeared in the 1910s near Chaska and in the 1920s in the Red River Valley (Norris 2005). Migrant workers were often housed in little more than chicken coops or other outbuildings. Some farmers built a small colony of 5 to 8 identical shacks for the workers. After World War II, the American Crystal Sugar Company acknowledged that improved housing could be used as a means of enticing good workers to come to Minnesota, but it is not known how many farmers that contracted to grow beets for the company followed this advice (Norris 2005).

In the early 1950s the poor quality of migrant housing was brought to the public forefront. Migrant housing was investigated at the federal level by the Truman Commission on Migratory Labor and on the state level by a commission headed by Hubert Humphrey. Yet ensuing recommendations for improved housing were largely ignored through the late 1950s and the early 1960s (Norris 2005).

While in the 1960s migrant workers were no longer housed in chicken coops, housing was still minimal. According to one *Minneapolis Tribune* reporter in 1969, the "life of a migrant isn't just working in the fields 6 or 7 days a week. It's living in a dilapidated shack, courtesy of the farmer for whom you work. It's getting water from the farmer's hose because your house doesn't have running water . . ." (quoted in Diebold 1981: 103).

In the 1960s some western Minnesota farmers housed migrant workers in abandoned farmhouses fitted up for summer occupancy. Broken windows were replaced, the roof was checked for leaks, doors were tested to make sure they shut, and a screen door was added where necessary. Electricity was mandatory, but outdoor privies were common and water was often pumped at an outdoor well and carried into the house. If two families occupied the house, sheets of plywood could be used to separate the front from the back of the house. If a staircase was located near the front door, plywood partitions could be installed so the family living downstairs used the back door and the family upstairs used the front door and the staircase. Farmers furnished workers' housing with used equipment purchased at farm auctions including beds, mattresses, tables, chairs, stoves, washtubs (for baths), sinks, and refrigerators (Plank 2005).

The conditions of much migrant farm worker housing were still poor in 1997 (Contreras 2001: 4-5).

PREVALENCE

Relatively few buildings in Minnesota were constructed specifically for hired workers' housing, therefore extant examples are likely rare. Most workers were instead housed in the farmhouse, barn loft, or in another structure adapted for the purpose.

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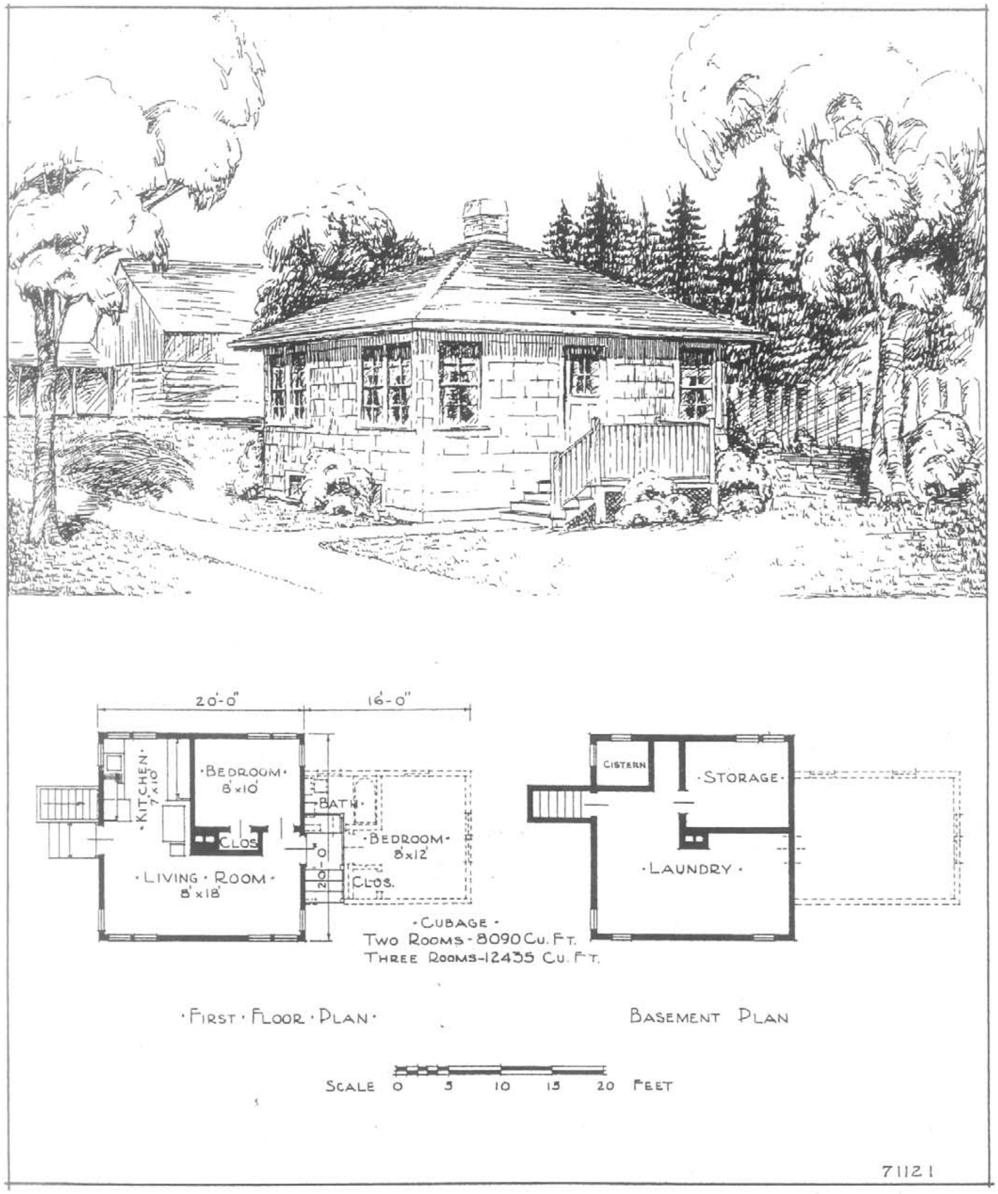
A sugar beet worker near Fisher in the Red River Valley. Polk County, 1937. (MHS photo by Russell Lee)



Plans for this small house for a tenant or hired worker were distributed by Midwest Plan Service in the 1930s. The house measured 20' x 20' and had a kitchen, living room, and bedroom. An outdoor privy was assumed, but the plans show optional expansion for a bathroom and another bedroom. From Midwest Farm Building Plan Service (1937).

■ HOG BARNS AND HOG COTS

- Hogs were usually sheltered farthest from the farmhouse
- Hog housing could be either permanent or portable
- Permanent houses ranged from simple shelters to barns with central alleys and lofts
- By the 1920s portable or “colony” houses were helping control soil-borne diseases
- Confinement systems were first used in Minnesota in the 1940s

“A pig is considered by some to be the most intelligent of domestic production animals. Contrary to popular belief he is extremely clean in habit, only becoming dirty and odoriferous when forced so by unclean surroundings or thermal stress” (Hazen and Mangold 1960: 589).

During the early settlement era, Minnesota farms often kept a mixture of livestock that almost always included oxen or work horses, poultry, a couple of dairy cows, and a pig. Pigs were first reared in pastures in the summer and in very makeshift structures in the winter. They were fed farm leftovers and garden scraps, a practice that continued through the 1950s although it was discouraged by many experts.

As Minnesota farmers began to shift their strategy away from growing only wheat in the late 19th and early 20th centuries, hogs were among the animals they added to their newly-diverse operations. Hog manure was valuable for fields, and hogs were good companions to dairy cows because they could be fed the skim milk that was separated from the marketable cream. Hogs could also eat other farm by-products that had little or no market value, as well as crop residue left in the fields after harvest.

Before about 1915, however, heavy losses from hog cholera made it risky for farmers to raise large numbers of pigs. In 1907, a successful vaccine for hog cholera was developed, and by 1915, hogs were being routinely vaccinated, allowing farmers to increase the size of their herds. The struggle to conquer hog cholera continued until World War II (Cavert 1956: 22; Cochrane 1993: 109)

Farms that raised pigs were found throughout Minnesota in 1930. The prevalence ranged from counties in southwestern Minnesota, where nearly all farms raised pigs, to northeastern Minnesota’s cutover land, where only 14 percent of farms had pigs in 1930 (Engene and Pond 1940).

Pig shelters – also called hog barns, swine houses, or piggeries – were built on a large percentage of Minnesota farms. Pig-raising was not regulated like the dairy industry, and a wide variety of structures were used. Sometimes a farm needed a succession of structures because pigs were “hard” on their housing and tended to push against the side walls, gnaw on wood, and root in dirt floors and under walls. While pigs could be housed in a general purpose or combination barn, few farmers did so because the milk from the dairy cows tended to absorb odors from the pigs. As broadening markets, economical feed sources, advancing technology, and improved methods made

See also
Stockyards
Develop of Livestock, 1900-1940
Appendix: Focus on Minn Livestock

hog-raising more profitable, specialized hog housing was increasingly built. However, many farmers continued to use makeshift structures for all but farrowing because pigs were relatively cold-hardy.

In their 1982 study of settlement-era farm structures in central Minnesota, Marilyn Brinkman and Bill Morgan encountered early pig houses built of logs and other indigenous materials. One was a square structure, measuring about 7′ x 7′, built of poles, planks, and rails nailed to a vertical log framework. It had a dome-shaped roof thatched with hay. On the same farm was a larger hog barn measuring about 12′ by 18′ that was built with a combination of log and woodframe construction (Brinkman and Morgan 1982: 76).

While pigs could live most of their lives outside, baby pigs were not as hardy as adults. If the pigs farrowed outdoors or with only light shelter, farmers timed their breeding so the litters were born in June when the newborns could survive outdoors. Piglets growing all summer were also better able to flourish during the winter. With most of the state's pigs being born at the same time, however, prices were low when the finished hogs were shipped to market. One Minnesota farmer wrote in 1909, "If you have all outdoors for a pen and the sky for a roof, you cannot have pigs coming the first of March . . . " (Meade 1909: 227). To have March or April litters that could be marketed sooner and capture better prices, farmers needed to build enclosed hog barns.

In addition to being vulnerable to the cold, piglets were also susceptible to a host of disease and parasitic problems. In 1943, after farm specialists had been grappling with the problem for decades, about 30 percent of pigs nationwide were still dying before they reached the market, with losses up to 40 percent in some states (Hansen 1943: 9). In 1950 one-third of Minnesota's piglets died and another one-third were stunted due to parasites and disease (Zavoral 1950: 3).

LOCATION

Hog barns were best situated on well-drained land far from the house, southeast of other work areas, and away from drinking water sources. One expert wrote that it was untrue that swine liked to lie in water and mud (except in hot weather when no shade was available) and, "three-fourths of the epidemics among hogs can be traced to the insanitary wallow" (Moore et al 1920: 559). A clean, cool place with protection from winds, access to shade, and a short route to pastures was preferred. The corncrib and/or a root cellar were often sited nearby to make feeding more efficient.

SOIL SANITATION

By the 1910s experts were recommending that pigs not be raised on the same ground for two successive seasons. By the 1920s many farms were either farrowing the sows in scrupulously-cleaned farrowing barns and then moving the mother and litter to clean ground as soon as possible (about 10-14 days after farrowing), or farrowing in shelters out in the pastures. The shelters were moved to clean ground each season (Carter and Foster 1941: 241). The dirt-surfaced hog yard that was used by the state's earliest farmers was essentially obsolete by the 1940s.

PERMANENT HOG BARNS

Permanent hog barns – also called community houses or central houses – were generally used during the winter, and for farrowing and raising piglets until they were old enough and/or the weather was warm enough for them to go outside. Early Minnesota examples are described in 1896 and 1898 issues of the *Farmers Institutes Annual* (Murphy 1896; Louis 1896; Henry 1898). Permanent barns were often recommended for farmers who raised more than just a few pigs. Because the animals were gathered in one building, chores like feeding were more efficient. Some farmers, however, found permanent hog houses to be too expensive since the housing was only used part of the year – usually in winter and during spring farrowing. In response, agricultural engineers suggested that hog barns be used during the summer as storerooms, sheep barns, or implement sheds. Some barns were designed with interior pens that were hinged or removable to accommodate alternate uses (Moore et al 1920: 550). Removable pens also helped with barn cleaning.

Permanent houses were typically one-story, woodframe buildings with shed, gabled, gambrel, or half-monitor (or "broken") roofs. Ceiling insulation was recommended in cold climates (Clarkson and Whitnah 1920: 70). Some hog houses were built of brick or structural clay tile, both of which were more expensive than wood but durable and cleanable.

Some permanent barns had upper lofts in which bedding was stored. These barns resembled dairy or general purpose barns, but were shorter. In addition to being convenient, a straw-filled loft helped insulate the barn. If a permanent hog house did not include space for storing food and bedding, storage had to be provided in another structure nearby. (Many farmers didn't store feed in a pig barn because the grain absorbed odors and became objectionable to the pigs.)

Some of the first pig barns had dirt or wooden floors, which farmers found hard to clean and susceptible to damage by the pigs. By the turn of the century, many hog barns had poured concrete floors, which held up well to the constant cleaning. Well-designed floors were sloped to allow manure to run into gutters or drains, away from the pigs and their straw bedding. Because lying on cold concrete caused pigs to become rheumatic, however, some barns had 4′ x 4′ or 6′ x 6′ wooden platforms or overlays within the pens. The platforms were often hinged or removable for cleaning. If the pen or barn were used solely for farrowing, the floor of each pen was completely covered with wood so newborn pigs were never in contact with the cold concrete. Most pens had low fenders or guardrails to prevent the sows from crushing the piglets against the wall.

Supplying the barn with running water was useful because of the frequent cleaning required. Some experts recommended that the interior of the barn be regularly whitewashed to increase reflective light and facilitate cleaning.

The size of average pig barns did not vary significantly between the 1910s and 1950. Experts advised that the buildings not be too large because they would be cold in winter. A small house for a few hogs might measure 8′ x 14′. A house with a single row of pens might be 12′ x 42′, and a house with two rows might measure 20′ x 30′, 24′ x 24′, 24′ x 32′, or 24′ x 48′. A larger barn, perhaps used by a pig breeder might measure 26′ x 60′ or 28′ x 80′. Pens measured 6′ x 8′ or 8′ x 8′ and were sometimes removable so the feeder pigs could run freely after being weaned (Midwest Farm 1933; Kelley 1922; Fox 1940).

Barns with one row of pens were typically aligned east and west. A bank of windows along the south wall or on the south-facing slope of the roof supplied the pens with sunlight and air (Wooley 1946: 102).

Barns that contained two rows of pens flanking a central alley were oriented either east-west or north-south. In the east-west alignment, experts recommended that two rows of south-facing windows be provided – one for each row of pens. The windows might be located on two south-facing slopes of a gambrel roof, or along the south wall and in a clerestory level. In the north-south alignment, windows facing east and west were often placed within the pitches of a gabled and gambrel roof (Murphy 1896; Wooley 1946: 103).

One farming manual advised in 1920 that windows were "of special advantage in winter when the hogs delight in sunshine" (Moore et al 1920: 549). Windows built into the roof (and were therefore slanted) captured more light, but let more heat escape in the winter (Clarkson and Whitnah 1920). By the mid-1940s, some experts were suggesting that the benefits of sunlight from windows did not offset the loss of heat in the winter. Some recommended that windows be small, shuttered, or omitted entirely (Wooley 1946: 99-100).

Each hog pen held two to three adult pigs, or a boar, or a sow and her litter. The alley was sized to accommodate feed carts and manure wagons, widening from 4' to 8' as machine size grew. Beginning in the 1910s and 1920s, mechanical manure carriers and feeding equipment were often installed. Some pig barns also had a small workroom, butchering room, or feed room with a feed cooker.

Each pen had a food trough that was served from the central alley. Some pens had awning-type hinged doors that opened over the troughs to allow the worker to fill the trough with swill without interference from the strong hungry pigs.

Each pen also had a pig door leading to an outside yard. To conserve feed and improve sanitation, many farmers paved the feeding portion of the yard with concrete. Eventually most hog yards were entirely paved with concrete to facilitate cleaning.

To keep pigs healthy, adequate barn ventilation was critical. Before the 1950s farmers used adjustable windows and passive ventilation shafts with rooftop caps or cupolas, adapted from dairy barn technology. However, because hog barns were shorter than dairy barns, ventilation shafts were often too short to draw effectively. The problem was solved with electric fans, which became common in the 1950s.

By the early 20th century some farmers were using individual or "colony" huts or "cots" in the pasture so that sows and young litters had some protection when they were moved from the permanent barn to the pasture (Gaumnitz 1909: 233-234). When universities began to emphasize sanitation to reduce disease in the 1920s, experts recommended that sows and piglets be moved to the pasture as soon as possible (for example, at 10-14 days). In some cases the animals were hauled by wagon or truck to their field quarters so they wouldn't come in contact with the ground (Wooley 1946: 98). (By the 1940s some pigs were herded down washable concrete lanes that led to the pastures. An alternative was to transport the pigs to the clean pasture by trailer.)

Pole-framed buildings were developed in the 1930s and widely used by the 1950s (Reynolds 1953). Metal-sided buildings (with various types of frames) were used as early as the 1910s and widespread by 1950.

By 1940 improved technology was helping reduce disease in central permanent houses. Methods included spraying the interior with disinfecting chemicals. *Successful Farming* magazine reported in 1940, "Concrete floors and modern disinfectants have made the central hog house popular for early litters of strong pigs" (Fox 1940). The same author wrote, "In planning your farmstead, you are therefore free to a choice between [centralized or colony] systems. The central house represents a very heavy investment, but when built correctly its annual cost may fall reasonably close to the less expensive and shorter-lived [colony] structures" (Fox 1940).

HOG COTS OR COLONY HOUSES

Individual, portable pig houses – called hog "cots" or "colony" houses – were first used in the early 20th century (Gaumnitz 1909: 233-234). They were inexpensive structures that were placed in the pasture for the mother pig and young litter. Because they were portable, they could be shifted to new ground each season, thereby avoiding the transfer of soil-borne diseases. And because the pigs were separated, disease didn't spread as easily from litter to litter. One expert wrote in 1920, "if the movable hog house system could be introduced on every farm, it would greatly aid in stamping out the dreaded cholera" (Moore et al 1920: 553).

Hog cots had other advantages. Pigs could be shifted from open pasture to shade or shelter depending on the season. Cots were economical because farms could start with only a few pigs and then add more houses as the herd increased. Hog cots were also an asset to tenant farmers because they could be moved from farm to farm.

Hog cots were small lightweight wooden structures, built on treated-wood skids, with shed, saltbox, gabled, or A-frame roofs. They were built on the farm, and by 1927 were also being sold ready-made by lumberyards. In Nebraska this came at the urging of University of Nebraska staff who, in 1927, were trying to curb swine disease by encouraging lumberyards to sell cots. In Nebraska in 1927, most farmers who were purchasing cots from lumberyards were buying about ten at one time (Wood 1927).

The A-frame type was most the common type of cot, according to a 1946 source (Wooley 1946: 244). Shed-roofed cots were roomier than A-frames but less warm in winter and hotter in the summer because of the amount of roof surface. Some cots had hinged roof panels so the farmer could stand up inside to clean the house. Footprints of about 6′ x 7′, 6′ x 8′, or 8′ x 8′ were typical. Small doors and adjustable window openings were placed on opposing walls for access, light, and ventilation. Some huts had ventilators at the ridge line or in the gable ends. A few farmers used double-wide cots to house two litters (National Plan ca. 1950).

Inside the hog cot, fenders or guardrails lined the lower walls to ensure that the little ones were not crushed by the sow. Fenders were unnecessary on the sides of an A-frame cot because of the slope. Cots typically had wooden floors, but some styles omitted floors to make the cots easier to clean and move. If the cot had no floor, wire mesh was sometimes buried a few inches beneath the dirt so the hogs wouldn't dig under the house.

Pigs were at first farrowed in a hog barn and then moved to individual hog cots. By the mid-1920s, some farmers were using individual cots for both farrowing and pasture housing. To use cots for farrowing, some farmers place them close together in a row, facing south, with straw packed behind and between the huts for extra warmth. (The straw was held in place with fencing.) When the litters were two weeks old, the houses were scattered around the pasture. In Minnesota pigs could farrow in May and June using cots. By 1946 some cots had heaters for earlier farrowing.

In another method, some farmers farrowed pigs in individual huts and then moved the pigs into a permanent house for winter feeding. By winter the pigs were several months old and more resistant to the diseases found in communal quarters (Zavoral 1950: 10).

Farmers could also use hog cots as summer houses for sows by turning the door to the southeast so the hottest sun wouldn't shine into the cot. Some farmers made several cots into a long, continuous house by rotating them so each cot's doors pointed east and west and then attaching them together (Wood 1927).

Pigs in pastures needed water, food, and shade. Water could be piped out to the pasture, or diverted from drainage tiles, or drawn from a shallow well (Zavoral 1950). Many farmers used "self-feeders" filled with corn or grain to save labor. Portable "shades" were built of wood or metal, or purchased ready-made.

In the winter, some farmers gathered cots around a concrete feeding yard and used them for winter housing (Moore et al 1920: 556).

Around 1940 the Economy Portable Housing Company was selling portable hexagonal farrowing houses. Each had an incubator in the center and six small pens. Prefabricated of tongue-and-groove fir flooring, the structures were sold in sections and could be assembled in about two hours. The company also made portable hexagonal chicken brooder houses of similar prefabricated design (Economy ca. 1940).

Minnesota Extension reported in 1946 that "some of Minnesota's largest swine growers use movable colony houses" (Zavoral 1946). In 1960 another author wrote that, because of the success in using individual houses to fight swine disease, "many large swine buildings stand today as empty monuments," replaced by colony houses (Ross 1960: 584).

CONFINEMENT SYSTEMS

The term "confinement" was being used in technical articles as early as 1943 (Hansen 1943; Zavoral 1946). Confinement had the potential to increase sanitation, suppress disease, reduce labor, and give farmers more control over other facets of production.

In one management plan recommended by Minnesota Extension in 1946, pigs were housed in a single building where everything "can be done under one roof – farrowing, marketing, weaning, weighing, castrating, vaccinating, sorting, and loading for market." The house was entirely surrounded by a concrete yard. A concrete paved lane led from the yard to four pastures, which were rotated in three- or four-year intervals so that the pigs never walked on ground that wasn't "clean" (Zavoral 1946). In these systems the barn and concrete areas had to be frequently cleaned with power washers and then disinfected to reduce disease (Wooley 1946: 98).

Eventually some operations used separate buildings for particular stages of the pigs' life cycle. One such system under study in 1959, for example, consisted of bringing the sows into a farrowing barn to give birth, moving them back to the pasture when the litter was a few days old, raising the pigs in the pasture for three to five weeks, bringing the pigs by trailer to a "growing" building for three to five weeks, moving the pigs to a finishing building for 12 to 16 weeks, and then marketing them. Farrowing was timed so that the buildings were filled for about five weeks and then cleaned for one week before the next group was brought in. Two growing buildings were sometimes used to allow one building to "rest", which further reduced disease (Powell 1959). One-, two-, three-, and four-building systems were all under development in 1960 (Ross 1960; Hazen and Mangold 1960; Jedele 1960).

In 1960 a University of Illinois animal scientist wrote, "Changes in swine production nearing revolutionary proportion is taking place, or will appear on the horizon in the near future. While the practicality of confinement systems of swine production has been demonstrated over and over again by research institutions, universal acceptance by swine producers has been slow. . . . I believe most of the hogs of tomorrow will be raised under some sort of confinement program" (Ross 1960: 584).

Today, most pigs in Minnesota are raised in confinement systems.

HOG CRATES

As part of the transition to confinement barns, hog crates were used for farrowing. These sturdy but portable metal crates were used inside hog barns. They were about 2′ x 6′ and were placed within a pen that measured about 5′ x 8′. The sow remained in the crate from just prior to the birth until the piglets were weaned. Hog crates held the sow in place but allowed the piglets, which could fit through the crate's widely-spaced bars, to run freely in the pen. The babies had a greater survival rate as they were not as easily crushed by the mother. The portable crates could be placed in any type of structure and were easy to clean and maintain. The crates were manufactured by metal fabricators such as the Wick Manufacturing Company of Madison, Minnesota, which made the brand Marvin Crate (D. Quackenbush 2005; J. Quackenbush 2005).

Today hog crates are often called "farrowing stalls" and are attached permanently to the floor of confinement barns.

EQUIPMENT

Before the 1960s it was common to feed the hogs household garbage or "slop" that was mixed in "swill barrels." Some farmers heated the mixture in feed cookers which stood outside or in feed rooms attached to the barn. Experts discouraged using garbage because of concerns for the animals' health, but the practice was widespread. Feed cookers were also used to render lard at butchering time.

In their 1982 study of farm structures in central Minnesota, Brinkman and Morgan documented a below-ground feed cooker. They wrote: "Near the smokehouse is another unique addition to the [Grausam] farm – a swill pit, dated 1923. It is a deeply-rounded cement hole that looks like a large cooking pot embedded in the ground. It was used to cook mash for the hogs. Potatoes, water, and ground corn and oats were all dumped into a huge kettle and set on scrapwood in the pit to cook. Math [Grausman] said the pit was practical as well as useful because, 'Cement keeps the heat all in. Otherwise, in the open, it takes much more wood. This was better and that was good feed. It was poured into troughs we built ourselves out of planks'" (Brinkman and Morgan 1982: 111).

While farmers traditionally fed hogs by scattering or dumping feed on the ground, troughs were recommended to conserve feed and reduce illness. Many hogs were fed in V-shaped troughs that were attached to pens. Free-standing troughs that were used outdoors had to be designed so hogs couldn't tip them over. They were often made of heavy concrete. Some self-feeders for ear corn and alfalfa were wooden, angled, corncrib-like structures built on skids so they could be moved around the yard. Self-feeders for ground corn or other feed had a slightly different design. Vitamins, iodine, and other supplements were added to feed beginning in the 1930s and 1940s.

Hog farmers also used creep feeders to enable young pigs to get enough to eat without being pushed aside by the sows. Creep feeders typically consisted of a wooden framework with slats spaced so the piglets could fit through but the sows were held back.

YARDS, PASTURES, AND FIELDS

Hog yards surrounding permanent buildings were usually paved with concrete so they could be cleaned and disinfected. The yards were surrounded by sturdy wooden fences. It was common to make the fence sections movable so pigs could be separated by age and sex.

Equipment such as dipping vats, concrete wallows, loading chutes, breeding crates, or stocks for veterinary procedures were often located within or near the hog yard (*Farm Building Plans* 1953).

POST-WORLD WAR II CHANGES

After World War II, hog-raising expanded nationwide as U.S. population, consumer demand for meat, and corn production all grew. The size of herds in Minnesota increased considerably as growers took advantage of new developments in corn-raising, breeding, feeding, and mechanization. Under pressure to modernize, some farmers stopped raising pigs entirely rather than invest in the necessary new equipment.

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

Artificial insemination for hogs was developed commercially in the early 1960s. Farmers timed breeding to have several litters born year-round, which helped make better use of expensive buildings.

As herd size increased, good sanitation became an increasing concern. Hogs raised on concrete developed feet and leg problems, and wire and other types of flooring were tested. New methods of handling manure were also developed as the number of pigs per farm grew (Ross 1960).

PREVALENCE

Minnesota farmers used a variety of types of pig barns. These structures may not have survived for several reasons: some pig barns were makeshift structures, some deteriorated through the years because pigs were hard on their housing, some weren't maintained through time because they stood far away from the main cluster of buildings, and most portable or colony houses were made of lightweight materials that eventually deteriorated. Some permanent pig barns, on the other hand, were built to be strong and durable. These are the most likely to be standing. Some of the earliest examples of 1940s production methods and confinement housing may be extant.

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Young ones at a piglet-sized trough, probably shortly after weaning. Warneke Farm, Anoka County, 1904. (MHS photo)

Sows with their litters in a hog yard. This hog barn had an upper loft for bedding and a ventilation system with flues for each pen. This barn's flues were tall to help them draw correctly. Note the sturdy board fence. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

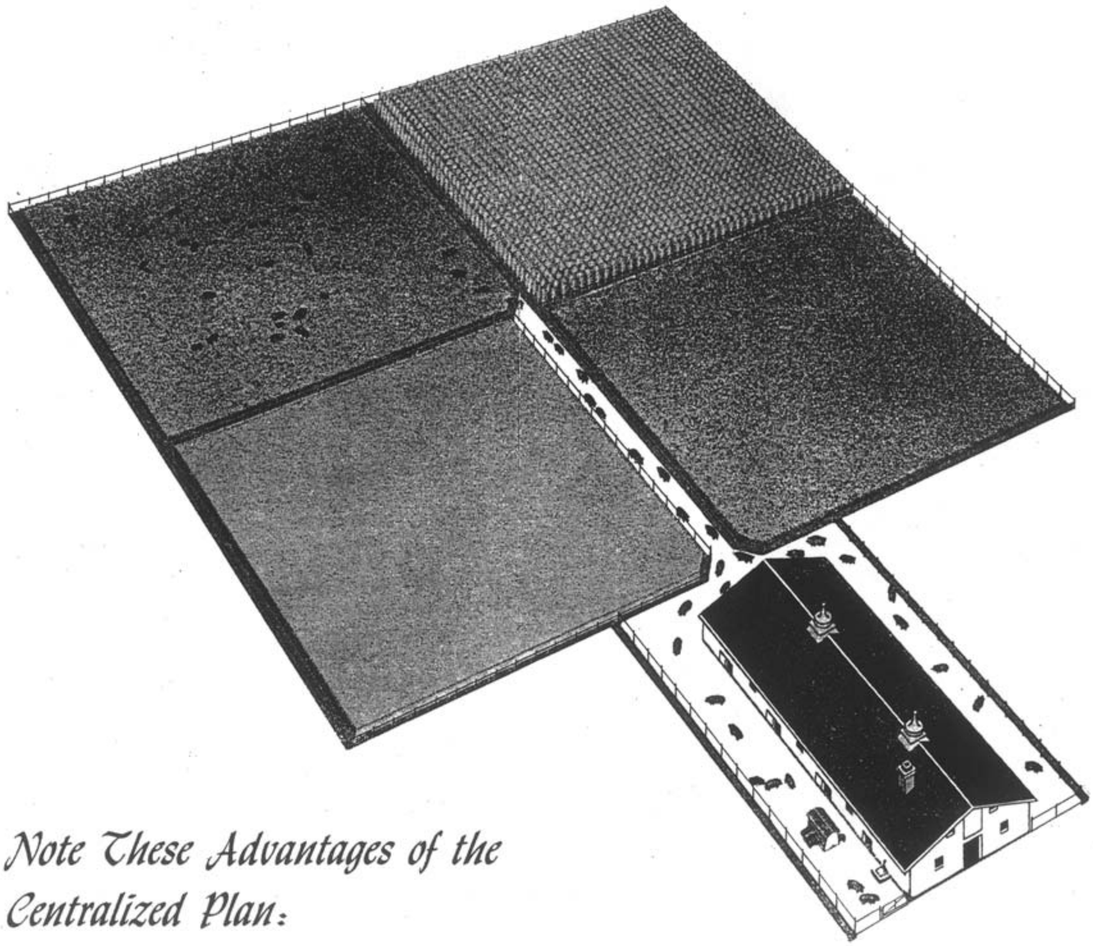
By the mid-1940s the A-frame was the most common style of hog cot. Colony houses or cots like this were typically built on skids and moved to fresh ground each season to inhibit the parasites and diseases that plagued swine. As late as 1950 one-third of Minnesota's piglets were still dying from disease and another one-third were stunted. Location unknown, circa 1925. (MHS photo by Harry Darius Ayer)

These cots were lined up, facing south, for farrowing in the spring. Straw was packed behind and between the huts for extra warmth and held in place with fencing. When the litters were about two weeks old, the cots were spread apart in the pasture. Location unknown, circa 1925. (MHS photo by Harry Darius Ayer)

Permanent hog barns of this design were built in Minnesota by the 1890s. The position of the windows indicates that the house had two rows of pens – one lit by the south-facing first-story windows and the other by windows at the clerestory level. By the 1920s disease prevention programs were discouraging farmers from using dirt-surfaced hog yards like this one. Location unknown, 1913. (MHS photo)

This hog house was typical with its long, narrow footprint and single-story design. Many hog barns resembled chicken houses, but had fewer windows. Kvistad Farm, location unknown, circa 1914. (MHS photo by Ole Mattiason Aarseth)

Outdoor troughs were commonly built of concrete so pigs couldn't tip them over. Location unknown, 1926. (MHS photo by Paul W. Hamilton)



Note These Advantages of the Centralized Plan:

(1) A modern, permanent hog house which can be used the year round. (2) A concrete feeding floor equipped with gutter for easier cleaning. (3) Concrete-floored lane giving hogs access to pasture without contact with contaminated ground. (4) Four fields which can be rotated so that hogs will always have a clean pasture.

In this early confinement-type plan recommended in 1946 by Minnesota Agricultural Extension, pigs were housed in a single building where "farrowing, marketing, weaning, weighing, castrating, vaccinating, sorting, and loading for market" were all done under one roof. The house was entirely surrounded by a concrete yard. A concrete-paved lane led from the yard to pastures that were rotated so that the pigs never walked on ground that wasn't "clean." Soil-borne diseases remained in the pastures for about three years, hence the rotation. From Zavoral's "Centralized Hog Plan," University of Minnesota Agricultural Extension (1946).

■ HORSE BARNS

- Horses were the primary source of mechanical power until about 1920, and were used on Minnesota farms until the mid-1950s
- In 1930 most Minnesota farms kept four to seven horses
- On small farms, horses were kept with dairy cows or in a general purpose barn
- Farms with more than 5-6 horses sometimes housed them in a separate horse barn

Work horses and mules were the main source of mechanical power on Minnesota farms beginning in the early settlement period. Nearly all horses on farms in Minnesota were used for draft; very few were kept solely for riding. Some farms needed to devote 25 percent of their land just to growing oats, hay, and straw for the farm's own work horses.

In 1900 Minnesota had about 154,600 farms and about 600,000 horses that were two or more years of age, making an average of about four horses per farm. Thirty years later horses were still an important source of power. In 1930, most Minnesota farms kept an average of four to seven horses and mules, except farms in the northeastern Minnesota cutover and in the Twin City suburban area, where there were an average of one to three horses and mules per farm (Engene and Pond 1940). In 1938 Minnesota had 682,000 horses and 13,000 mules. That year Minnesota ranked fourth among states in the total number of horses on farms (Harvey 1938: 3).

One author in the 1940s estimated a work horse was needed for each 25 to 30 acres of cultivated land, if no other sources of power were used. This meant that a 160-acre farm with 140 tilled acres needed about 5 to 6 horses (Anderson 1943: 656).

Nationwide the number of horses expanded with the growth of agriculture and peaked around 1913-1918. As the use of tractors increased in the 1920s-1940s, the number of horses gradually decreased. Many Minnesota farmers phased out the last of their draft horses in the mid-1950s.

Many small- to average-size farms kept draft horses in the same barn as the dairy herd or in a general purpose (also called combination) barn that might be "planned to house horses, dairy cows, and perhaps beef cattle, hogs, and sheep" (Wooley 1946: 119). This was not ideal, however, and often hogs and dairy cows had their own quarters, leaving horses, sheep, and beef cattle for a general purpose barn (Wooley 1946: 119).

Horse barns were usually built on farms that needed more than the average of 5-6 work horses, in part to protect the investment of these animals. One farm manual advised in 1920: "Horses require light, airy and dry shelter, and are too valuable to be housed in buildings which do not meet these requirements. Horses, shut up in dungeons without light or ventilation, cannot be expected to come out of such quarters in good condition for work . . . ." The article concluded that "convenience, sanitation, and contentment on the part of the animals are the three things to strive for in building any [horse] barn" (Moore et al 1920: 540).

See also
Implement or Machine Sheds
Appendix: Focus on Mechan Techno
Appendix: Focus on Minn Livestock

The horse barn needed to be accessible to all farming operations and yet, because of the aroma, was usually somewhat removed from the house. A site downwind was recommended.

The size of the barn depended on the number of horses (and sometimes mules) being housed. One recommendation from 1923 allocated 75-90 sq. ft. per horse (including the alley). Using this advice, a barn housing six horses would need about 480 sq. ft., or be perhaps 20′ x 24′ (Louden 1923). The Midwest Plan Service in 1933 offered plans for a 36′ x 58′ barn for 16 horses (Midwest Farm Building 1933).

It was recommended that every horse barn have a separate wagon and equipment room, a central service alley, and a separate harness room – the latter to protect the leather "from the fumes of the manure and from the accumulation of dust" (Moore et al 1920: 540).

While there were horse barns where the animals faced in toward a central feed alley, most experts recommended facing horses out from the alley for several reasons – it made "cleaning the barns, caring for harness, grooming the animals, and handling larger teams a little more convenient" and allowed each horse to see outside (Wooley 1946: 116).

A 1920 manual advised: "One 3′ x 3′ window should be provided for every stall, and it should always be low enough for the horse to look out. Nothing adds more to a horse's contentment than the ability to see what is going on about it" (Moore et al 1920: 542).

Horses were kept untethered in stalls. Single stalls were usually about 5′ wide by 9′ long, with double stalls measuring perhaps 8′ x 10′. Teams were often housed together. One early plan called for smaller stalls of 3′6″ by about 6′ (Moore et al 1920: 542). Box stalls for carriage or riding horses, or to be used for a mare with a young colt or a sick horse, were at least 9′ x 12′ or preferably 12′ x 12′. Each stall had provisions for water and feed.

Stalls were primarily constructed of wooden planks, with 2″ wood planks covering the floor. Beneath the wood flooring could be a sloped concrete floor, and the lower stall walls and manger could also be concrete.

The carriage room, which housed wagons, spreaders, and other equipment, was frequently a drive-through space. While a harness or tack room was often provided, some farmers used this room for miscellaneous storage and hung each horse's harness on a peg in its stall. The barn's feed room had feed bins, scales, and equipment for grinding and mixing grain. After commercial and fortified feeds became widespread, feed rooms were often converted to other uses. Most barns stored hay and bedding in a loft, with chutes through which it could be dropped to the first floor (Wooley 1946: 116-119).

Ventilation of horse barns was important and several passive systems were used. In the King system, fresh air entered the barn near the top of the first story, dropped to the floor, and was drawn out by flues built into the walls via intake openings near the floor.

Like general purpose barns, horse barns were built of wood, clay tile, concrete block, and, less often, stone and brick. Gabled, gambrel, and gothic-arched roofs were common.

After 1918 the numbers of draft horses began to decrease as the use of trucks and tractors grew nationwide. The use of mules also began to decline, after peaking in the U.S. about 1925 (Anderson 1943: 621, 630).

During the period of transition from horses to tractors, the need for a separate horse barn diminished. During the transition, combination buildings were designed to accommodate horses, trucks, tractors, and other farm equipment. One 1946 plan, for example, provided a machinery storage area and room "for 6 horses, 250 bu. of corn, 500 bu. of oats, 20 tons of hay, and 10 tons of bedding." The machinery area encompassed almost two-thirds of the 30' x 60' building (Wooley 1946: 117).

Despite the progress of mechanization, 72 percent of farms in the U.S. still kept horses or mules in 1940 (Anderson 1943: 631). By 1953, however, the University of Minnesota was no longer including plans for horse barns in their standard plan book for farmers. Instead, housing for horses was shown only within general purpose barns. Many Minnesota farms retired their last horses in the mid-1950s.

PREVALENCE

It is not known how many Minnesota farmers built dedicated horse barns. They were most often built on large farms where more than seven or eight draft animals were needed. As horses were replaced by tractors, the barns were likely converted to other uses. Extant examples may be rare.

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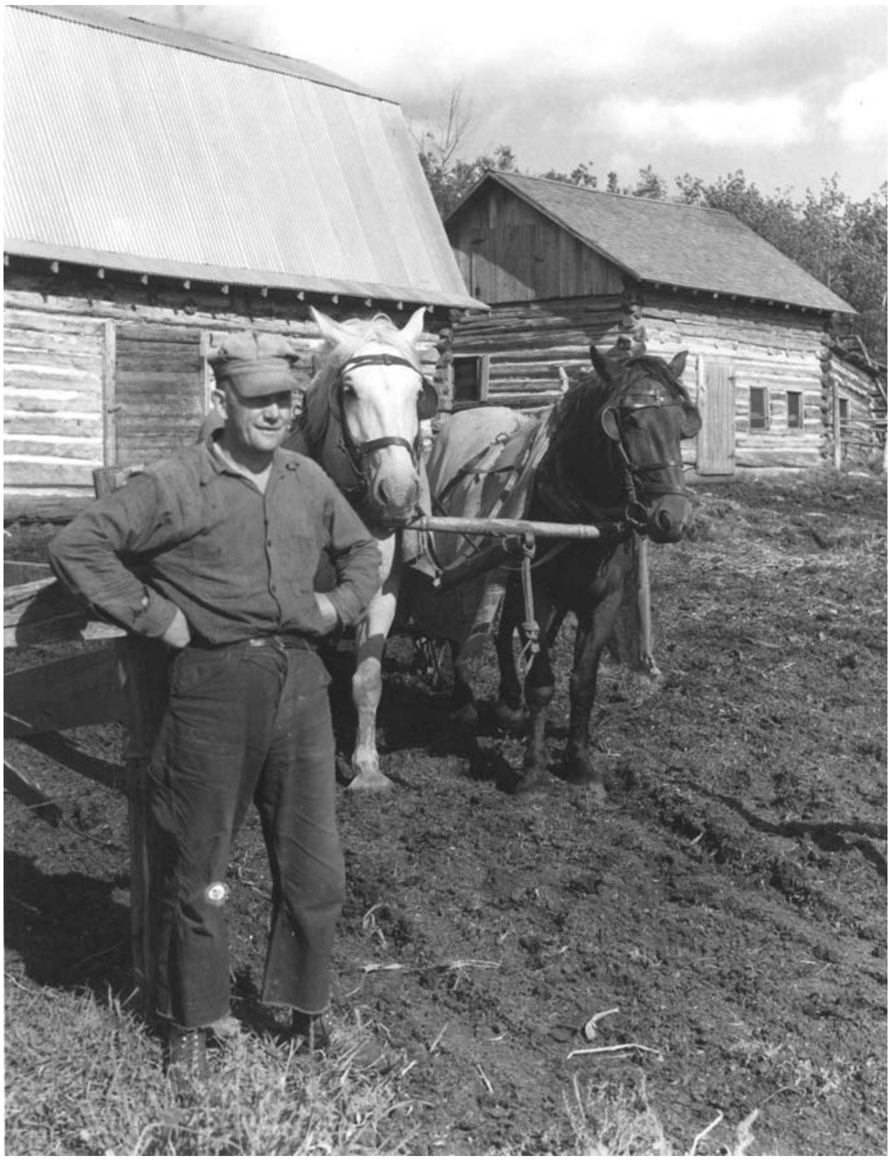
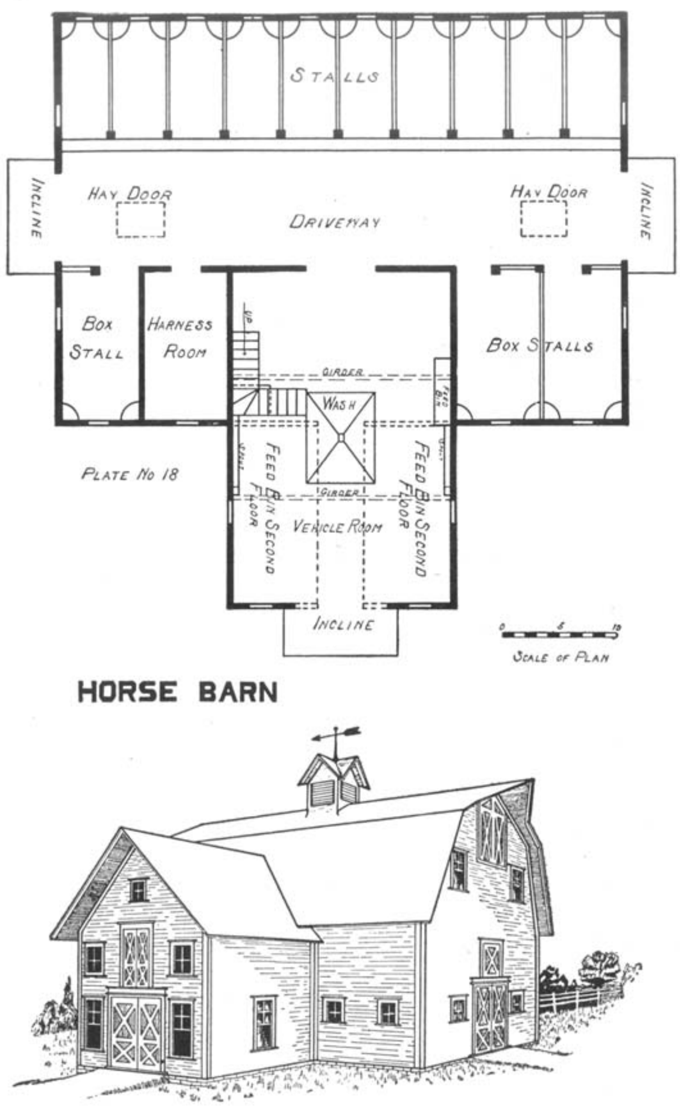
This general purpose or combination barn housed horses and cattle. Note the closely spaced windows, one for each stall. Oak Hill Farm, location unknown, circa 1910. (MHS photo by Harry Darius Ayer)



Finding and training a well-matched team was difficult, and such horses were valuable and often housed together in the same stall. As farms adopted tractors beginning in the 1920s, the draft horses also had to work well in the field next to the loud machinery. This farm was located in Lake of the Woods County. Circa 1942. (MHS photo by Kenneth Melvin Wright)



A horse barn plan issued by the North Dakota Experiment Station and printed in a 1920 farming manual distributed in the Midwest. The barn had 10 regular stalls, three box stalls (used for teams, foals, or sick animals), and the recommended harness room, wagon room, and provisions for feed mixing and hay and straw storage (Moore et al 1920).

■ HOUSEBARNS

- Housebarns provided shelter for farmers and their livestock "under one roof"
- They are extremely rare in the U.S., with one example known to be standing in Minnesota

Among the accounts of housebarns during Minnesota's early settlement period is that of Merill Jarchow, who wrote, "Near Sleepy Eye, a Danish family built a sod house large enough to accommodate not only themselves, but their cows and oxen as well. Within it copper utensils brought from Denmark seemed almost out of place" (Jarchow 1949: 83).

In a National Register nomination for the Seitaniemi Housebarn in St. Louis County's Waasa Township, historian Michael Koop wrote in 1989:

> Despite its widespread use as a building tradition on the Continent, few housebarns were constructed in the New World. Of the fifteen or twenty housebarns known to have been built in America, all of them are located in the Upper Midwest and Great Plains states of Kansas, Michigan, Missouri, Nebraska, North Dakota, South Dakota, Texas, and Wisconsin. Interestingly, nearly all of these buildings were constructed by German or Czech-Bohemian immigrants (Koop 1989: 8.1).

The Seitaniemi Housebarn was built circa 1907 and enlarged circa 1913. Koop described it as a two-story log structure in which living quarters for the farm family shared a common wall with housing for horses, cattle, and later sheep, as well as provision for hay storage. The building made efficient use of resources, and allowed heat from the livestock to help warm the house while the stored hay help provide insulation (Koop 1989; see also Alanen 2000: 2.112-2.127).

PREVALENCE

Housebarns were rarely built in Minnesota. Today there is only one known example in the state.

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See also

Combination Buildings
Saunas

The Seitaniemi Housebarn, shown here, was built by Finnish immigrants circa 1907 and enlarged circa 1913. Waasa Township, St. Louis County, circa 1988. (MHS photo by Michael Koop)

▪ ICEHOUSES

- Usually small free-standing structures with gable roofs
- The simplest icehouses stored cakes of ice buried in insulating material
- More elaborate structures separated ice cakes from the insulation
- Ice was needed, for example, to quickly cool raw milk and fresh eggs
- Used until electric refrigerators were common

A staple of many early farms, icehouses were used to store ice for cooling food before electricity and mechanical refrigeration became available. Chunks of ice were floated in the milk house cooling tank, for example, to quickly cool the warm raw milk. Eggs gathered from the hen house also needed to be quickly cooled and then stored for several weeks in cold conditions. In the 1940 federal census, Minnesota ranked 38th among states in the number of farms with mechanical refrigerators in the farmhouse. Instead of using refrigerators for cooling, many farms cut and stored their own ice.

In Minnesota, icehouses were especially associated with milking cows and raising poultry, and many were built when farms diversified in 1875-1920 (depending on location in the state).

Some icehouses had a cold storage room, similar to a present-day walk-in cooler. Icehouses were especially important on dairy farms where milk had to be quickly cooled and then stored cold. Some dairy experts recommended that an icehouse and a milk house could be "built under one roof" (Washburn 1931: 301).

Agricultural experts urged farmers to see a farm icehouse, not as a luxury, but as a smart business investment. "When one considers the quantity of meat and other supplies spoiled during the heated periods, or the cans of cream that are graded lower or rendered entirely unsalable, it will be seen that an icehouse should really be considered a necessity, and that it can be made to pay for itself in one or two seasons" (Welch 1914: 186).

Icehouses were most often woodframe or masonry structures, but came in a wide variety of forms and sizes. Most had gabled roofs, and floors were often wooden or poured concrete.

Icehouses were usually free-standing structures although they sometimes adjoined the farmhouse or milking barn. Some icehouses were cut into hillsides or built partly underground for better insulation. Good drainage and convenience to the farmhouse were the main factors in location (Midwest Farm 1937; Welch 1914: 186; Brooks and Jacon 1994: 64).

The size of the icehouse depended on the needs of the farm. A minimal recommended size was 8′ x 8′ x 8′ and held about 14 tons of ice – enough to "furnish all the refrigeration needed by the ordinary family" (Welch 1914: 187). Typical footprints ranged from 12′ x 12′ to 16′ x 20′. One

See also

Milk Houses
Springhouses and Springboxes
Root Cellars

publication suggested that several families could join together to build and stock a larger icehouse (Welch 1914: 187).

In areas where ice was expensive or hard to get, well-constructed icehouses with thick, insulated walls were recommended. In places where natural ice was easily obtained from nearby lakes or streams and storage loss was not a concern, uninsulated icehouses were preferred (Welch 1914: 189; Midwest Farm 1937). The two forms are described below:

Uninsulated Icehouses. A simple, uninsulated woodframe icehouse could be built quite easily by any farmer with rough carpentry skills. This type typically had a stone or concrete foundation and floor. A single wall of shiplap or drop siding covered the outside of the studding. The inside studs were often left unfinished or they could be lined with rough boards for greater strength. A drain in the center of the floor carried away water as the ice melted. A door, made of loose boards fitted into grooves, ran from the sill to the rafters. Slatted louvers in both gable ends vented moisture. More substantial icehouses were built of masonry block with cement asbestos shingles and a cupola for ventilation (Midwest Farm 1937; Welch 1914: 187-188).

The ice was packed in loose sawdust or dry planer shavings, which many sawmills put up in bales. The floor of the icehouse was covered with a foot of sawdust or shavings, and a 12″ to 18″ layer was packed all around the ice pile. The top of the ice pile was covered with another 2′ layer of sawdust.

Uninsulated icehouses were cheap to build but inconvenient. The sawdust had to be unpacked and then repacked each time ice was removed. The ice blocks had to be washed before use and there was considerable ice loss from breakage and melting (Welch 1914: 188).

Insulated Icehouses. More complex, insulated icehouses separated the ice cakes from the insulating material. They were more expensive to build but saved on labor and waste. This type of icehouse had a concrete foundation and floor and woodframe construction with walls, ceilings, and doors that were all double-layered. The cavities in the walls, door, and ceiling were tightly packed with sawdust or wood shavings. Corn stalks, flax straw, corkboard, cardboard-like compo-board, or other insulating materials were also used. Because the insulation was contained within the walls, ice cakes could be stored clean, away from the sawdust (Midwest Farm 1937; Welch 1914: 190-191).

Insulated icehouses often had drop siding on the exterior and tongue-and-groove sheathing on the interior, both over waterproof building paper. Screened louvers in the gable ends provided ventilation.

PREVALENCE

Farm icehouses were built throughout Minnesota and used for many decades. Eventually, however, icehouses were supplanted by electric refrigerators and freezers (including walk-in style coolers), and by bulk milk tanks. When they were no longer needed for ice, many icehouses were converted to sheds, smokehouses, or other uses. Some extant examples likely still exist.

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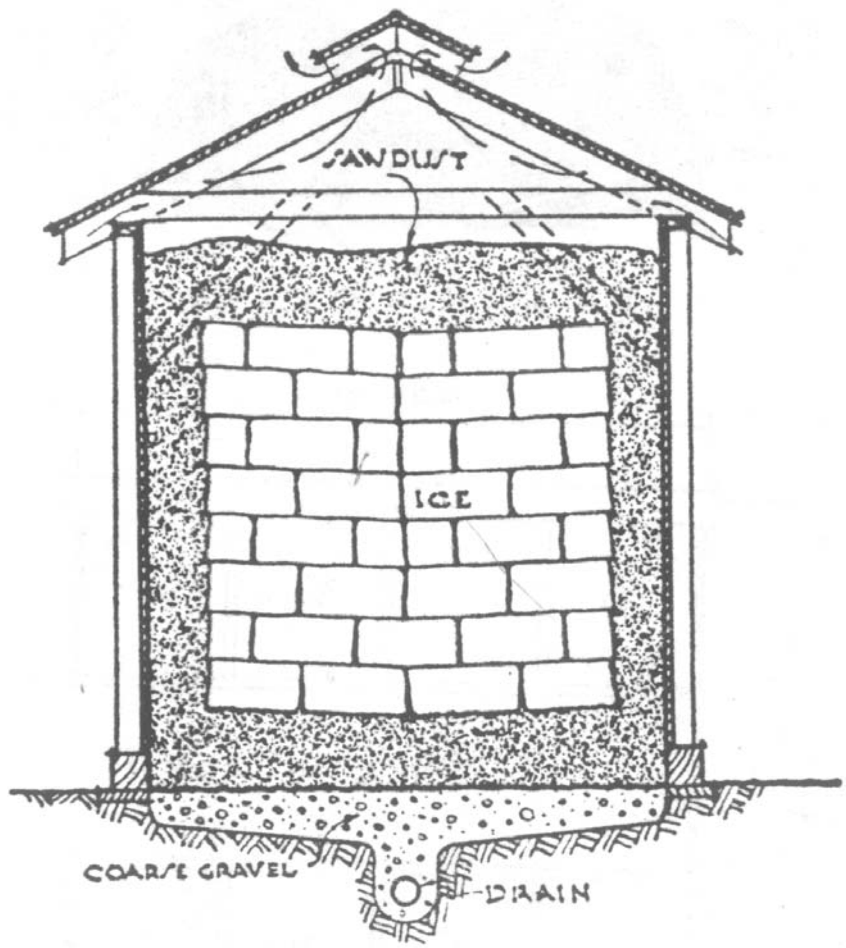

Icehouses were frequently insulated with sawdust. This recommended design appeared in a textbook written by agricultural engineers from the University of Illinois and published in 1941. From Carter and Foster's *Farm Buildings* (1941).

These buildings are apparently icehouses. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

▪ IMPLEMENT OR MACHINE SHEDS

- Found on most Minnesota farms beginning in the late 19th century
- Important to protect and lengthen the life of mechanical equipment – a major farm investment
- Increasingly built after average farmers adopted tractors in the 1920s
- Implement sheds lent themselves to prefabricated, buildings without interior posts
- Eventually implement sheds rivaled livestock barns in size and importance

Implement or machine sheds (also called wagon sheds) were constructed to house valuable farm equipment. Found on most Minnesota farms beginning in the late 19th century, they were first used for horse-drawn wagons and implements.

In 1912 L. B. Bassett of the University of Minnesota urged farmers to build a machine shed. He argued, "On the 56,138 farms in Minnesota, there is over fifty-two million dollars' worth of farm machinery, according to the 1910 census report. Much of this machinery stands idle 95 percent of the time. During this 95 percent of the time or 348 days of the year, most of the machinery is left in the open or in poorly constructed sheds" (Bassett 1912: 119).

Machine sheds came into increasing use with the adoption of gas-powered machinery in the 1920s. According to the University of Minnesota, 99 percent of Minnesota farmers still used work horses in 1930, but the number of horses had declined 27 percent over the previous 12 years and was steadily dropping as farms added a tractor to their operation (Cavert 1930: 4).

While the original costs of erecting an equipment storage building sometimes seemed prohibitive, experts cited long-term cost savings from protection of the machinery. They reasoned that having a well-constructed implement shed could be the difference between equipment lasting 5 years or more than 30 years. Wooley and Carter pointed out in 1933 that "the life of most farm machines is almost entirely unrelated to the amount of work performed each year: few machines are actually worn out." Further, Wooley advised the use of implement sheds as a means to maintain a strong credit record. He wrote, "If there is any one thing that impresses a banker as poor management, it is neglect of farm machines" (Wooley and Carter 1933: 1; Wooley 1946: 259).

An implement shed was typically located on well-drained land near the center of farm activities. In 1912 Bassett recommended that it be quickly accessible to the fields, and in relatively close proximity to the farmhouse, barns, workshop, and garage to reduce "miles of unnecessary travel" throughout the year. Orientation varied, but the shed often faced east or south. Some experts suggested that a machine shed be used as a windbreak for the farmyard. Some also advised that the shed be built and positioned so that it could be expanded at a later date (Bassett 1912: 119; Neubauer and Walker 1961).

In the early 20th century, old unused buildings were often used to shelter farm equipment, but frequently provided little protection. Boss wrote in 1914 that equipment stored in poor "sheds with

See also
Farm Shops
Garages
Appendix: Focus on Mechan Techno

leaky roofs and wet floors, often rust quite as badly as if they were standing outdoors" (Boss 1914: 117).

Simple woodframe structures with open sides were the earliest sheds built specifically to store implements. Many were lean-tos attached to other farm buildings. One of the most basic styles – and popular for many decades – was a three-sided building with the fourth side entirely open.

Fully-enclosed implement sheds provided greater protection and more versatility of use. They protected machinery from the weather, kept out birds and animals, provided space to make repairs, and protected against theft. Some housed a workshop for maintenance and repairs. These areas usually had a stove pipe or chimney for heating. Like three-sided sheds, fully-enclosed sheds were usually woodframe. (See also "Farm Shops," another individual farm elements section.)

Though implement sheds were built in all shapes and sizes, they needed to be of adequate size to store and maneuver machinery. Historically the most common shape was a long narrow building from 20' to 36' wide and 40' to 100' long. While some sheds had one large open space, many had individual stalls, each often 12' wide. A 1912 *Minnesota Farmers' Institutes* article, for example, described an 18' x 90' shed with stalls of varying widths to house a manure spreader, rack wagon, box wagon, ensilage cutter, gang plow, corn planter, cultivators, grain binders, disc, grain drill, hay loader, tedder rake, and workshop. This building could be built for $400 ($7,500 in 2003 dollars) (Bassett 1912: 120-122; Carter and Foster 1941: 283-284; Neubauer and Walker 1961: 241, 243).

Some machinery storage sheds had a driveway down the length of the building, with rows of stalls on each side. Others had shorter drive-through areas for tractor-pulled wagons, spreaders, and other often-used equipment, as well as enclosed areas for seldom-used machines (Wooley 1946: 262).

Implement sheds needed large doors that could be conveniently opened with plenty of clearance for larger machinery. The doors were usually hinged on smaller buildings, and hung on roller or sliding-type hangers on larger structures. As equipment got larger, door size increased.

Before farms were electrified, implement sheds often had windows, as well as large doors, to bring in natural light. Electrification was a boon to implement sheds, according to one agricultural engineer, who wrote their utility was wonderfully improved the moment two or three wires were extended into them (White 1936: 19).

Implement sheds were most often built with dimensional lumber and sided with wood. Structural clay tile and concrete block were more durable and withstood strong winds, but were also more expensive. Early sheds typically had floors of packed dirt or clay, cinder, or crushed rock or gravel. Eventually concrete became the standard recommendation although occasionally asphalt was used. Some machine sheds had repair pits so workers could more easily access machines.

Because of their simplicity, implement sheds lent themselves well to engineering innovations and materials that became available after World War II, as well as to the post-World War II trend of constructing buildings with multiple uses. On some Minnesota farms, the implement shed was the first building to exhibit "modern" materials and methods as farms built new sheds after the war to house expensive new equipment.

Pole-framed buildings – often with gabled roofs, steel siding, and concrete floors – became popular after World War II, although the building type had been developed in the 1930s. An implement shed that could double as a livestock barn was featured in a 1933 plan by the Midwest Plan Service, for example. It was a pole-framed, wood-sided building. In circa 1960, Merickel Buildings of Wadena offered pole-framed options in three sizes. They had no interior posts to interfere with moving machinery and had "precision-sawed" rafters to give them strength and rigidity. The sheds could be sheathed with either corrugated steel, fir plywood, or shiplap siding (Midwest Farm 1933; Merickel ca. 1960).

Prefabricated metal units became common in the 1940s. Many had frames, walls, roofs, and doors all built of metal. In 1948, for example, 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", "Quonset 20", "Quonset 24", and "Quonset 32" for machinery storage and other uses (Stran-Steel 1948; Stran-Steel 1957; Flintkote 1946).

As farms modernized, some implement sheds became known as "farm service centers," complete with a repair shop and an office to manage farm interests. Implement sheds became larger as machinery became more expensive, more varied, and more complex. Eventually the implement shed rivaled the livestock barn in size and importance on many Minnesota farms.

PREVALENCE

Virtually all Minnesota farms had some provision for storing equipment – usually a free-standing implement shed. Examples from the pre-gasoline tractor era (the 1920s) may be rare. It is likely that well-preserved examples from other eras are still standing.

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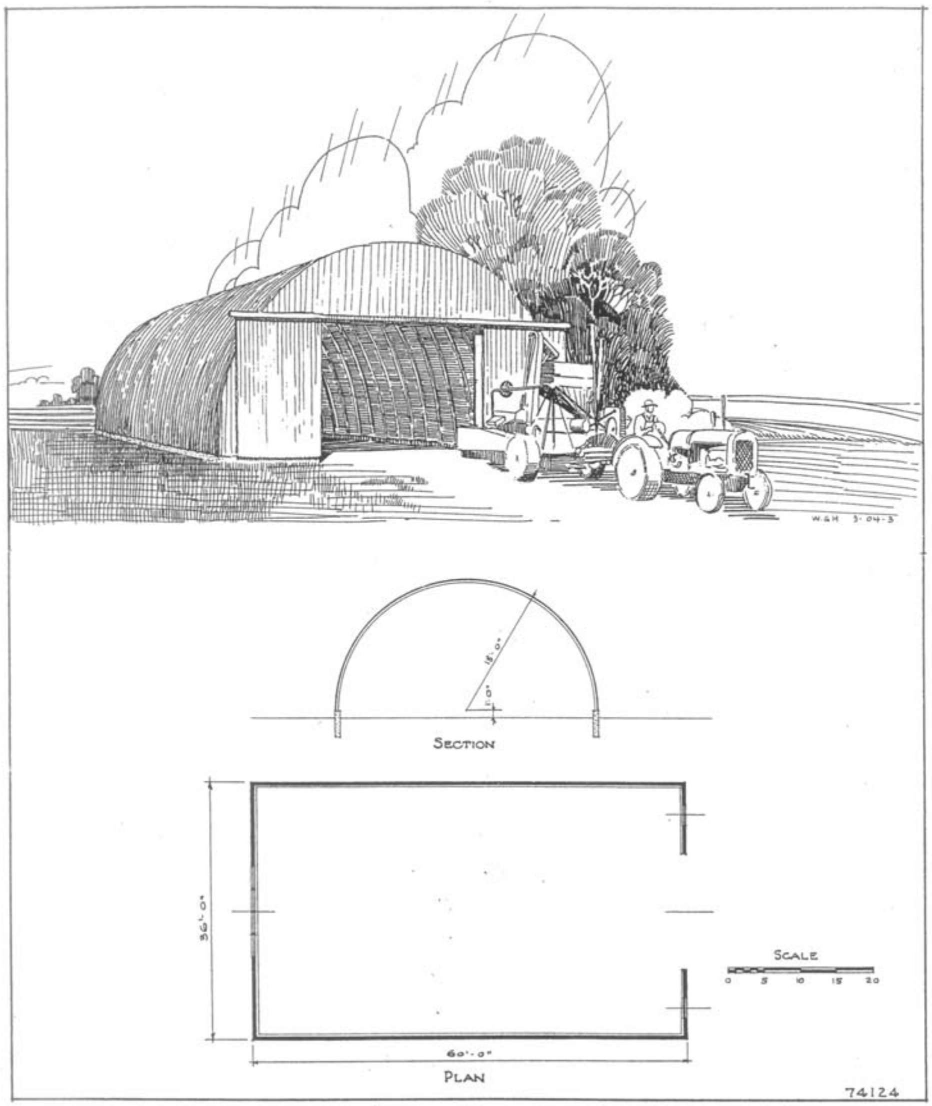
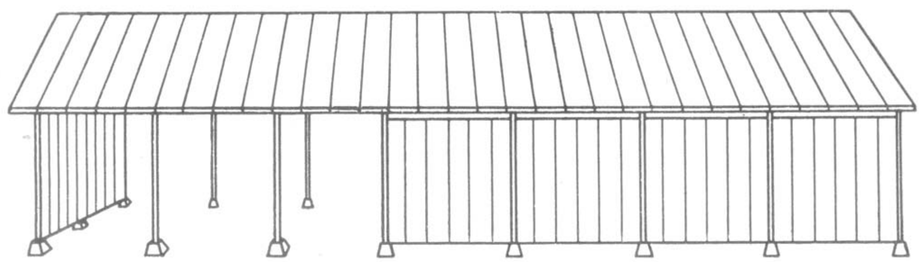
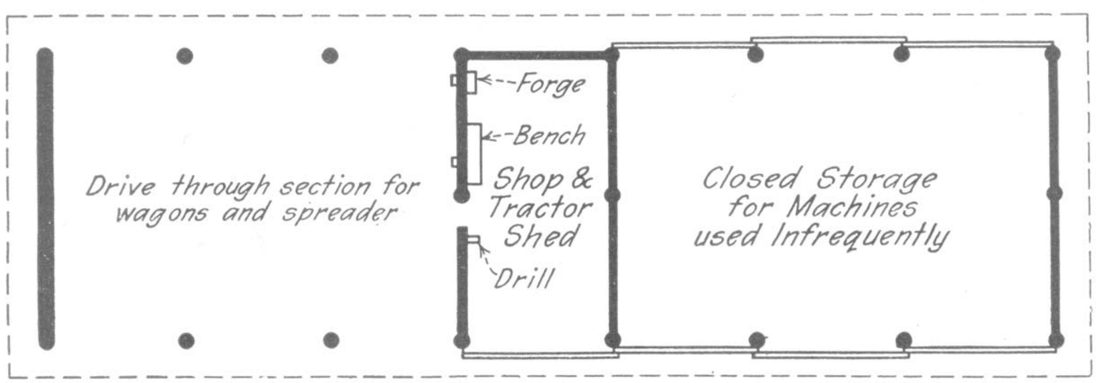
An implement or machine shed. It had a standing seam metal roof and the walls were sheathed in corrugated metal. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)



Maximizing floor space by eliminating structural posts was useful in an implement shed. The 36′ x 60′ building in this 1933 plan was supported by arches built-up from 1″ x 4″ or 1″ x 3″ boards, and was sheathed with corrugated metal. From Midwest Farm Building Plan Service (1933).





This combined implement shed and farm shop had a "drive-through section" for frequently-used wagons and manure spreader, a central shop with workbench, forge and stationary drill, and an enclosed implement shed for equipment used less often. From Wooley's *Farm Buildings*, a 1946 manual for "farm managers, appraisers, county agents, vocational teachers, and farm operators," according to the preface.

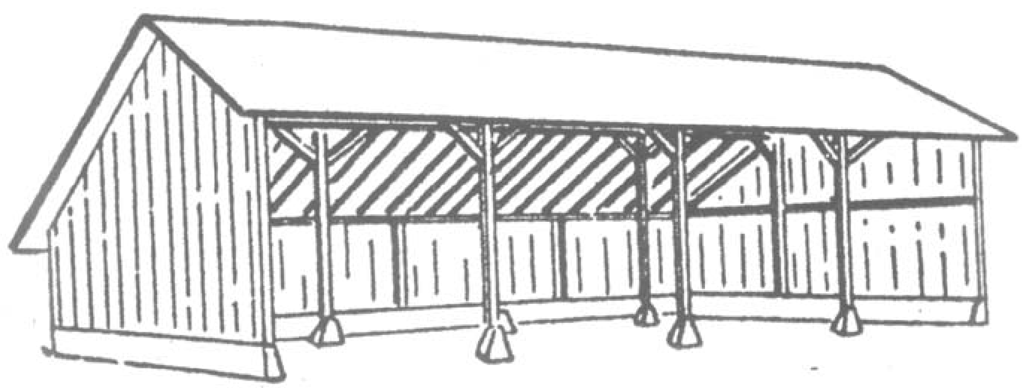


FIG. 139.—An open-front storage shed.

Some implement sheds were relatively simple open-fronted buildings with wood or metal siding and gravel floors. From the 1946 manual *Farm Buildings* by the University of Missouri's John C. Wooley.

■ IRRIGATION STRUCTURES

- Irrigation in Minnesota began on a very small scale in the 1920s
- The center pivot irrigator was patented in 1952; concrete pads were added in the 1970s
- By the early 1960s about 20,000 acres were under irrigation in the state

The first irrigation systems in Minnesota were used by truck farmers who raised produce around the Twin Cities area in the 1920s. The number of acres irrigated was very small and much of this land has been consumed by suburban growth (Wright 2005). Other early irrigation systems during this era included a one-acre field (crop unknown) along Highway 10 in Sherburne County and the Sanford family's one-acre strawberry field near Elbow Lake. Potato and sugar beet farmers in the Red River Valley also experimented with irrigation around the 1920s (Wright 2005). Irrigating potato fields in the valley became more common in the 1950s (Kenney 1995: 189).

The number of farms that were irrigated grew slowly. By 1941, about 250 of Minnesota's 197,000 farms were irrigating a total of about 1,500 acres of land (Young and Woods 1987: 3).

Nationwide, agricultural irrigation was advanced by the development of lightweight aluminum pipe around the time of World War II.

In 1950, about 4,200 acres were being irrigated in Minnesota. The number grew to 9,200 acres in 1954. According to one estimate, there were 15,000 acres irrigated in Minnesota in 1956 (Wood 1957: 419). By the early 1960s there were some 20,000 acres irrigated in the state (Wright 2005).

One area noted for its irrigation in the mid- to late 1960s is "Bonanza Valley," located near the town of Brooten and extending to the Villard, Glenwood, and Paynesville areas in Stearns, Pope, and Kandiyohi counties. At its center is about 50,000 to 60,000 acres of outwash sand plain soils with a prolific water aquifer. Irrigation started in the Bonanza Valley when farmers – mostly dairymen – began to irrigate alfalfa and corn. They later irrigated peas and sweet corn seed. About 1,000 acres were under irrigation there in 1966, the year the Bonanza Valley Irrigators Association formed (Scholten et al 1993). Today a wide area is irrigated and a Brooten community sign reads "Brooten, the Heart of Bonanza Valley, Welcomes you to Irrigation Country."

Irrigation in Minnesota grew during the drought years of 1976 and 1977, finally becoming more common in the state (Wright 2005). In 2002 there were some 432,888 acres irrigated in Minnesota. The greatest number of irrigated acres were in these 10 counties: Otter Tail, Pope, Dakota, Stearns, Sherburne, Swift, Wadena, Hubbard, Morrison, and Todd (Wright 2002).

The type of crops irrigated in Minnesota changed through the decades. In the 1920s produce and truck crops such as strawberries were irrigated. By the 1970s commonly irrigated crops included corn, beans, alfalfa, and sunflowers.

See also
Fields and Pastures
Erosion Control Structures
Drainage Structures

IRRIGATION EQUIPMENT

The historically simplest form of agricultural irrigation, the water-filled canal or trench, did not work well in Minnesota because of the state's soil types. The first irrigators used in the state were known as sprinkler irrigators and consisted of vertical steel pipes with sprinkler heads mounted on top (Wright 2005; Wood 1957: 418).

The state's most prevalent type was the center pivot system, which was invented in 1947, according to one source (Kenney 1995: 189). The center pivot system was apparently patented in 1952. Center pivot irrigators consisted of long horizontal pipes with one end mounted on wheels and the other end attached to a rotating joint at a fixed location. As the system pivoted, water dripped from the pipe resulting in a circular irrigation pattern with the rotating joint at the center. The first systems were water-driven, but by the late 1960s fuel- or electric-powered motors were used to rotate the irrigators. In the 1970s farmers began to use a concrete pad to support the pivot point and its pump station. Until this time irrigation systems were essentially temporary structures that, when no longer used, could be moved or dismantled leaving little physical evidence (Beyer 2005).

The corners of a rectangular field did not receive water with a center pivot system. About 149 acres of a 160-acre field were normally irrigated. The corners were usually planted with crops that were better able to withstand dryer soils (Beyer 2005).

Two systems uncommon in Minnesota were "wheel lines" and "traveling guns." Unlike the pivot system which traveled in a circle, the wheel line traveled in one direction. To be used successfully, the field had to be long and narrow and planted with short crops such as strawberries, onions, or turf grass. The traveling gun system resembled a piece of farm machinery on four wheels. It had to be moved by the farmer every six hours (Wright 2005; Beyer 2005).

Farmers first drew irrigation water from shallow wells and from public rivers, lakes, and reservoirs. Today, according to the Minnesota Department of Natural Resources (MnDNR), a farmer can take only enough water per year to equal a 6" rainfall if drawing from a river, but can take the equivalent per year of a 12"-15" rainfall if drawing from ground water (Young and Woods 1987). Beginning in the late 1960s or early 1970s, a farmer needed a permit from the MnDNR to irrigate, although the law was not rigorously enforced. By the mid-1970s, the development of heavy well-drilling equipment helped shift the trend toward pulling irrigation water from deep wells.

Each center pivot irrigator usually had its own well, but it was not uncommon for several systems to be run from a single well. The water would be piped from one system to another with water lines that, in Minnesota, could extend a mile or more (Beyer 2005).

A farmer's decision to irrigate was not only related to potential profits from the investment, but also to the conditions of particular fields on the farm. For example, one farmer might irrigate only 40 acres of his 640-acre farm, while another farmer might irrigate 300 acres of a 350-acre farm. A field did not have to be flat to be irrigated. A center point irrigation system could "climb" 20' to 40' above the pivot point (Beyer 2005).

On some farms, fences and shelterbelts were removed from farm fields to facilitate irrigation. However, the size of the irrigation system was generally determined by the size of the field, not vice versa (Beyer 2005).

Today most center pivot irrigation systems in Minnesota range in length from 200' to 2600', with the majority being about 1,300' long (Beyer 2005).

PREVALENCE

Few, if any, pre-1960 irrigation systems are likely to be found in Minnesota. Those dating from the 1960s, and especially in the 1970s, are probably much more common.

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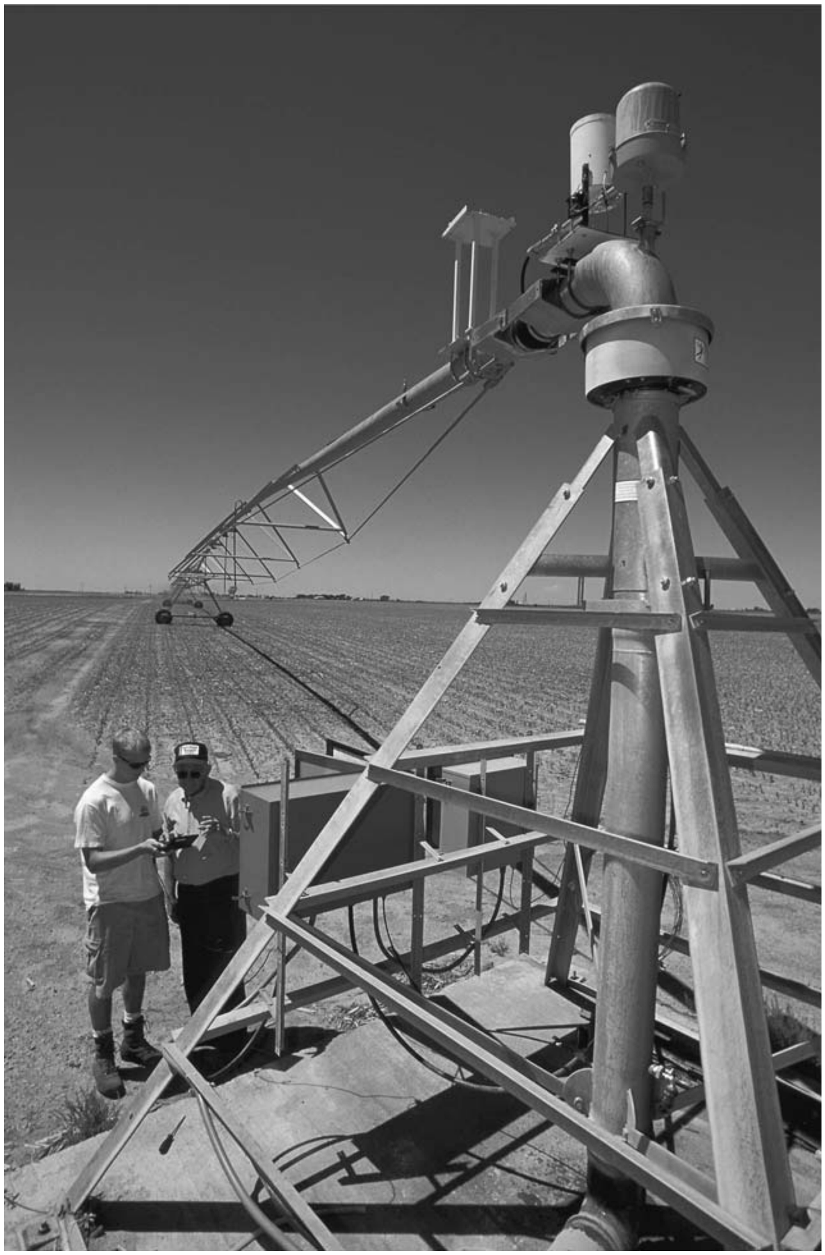

The center pivot irrigation system, like the example shown here, was patented in 1952. Concrete pads were added in the 1970s. By the early 1960s about 20,000 acres of cropland in Minnesota were being irrigated. (USDA-ARS Image Gallery photo by Scott Bauer)

■ LANDSCAPING AND ORNAMENTAL PLANTINGS

- The ideal plan divided the farmstead into separate service, private, and public areas
- Farmsteads were planted for both beauty and utility
- Open, mowed lawns were found on Minnesota farms by at least the 1890s

University of Minnesota horticulturist LeRoy Cady explained in 1919 that Minnesota's first settlers could spare little time for "planting and adorning" their farmsteads. Instead, they had to "provide the necessities of life and lay the foundation for a permanent home." He wrote, "that stage has passed in most parts of our state" and "more attention may now be given to making our homes attractive and comfortable" (Cady 1919:1).

As early as the 1890s, however, Minnesota experts were encouraging farmers to beautify their property by planting front and back lawns, shade trees, ornamental shrubs, foundation and screen plantings, and colorful flower beds. One author wrote in 1910 that "the most common fault to be found with the great majority of farm homes, throughout the Middle West, is that they seem to have had little thought expended upon them in planning, planting, or up-keep." Not mincing words, the writer grumbled, "Most of these places are bare and untidy. The planting, if any has been done, is often poorly chosen and badly placed. Furthermore, they lack the great essential of a home, attractiveness" (Kirkpatrick 1910: 269-270).

Fears of a swelling farm to city exodus sparked an early 20th century reform effort that became known as the Country Life Movement. Believing that something deficient in rural life was driving people to the cities, progressive-era reformers sought to stem rural migration by raising the standard of living for farm families. Among the recommendations of a 1909 federal commission on bettering the quality of farm life were cultural and aesthetic improvements on the farm.

It was against this background that Minnesota experts took up the cause of farmstead beautification: "If the home is attractive, both inside and out, something that is comfortable and can be shown to friends with pride, the young people will not hurry away to the city, but will stay and help improve and enjoy it" (Cady 1919:1).

Farm experts also stressed the economic benefits of landscaping the farm. Landscaping "increases the selling price of the land many per cent above the expense incurred," one author wrote in 1910 (Kirkpatrick 1910: 270). Another wrote in 1950, "The farmer will find that a well-arranged and carefully landscaped farmstead not only will speak proudly for his farm but will actually contribute to the efficiency of his farm business" (Snyder: 1950:3). And a 1937 expert noted, "Success is often reflected in the quality and appearance of the house and its immediate surroundings" (Hunt 1937: 2).

See also

Farmsteads
Gardens (Vegetable)
Orchards
Windbreaks

SERVICE, PRIVATE, AND PUBLIC AREAS

One of the main goals of a landscaping plan, experts explained, was to separate the business and service areas of the farmstead from the public and private spaces. A good design could hide the unattractive and rough elements of the farm workplace, enhance the appearance of the house, and create pleasant, homey outdoor living areas for relaxing and socializing (Snyder 1950: 3; Hunt 1937: 28).

The service area extending from the back door of the house, for example, contained by necessity elements, "can not be made to look particularly attractive" (Hunt 1937: 7). However, this area could be hidden from public view with hardy hedges, trees, and screen plantings, while at the same time accommodating farm chores and deliveries (Hunt 1937: 6-8; Snyder 1950: 4).

The private area of the farmstead, where the family socialized and entertained, was usually located to the rear or side of the house. Here, the landscaping goal was to create a cheerful, secluded space bordered by flowers, shrubs, and small trees. The ideal private area had an open lawn, shade, comfortable outdoor furniture, and special landscaping accessories such as a birdhouse, birdbath, rock garden, pond, arbor, fireplace, or rose garden (Hunt 1937: 8; Snyder 1950: 4-5).

The public area of the farmstead generally included the driveway and the front of the house. A goal of landscaping in this area was to frame and highlight the house and lead visitors to its main entrance. Experts recommended an open grass lawn, proportionate to the size of the house, "with the boundaries softened by judicious planting of shrubbery" (Hamilton 1908: 96). In an ideal arrangement from the mid-century, the driveway approached the house from one side and included a parking lot near the door (Hunt 1937: 6-8; Snyder 1950: 4).

In 1910 a Minnesota Farmers' Institutes author spelled out a set of landscaping principles for the ideal farmstead, which remained consistent in similar publications through 1950:

- the farmstead was planned with a purpose
- the buildings, lots, and lawns had a pleasing relation
- the place was well-furnished with trees and shrubbery, which were grouped at the sides and rear, and around the foundation of the house, rather than set in rows or scattered haphazardly around the grounds
- there was an open, mowed lawn
- there were no unnecessary fences, walks, or drives, and the yard was uncluttered
- the place was neat and well-kept, restful and homelike (Kirkpatrick 1910: 271; Cady 1919; Hunt 1937; Snyder 1950).

ORNAMENTAL PLANTINGS

According to historian Merrill Jarchow, even in the early, hardscrabble decades of Minnesota agriculture, "often a real effort was made to beautify the farm by spacing stately elms or evergreens along the drive leading to the yard and by arranging flower beds and shrubbery in attractive designs around the house" (Jarchow 1949: 99).

A 1921 survey of Minnesota farm women, many of whom had lived through the difficult pioneer period, showed that most put a high value on the "pleasing effect" of ornamental plantings (Lundquist 1923: 16).

To help farmers make their farmsteads into places "where one would like to live," the University of Minnesota and others distributed sample landscaping plans with species lists and detailed instructions (Kirkpatrick 1910: 271). Most of the recommended species were tested for hardiness and vigor at the University's experiment stations.

Lawns. The lawns were the most important part of the farmstead planting plan and usually the first thing to be planted. Experts recommended installing a spacious, well-drained, Kentucky bluegrass lawn with few objects to interfere with mowing. Early experts approved of allowing sheep or horses to graze on the lawns to keep them neatly clipped, but warned farmers to keep the sheep away from the tempting shrubbery (Snyder 1950: 5; Cady 1919: 2; Wilson 1909: 26; Kirkpatrick 1910: 272).

Borders and Hedges. Borders and hedges separated the farmstead grounds into distinct areas. If there was plenty of space, "the combination shrub and perennial border [12' to 20' wide] is probably the most satisfactory" divider, the Extension Service said (Hunt 1937: 10). If there was not enough room for a shrub border, a hedge 3' to 6' wide could be planted. In very cramped spaces, vines trained on trellises or fences made an effective division. Hardy perennial vines also made attractive screens for covering clothesline posts, fuel tanks, rock piles, the outhouse, and other structures (Cady 1919: 7; Hunt 1937: 10; Snyder 1950: 8-9).

Trees. Trees were recommended to shade the house and outdoor living areas, frame the view of the house, and to provide a backdrop for the house. Trees also hid undesirable views and provided wind and snow protection (Wilson 1914: 57; Snyder 1950: 6).

Flowers. Flowers added color and interest to the farmstead. Extension experts encouraged using flowers in borders and foundation plantings, but frowned on isolated flower beds out in the middle of the yard because they were "difficult to maintain and clutter up the lawn." Perennials were usually preferred in borders, and experts reminded farmers to harmonize flower colors. Specific hardy species were recommended. It was suggested that a separate flower garden for cutting be planted at the back or side of the house (Snyder 1950: 8-9; Hunt 1937: 7; Cady 1919: 6-7).

PREVALENCE

Like all vegetative features, lawns, trees, and other ornamental plantings are often lost to plant disease and other natural processes. However, because they were so widespread historically, it is expected that vestiges of ornamental lawns and plantings will remain on many Minnesota farms. Small shrubs and flowers may have survived in fewer numbers.

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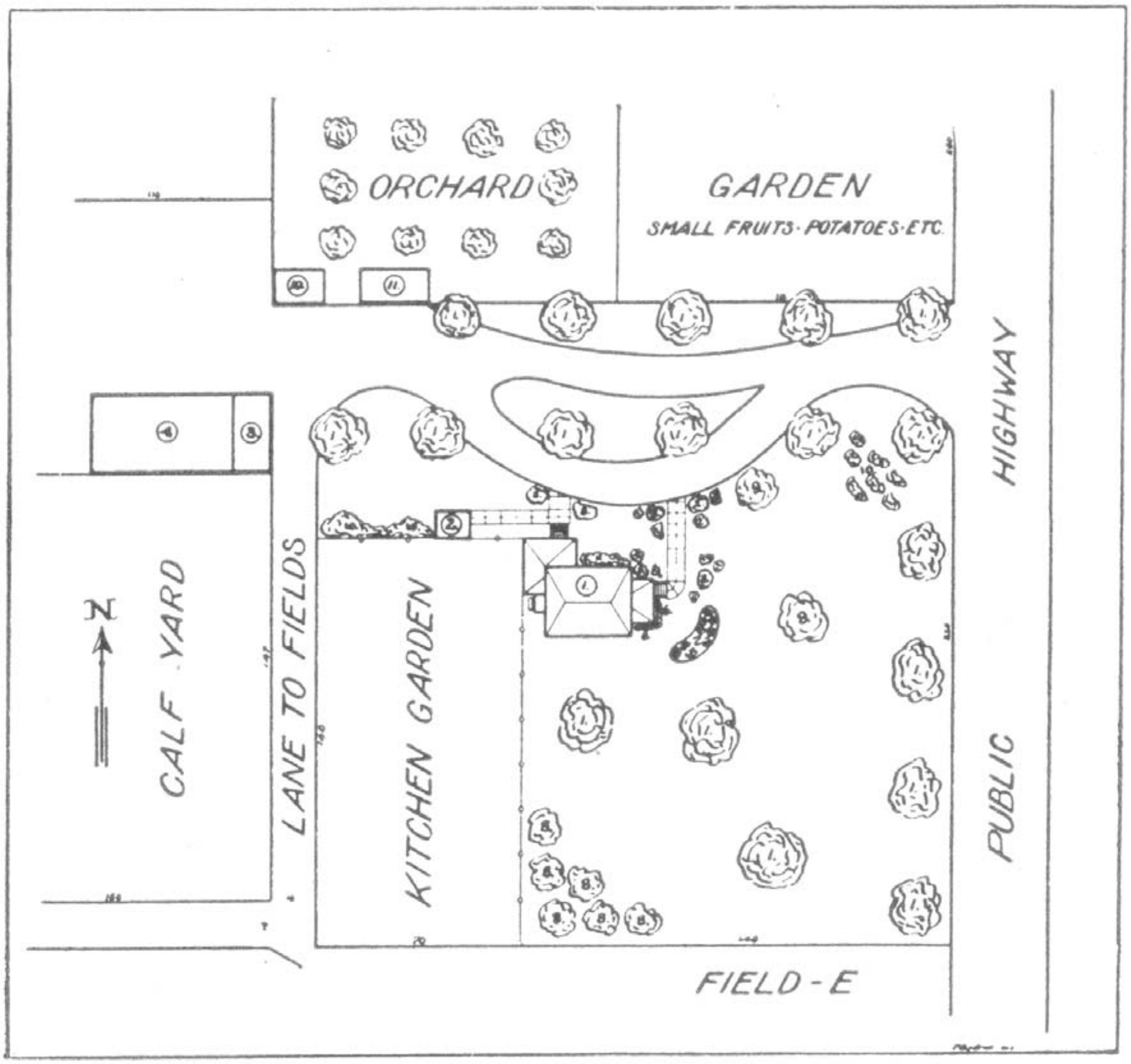

This drawing appeared above the caption "Suggestive arrangement of buildings and grouping of shrubbery and trees on a well planned farmstead." From the 1914 book *Farm Management* by the University of Minnesota's Andrew Boss.

A farmstead with elaborate – and atypical – ornamental plantings. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

■ MANURE PITS OR BUNKERS

- A three-sided, roofed, concrete structure used for storing manure
- Widely used from about 1920 to 1960

The manure pit or bunker – built by farmers by the 1910s – stored manure after it was removed from the barn, before it was spread on the fields. During the first half of the 20th century before chemical fertilizers were widespread, livestock manure was a farm's major source of nitrogen. Raising livestock along with crops, and using animal manure to fertilize those crops, were major tenets of diversified farming. As one educator wrote, "To pile up manure in the barnyard where one-half of the nitrogen will leach away and the other half will go off as ammonia is a very foolish extravagance. To bore holes in a wooden [barn] floor for the urine to run through is even worse waste" (Moore et al 1920: 501).

A manure pit typically consisted of a roofed, three-walled, poured concrete structure. The supporting posts were tall enough to allow a tractor and manure spreader to drive beneath the roof for loading and unloading. The lower walls were about 4' high, while the upper walls were left open for ventilation. Sometimes the manure spreader was stored within the manure pit when the spreader was not in use.

Monolithic concrete pits were superior to simply piling manure in the farmyard because they captured the valuable liquid manure. The floor of the pit was often sloped so that the liquid could run into a cistern opening in a corner. The liquid was periodically pumped out and spread on the fields.

Plans from both 1933 and circa 1950 indicate that an 18' x 37' manure pit was considered suitable for handling 18 dairy cows, a typical number for a Minnesota farm in the early 20th century (Midwest Farm 1933; National Plan Service ca. 1950: 57).

Manure pits were usually situated at the end of a litter carrier track that emerged from the barn. On hilly sites the manure pit could be built into the side of a slope, but engineers pointed out that the pit should be placed where the farmer did not have to push manure loads up hill. Engineers also cautioned, "Both local and state milk ordinances should be consulted in determining the location of this structure with respect to the milk house and barn. Also, some ordinances require the use of screens over all openings" (Midwest Farm 1933).

A more recent method of manure handling, the manure lagoon, came into use with the practice of raising large numbers of livestock in confinement operations. One longtime University of Minnesota animal scientist (now retired) estimated that he first saw a manure lagoon on a Minnesota farm around 1970. One of their first uses was under the floors of confinement barns (Hanke 2005).

See also

Stockyards
Dairy Barns
Farmyards

PREVALENCE

Manure pits were widely used on Minnesota farms that kept livestock. Their use declined as farms phased out their animals and as the use of commercial fertilizers increased. Intact manure pits may be uncommon.

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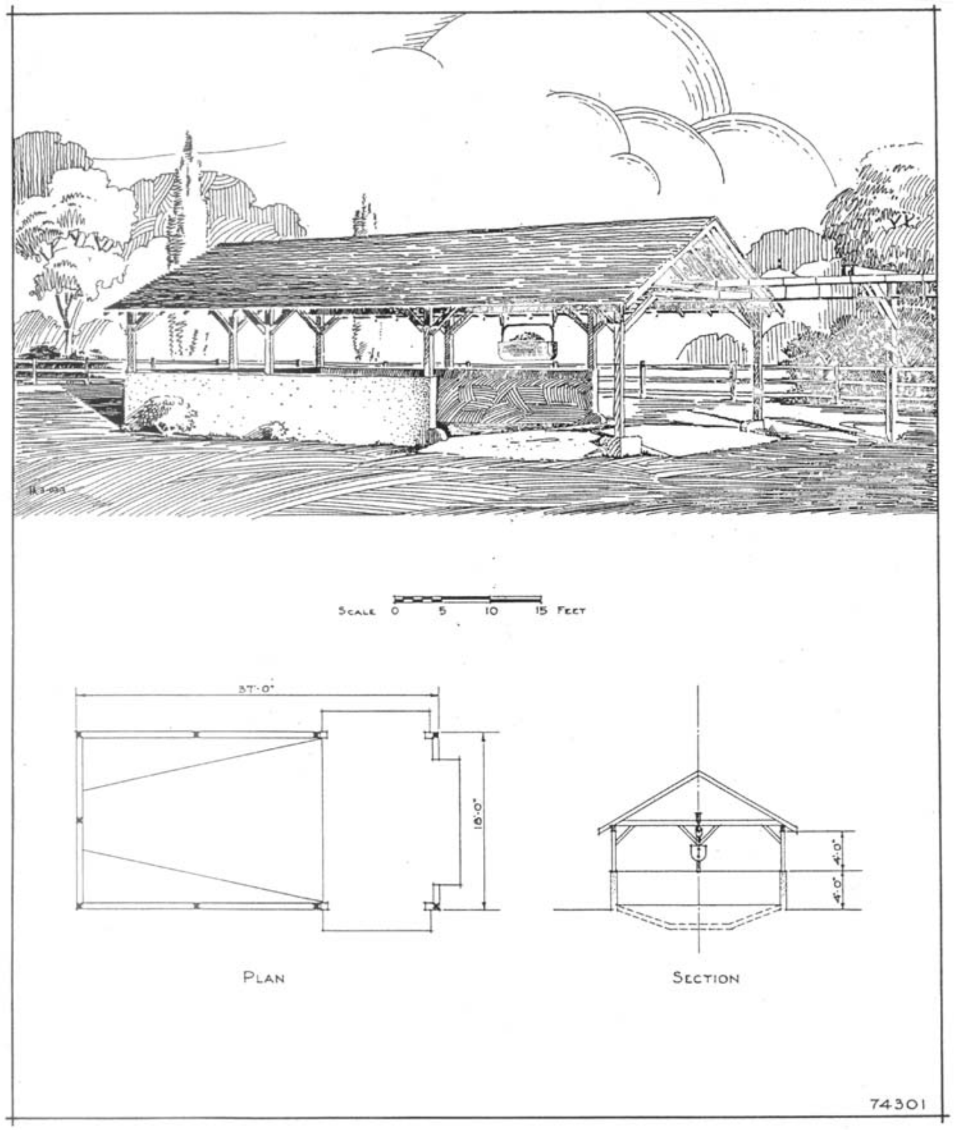

A 1937 manure pit plan issued by the Midwest Plan Service. The structure measured 18′x 37′ and had a slanted concrete floor. From Midwest Farm Building Plan Service catalog of plans (1937).

▪ MILK HOUSES

- Minnesota's earliest milk houses likely date from the mid-1890s
- Except during the earliest period, a milk house was necessary for a dairy farm to function
- Milk houses were small one- or two-room buildings whose design and operation were increasingly regulated by dairy sanitation laws
- One author called the milk house cooling tank the second most-important piece of equipment on a dairy farm after the cream separator
- In the 1950s refrigerated bulk tanks steadily replaced cooling tanks; both resided in the milk house

The milk house was a dedicated space in which raw milk was cooled, strained, and stored at the correct temperature before being taken to market. The cream separator was usually housed here as well. See also "Dairy Barns" and "Milking Barns", two other individual farm elements sections.

On Minnesota's earliest dairy farms there were no specialized facilities for handling and storing milk, cream, and butter. Milk was often cooled and stored in a bucket suspended down the well shaft, in a spring house (if the farm was fortunate enough to have a spring), in a root cellar, or in an icehouse. Historian Merrill Jarchow explained, "The milk was set in shallow pans or earthen crocks, which were placed on racks or some cheap structure. After the milk had set, the cream was skimmed off, and the milk was fed to the family, the pigs, or the calves. The cream was placed in a dash churn and made into butter, a strenuous job" (Jarchow 1946: 107-108). While used on some farms by necessity, root cellars were not desirable for storing dairy products because the cream and butter tended to absorb odors and flavors from the vegetables.

Another historian wrote, "Only a few [Minnesota] dairymen had continuous running cold water direct from the well. The one with a flowing [artesian] well was fortunate and had no problem keeping his cream sweet or milk of desirable quality and so produced a higher quality butter" (Wayne 1977: 19).

AN ESSENTIAL BUILDING

A milk house or milk room was sometimes called a dairy, milk shed, or separator room. It was a structure essential to a Minnesota dairy farm and – in the words of geographers Noble and Cleek – "an unmistakable trademark of the dairy farm" nationwide (Noble and Cleek 1995: 140).

Milk houses, dairy barns, and milking barns were the farm buildings most subject to government regulation in Minnesota. Barn cleaning, manure handling, milking, equipment sanitation, milk cooling, and milk storage were all subject to rules and inspections that increased through time. In 1924 the U.S. Public Health Service published a "Proposed Standard Milk Ordinance" that helped guide many state and local laws. A set of Minnesota regulations was developed about the same time.

See also

Dairy Barns
Milking Barns
Icehouses
Springhouses and Springboxes

Diversification & Rise of Dairy, 1875-1900

Minnesota adopted a "Grade A" certification system in 1945, and the state's dairy requirements were strengthened considerably in the 1970s. (See also a discussion of dairy regulations under "Focus on the USDA and the Minnesota Department of Agriculture" in this report's appendices.)

The milk house often contained facilities to clean the milking equipment and cream separator. In the early 20th century, many farmers cleaned the separator and milk cans in the farmhouse kitchen. But as herds grew larger and milk houses were built or improved, milking and separating equipment was often cleaned and air-dried in the milk house. (In her study of Stearns County dairy farmers, Marilyn Brinkman found that, on many farms, both men and women milked, and then men left for the fields while women took apart and washed the milking machines and cream separator (Brinkman 1988: 17; Neth 1995: 19-20).)

Dairy laws eventually dictated that no extraneous material could be stored in a milk house and no extra activities could occur there.

The milk house could be incorporated within the dairy barn, be an addition to the barn, or be detached from the barn. Eventually dairy laws required that milk houses be strictly separated from barns, even if they were physically connected to them.

Minnesota's earliest milk houses likely date from the mid-1890s. One of the University of Minnesota's early publications, the *Minnesota Farmers' Institutes Annual*, was carrying articles on milk house design by 1895 and 1898. A milk house described in 1895 was a three-room area within a dairy barn that contained a wood stove on which to heat water for cleaning, a cream separator, piping to carry skim milk to a calf barn to be fed to the calves, a hand pump to draw water, and another pump to send water to buckets near the cows (Casselman 1895: 73; Flaten 1898).

Experts advised that capital invested in the construction of a milk house would be soon recovered in milk and cream that would otherwise spoil.

One of the University of Minnesota's top dairy specialists, R. M. Washburn, wrote in 1914 of the merits of the milk house:

> Any farmer with 10 or more cows, used for purposes of cream- or milk-production, can ill afford to be without some clean and convenient place in which to separate the milk and keep the cream. The separator must be housed, preferably in a place free from dust and away from odors. The cream-cooling tank, which occasionally is found in the yard by the pump protected from sun and dust by old boards or a door, would last longer and preserve the cream better if inside a building. To keep the cream cool in summer and to prevent it from freezing in winter are both important. If we add to these concrete statements the further fact that far more pleasure and satisfaction can be had from work when performed in a more definite and sanitary way, we shall have ample reason to encourage the construction of modest dairy buildings (Washburn 1914: 181).

LOCATION

It was recommended that a milk house be sited on well-drained land with a good supply of water, be close to the barn for ease of hauling heavy milk, be on the "clean" side of the barn (away from the manure pile or pit), be sited so it didn't interfere with silo loading and unloading, and be handy for the milk truck. It was helpful to build the milk house at the base of the windmill and its pump. In 1940, *Successful Farming* magazine also suggested that, if visible from the highway and attractive, the milk house could draw passers-by to purchase dairy products (Fox 1940: 48).

If milk houses were built onto barns, they were generally required to have a separate entrance or have a vestibule or passage with closeable doors that separated the milk house from the barn (White 1923:100; National Plan 1951: 10).

On some farms the milk house was combined with the icehouse or with the milking barn. The National Plan Service, for example, offered plans in 1951 for an 18′ x 44′ concrete block building with a four-stall milking barn that comprised about 2/3 of the interior and a milk house that occupied the rest (National Plan 1951: 9). (See "Milking Barns" and "Icehouses", two separate property sections.)

SIZE

Milk houses were generally small one- or two-room buildings with just enough space for necessary functions and equipment. A milk house that was too large was hard to heat and clean, and tended to attract the storage of extra clutter (Jones and Hill 1934: 28). Recommendations for milk house sizes stayed relatively constant between the 1910s and the 1950s.

The minimum recommended size was 8′ x 8′. Plans for a woodframe 8′ x 8′ milk house were being offered by the *Successful Farming* magazine in 1934, the Midwest Plan Service in 1937, and the University of Minnesota in 1953.

R. M. Washburn, in both 1914 and 1931, recommended a 10′ x 10′ milk house for herds of less than 20 cows. If a small gasoline-powered motor (to run the separator) were included, the building should be 10′ x 12′. If the herd were 20 or more cows, Washburn recommended that the milk house be 18′ x 20′ and include a sink, hot water, and other provisions to wash the cream separator and milk cans instead of the equipment being washed in the farmhouse kitchen (Washburn 1914: 181-182; Washburn 1931: 293-301).

In 1937 the Midwest Plan Service was offering plans for milk houses that were 8′ x 8′, 8′ x 12′, 11′ x 11′, and 12′ x 16′. A larger house, about 21′ x 24′, could be built if fluid milk was being bottled on the farm (Midwest Farm 1937). In circa 1950 the National Plan Service was offering plans for a 9′ x 12′ woodframe milk house that closely resembled those of earlier decades (National Plan ca. 1950).

MATERIALS AND EQUIPMENT

To preserve the quality and taste of the milk, the milk house needed to be an odorless, clean, cool area with an indoor air temperature of about 50 degrees. Maintaining this temperature in the winter was eventually made easier by electric heaters.

Milk houses built before World War II were usually made of wood. Because of the constant presence of moisture, however, concrete block, poured concrete, concrete staves, structural clay tile, and brick were also used. In all cases, a concrete floor was advised. It was recommended that the foundation rise about 18" above ground to keep the wooden sill and siding above the moisture (Washburn 1914: 185-186; Noble 1984: 116; Structural Clay 1941; National Plan ca. 1950).

Milk houses needed windows for light, especially in years before electricity. Experts cautioned that the windows shouldn't be too large, however, or the interior temperature would be hard to control. Window screens were needed to keep out insects.

It was best if interior walls and ceilings were finished with a smooth, durable, washable surface like concrete block, tile, or tough enamel paint to facilitate cleaning (Washburn 1914: 186). A light color of paint increased visibility within the building.

Cooling Tank. Before the introduction of bulk milk tanks in the 1950s, milk cans were cooled and stored in the milk house's water-filled cooling tank. The milk was stored here until it could be delivered to (or picked up by) the creamery or cheese plant.

Washburn wrote in 1914 that the cooling tank was the second-most important single piece of equipment on the dairy farm after the cream separator (Washburn 1914: 184).

Early tanks could be round and made of wooden staves, or could be rectangular and made of wood lined with galvanized iron (Brinkman 1988: 84). They were soon built almost exclusively of poured concrete. Most tanks were insulated. It was recommended that cooling tanks be only large enough to hold the requisite number of milk cans and be compartmentalized so the cans wouldn't tip. Except in the earliest milk houses, the cooling tank was often recessed into the floor so the heavy cans could be maneuvered out of the tank more easily. To preserve the life of a cooling tank, experts recommended that a block and tackle be used to raise the cans (Fox 1940).

Milk had to be cooled rapidly – simply setting the warm milk in an icebox or icehouse, for example, was not effective (Eckles and Warren 1916/rpt. 1921: 179). It was also important that farmers didn't mix the warm evening's milk with the cooled morning milk.

To quickly cool the milk, water in the cooling tank could either be continuously-flowing well water, or water in which ice from the icehouse was floated. (If the tank had continuously-flowing water, the water was often used for livestock (for drinking) after it left the milk house.) By the early 1940s, electricity was used to maintain the water temperature. In the 1950s some milk houses had a cold-water spray that discharged over the cans by a motor-driven pump (Flaten 1898: 33; Washburn 1914: 184-185; Fox 1940).

Washing and Sterilization Equipment. Milk houses often contained sinks, hot water, and other equipment for washing and sterilizing. In the 1910s-1930s, the sterilizer could be an oven or a small, tight concrete room in which instruments were steamed, or a "steam jet through the drain board of the sink" (Washburn 1914: 184; Washburn 1931). Electric sterilizers were introduced by the 1930s and were eventually used on most farms. Milk houses often had an interior rack to air-dry cans and equipment. Many also had an outside rack attached to an exterior wall.

Cream Separators. Cream separators were often kept in the milk house. Prior to the use of on-farm separators, farmers took whole milk to the creamery or skimming station and usually returned home with skim or sour milk which was fed to the livestock. With the advent of separators, the milk was separated on the farm and only the cream was hauled to the creamery. This changed again with the introduction of refrigerated bulk tanks in the 1950s.

Mechanical cream separators were first introduced in the U.S. in 1878 but, according to Jarchow, "did not appear in Minnesota until late in the century" (Jarchow 1946: 118). At first both gravity and centrifugal devices were used, but the centrifuge eventually became most popular. Separators were first cranked by hand and eventually had electric motors. In her 1988 study of Stearns County dairying, Marilyn Brinkman wrote, "By the beginning of World War I, [mechanical cream separators] were a common fixture on dairy farms, despite the painstaking task of cleaning them after each use" (Brinkman 1988: 76).

Cream separators were about 4' tall and bolted to the milk house floor. The milk house foundation needed footings sunk deeply so that frost wouldn't heave the floor and unbalance the separator.

Bulk Tanks. By the 1950s stainless steel refrigerated bulk tanks were becoming affordable for Minnesota dairy farmers, leading one expert to write in 1957 that "the time honored milk can may soon become as much of a novelty as the walking plow" (Meyer 1957: 14). Minnesota had about 600 bulk tanks in 1954. By 1957 the number had jumped to about 5,200 tanks, with 110,000 Minnesota farms milking cows that year. Bulk tanks were installed in the milk house in place of the cooling tank. The University of Minnesota advised in 1957, "It may be possible to find a cooler to fit an existing milk house" – which suggests that the addition of bulk tanks may have been responsible for the construction of a number of new milk houses on Minnesota farms (Meyer 1957: 14).

PREVALENCE

Milk houses were built on nearly all farms in Minnesota that produced dairy products to be marketed commercially. It is likely that many will still be standing. Most milk house cooling tanks were replaced by bulk tanks in the 1950s or early 1960s. Early milk houses with intact cooling tanks and other equipment are likely rare.

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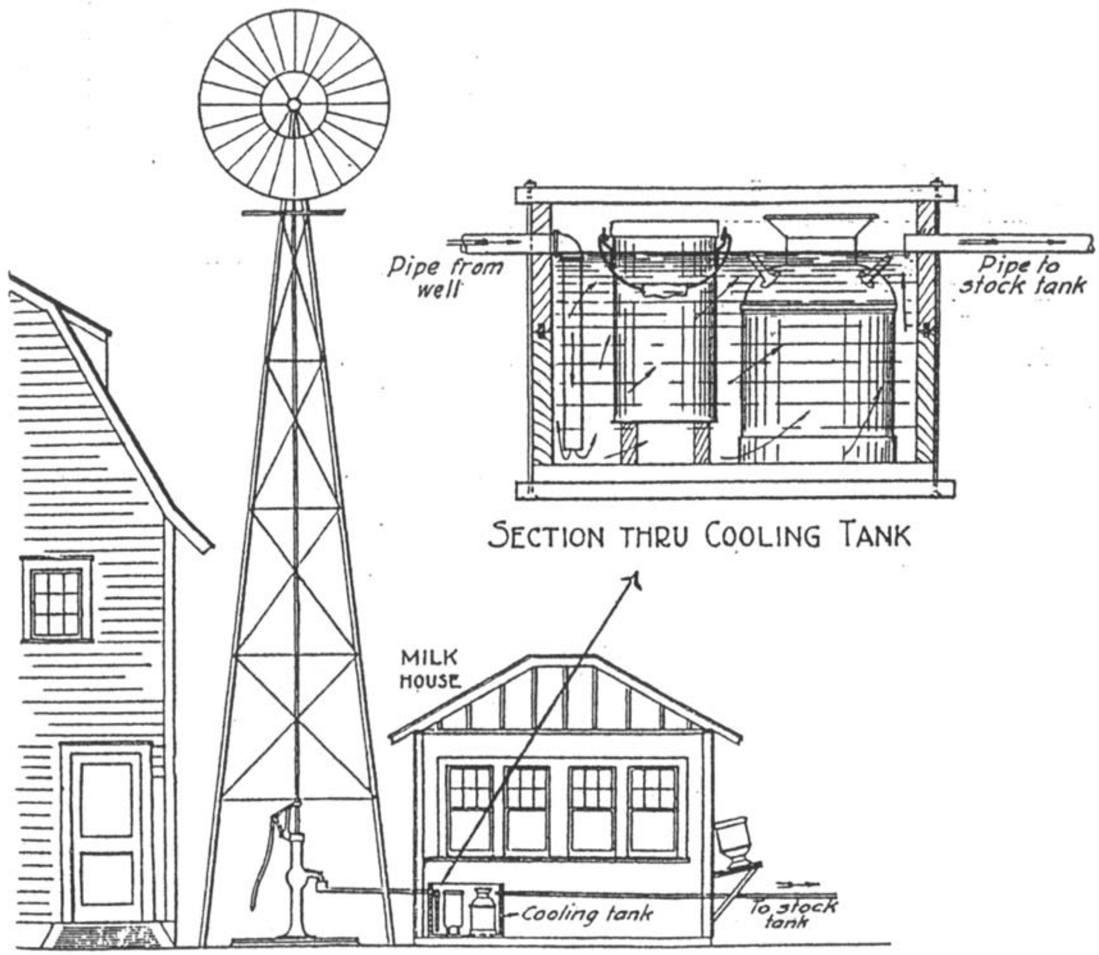
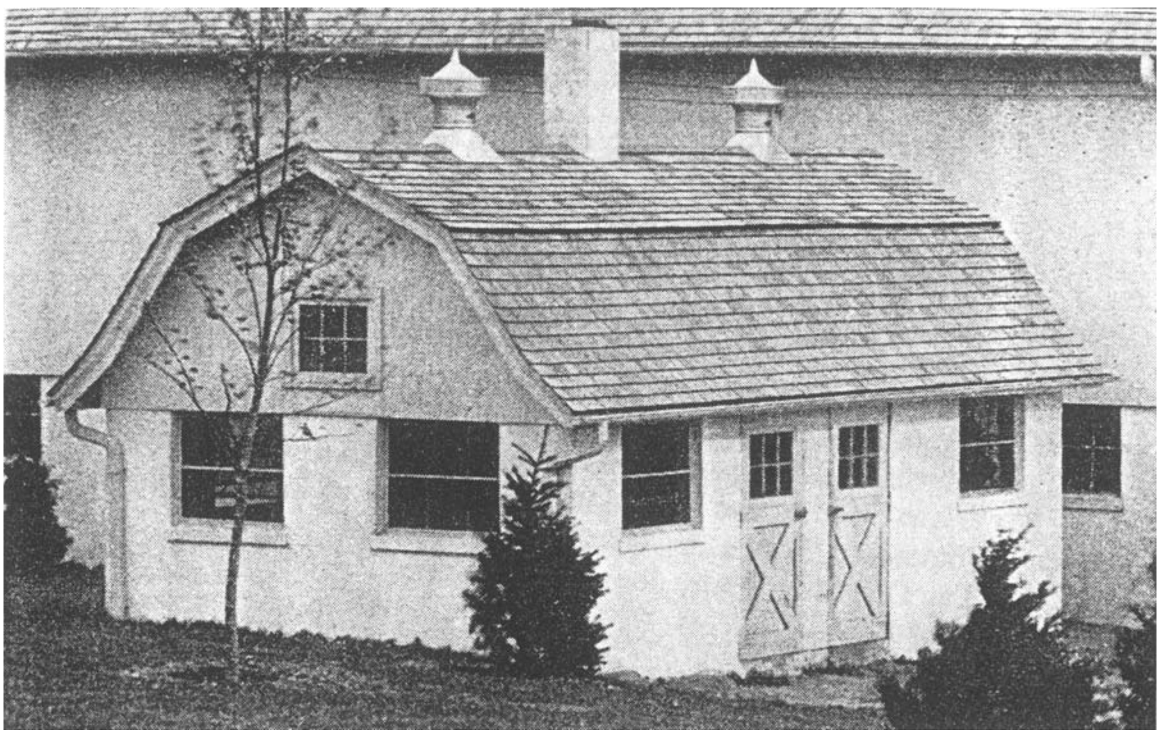


A convenient place to site the milk house was near the windmill where a good source of water was available. In this diagram by the Minnesota Cooperative Creamery Association, the milk cans were cooled by pumping cold well water into the cooling tank. The water was then discharged to the stock tank for livestock to drink. Note the outside rack for air-drying the milk cans and other equipment. From a 1925 Minnesota Extension Service bulletin by Harold Macy.

An adequate milk house could be as small as 8′ x 8′, although a 10′ x 12′ design was more accommodating. This house had a concrete foundation, wood siding, and an outside drying rack, all typical. The black device (with handle) near the door was probably an insulated water shut-off valve. Believed to be Douglas County, circa 1950. (MHS photo)

A milk house standing in St. Louis County, circa 1940. (MHS photo)



A substantial poured concrete milk house in a 1941 agricultural engineering textbook written by University of Illinois faculty. From Carter and Foster's *Farm Buildings* (1941).

▪ MILKING BARNS

- Usually found on farms using a pen barn with loose housing
- Uncommon before 1950

A milking barn (also called a milking room or a milking parlor) was generally the companion to a pen barn or "loafing" barn. In this dairying system, the cows lounged on deep straw bedding in the pen barn, and were led to the milking barn twice a day to be milked. This contrasted with the stall barn system – much more common in Minnesota – in which the cows were both confined and milked in small fixed stalls. (See "Dairy Barns," another individual farm elements section, for information on both pen barns and stall or stanchion barns.)

A milking barn could be a separate building or a segregated room within a larger barn.

Milking barns and other dairy facilities were subject to increasingly stringent dairy regulations, particularly after World War I. Both state and local laws guided many aspects of milking barn design and operation, especially for farmers who produced milk for the fresh, fluid milk market (Grade A), as opposed to milk sold as an ingredient for processed foods (Grade B).

LOCATION

Milking barns were usually located close to the barn in which the cows were housed, and sited within an integrated system of pens, stockyards, and pastures. The farm's milk house, where raw milk was handled, was always located near the milking barn.

On some farms, the milking barn was integrated with the milk house. In 1937, for example, the Midwest Plan Service offered plans for a one-story combination milking barn and milk house. The building had a poured concrete base (below the window sill level) and woodframe upper walls. The milking area was 20′ x 20′ with six milking stalls – apparently adequate for 30 to 60 cows. The milk house portion was 10′ x 20′ (Midwest Farm 1937). In another example from 1951, the National Plan Service provided plans for an 18′ x 44′ concrete block building with a four-stall milking parlor that comprised about two-thirds of the interior, and a milk house that occupied the rest (National Plan 1951: 9). (See also the individual farm elements section entitled "Milk Houses.")

DEVELOPMENT

The use of milking barns in the Midwest probably dates from the late 19th century. One of the earliest reports on the subject was an article written in 1905 by Wilbur Fraser of the University of Illinois. Fraser reported on 18 farms in Illinois that were using loose housing and milking barns. One of the farms had been using the system since 1891. The method showed such promise that the University of Illinois began to use it for part of its herd in 1903 (Fraser 1905). In 1941 the

See also

Dairy Barns
Milk Houses
Silos
World War II & Postwar, 1940-1960
Appendix: Focus on Minn Livestock

University of Wisconsin embarked on a several-year dairy research project whose results were reported widely. The study found milking barns and loose housing to have many advantages, which helped encourage Midwestern farmers to try the method (Witzel and Barrett 1944; Witzel and Heizer 1946; Engene et al 1948; Witzel and Derber 1952).

Systems with a milking barn were considered more sanitary than those in which cows were milked and housed in the same stalls. The farm needed two separate structures – one for milking and one for housing – but the two buildings could be less complicated than a traditional stall barn. Using a milking barn was considered to be an efficient use of labor, and healthier for the cows who weren't confined all day in stanchions. (For more information see the individual farm elements section called "Dairy Barns.")

Milking barns had another disadvantage: in very cold climates it was sometimes hard to keep a milking barn warm enough in the winter without artificial heat, which was an added expense. In traditional stall barns, the cows themselves produced sufficient heat to keep the indoor air temperature warm. But only a few cows occupied a milking barn at any one time. A cold milking barn could make conditions miserable for the farmer, who already contended with cold, chapped, and constantly wet hands as each cow's udder was cleaned before she was milked. By 1960 artificial heating was standard in many milking barns.

Milking barns were fairly rare before World War II. A 1931 issue of *Agricultural Engineering* reported that some of the farms that had been studied by Fraser in Illinois in 1905 were still successfully using milking barns in 1931 (Long 1931: 399). According to an article in *Successful Farming* in 1934, milking barns were growing in popularity (White and Witzel 1934). According to University of Minnesota authors, they had become "quite common" in 1936 and "increasingly popular" in 1950 (White et al 1936: 3; Eckles 1950: 514).

COMPONENTS AND OPERATION

After World War II, milking barns were often built with pole frames, corrugated steel or aluminum siding, and other prefabricated materials. Nearly all were one story. Because interior cleanliness was paramount, poured concrete was almost always used for the floors and sometimes for the lower walls.

Milking barns were designed for milking efficiency. Twice a day, the cows were led into the milking barn a few at a time. Typical milking barns had 4 to 12 milking stalls, most with stanchions. In some milking barns, the cows walked toward the milking stalls in single-file, almost assembly-line fashion, and were washed before they reached the milking stalls.

Milking stalls were built in various styles – some allowed two cows to be milked at once, some allowed the cow to back out after milking was over, some allowed the cow to exit in a forward direction, and some were arranged in a "herringbone" pattern. Developed in New Zealand in 1957, the herringbone had two rows of milking stalls angled outward from a central alley. The cows faced outward and the worker stood in the central alley. The arrangement was efficient because the worker only had to move about 40 inches between cows' udders instead of 8' between udders in traditional stall arrangements (Fuller and Larson 1960: 7).

Dairy cows were usually fed grain while being milked (or shortly before). Most stalls had individual feed cups.

By 1931 milking barns were being designed with two levels of flooring so that the farmer stood about 24" to 30" below the cows, reducing the tiresome bending and stooping associated with milking. In the 1930s new features being added to milking barns included "fly brushes" – a set of large brushes through which the cows walked as they entered the milking barn so that fewer insects were carried inside.

By the 1930s and 1940s milking barns were being promoted for their labor-saving efficiency. A 1948 University of Minnesota bulletin provided the following advice for using a four-stall milking barn effectively:

> For herds of up to 30 cows, labor will be used most efficiently if one man does the milking, using two single [milking machine] units. With a well-organized routine, he can milk 20 or more cows an hour. Milk [the] cows on an 'assembly line' basis. That is, release the milked cows and bring in the unmilked cows one or two at a time, while the milking machines are working on other cows. Time is wasted if all of the cows in the milking room are milked, then all are released at the same time (Engene et al 1948).

In 1930 a rotary milking system called the "rotolactor" was just being tried in a New Jersey milking barn. The barn had a ramp leading to an elevated circular platform that had stanchions facing toward the center. A steady line of cows walked up the ramp and onto the slowly revolving platform. In a revolution that lasted about 12 minutes, the platform moved the cows past stations at which workers washed the cows and attached milking equipment. The milker was detached near the end of the circle's revolution about 10 minutes later, and the cow walked down the ramp and away from the platform (Long 1931: 399, 404). Today similar rotary milking platforms are used on Minnesota's largest dairy farms.

In 1960 the University of Wisconsin's S. A. Witzel summarized good milking barn design, including features then required by dairy laws (Witzel 1960: 602-603). These elements included:

- walls smooth and easily cleaned
- floors sloped to drains
- good lighting, both natural and artificial
- insulated construction and good ventilation
- correct flow of cows through the room
- proper washing of udders using antiseptic in the water
- proper handling of feed
- dust- and rodent-proof feed storage
- properly designed hand-washing and toilet facilities
- vestibule between the milking barn and the milk house
- inward swinging door from the milk house
- manure cleaned up
- proper waste disposal system
- room temperature of about 50 degrees

By 1960 many milking barns had attached elevated bulk feed storage containers, some with conveyors and metered feeding (Witzel 1960: 602).

PREVALENCE

Dairy barns were widely built throughout Minnesota but most were stall barns. Milking barns, which were used with pen barns and loose housing systems, were uncommon before 1950. Pre-1960 examples are assumed to be uncommon, with pre-1950 examples being fairly rare.

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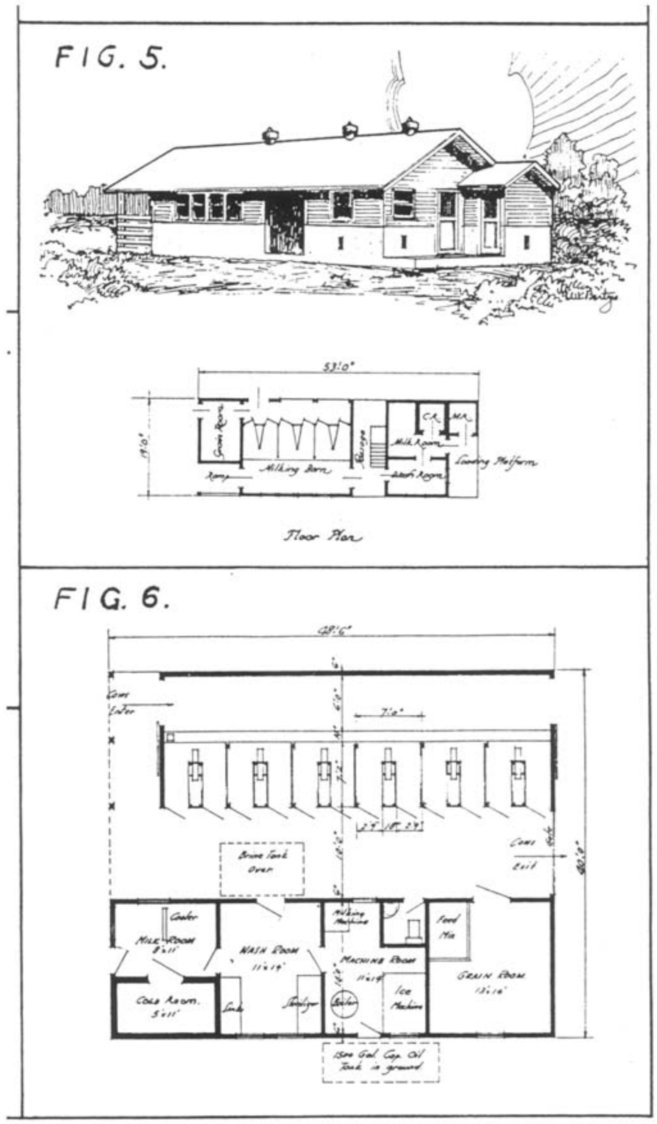
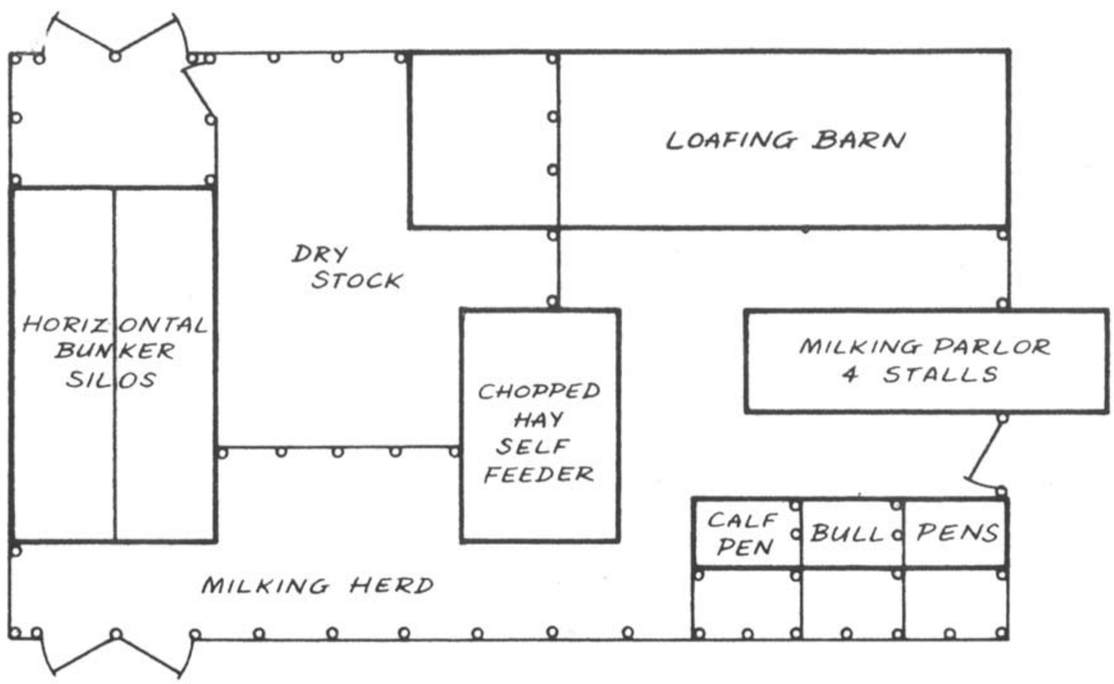


The milking barn on top had concrete lower walls and a woodframe superstructure. It housed six parallel, walk-through milking stalls through which five cows per hour could move. The lower barn had 12 stalls with small flags hinged to the stall doors that "signal the milk house operator when a cow had been released" so that a constant stream of cows could be milked. Both milking barns had integrated milk houses and grain storage. From J. D. Long's "Present Trends in Dairy Management," *Agricultural Engineering* (Nov. 1931). The upper plan also appeared in the Midwest Plan Service's set of plans issued in 1937.



"An efficient and convenient dairy layout" from a 1961 text entitled *Farm Building Design*. Milking barns or milking parlors were best sited with easy access to the milk house, pen barn, stockyards, feed storage structures. From Neubauer and Walker (1961).

▪ ORCHARDS

- Orchards and gardens were usually placed within easy reach of the house
- The best place for an orchard was the northeast slope of a hill or in the shelter of a windbreak
- Poultry were kept in the orchard to help control insects

University of Minnesota publications on farmstead planning from the 1890s to the 1950s consistently showed an orchard and garden on every farm and argued that no farm could afford to be without provisions to grow fruits and vegetables (Hays 1894: 272-278; Kirkpatrick 1910: 273; *Farm Building Plans* 1953). And in a 1921 survey sponsored by *Farmer's Wife* magazine, farm women expressed "in no uncertain terms the value they place upon the orchards on their farms" (Lundquist 1923: 15).

Farm orchards provided fruit for both home use and for sale. A farm orchard might range from 30-40 trees to several hundred. One source in 1956 recommended that farm orchards be one-half to one acre in size (Roberts et al 1956: 244).

On many Minnesota farms, orchards – like gardens and flocks of poultry – fell within the traditional sphere of women's responsibilities. Orchards, gardens, and poultry houses were all placed near the farmhouse so that their products would be convenient to the kitchen, and so that women could care for them while simultaneously watching children, cooking, washing, and cleaning. Placing poultry houses within (or near) the orchard made double use of the space and helped keep the insect population down (Lundquist 1923: 14; Wilson 1909: 26; Wilson 1914: 58; *Farm Building Plans* 1953; Hays 1894: 272-278; Kirkpatrick 1910: 273).

Orchards for growing apples, pears, and plums were planted in straight, evenly spaced rows, for ease of cultivation and management. Whenever possible they were planted on sloping land so that air circulation reduced diseases, and near a temperature-moderating body of water. The best location for an orchard was the north or northeast slope of a hill. Horticulturist LeRoy Cady explained in 1910, "The northeast slope protects from the drying south and southwest winds, and also aids in protecting from sunscald" (Cady 1910: 281; Hart 1998: 257-258).

In 1914 the University of Minnesota's Andrew Boss wrote:

> Fruit growing like vegetable growing is an intensive form of farming calling for high capitalization and requiring a large amount of labor per acre. It is adapted to somewhat larger land areas than truck gardening, and a family can handle from five to forty acres and often more where fruit growing is made the specialty. Great care is required in the management of the orchards in most localities. While this type of farming is often urged as particularly remunerative and easy, the opposite is usually the case (Boss 1914: 46-47).

See also

Gardens (Vegetable)
Farmsteads
Landscaping and Ornamental Plantings
Roadside Markets
Appendix: Focus on Minnesota Crops

Fruit trees were subject to wind and snow damage, so orchards were often planted in a part of the farmstead protected by a windbreak. However farmers had to be careful not to plant fruit trees in a spot that was too sheltered in the winter, "as the trees are apt to freeze and thaw during the warm days" wrote Cady (Cady 1910: 281; Wilson 1914: 58).

When an orchard was to be used for growing a cash crop rather than for home use, it was even more important that it be laid out so that the trees would flourish and chores like pruning and harvesting would be efficient. In 1920 four competing patterns of tree layout were in use – rectangular, quincunx, alternate, and hexagonal – and there was controversy over optimal spacing. Selecting hardy productive stock, mulching, spraying, and pruning trees, and care of the soil were all important. In 1920 experts were recommending against the common practices of cutting hay and pasturing livestock in the orchard because of damage to the trees and reduction of soil fertility (Moore et al 1920: 245-267). By the mid-1950s, electric insect traps were being used in some orchards and truck gardens.

The need for farm orchards declined as roads and transportation improved and farmers could shop in town more often, as farm labor decreased, and as prepackaged and frozen foods became increasingly available, particularly after World War II.

PREVALENCE

Because orchard trees are more long-lived than more ephemeral gardens, it is expected that more remnants of historic orchards than vegetable and flower gardens have survived on Minnesota farms. Orchards may be much reduced from their historic size of several dozen trees. Like all vegetative features, fruit trees are subject to decline by natural processes.

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Harvesting an apple crop, possibly for cash sale. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

Poultry houses were commonly sited within or near the orchard so that the birds would eat the insects that might mar the fruit. Both were often located near the farmhouse. Location unknown, circa 1918. (MHS photo)

■ OTHER ANIMAL HUSBANDRY ELEMENTS

► Includes miscellaneous farm elements associated with animal husbandry

Miscellaneous animal husbandry elements on Minnesota farms include structures such as:

- breeding racks and loading chutes
- egg cooling structures
- feed houses
- hives and other beekeeping structures
- hog wallows
- livestock dips
- range or temporary shelters
- riding horse barns
- shades for poultry, cattle, or hogs
- sheep shearing sheds
- stock ponds, man-made
- sun porches for poultry
- swill pits or feed cookers

For more information, see sources such as those listed below.

PREVALENCE

Miscellaneous animal husbandry elements are likely to be found throughout the state, with early intact examples being the most rare.

SOURCES

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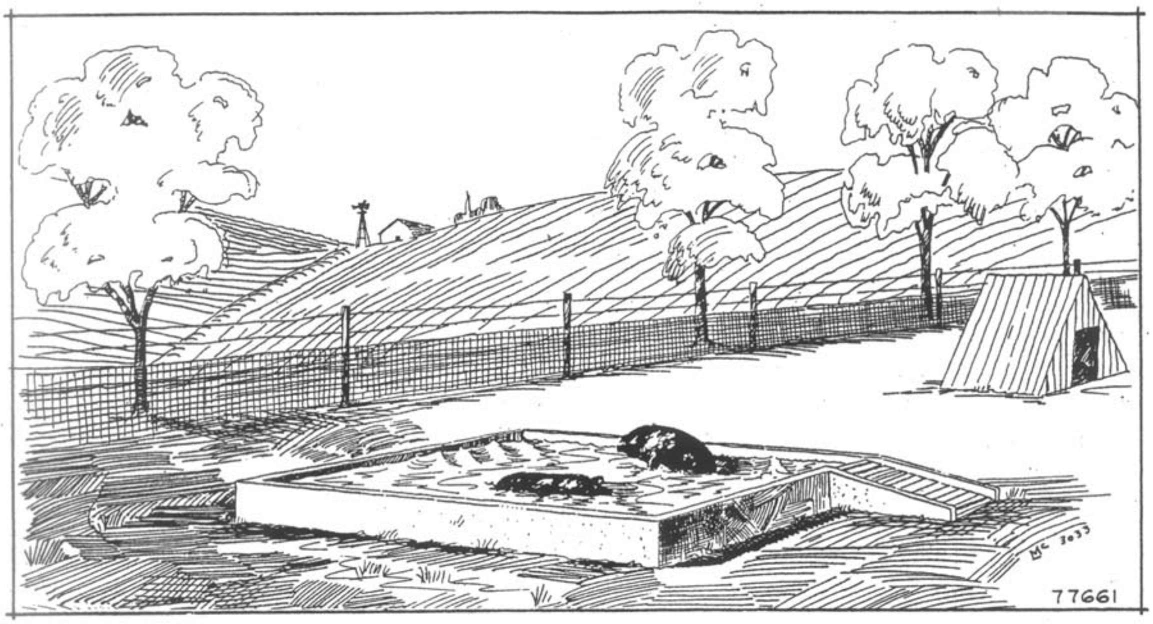
See also
Animal Underpasses
Stock Tanks



Hog wallows were shallow water-filled pools in which pigs could cool off. Oil or chemicals were sometimes added to the water to control parasites. In 1937 the Midwest Plan Service was offering plans for this 14′ x 14′ concrete pig wallow. Note the adjacent hog cot and the woven wire (or "hog" wire) fence topped by the typical two strands of barbed wire. From Midwest Farm Building Plan Service (1937).

■ OTHER CROP HUSBANDRY ELEMENTS

► Includes miscellaneous farm elements associated with raising, storing, and processing crops

Miscellaneous crop husbandry elements on Minnesota farms include structures such as:

- drying sheds or dry houses
- elevated metal feed bins, also called hopper bins
- packing sheds
- sorghum mills or presses

For more information, see sources such as those listed below.

PREVALENCE

Miscellaneous crop husbandry elements are likely to be found throughout the state, with early intact examples being the most rare.

SOURCES

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See also

Tobacco Barns
Sugarhouses
Scale Houses

Elevated feed bins like the one shown here were in use by the 1950s. Erickson Farm, Marine Township, Otter Tail County, 1974. (MHS photo by Eugene Debs Becker)

■ OTHER DOMESTIC ELEMENTS

► Includes miscellaneous farm elements related to domestic life

Miscellaneous domestic elements on Minnesota farms include structures such as:

- birdhouses
- carriage houses
- garden seats and arbors
- graves and gravestones
- lawn art, ornaments, statuary
- picnic fireplaces
- religious icons
- school bus waiting shelters
- statuary
- storm cellars
- walls

For more information, see sources such as those listed below.

PREVALENCE

Miscellaneous domestic elements are likely to be found throughout the state, with early intact examples being the most rare.

SOURCES

Farm Building Plans. St. Paul: University of Minnesota Institute of Agriculture, Dept. of Agricultural Engineering, 1953.

Visser, Thomas Durant. *Field Guide to New England Barns and Farm Buildings*. Hanover, NH: University Press of New England, 1997.

See also
Saunas

The Lingen family cemetery is a small fenced plot in a wooded area of the farmstead. There are five graves in a grassy square that measures about 24′ x 24′. Pope County, 2005. (Gemini Research photo)

■ OTHER SERVICE AND UTILITY ELEMENTS

▸ Includes miscellaneous elements related to the farm's service and utility infrastructure

Miscellaneous service and utility elements on Minnesota farms include structures such as:

- bridges
- clothes lines
- fuel tanks for gasoline, diesel, kerosene, heating oil
- landing strips
- mailboxes
- retaining walls
- secondary income structures such as:
  - auto repair shops
  - blacksmith shops
  - brick kilns
  - lime kilns
  - resort cabins
  - sawmill sheds
- "sheds" (e.g., for storage, etc.)
- signs with farm's name or products
- tornado shelters
- trash incinerators

Small multi-purpose storage structures – today often called "sheds" – were apparently not often constructed on Minnesota farms before 1960. None of the historic plan books, farm building texts, and farm periodicals reviewed in this study discussed construction of a "shed." The small pre-1960 "sheds" that stand on farms today were more likely to have been built for another purpose (such as a smokehouse, brooder house, or power house) and used as a storage shed for part of the year, or used as a shed full-time after the original function was no longer needed.

For information on landing strips, see "Airplane Hangars," an individual farm elements section.

PREVALENCE

Miscellaneous service and utility elements are likely to be found throughout the state, with early intact examples being the most rare.

SOURCES

Boss, Andrew, and George A. Pond. *Modern Farm Management: Principles and Practice*. St. Paul: Webb Publishing Co., 1951.

Farm Building Plans. St. Paul: University of Minnesota Institute of Agriculture, Dept. of Agricultural Engineering, 1953.

See also

Woodsheds
Water Power Structures
Propane Gas Structures
Airplane Hangars

A Stevens County farm mailbox. Ehlers Farm, Framnas Township, Stevens County, 2004. (Gemini Research photo)

▪ POTATO WAREHOUSES

- Usually two-level structures with potatoes stored in the lower level
- The drive-in floor had multiple trap doors for depositing potatoes below
- Floors, walls, and bins were slatted for ventilation
- Most potato warehouses in Minnesota postdate 1900

Minnesota's principal potato-growing regions were 1) counties north of the Twin Cities such as Anoka, Isanti, and Chisago and into the cutover; 2) the Red River Valley, and; 3) north central Minnesota between the Twin Cities and the Red River Valley.

Potato warehouses arose from farmers' need to preserve the best market possible for their crops. While improvements in production and harvest in the early 1900s made it possible to boost volume, the potential to glut the market also increased (Moore et al 1920: 581). To avoid this problem, warehouses were needed that could protect potatoes from post-harvest elements such as cold weather, sprouting, mold, shrinkage, rot, and rodents. Most potato warehouses in Minnesota date from 1900 or later. Similar structures were also used to store onions.

Traditionally, potatoes were planted on Good Friday and harvested in late summer or early fall. Those harvested for family use were stored in bins in the farmhouse basement, or in the farm's root cellar. If potatoes were grown for sale, a potato warehouse was built. Unlike crops such as grains, potatoes were tricky to hold and they needed optimal conditions and constant monitoring while in storage.

Maintaining temperature was the most important function of a potato warehouse. The interior needed to be sufficiently cool to keep potatoes dormant but warm enough to avoid freezing. Experts recommended temperatures between 34 and 38 degrees Fahrenheit. Artificial heat was usually not needed, but stoves were used if necessary. As technology improved, temperature specifications for storing different types of potatoes emerged. Proper ventilation required intake and outtake flues at regular intervals around the structure. After World War II, more modern warehouses used electric fans to circulate air (Moore et al 1920: 582; Kelley 1930: 371; Wooley 1946: 289).

Warehouses were generally two-level structures built in areas with sufficient drainage. Some farmers built into hillsides to augment water runoff. Early warehouses were built completely into the ground like typical root cellars, but later models extended partly above ground with an access door, a gabled roof, and windows in the working areas within the warehouse. In 1920 the most common models were partly above ground. Wagons could drive through the above-ground portion of the warehouse to deposit potatoes through the floor into storage bins on the lower (below-ground) level (Moore et al 1920: 582).

Lower levels had concrete floors sloping toward a drain tile in the middle. The foundation walls were typically hollow tile, or poured concrete framed out with 2" x 4" studs and covered with

See also
Root Cellars
Developing the Cutover, 1900-1940
Appendix: Focus on Minnesota Crops

boards. Hollow tile walls were occasionally extended above ground to the roof to maximize the structure's ability to stabilize temperature, but the upper level was more typically woodframe (Moore et al 1920: 582).

The above-ground walls needed to be insulated. Farmers used a variety of insulation including cork products, mineral wools, hair felt, rock wool, vegetable fibers, wood shavings, and sawdust.

Typically, ceilings were low, with a maximum of 2' of air space between the top of the potatoes and the ceiling. This provided insulation for the produce while preventing condensation from dripping onto the potatoes. Slanted ceilings aided air circulation, which also hindered the formation of water vapor. Slatted floors and walls were used for the same reason.

Openings covered with trap doors were cut in the upper-level floor. They were generally two feet wide and could extend the length of the building. One author explained, "The wagon enters at one end of the building, the potatoes are dropped through the trap into the proper bin, and the wagon goes straight on and out the door at the other end" (Moore et al 1920: 582). Some later model warehouses built along railroad tracks had featured a gabled dormer with a chute filling railroad cars.

Warehouse doors needed to be wide enough for easy access, that is, sufficiently large to accommodate people carrying bushels of potatoes, or, if a larger warehouse, a wagon. Doors were important for ventilation as they could be opened or closed to create an immediate effect of cooling or warmth. Sliding doors were discouraged because they tended to leak more air.

Bins also needed to be constructed and arranged for proper ventilation. The size of the bins depended on the maturity of the potatoes but generally ranged from five to eight feet in width and eight to ten feet in depth. The bin walls used double-slatted partitions with a false floor to permit the circulation of air through all sides of the pile. The slats needed to be correctly spaced so the potatoes couldn't be bruised between the slats and then rot (Wooley 1946; Kelley 1930; Whitnah 1923).

Potato warehouses needed equipment for handling and managing the crop. These items included a manhole, thermometer, sack elevator, trap doors, conveyors, hopper for sacking, potato sorter, stove, and scale.

PREVALENCE

Potato warehouses were concentrated in Minnesota's principal potato-growing regions. It is likely that some well-preserved examples will still be standing.

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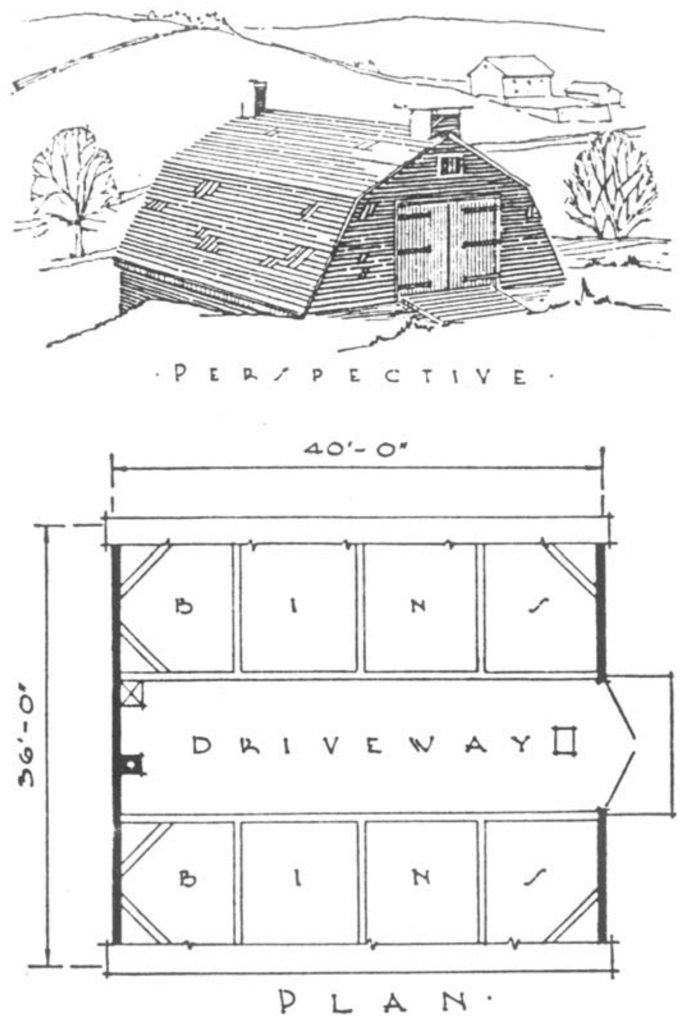

Drawing of a 40′ x 56′ banked potato warehouse published in a 1941 agricultural engineering text whose authors were from the University of Illinois. From Carter and Foster's *Farm Buildings* (1941).

Potato warehouses had large bins in which to store the crop, and slatted bin walls and floors for ventilation. The potatoes were usually stored in a fully- or partially-excavated lower level. The warehouse in this photo is atypically large; it may be on a large farm or be the warehouse of a buyer or middleman. Location unknown, circa 1910. (MHS photo)

■ POULTRY HOUSES

- Found on nearly all Minnesota farms by 1890
- Often the animal building nearest the house
- Often built within or adjacent to the orchard or garden
- Lighting was critical to egg-laying so houses were oriented so windows faced south or east
- Usually made of wood to be warm and dry, usually well-insulated
- By 1950 new buildings were designed to support larger flocks and mechanization

Chickens were the most common type of poultry in Minnesota. The poultry houses described herein – also called laying houses or hen houses – were most often used for chickens, but could also house the ducks, turkeys, and geese raised in much smaller numbers on Minnesota farms. Turkeys, which were even more susceptible to disease than chickens, were not common in the state until about 1950.

Many farms had a separate brooder house in which chicks were raised during the time they needed special care. See "Brooder Houses," another individual farm elements section.

In 1875-1900, raising poultry was a key way in which Minnesota farms diversified away from a wheat-only regimen. In 1914 poultry was being kept on at least 90 percent of Minnesota farms. A University of Minnesota specialist wrote in 1914, "Poultry pays the farmer in most cases better than any other farm enterprise when the small amount of money usually invested is considered." He advocated that average-sized farms should have sufficient waste grain, extra vegetables, and other discarded food to keep a flock of at least 100 hens profitably (Smith 1914: 170).

Until 1950 eggs were the commodity most often sold off the farm, while both eggs and poultry meat were important sources of food for the farm family.

In 1930 most Minnesota farms had 70-150 chickens, with the average flock being about 100 birds. Poultry became increasingly important in the 1930s and 1940s. Between 1932 and 1948 both the number of chickens raised and the number of eggs gathered increased considerably (Hady and Nodland 1951). In 1939, 90 percent of Minnesota farms kept poultry, and the average farm produced 775 dozen eggs per year (Engene and Pond 1940; Engene and Pond 1944). New buildings were constructed in 1910-1940 to support this increased production.

Before World War II, large-scale poultry farming was not common in Minnesota with one exception – near the Twin Cities. In 1930 about four percent of farms surrounding the Twin Cities raised significant numbers of poultry to feed the urban population (Engene and Pond 1940). After the war, consumption of poultry meat, as well as eggs, increased. Methods to control chicken and turkey diseases improved, and large-scale growers emerged. In the 1950s and 1960s, Minnesota's poultry industry became concentrated in central Minnesota, especially in Kandiyohi, Swift, Meeker, and Stearns counties.

See also
Brooder Houses
Appendix: Focus on Minn Livestock

On average-sized Minnesota farms, eggs were traded or sold in local markets on a weekly basis, with whole or dressed chickens being sold less often. Income from eggs, cream, and butter – plus the occasional sale of livestock – was often the only money that came into the farm between harvests (Thompson 1913: 7). Caring for poultry was commonly the farm woman's responsibility and "egg money" was often spent at her discretion although it went usually for household rather than personal purposes (Thompson 1913: 9). In 1951 a Minnesota Agricultural Experiment Station Bulletin confirmed that women were primary raisers of poultry in that era (Hady and Nodland 1951: 14-15).

Development of Specialized Poultry Houses. According to Allen G. Noble, in early settlement periods throughout the U.S. chickens were often allowed to wander about farms choosing their own places to roost and nest. Eggs for the table were gathered as needed. Eventually farmers built makeshift shelters or remodeled buildings into poultry houses to protect the birds from predators and weather and to make egg-collecting easier. As the potential for poultry income grew, poultry house design received increasing attention (Noble 1984: 116). Until 1950 in Minnesota, however, it was still fairly common to let chickens run free and to, for example, fence the vegetable garden to keep the chickens out, rather than fence the chickens in.

As early as 1891 the Minnesota Farmers' Institutes were encouraging the state's farmers to use sound chicken house practices to increase productivity. One author explained in 1892, "Experience has proved that twenty fowls, properly housed, provided with suitable food, pure water, clean nest boxes, plenty of dust, lime in some form, and gravel, will return more clear profit than fifty, kept as they generally are upon farms" ("Model" 1891; "Convenient" 1892: 203).

A University of Minnesota author wrote in 1914:

> Better poultry houses are needed on our Minnesota farms. Poultry is one of the farm's largest and most successful industries, financially. That the financial benefits of this branch of the farm might be materially increased by providing better quarters for the fowls will be conceded by all those who are acquainted with the conditions which surround poultry raising in Minnesota. That many of the farmers themselves realize this situation is evinced by the fact that 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. To meet this demand, a house for one hundred laying hens that can also be used for such other purposes as poultry houses in general are used for – that is, for housing surplus stock in the fall, and as a combined breeding and laying house in the spring – has been planned (Smith 1914: 165).

Design Goals. Hens were sensitive animals that wouldn't lay eggs, or would only lay small eggs, if their housing was too cold, hot, drafty, damp, or dark. Birds of all ages were susceptible to diseases and pests, with chicks and young birds being particularly vulnerable (hence the need for specialized brooder houses). The best poultry houses were dry, clean, well-ventilated, roomy enough to provide exercise, warm during cold weather, and well-lit with some darker areas. Many houses were built with removable roosts and other fixtures so that the building could be given a thorough annual cleaning with disinfectant (Cooke 1925: 84).

Many of the diseases and parasites that threatened poultry lived in the soil for up to three years. Hence some farmers built poultry houses on skids so they could be moved to new ground, or built elevated runs so that the birds would not come into contact with the soil. These practices were even more important for brooder houses because chicks were particularly susceptible.

Lighting was another critical design consideration because hens slowed their eating, activity level, and egg-laying in the late fall and winter when daylight declined. As egg supplies decreased during winter months, egg prices rose, giving farmers strong incentive to devise ways to increase winter laying.

Location. The poultry house was usually the closest outbuilding to the farmhouse so that women could conveniently tend chickens and gather eggs while also cooking, cleaning, churning butter, and caring for children. Poultry houses were usually sited within, or near, the farm orchard and/or adjacent to the vegetable garden to make good use of space, help make women's labor more efficient, and allow poultry to keep the insect population down near the fruits and vegetables. The houses were not sited in the shade of large trees because maximum sunlight was needed. The poultry house was often placed on the leeward side of a windbreak or hedge to help it stay warm. The site needed to be well drained, and fresh green grass was helpful. Houses almost always faced south or east to catch maximum sunlight. Post-World War II poultry buildings were also sited for easy access to electrical service, feed storage, and truck access.

Size. The size of the poultry house was generally determined by the size of the flock. Three to four square feet of floor space per bird was recommended, with smaller breeds needing less space (Cooke 1925: 77; Cooke 1948: 3). Plans distributed by the University of Minnesota included poultry houses in a range of sizes including 12′ x 14′, 16′ x 30′, 16′ x 32′, and 24′ x 24′. Using the recommended capacity just noted, these buildings would have housed flocks of 38, 136, 146, and 164 birds (*Farm Building Plans* 1953). Poultry houses made up of several side-by-side pens or cribs were often called "continuous" or "long" houses. They were sometimes the result of farms expanding their housing as the size of the flock grew.

In 1914 the University of Minnesota developed plans for a "Minnesota Model Poultry House." Several sizes may eventually have been designed, but the first was a 16′ x 30′ shed-roofed building covered with vertical siding. On the main facade the house had three double-hung windows with transoms and two small, low chicken doors. There was a pedestrian door on one end wall. The interior was divided into two spaces with the largest occupying two-thirds of the interior. The cost of materials was about $1,650 in 2003 dollars (Smith 1914). The University also designed "Minnesota Model" brooder houses (Smith et al 1936).

Stories. Most poultry houses were one story tall, but some were a story and a half to allow feed, bedding, or other items to be stored in a loft.

Two-story poultry houses were much less common. A national history of poultry production indicates that "Multi-storied houses appeared in the 1920s, first in the Northeast and later in the Midwest and other parts of the country" (Hanke et al 1974: 227). Two-story houses were sometimes used in locations where land values were high. A two-story structure could also result in a net savings of materials over two one-story buildings (Midwest Farm 1933; Barre and Sammet 1950: 260). The Midwest Plan Service offered plans for two-story houses in both 1933 and 1937. A 20′ x 20′ building, for example, could house 175 to 225 hens. Plans for much larger two-story houses were offered by Midwest Plan Service in 1937 and by the University of Minnesota in 1953. They were 26′ x 100′ and 28′ x 86′, respectively, and both included an indoor feed room. A 1948 University source suggested a two-story house might be useful for flocks of more than 1,000. In 1943 an article in *Agricultural Engineering* (Otis and White) provided an analysis of a two-story poultry house on breeder George Ghostley's farm in Anoka. The text suggested that large, two-story houses were fairly new in Minnesota (Cooke 1948: 15; Midwest Farm 1933; Midwest Farm 1937; *Farm Building Plans* 1953; National Plan ca. 1950; Otis and White 1943).

Materials. Poultry houses were generally not expensive to build or operate. Only simple carpentry skills were needed, and some farmers built them with wood harvested on the farm or with salvaged materials. Some farmers remodeled old buildings. Some even built poultry houses of straw, although these were usually temporary.

Most poultry houses in Minnesota were framed with dimensional lumber and sheathed with wood siding. Some were sided with tar paper, especially in northern Minnesota's forest cutover areas. Some had interior walls of lath and plaster. Experts favored wood over masonry materials like brick, hollow tile, or concrete block because wood was better at keeping moisture and frost from accumulating.

In the late 1930s and 1940s new building materials and methods were introduced. Pole-frame and factory-built structures (either fully- or partly-prefabricated) were sold for poultry housing, just as they were for cattle and hog shelters and for storing grain and farm machinery. In 1933 a modular steel poultry house was being advertised in *Successful Farming* magazine ("New Steel" 1933). In 1955 Stran-Steel was promising "There's a Quonset for Every Job on Your Farmstead," including housing poultry (Stran-Steel 1948; Stran-Steel 1957).

Roofs. Poultry house roofs were often shed, gabled, or saltbox, and were covered with conventional roofing materials. Shed roofs were easier to construct and had the advantage of shedding rain to the rear rather than forward into the chicken yard. Since a poultry house needed a low ceiling to conserve heat, the total height of the building was often around 6′ to 7′. Gable-roofed houses accommodated more insulation in the attic and were often called "straw loft" houses. Some poultry houses also had roofs with a half-monitor projection that provided extra windows in a clerestory. Houses with clerestories may have been less common in Minnesota than other states because of winter heat loss from the extra windows.

Floors. Makeshift poultry houses often had dirt floors that might even be below grade and therefore cold and soggy. A few experts suggested that dirt floors could be used for flocks of less then 200 but cautioned against moisture accumulation. Wood floors were sometimes built with tar paper sandwiched between two layers of wood for warmth and to keep out moisture. While wood was popular, some specialists pointed out that wood floors were vulnerable to gnawing rats who might raid the nests (Welch 1906: 256). Poured concrete floors were promoted for washability. In some plans the University of Minnesota noted that floors could either be poured concrete or carefully-laid layers of coarse gravel, topped by fine gravel, topped by hard-packed clay, and then topped by a final layer of fine sand (*Farm Building Plans* 1953). Whatever the floor material, experts recommended that houses have a foundation of mortared stone, brick, or concrete that was laid deep enough to prevent frost heave. It was optimal to build the foundation high enough to allow the floor to be elevated about 1′ off the ground. Most floors were covered with straw bedding to protect hens from cold and to reduce humidity (Cooke 1943: 4; Wooley 1946: 88).

Doors. A people-sized service door that opened inward was usually placed on the main facade or on an end wall. Both service doors and interior doors were usually hung about 8″-10″ above the floor so the bottom edge of the door wouldn't scrape the pile of accumulated droppings and bedding straw which grew higher as the winter progressed. Since doors were hung higher than floor level, tall thresholds were needed so the chickens wouldn't escape. Experts advised that doorways be sufficiently wide to allow a thorough annual cleaning, including removal of nesting boxes and other interior fixtures.

Many poultry houses had small chicken doors, about 1′-square, that allowed the birds free access to the outside. Angled gangplanks led from the doors to the ground (or to elevated poultry runs). The walkways often had strips of lath nailed crosswise at intervals. The small doors were generally closed during the winter and at night to keep out cold and predators.

Ventilation. Environments with damp, cold, or overly-humid air made poor poultry houses. Good ventilation was important to preventing the build-up of pathogens, dust, and ammonia, and to keeping the interior dry (Greene "Poultry" 1904: 239; Smith 1914: 165). In the simplest poultry houses the door was simply propped open – a practice that didn't support fine adjustment of air quality. Features that improved ventilation included adjustable window sash, windows on the end walls, transom or window openings covered with screens of muslin cloth, louvered openings, and passive ventilation flues. The flues consisted of hollow wooden channels that began at a point about 3″ above the floor and extended up through the roof. Muslin screens over window openings tended to clog with dust and were superseded by adjustable louvers and wire mesh screens.

As flocks grew larger the need for ventilation increased. Around 1950, for example, the National Plan Service was providing plans for a large 1 1/2-story poultry house with a 40′ x 40′ footprint and a storage loft for feed and bedding. The lower 4′ of the front wall was entirely covered with woven wire fencing for ventilation, anticipating the open sides that would become standard on large poultry houses after 1960 (National Plan ca. 1950).

Insulation and Heating. To protect the birds from cold it was recommended that ceilings be about 6′ tall and walls and ceilings be 4″ to 6″ thick and well-insulated. If the building's roof was higher than 6′, a loft space was created and filled with insulation. Until 1940 most chicken houses were insulated with straw or fine wood shavings. Sawdust was not recommended because it settled and could cause rot near sills and studs. Structural insulation board was being tested and recommended in 1937 according to one author (Ward 1937). Barre and Sammet wrote in 1950 that exposed insulation board did not hold up well to the pecking of chickens (Barre and Sammet 1950: 250).

During long Minnesota cold snaps, insulation was sometimes not sufficient and heat lamps or other artificial heating was used (Fox 1940).

Windows. Windows on the south elevation were preferred to allow strong sunlight to shine inside. Sunlight helped heat the building and maximize brightness during the late fall and winter when the birds stopped laying as daylight declined. Many experts recommended that about one-quarter of the south elevation of the building consist of windows, but some cautioned that too many southern windows could cause overheating during the day. Some suggested that the interior be whitewashed four times a year to increase reflective light and facilitate cleaning (Brown 1910: 150).

Artificial Lighting. By the 1920s research was confirming that artificial light helped sustain egg-laying through the late fall and winter, and farmers were encouraged to install lights when their farms were electrified to take advantage of winter egg prices.

Despite the fact that electric lights could significantly increase winter egg production and profits, poultry houses were not the first farm buildings to receive electric lights. On most Midwestern farms, the house and dairy facilities were usually lighted first. One study of electrification on demonstration farms in 1927 found fewer than one-third had lights in their hen houses (Brown and Boonstra 1927: 213). During the 1930s poultry house lighting increased statewide.

According to University of Minnesota poultry specialist Cora Cooke, a common practice was to light the hen house from 5 a.m. until daylight and again from dusk until about 8 p.m. Usually the house was equipped with dimmers to simulate natural light changes. Cone-shaped reflectors around the lamps helped even the light. The lamps were usually placed about 6' from the floor (Cooke 1948: 14-15). Specific lighting schedules were eventually found to be unimportant – according to a 1974 history of the poultry industry, "Experiments with various lighting schedules showed clearly that it made little difference whether one used morning lights, evening lights, or both, to lengthen the hens' working day. Even dim all-night lights were reasonably effective" (Hanke et al 1974: 232).

Runs and Sun Porches. Many poultry houses were built with fenced yards south of the house. Continuous poultry houses often had an exercise run extending from each interior pen and chicken door. Yards or runs could be "freshened" by seasonally planting new crops of small grains within them (Smith et al 1936: 4). Fences had to be sized so birds couldn't fly over them, and horizontal boards along the base of the fences were sometimes needed to keep out invaders. Chicken yards often had feed troughs.

Some poultry houses had "sun porches" attached to the south side, or free-standing in the yard. They were usually elevated above the ground so that the birds could exercise without direct contact with disease-harboring soil. Sun porches were usually long and narrow and built of a combination of wood and poultry netting. Their tops were sometimes built of glazed windows (somewhat like a cold frame for starting seedlings) to allow the chickens to receive beneficial sunlight during cool weather (Fox 1940).

Some farmers used lightweight movable roosting shelters made of wire mesh that were placed in a yard or pasture. The structures were often called "range shelters" (Cooke 1943: 4).

Interior Arrangement. Experts recommended that a poultry house have two or more interior pens. Multiple pens allowed birds to be separated by sex and age (both strong determiners of behavior) so that each population received appropriate care. Breaking up the flock prevented disease from spreading, and also helped the caretaker keep better track of individual birds and their health. Interior dividing walls were often solid near the floor to prevent floor drafts and chicken fights, but made of wire netting above to facilitate air circulation.

Equipment. Most chicken houses had dust boxes, roosts, nesting boxes, broody coops, water containers, and food troughs. Some experts suggested that poultry houses also include a place for a pencil and paper for daily record-keeping. Most of the equipment could be built on the farm, although after 1950 it was often factory-made. In 1953 the University of Minnesota was still providing plans for farm-built alfalfa racks, droppings pits, roosts, nests, removable nests, community nests, water stands, and sorting crates for separating birds (*Farm Building Plans* 1953).

Dust Box. Dust boxes were shallow wooden boxes (e.g, 2′ x 5′ x 6″) that allowed chickens to take dust baths, which kept them free from lice (Cooke 1925: 83). One author wrote in 1906, "Did you ever see a hen so happy as when she can kick her feathers all full of dust and then lie in the warm sunshine?" (Welch 1906: 263). Dust boxes were filled with road dust or ashes and placed in a sunny spot on the floor.

Roosts. Most poultry houses had wooden roosts or perches on which the birds could settle. Many roosts were simply parallel sets of wooden rails that could be removed for cleaning. The roosts were built at a uniform height so the birds didn't fight over the highest perch (Moore et al 1920: 564). Many houses had removable droppings boards beneath the roosts that caught the droppings and could be taken outside for cleaning. Some roosts had a curtain to keep the chickens warm at night.

Nesting Boxes. Individual nesting boxes were wooden or metal cubicles attached in tiers to the walls, the lowest about 18″ above the floor. A 16′ x 30′ poultry house might have 30 nesting boxes. Some had hinged doors so the nests could be darkened to discourage hens from eating their eggs. While they were initially square, many later nesting boxes had circular openings. Community nests were spaces large enough to accommodate several birds at once. They were used because hens liked to nest together, but needed to be sized correctly so the eggs wouldn't be broken.

Broody Coops. Broody coops were used for "broody hens" or those hens which were sitting on eggs until they hatched into chicks (a three-week process). Farms needed a significant number of new chicks each year to keep the laying flock young and productive. A simple broody coop could consist of a poultry-net enclosure that was hung in an upper corner of the poultry house. The coop was placed near the ceiling so that other hens wouldn't roost on top of it. Male birds or sick hens could also be segregated in the broody coop. By 1900 some farms had incubators powered by kerosene or another fuel that provided consistent heat to hatch eggs. By the 1910s commercial hatcheries were becoming more common and by the 1920s many farms bought chicks instead of hatching their own, unless only a small number was needed. After the late 1930s hatcheries sold sexed newborns, which allowed farmers to spend their feed dollars on chicks that would become laying hens, rather than on undesirable male chicks.

Water and Food Containers. Water containers and food troughs or "feeders" were sometimes attached to interior walls to maximize floor space and to keep the hens from standing in the food pans or scratching dirt into them (Greene "Poultry" 1904: 245). Some troughs were portable to facilitate thorough cleaning of both the trough and the house (Cooke 1948: 13). Some feeders had hoppers to store and dispense the feed. Water containers were sometimes shallow pans or rectangular galvanized iron boxes. Water stands were wooden frames designed to hold pails of water. If the house was furnished with running water, a stand might be placed by the spigot.

Alfalfa Rack. An alfalfa rack or green feed rack was a hopper-like enclosure attached to the wall with sides built of poultry netting. The rack was filled with chopped alfalfa or other fodder. A 1937 source suggested that "green cured alfalfa" had just come into favor in the 1930s as winter feed (Midwest Farm 1937).

Droppings Pit. A droppings pit was an elevated platform made of poultry netting that was sometimes placed under the roosts. Bird droppings fell through the netting, keeping the birds clean. The framework was periodically tipped up and the manure removed from the floor.

Electrical Equipment. As farms were electrified in the 1930s-1950s, farms increasingly used electrical equipment in the poultry house. Devices included artificial lighting systems, electric waterers, drinking water warmers, heat lamps, brooder heaters, egg incubators, ventilation fans, feed conveyors, egg conveyors, egg coolers, egg cleaners, egg candlers, egg graders, and burglar alarms. By 1954, 39 percent of the state's poultry farmers had an insulated poultry house and 20 percent had a fan-ventilated house; both were more common among large producers (Hjort and Manion 1955: 35).

Egg-Cooling and Storage. Eggs needed to be gathered twice a day and cooled as quickly as possible. A 1954 Minnesota survey found that "56 percent of farmers gathered eggs in a pail or can, 40 percent used a wire basket, and 4 percent used some other container" (Hjort and Manion 1955: 35). Properly stored, eggs could last at least six months. Historically Minnesota farms cooled and stored eggs underground – for example, in a root cellar, other outdoor pit, or basement – or in a cooled building such as an icehouse or springhouse. In 1954, 66 of Minnesota poultry farmers stored their eggs in the house basement, 13 percent in (or on) the house porch, 11 percent in the kitchen, and 10 percent in another location such as a refrigerator, pumphouse, well, barn, or "egg house" (Hjort and Manion 1955: 36). Mechanical cooling equipment such as evaporative coolers, spray coolers, and basket coolers were still uncommon. To protect egg quality, by 1961 experts were recommending a homemade cabinet egg cooler for flocks under 2,000 and a room-type cooler for flocks over that number. Egg coolers contained shelves with wooden slats or mesh-covered holes. Wire baskets of eggs were placed on the shelves and fans moved air through the cabinets to cool the eggs (Neubauer and Walker 1961: 273).

Fattening Houses. Fattening houses were uncommon and were only used by large-scale poultry producers. They were small one-story buildings in which broilers (chickens to be sold for meat) were kept in tiers of crates while being fattened for market (Plumb 1918: 377).

TRENDS IN THE 1940S-1960S

Research conducted in the 1930s and 1940s suggested that poultry could flourish under colder temperatures than had been previously thought, and poultry house designers responded with larger screened windows and more ventilation. Experiments in feeding revealed the benefit of various supplements and the positive effect of all-mash diets on egg production.

By this time artificial lighting was having a significant impact on poultry raising. A 1953 Rural Electrification Administration survey of farms in Ohio and Indiana before and after electrification showed that within five years of electrification the number of laying hens increased 55 percent, the number of chicks hatched increased 130 percent, and the number of turkeys raised increased 109 percent – largely due to electricity (Pringle 1953: 330). As electricity was adopted, the need to align poultry houses with south-facing windows for lighting diminished.

After World War II the population of the U.S. increased considerably, as did consumer demand for meat. "Broilers," or poultry raised for meat, became increasing important in Minnesota. Poultry raising moved away from an enterprise distributed on farms throughout the state. Some Minnesota farmers enlarged their flocks, taking advantage of improvements in breeding, feed mixtures, labor-saving building designs, and mechanized equipment. The majority of farms stopped raising poultry entirely, unable to compete with farms that were mechanizing. One effect of this change was to displace Midwestern farm women from one of their traditional farm jobs (Jellison 1993: 156-157).

By 1950 poultry houses on some large farms included multi-storied buildings and/or buildings designed to support mechanized equipment and other new techniques. Eggs, water, feed, and manure were all handled in new ways to maximize efficiency. By the mid-1950s, flocks of 500 to 1,000 layers were common in Minnesota, and turkey flocks were often 1,000 birds or more (Cavert 1956: 23). Most Minnesota poultry became concentrated on a few large-scale farms, mainly in central and west-central Minnesota.

Features introduced in the 1950s and 1960s to facilitate controlled growing environments and intensive production included:

- buildings deeper than traditional narrow poultry houses (e.g., 36′ or more deep)
- two-story houses
- confinement housing
- centralized feed centers around which pens were arranged
- mechanical overhead feed carriers
- bulk feed storage
- better placement of feed troughs to make feeding more efficient
- better placement of nests to speed egg collection
- 6- to 12-case egg coolers; egg cooling rooms
- larger pens
- mechanical ventilation to mitigate crowding
- concrete exercise runs
- isolation areas for sick birds
- radiant slab brooders
- slat or wire floors for cleanliness and manure handling, especially in milder climates
- use artificial insemination
- elimination of roosts
- increased use of cage houses in which birds were confined to wire cages installed in rows (Barre and Sammet 1950: 262-263; Neubauer and Walker 1961: 86- 95).

In 1956, Minnesota ranked second in chicken production and fourth in turkeys (Roberts et al 1956: 396). In 1972, just 62 farms grew nearly two-thirds of Minnesota turkeys (Tweton 1989: 277).

PREVALENCE

Since poultry was kept on at least 90 percent of Minnesota farms in the first half of the 20th century, a poultry house was found on nearly every farmstead. It is expected that many will still be standing. Early examples of the post-World War II trend toward raising very large flocks with mechanized production methods may also be extant.

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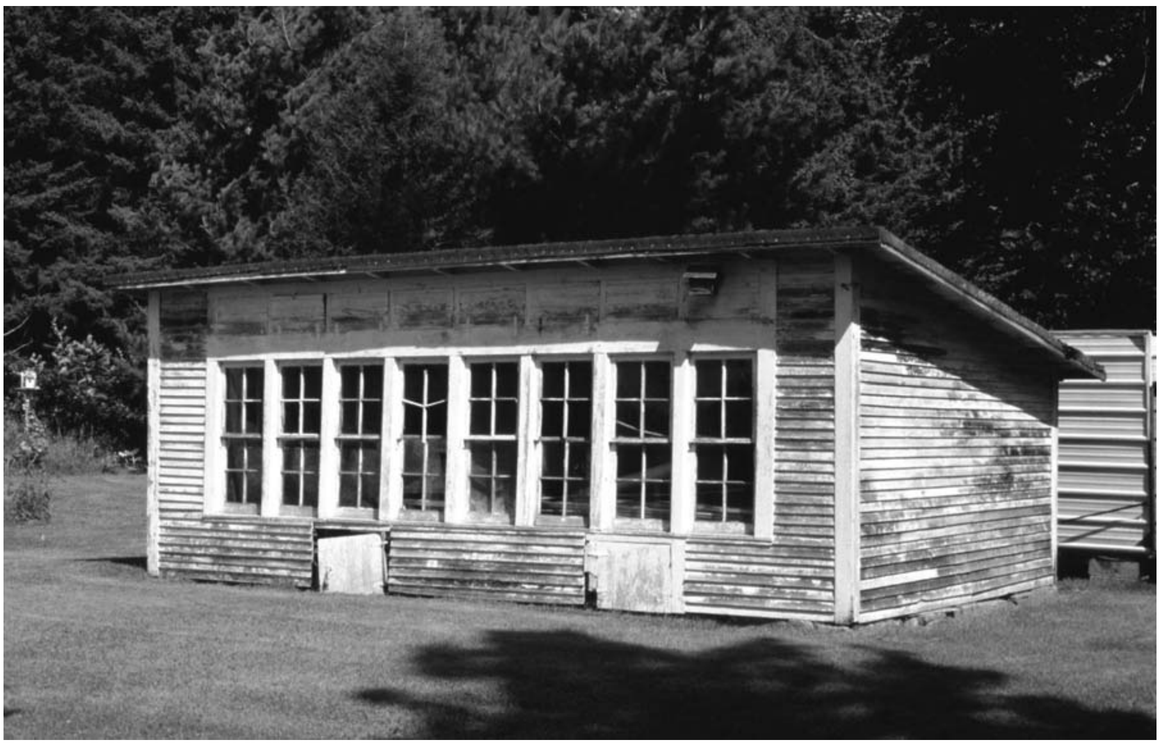
In addition to being in the Minnesota Historical Society archives, this photo appears in the 1925 *Minnesota Farmers' Institutes Annual* article "House the Flock for Comfort" by Cora Cooke, a longtime member of the University of Minnesota faculty. Cooke's caption reads: "The old and the new. Mrs. Beck at Barnum still finds the old log [poultry] house useful in addition to her new straw loft house." Note that the gabled house had ventilators or heater chimneys and an addition on its left end. All had expansive south-facing windows. The log poultry house could perhaps have been used seasonally as a brooder house. Beck Farm, near Barnum, circa 1912. (MHS photo by Horton)

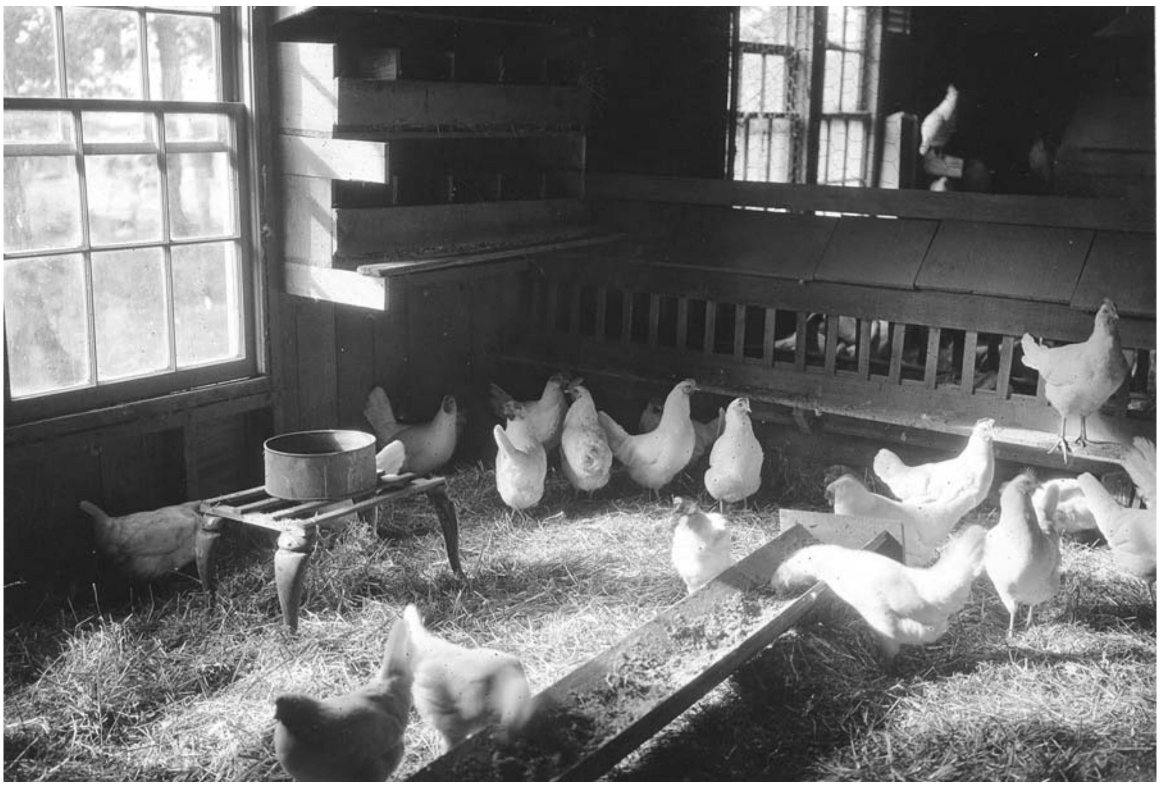
Poultry house designs changed little over many decades. This type of house was sometimes called "continuous" because it was made up of a series of adjacent interior pens. The house in this photo had roof vents as well as exercise runs built of poultry netting stretched between wooden posts. There were boards at the base of the fencing to keep out rats, foxes, and other marauders. An orchard of young trees was growing within the runs. Location unknown, circa 1915. (MHS photo)

The average Minnesota farm produced 775 dozen eggs in 1939. Eggs were taken to market about once per week, a job made easier by the automobile. Location unknown, 1952. (MHS photo by Norton and Peel)

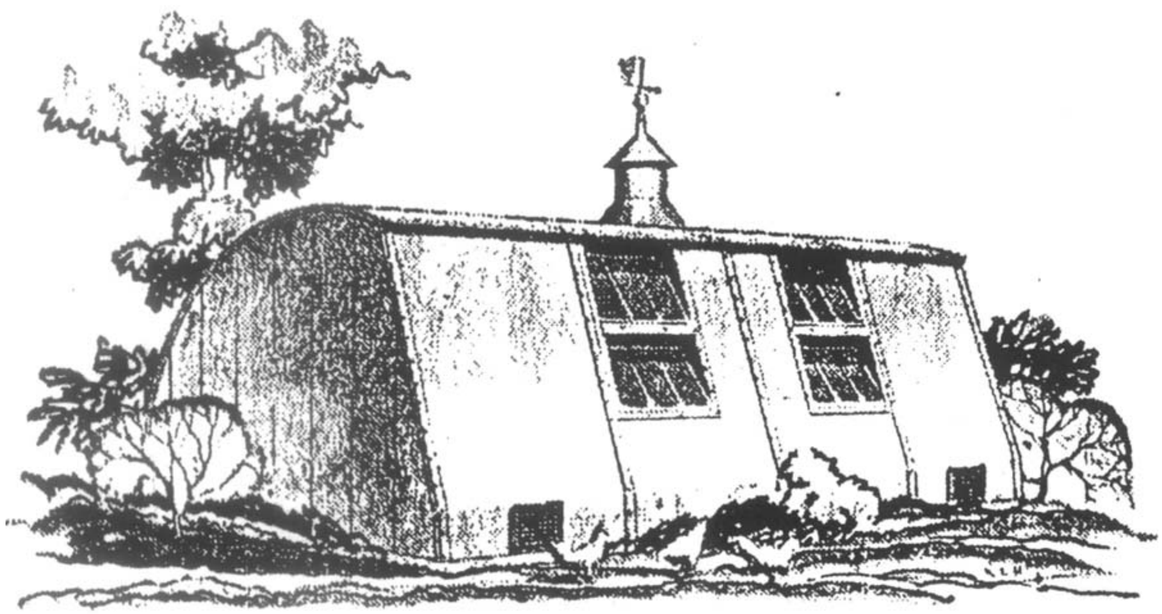


A 12′ x 18′ poultry house like this one would only be suitable for a small flock of about 60 chickens. Built circa 1924, this house has clapboard siding, eight double-hung windows, and a pedestrian door in the end wall. Its shed roof is covered with rolled asphalt roofing. Scott Farm, Garrison Township, Crow Wing County, 2003. (Gemini Research photo)

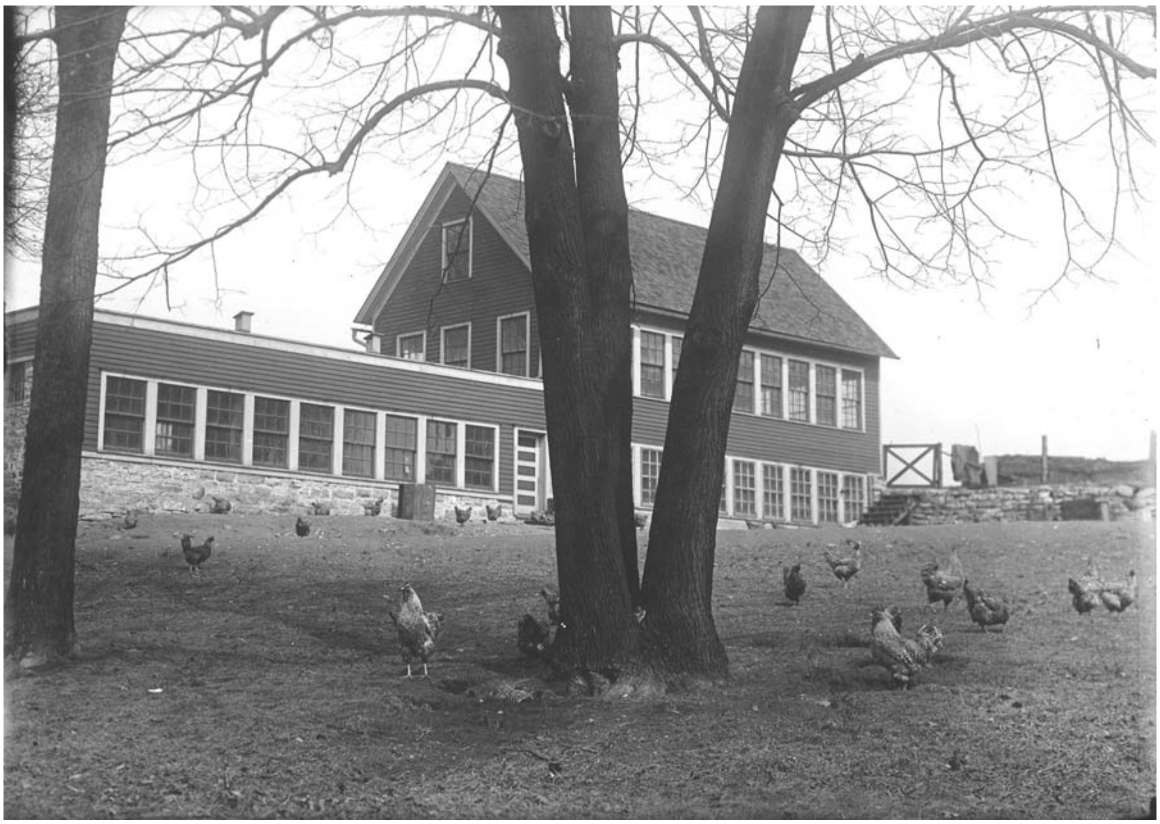
Most poultry houses were built of wood so they would be warm and dry. This house had a broody coop made of wood and poultry netting (mounted in the upper corner near the ceiling) where hens sat on eggs for new chicks to replenish the flock. Along the left wall were roosts on which the birds could settle over a droppings board that was removable to facilitate cleaning. Near the lower left corner of the photo were nesting boxes. The floor of the house was covered with straw bedding. This photo, which is in the MHS archives, also appears in Cora Cooke's 1925 article "House the Flock for Comfort" (*Minnesota Farmers' Institutes Annual*). Location unknown, circa 1910. (MHS photo)



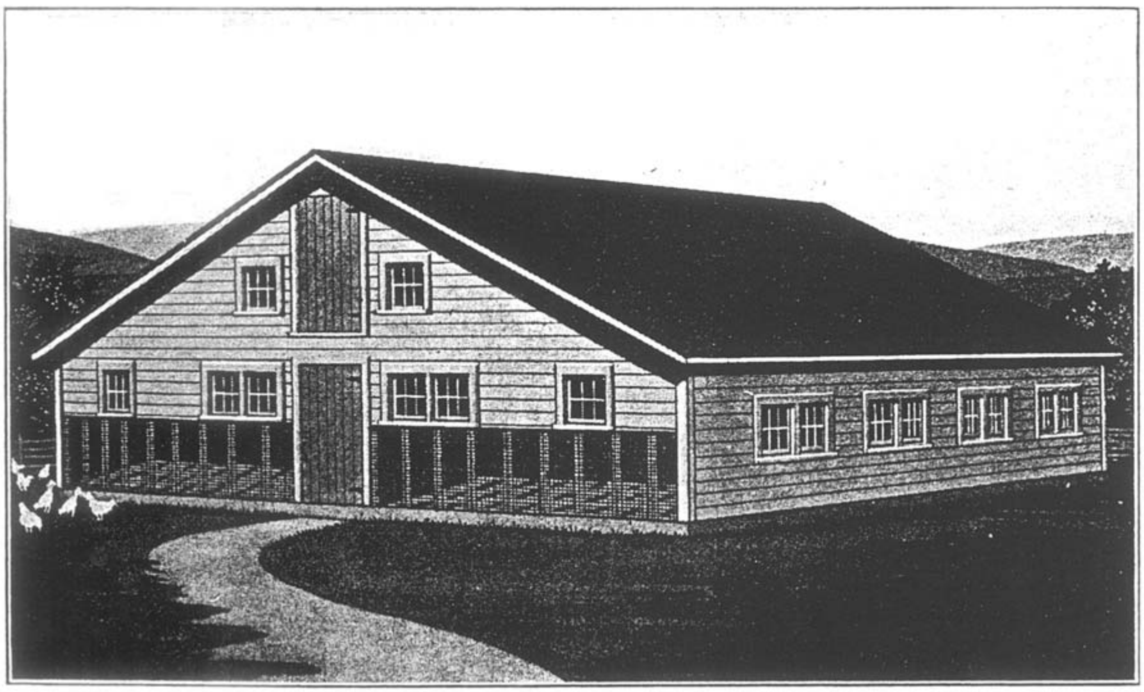
This photo in the Minnesota Historical Society collection was also featured in the 1923 Minnesota Agricultural Extension Service bulletin by G. A. Lundquist entitled "What Farm Women are Thinking." The building had nesting boxes attached to the wall, a feed trough, and a metal stand that was probably used for a heater. The upper portion of the dividing wall (upper right corner of photo) was made of poultry netting to facilitate air circulation. Location unknown, circa 1910. (MHS photo)



A steel poultry house available in the 1930s. It was sold in modular sections to make a building either 20′ x 14′ or 20′ square. From *Successful Farming* (Oct. 1933).



Improvements in poultry farming included selective breeding, reducing disease through better building design and sanitation, and optimizing feed mixtures. These advances spurred continual increases in productivity after 1920. Two-story poultry houses like the one shown here were uncommon in Minnesota, but some farmers built them where land values were high. Location unknown, circa 1925. (MHS photo)



Around 1950 the National Plan Service was providing plans for this 40' x 40' poultry house with a storage loft for feed and bedding. The lower 4' of the front wall was entirely covered with woven wire fencing for ventilation, anticipating the open sides that would become standard on large poultry houses in subsequent decades. From *Practical Farm Buildings* (ca. 1950).

▪ POWER HOUSES

- Power houses were usually small woodframe buildings
- Stationary gas engines were used by 1900
- Before the 1930s a significant number of farms generated their own electricity for lights and small appliances
- The most common method for generating electricity was a gasoline engine with a generator and storage batteries

In the years before electrification, many Minnesota farms used a stationary gas engine to provide power for chores, or to generate electricity. Such engines and generators were commonly housed in a small woodframe building called a power house.

Power houses were often free-standing buildings located near the farmhouse or between the farmhouse and barn. These were small, insulated buildings, often woodframe, with a footprint that might be 8' x 8'. Engines and batteries were usually mounted on a raised platform, often concrete, to protect them from moisture. The house often had an outlet hole for the gasoline exhaust (Brooks and Jacon 1994: 66).

STATIONARY GAS ENGINES

Farm engines that burned gasoline or kerosene were available by 1895, and by 1912, there were many brands of engines providing one to ten horsepower. Farmers used these engines to run all kinds of machinery, including corn shellers, grinding mills, grain cleaners, feed choppers, silo fillers, hay balers, concrete mixers, water pumps, lighting plants, washing machines, butter churns, cream separators, tool grinders, saws, lathes, and post drills. While useful, early gas engines were unreliable, especially in cold weather. When farms were electrified, stationary gas engines were generally replaced with cheaper, safer electric chore motors (Barlow 2003: 131).

ELECTRICAL GENERATION EQUIPMENT

In Minnesota electricity was little used on farms before 1917 although "an occasional farm had electricity as early as 1909," according to the University of Minnesota. It was estimated that about five percent of all Minnesota farms had electricity in 1929, and that the larger and more prosperous the farm, the more likely it was to have electricity. Most of these electrified farms were generating their own electricity, rather than receiving it from outside transmission lines (Cavert 1930: 8, 11, 67). (See "Utility Poles and Equipment," another individual farm elements section, and the essay entitled "Focus on Farm Electrification" in this report's appendices for more information on electrification.)

In 1939, about five percent of Minnesota farms (or about 9,760 farms) were lighting the farmhouse with electricity generated on the farm. Three parts of the state were above the state average: six

See also

Utility Poles and Equipment
Windmills
Water Power Structures
Appendix: Focus on Farm Electrification

percent of farms in the southeastern counties, seven percent of farms in the southwestern counties, and eight percent of farms in the Red River Valley were lighting the house with home-generated electricity in 1939. This compares with about 25 percent of Minnesota farms in 1939 that were lighting the farmhouse with electricity from an outside line (Engene and Pond 1944: 28).

The most popular farmstead electric power plant (also called "lighting" plant) was the gasoline-powered engine that drove a generator, which was combined with a set of batteries for power storage. Other methods of generating power – including wind power generators and water power generators – had to rely on steady wind or water flow and were less popular (Musselman 1912: 136; Mowry 1915: 4-5; Keilholtz 1921: 109; Kline 2000: 99-104; Wolfe 2000: 522).

The average farm plant produced only about one kilowatt of electricity – just enough for lights and a small motor. Home electric plants rarely powered major home appliances because their generating capacity was too low, and because electrically-powered barn equipment generally took priority over household uses. Several surveys in the 1920s and 1930s, however, found that farm families used home power plants mainly for household tasks such as lights, ironing, and running the washing machine and cream separator (Kline 2000: 104; Jellison 1993: 99).

The gas-powered engine that ran the electricity generator was often portable and often used for other purposes on the farm. Keilholtz wrote in 1921, ". . it was common practice to cart the engine anywhere about the place for ordinary gas engine jobs" such as separating cream, pumping water, sawing wood, running grinders, or washing clothes. Because the gas-powered engine was often taken away from the generator, a bank of batteries was often needed so that "electricity was available, theoretically anyway, without running the engine all the time" (Keilholtz 1921: 109).

In addition to supplying electricity for lighting, the farmstead electrical plant could also power a small stationary electric motor for running a grinding stone, corn sheller, fanning mill, root chopper, meat grinder, or other small machine. The electricity from home generators was not recommended for pumping water. Rather, a University of Minnesota publication advised farmers to buy a small gas engine just for pumping water for the stock, thus preserving the life of the larger and more expensive home electric plant (Stewart "Electricity" 1921: 115-116).

By 1916 there were some 100 companies manufacturing farmstead electric plants. One of the most popular was the Delco power plant, made from 1913 to 1947 by Dayton Engineering Laboratories of Ohio. Typically, an on-farm Delco plant consisted of a 32-volt, direct-current system with storage batteries and an energy capacity of 850 watts. (An electric iron used almost all of the output from an 850-watt Delco plant.) By 1935 at least 367,000 Delco-Light plants had been sold in the U.S. (Kline 2000: 103).

Midwestern farms commonly installed a low-voltage on-farm system of 32 volts, which required a battery of about 16 storage cells. A 110-volt system, which required a battery of about 60 storage cells, was too expensive for most farms. The low 32-volt system was not recommended if farm buildings were widely scattered, however, because the transmission wires required for a low-voltage system were too large to be practical for long distances (Keilholtz 1921: 110).

The basement of the house was probably the most common place for the farmstead electrical plant (Kline 2000: 104). But agricultural engineers suggested placing the plant in or near the building where most of the current would be used (Keilholtz 1921: 110). This saved installing long lines of expensive wire. "For example, don't place the electric plant at the house if there is only a moderate usage of current there, [and if] it is planned to run a milking machine twice a day at the barn with a 1/2, 3/4, or 1-horsepower motor" (Keilholtz 1921: 110).

Farmstead electric plants were one of the most complicated technologies on the farm, delicate, and often troublesome. Farmers often described the generators as notoriously unreliable. The engines were usually gas-powered, but some used other fuels, such as natural gas, liquid propane gas, alcohol, or kerosene. Early engines had to be cranked by hand to start them. Later self-starting engines were an improvement (Keilholtz 1921: 109; Wisconsin Motor 1960: 651).

After 1935, as centralized high-line power service became available, the number of farm electrical plants began to decline. However, some farmers who had already invested in gas engine-powered pumps, milking machines, and milk coolers were somewhat slow to adopt electricity because they felt that discarding working equipment would be wasteful and foolish (Schaenzer 1957: 447; Kline 2000: 208).

By 1954, the USDA estimated that there were about 28,000 home electrical plants in use on American farms (Schaenzer 1957: 445).

PREVALENCE

Many farms had a stationary gas engine or electric generator sheltered in a power house. It is likely that many power houses were eventually converted to other uses such as storage. Some may still be standing.

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A power house (left), grinding tool (front), and granary (right). Both buildings were covered with pressed metal siding simulating brickwork. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

It was common on Minnesota farms to use a gasoline-powered generator to produce electricity for lighting, and to move the gasoline engine around the farm to power equipment that would saw wood, separate cream, sharpen tools, or wash clothes. Location unknown, circa 1925. (MHS photo)

■ PRIVIES

- Earth vault privies were the simplest type
- Concrete vault and dry earth privies were recommended as more sanitary
- Still constructed in the early 1950s

Privies, also called outhouses, were small, unheated, outdoor toilets used before indoor plumbing became available on farms. They were usually square or rectangular woodframe buildings with gable or shed roofs. A typical outhouse might be 4' square. Most had vents in the gable ends and a small, high window. Many were portable (e.g., rested on skids) and could be moved to new locations as needed. Inside the building was a raised wooden toilet seat with one or more openings, sometimes covered by hinged wooden lids.

Early farm privies were usually earth vault (also called earth pit or deep vault) toilets that had an open pit underneath the building. The outhouse was moved when the pit became full. Farm educators excoriated the use of earth vault privies. In 1901 F. L. Marsh wrote in *Farmers' Institutes Annual* wrote: "That horrible abomination, the deep vault, is in common use in country and village. It should never be used. It is not only offensive, but forms a hotbed for the breeding of such disease germs as those of typhoid fever. The contents are continually draining down into the soil, where the germs will live for a long time, and there is often danger of their reaching the well" (Marsh 1901: 136).

The concrete vault privy was considered more sanitary. This style of outhouse sat over a poured concrete vault that had to be periodically cleaned out. It was recommended that the entire privy be raised on a concrete foundation.

Another style, the dry earth privy, also rested on a stone, brick, or concrete foundation. Underneath the toilet seat was a moveable, water-tight galvanized iron box, sometimes mounted on runners. A hinged door at the rear of the privy allowed the box to be removed periodically and emptied. Inside the building, next to the toilet seat, was a box containing fine dry earth, peat powder, or slaked lime. This was frequently sprinkled in the box to speed decomposition (Marsh 1901: 136; *Farm Building Plans* 1953).

Privies were usually located a "prudent distance" from the well and farmhouse and were moved as needed (*Minnesota Farmscape* 1980: 5). Dry earth privies were sometimes attached to other buildings or placed in the space between two buildings (Marsh 1901: 138).

The 1940 census indicated that only 12 percent of Minnesota farmhouses had running water. The University of Minnesota's Vernon Davies wrote in 1947, "Minnesota does not make a favorable showing in comparison with other states with respect to water and bathroom facilities and mechanical refrigeration. There was a higher proportion of flush toilets in farm homes in 32 other states, running water and private bath in 33 other states, and mechanical refrigeration in 37 other

See also
Cesspools and Septic Tanks
Farmhouses

states according to 1940 census data. Only North Dakota, South Dakota, and Missouri in the Midwest show a lower ranking" (Davies 1947: 10). Minnesota farmhouses also lagged far behind its urban houses in modern conveniences.

In the early 1950s the University of Minnesota was still publishing plans for farm outhouses (*Farm Building Plans* 1953). As late as 1960, 20 percent of Minnesota farmhouses still did not have running water and indoor toilets (Jellison 1993: 55, 169).

PREVALENCE

Privies were built on virtually all Minnesota farms. Some are still standing – both examples that are intact and some that were altered for other purposes after indoor plumbing was installed.

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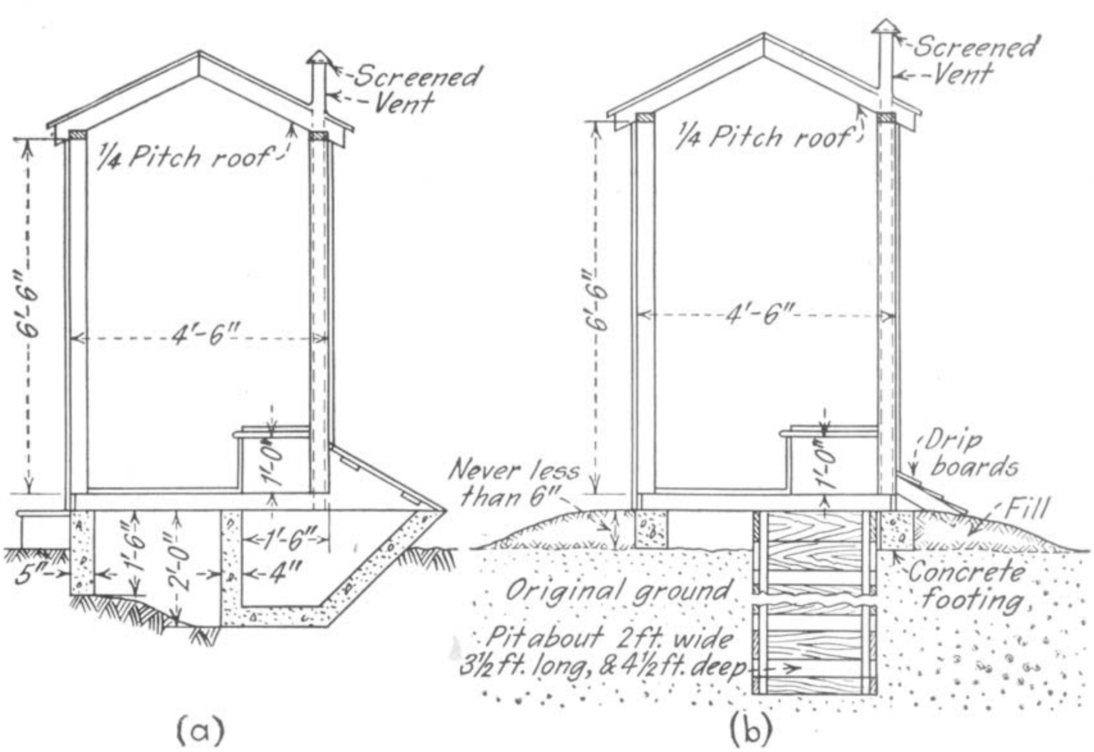
A farm privy or outhouse near Apple Valley, 1951. In 1940 Minnesota ranked 33rd among states in the number of farmhouses with flush toilets. (MHS photo)



This drawing illustrates a concrete vault privy on the left and an earth vault privy on the right. From Wooley's *Farm Buildings* (1946).

▪ PROPANE GAS STRUCTURES

- A pressurized gas used for heating, cooking, and operating crop dryers and other equipment
- Propane tanks were often located near the farmhouse or in the farmyard
- Bulk tanks likely date from the 1940s or later

Propane gas is a fossil fuel found underground mixed with natural gas and petroleum. It is stored in liquid form in pressurized tanks. Propane is the most common of several "liquefied petroleum" or "LP" gasses, and the terms "propane gas" and "LP gas" are often used interchangeably.

Propane was first "bottled" and sold in 1912, about two years after it was discovered. In 1927 the first domestic propane gas appliances were developed. The principal industry group was organized in 1931 as the National Bottled Gas Association. Sales of propane gas and gas-burning appliances and equipment increased considerably after World War II (National ca. 2002).

Fixed propane bulk tanks were generally located above ground in the farmyard mid-way between the farmhouse and another building in which the gas was used. Farms also used portable "bottles" or cylinders of propane that were installed on pads or racks on the side of farmhouses and other buildings.

Farm bulk tanks were refilled by propane dealers (including farmers' cooperatives) who drove to farms in tanker trucks. Dealers also delivered bottles of gas, or farmers picked them up on trips to town.

Today about one-half of U.S. farms use propane to heat farmhouses and other buildings and to fuel equipment like crop dryers and chicken brooders.

PREVALENCE

Propane tanks and associated equipment are found on farms throughout Minnesota. Most likely date from the 1940s and later. Examples that predate that era are probably uncommon.

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See also

Farmyards
Power Houses
Farmhouses

Bulk propane tanks usually stood near the farmhouse, or between the farmhouse and another building in which the fuel was needed. Propane was commonly used for heating and cooking, as well as for drying crops, fueling brooders, etc. Scott Farm, Garrison Township, Crow Wing County, 2003. (Gemini Research photo)

■ PUMPS AND PUMP HOUSES

- Pumps were found on nearly all farms to pump water from wells, springs, lakes, and cisterns
- Pumps were powered by hand, wind, or gasoline or electric motor
- Pump houses protected pumps from freezing

One of the essential features on almost every farm was the pump. Except for artesian wells, most wells required a pump to raise the water. These pumps used air pressure to force water up through a pipe. They could be powered by hand, by a windmill, or by a gas or electric motor (Stewart 1922: 13). (See also "Wells," "Windmills," and "Cisterns," three other individual farm elements sections.)

There were many types of well pumps. Simple, hand-operated pitcher pumps were commonly used indoors to pump water from a cistern. Pumps with drop cylinders, which had to be submerged in water, were used in shallow wells that had been dug or bored. For deeper wells, suction and force pumps were used. These types of pumps were capable of lifting water through a long pipe or into an elevated tank (Brooks and Jacon 1994: 67, 71; Stewart 1922: 13-15).

Pumps commonly used for irrigation were horizontal and vertical centrifugal pumps, deep well turbine centrifugal pumps, and plunger and air lift pumps (Brooks and Jacon 1994: 67, 71; Stewart 1922: 13-15).

To prevent freezing, pumps could be located above ground in an insulated pump house or underground in a covered dry well. Pumps were sometimes used with pressurized water tanks, which also could be housed in the well pit (Marsh 1902: 65; Stewart 1922: 11; Brooks and Jacon 1994: 72).

In artesian wells, natural pressure on the water table automatically delivers water to the surface. A 1933 USDA bulletin advised farmers to use heavy casing and valves to regulate the water flow and preserve their artesian wells (Brooks and Jacon 1994: 73).

When the farm had a good spring, a hydraulic ram was a simple and cheap way to pump water. This device harnessed the energy of the water flowing downhill through a pipe and into a circular pressure chamber. It produced an intermittent, but reliable, stream of water (Mowry 1914: 99-100).

Farms could also pump lake water by using a siphon pipe. It could raise the water as much as 25' above the lake to fill a cistern (Stewart 1922: 6).

Pump houses were small buildings that housed pump machinery. They were often located at the base of a windmill. They were usually one-story, square or rectangular woodframe structures with poured concrete floors. The floor usually sloped away from the pump platform to promote drainage. Pump houses had to be insulated or heated to protect the pump from freezing (Brooks and Jacon 1994: 66-67).

See also
Wells
Windmills
Water Tanks and Tank Houses
Cisterns

University of Minnesota specialists urged farmers to use insulated, above-ground pump houses rather than well pits, because "the pump and machinery can be kept dry, clean, and sanitary and the equipment is easier to reach for service and repairs" (Brooks and Jacon 1994: 67). Elevated water tank houses for storing water were sometimes built above pump houses (Stewart 1922: 2).

PREVALENCE

It is assumed that historic pump houses are likely to be extant on some Minnesota farms. Many were likely converted to other uses such as storage when they were no longer needed.

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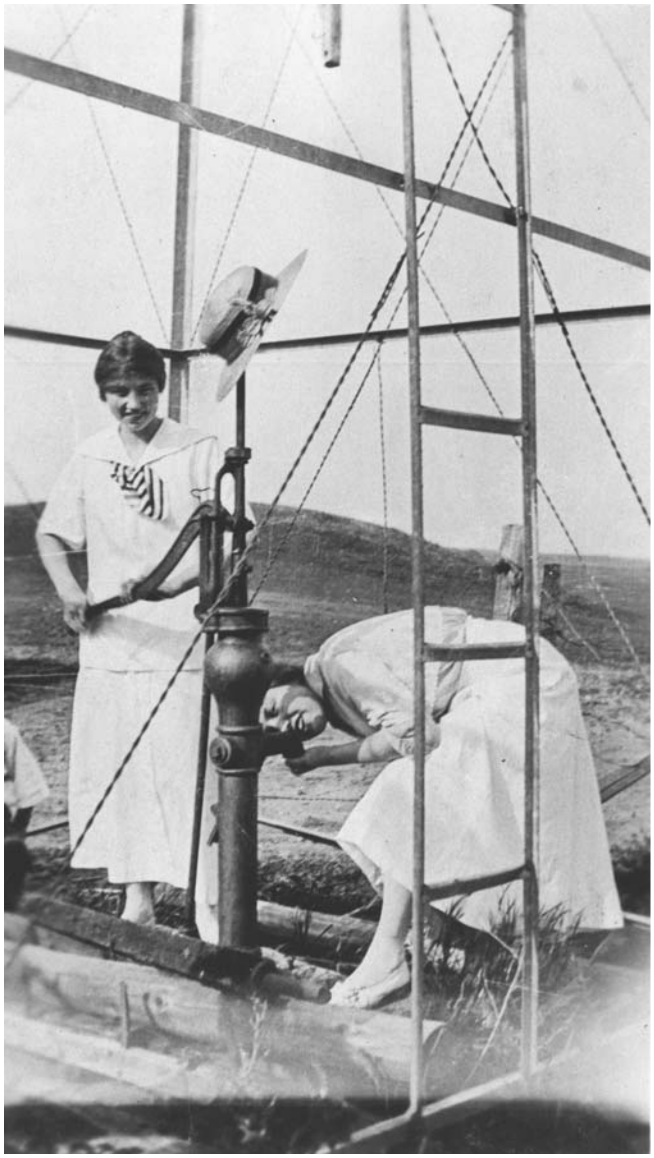
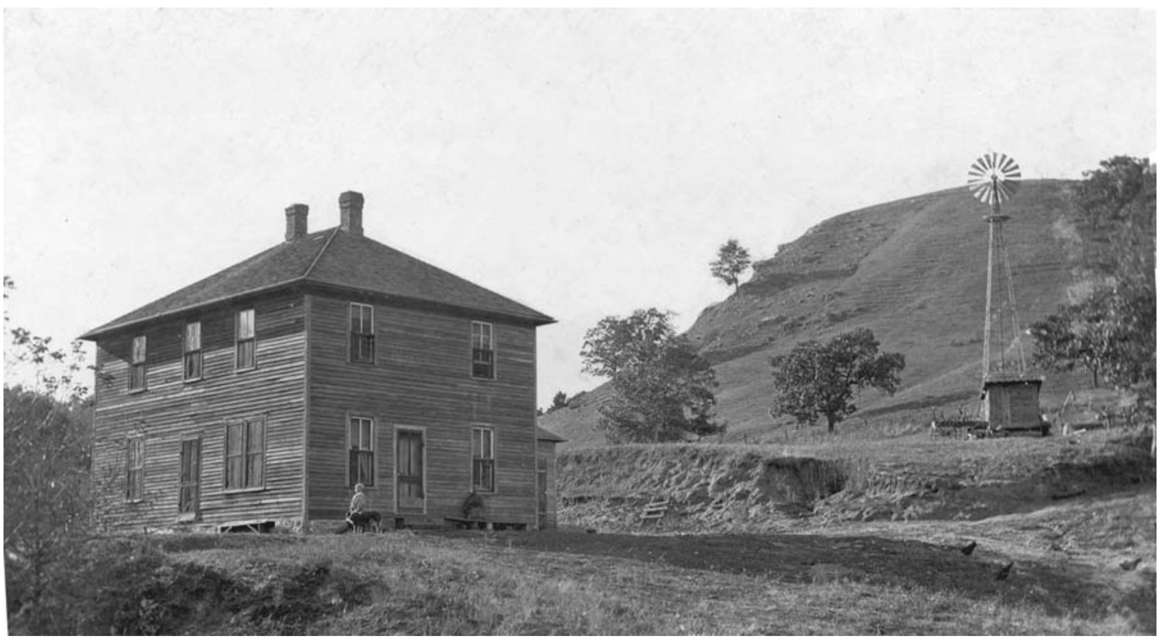
A hydraulic ram could be used if the farm had a good spring. It worked with the energy of the spring flow to produce an intermittent but reliable stream of water. Location unknown, circa 1920. (MHS photo)



A hand-operated well pump at the base of a steel windmill tower. Photo taken near Nassau in Lac qui Parle County, circa 1912. (MHS photo)



A pump house at the base of a windmill. Photograph taken near Welch in Dakota County, circa 1909. (MHS photo)

■ ROADS, LANES, TRACKS, SIDEWALKS

- An efficient farm road system minimized the amount of land devoted to roads and lanes
- Narrow unimproved lanes led between buildings, from farmstead out to fields and pastures, and between fields and pastures
- Livestock tracks were narrow well-worn paths made by animals
- The preferred driveway approached the house from one side

PUBLIC ROADS

In many parts of Minnesota – especially where flat topography permitted it – public roads were created along the section lines of the original Public Land Survey. These lines tended to form the boundaries of individual farms, rather than traveling through them. Straight roads were not the rule, however, and many public roads were winding and crooked because they were routed to bypass steep hills, lakes, ponds, and other low areas (Wayne 1977: 22).

Public roads sometimes evolved from private farm lanes or "cartways." Cartways were sometimes 16' or one rod wide, while public township roads were 32' or two rods wide.

Township and other public roads were used by farmers to access fields that were discontinuous from the primary farm. Geographer John Fraser Hart explained, "In Minnesota many local roads, which at first glance might be considered nonessential because no dwellings front on them and they carry little traffic, are actually vital because they provide the shortest routes between farmsteads and noncontiguous tracts of land" (Hart 1975: 87).

Mechanization advanced the construction of public roads. While horses could handle uneven trails with mud and ruts, the adoption of farm cars and trucks with their smooth tires spurred the improvement of hard-surfaced, all-weather rural roads. At first farmers only used their cars in good weather because of poor rural roads. The number of automobiles on American farms more than doubled between 1920 and 1950, and the number of farm trucks increased eighteen-fold during the same 30-year period. By 1953, there were 4.4 million farm automobiles and 2.6 million farm trucks in this country, and roughly two-thirds of American farms were located on an improved road (Cavert 1956: 20-25).

Farms on unimproved roads were at a big economic disadvantage. "When everybody lived on a mud road and used horses, it didn't make much difference whether one lived on a main road or on a side road," wrote one historian in 1956. "Today, being off the good road may mean lack of a milk pickup, of school bus facilities, and in some cases, the lack of electricity and telephone service" (Cavert 1956: 25).

See also

Roadside Markets
Animal Underpasses
Cattle Guards
Garages
Farms
Boundary Markers

For decades farmers were largely responsible for the maintenance of public roads in rural Minnesota. Farmers were taxed for road maintenance, an obligation they paid in either cash or, more often, road-dragging labor. In the 1910s and 1920s state road and bridge funding and the state highway department were established, and local governments began to buy equipment to maintain rural roads. As a practical matter, however, many farmers took it upon themselves to drag, grade, and clear snow from the public roads near their farm. This practice continues today on little-used township roads.

Motor transportation and improved roads made consolidated school districts and agricultural extension programs feasible. Cars and better roads "greatly enlarged the shopping area and widened the horizon of farm families" (Cavert 1956: 20). And mechanized transportation brought big changes in how farm products were marketed and distributed, creating global markets – and global competition (Cavert 1956: 20-25; Hart 1998: 374).

Farm Roads, Lanes, Cartways. Private routes within a farm were usually called roads, lanes, or cartways. The distinction sometimes depended on their width and level of improvement. Lanes or cartways were often narrow, generally unimproved routes that led between buildings, led from the farmstead to the fields and pastures, and connected fields and pastures to one another.

Lanes or cartways sometimes developed "informally" through the continued use of a customary path. Lanes were used to move livestock and equipment around the farm in everyday operations. They were sometimes improved with small bridges or other built structures, in which case they might be called "roads" (Hart 1998: 107; Howe 1940: 6; *Farm Building Plans* 1953)

Farmers tried to arrange their fields and pastures so as to minimize the amount of land that had to be sacrificed to unproductive roads and lanes. W. M. Hays wrote in 1894, "A simple lane around two or more sides of the barn, and leading, as an artery from the heart, to all the barn lots and out to the center of the farm, communicating with all the fields is a rarely found but most convenient thing" (Hays 1894: 275). Because pastures and fields were usually fenced, farmers also tried to reduce the number of gates that had to be opened and closed (Howe 1940: 5).

Experts encouraged farmers to maintain the roads and lanes within the farm. The University of Minnesota's Andrew Boss advised in 1914, "A day or two expended annually in putting the roads on the farm in good condition will often save much loss of time" (in getting stuck in the mud, for example) (Boss 1914: 162). Tractor-drawn drags and later equipment such as front-end loaders eased this task.

Livestock Tracks. Livestock tracks or "cow paths" were narrow, worn paths made by animals, often walking single-file. Dairy cows, for example, often walked in well-worn tracks between pastures and the dairy barn.

Driveways. The main entrance driveway usually served both the house and the farmyard. It had to be wide enough for farm vehicles and was usually sloped to reduce snow drifting. To be serviceable all year round, it also needed a gravel or hard surface (Snyder 1950: 5).

Driveway location and length was dependent on farmstead layout. In the late 19th and early 20th century, it was recommended that farmsteads be placed in the center of farms to provide the most efficient access to surrounding fields, which was particularly important when relatively slow draft horses were used. By the 1910s competing theories were recommending that farmsteads be placed closer to the public road. According to the University of Minnesota's Boss and Pond in 1951, this arrangement "avoids the necessity of maintaining an all-weather road [driveway] from the public road to the farmstead. In northern climates it may require considerable effort to keep a long lane free from snow in winter. In the days of horse travel this was not so important [because horses could walk over snow and sleighs were used] but with practically all road travel motorized it is important to keep a road open and passable at all times" (Boss and Pond 1951: 161). They also point out that "passing travel will create interest and break the monotony of daily routine in the household" and that telephone and electrical lines are more accessible if the driveway is shorter and the farmstead closer to the public road (Boss and Pond 1951: 161).

The preferred entrance drive approached the house from one side, then passed near the service door at the back of the house, and led to the garage. A good driveway arrangement included a turn-around area near the service door, and parking near the main entrance of the house to encourage visitors to come to the main door. The main drive usually branched off to the farmyard, which served the barns, stockyards, grain and feed storage buildings, and other business areas. Snow drifting patterns were also important in driveway placement (Cady 1919: 2; Snyder 1950: 5; Hunt 1937: 8, 12; *Farm Building Plans* 1953).

Sidewalks. Sidewalks were desirable near the house. Usually made of poured concrete, they provided a safe, hard surface for walking, led visitors to the main door, highlighted interesting features of the landscape, and kept the house cleaner. Farmers were advised to install one sidewalk leading from the parking area to the main door and another leading from the back door into the farmyard (Hunt 1937: 10; Snyder 1950: 5).

PREVALENCE

It is expected that roads, lanes, and driveways will be found on virtually all farms in all parts of the state, but may have been altered. Historic sidewalks may be less prevalent. Livestock tracks will be most evident in permanent pasture areas or on other land that has escaped tilling.

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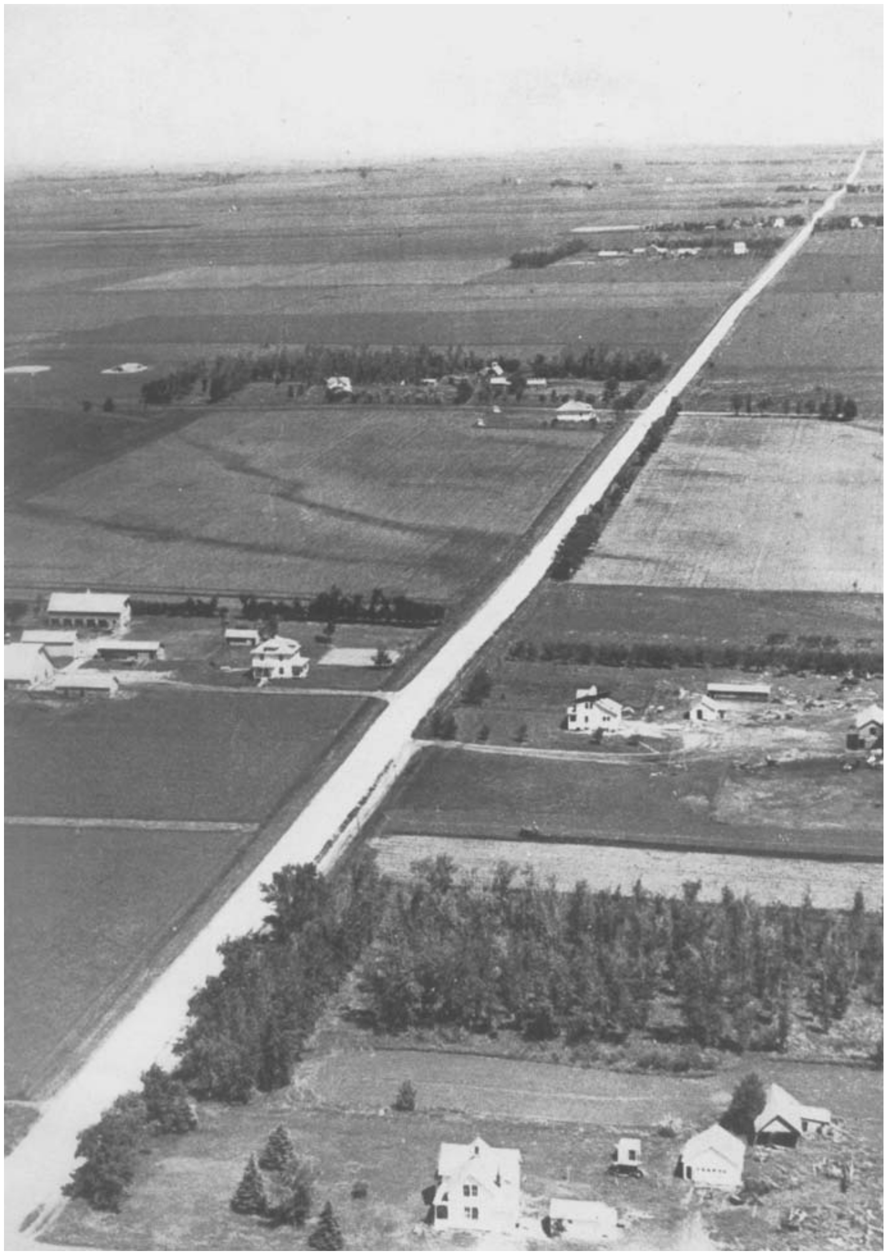
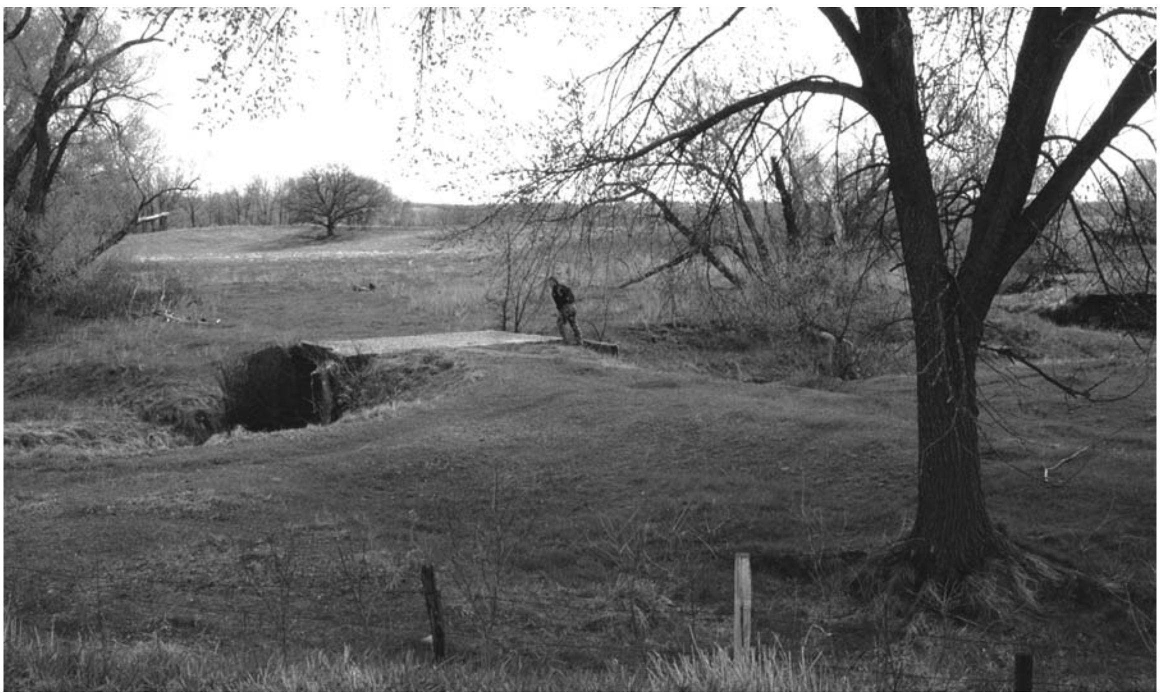


This circa 1950 aerial photo shows a hierarchy of public road, driveways, and smaller field lanes. This was a prairie area, judging by the windbreaks and the straight, unwavering public road, which was aligned north and south. From *Modern Farm Management* by University of Minnesota professors Andrew Boss and George Pond (1951).

A well-landscaped farm driveway. Photo taken near Duluth, 1935. (MHS photo)

Even as early as circa 1900 this farm had a neat lawn with a sidewalk near the house. Holton Farm, Lac qui Parle County, circa 1900. (MHS photo)



Narrow lanes or cartways connected buildings, linked the farmstead with fields and pastures, and formed routes between fields and pastures. Stearns County, 2004. (Gemini Research photo)

A well-worn livestock track along the edge of a stream. Most were made by animals walking single-file. Stearns County, 2004. (Gemini Research photo)

■ ROADSIDE MARKETS

- Small woodframe market structures used for selling seasonal produce
- Usually located along well-traveled highways
- Popular between about 1915 and 1965

Roadside markets or stands were generally used on farms that were located adjacent to well-traveled roads. They became fairly popular in Minnesota with the advent of autos, and were common through the 1960s. One author wrote circa 1950, "The automobile traffic on public highways has made it possible for farmers in many sections of the country to build up a good retail trade with steady customers" (National Plan Service ca. 1950).

Small market stands were operated seasonally by farm families who sold "farm fresh" fruit, vegetables, eggs, poultry, milk, cream, honey, and other products. The University of Minnesota's Andrew Boss and George Pond, writing in 1951, cautioned farmers, "The gain in prices received for goods sold must be sufficient to pay for the time of the attendant who gives the service," and concluded, "Roadside markets can not be given a blanket endorsement. Many of them tell their own story of disillusionment by rusty signs, and dilapidated housing or abandonment" (Boss and Pond 1951: 336).

Three popular plan catalogs for farmers, all released around 1950, contained plans for about eight styles of roadside markets. Some of the markets depicted were permanent, while others were portable to offer flexibility of location. All were one-story woodframe structures, and most had gabled roofs. Some markets had roof projections to protect customers during inclement weather (National Plan ca. 1950; National Plan 1951; *Farm Building Plans* 1953).

The smallest structures measured 3' x 4' and 6' x 6' while the largest was 16' x 20'. One structure depicted in the plan catalogs had a counter on which produce could be displayed and cash exchanged. Both sellers and buyers stood outside of the simplest open-walled structures, while the most elaborate were fully enclosed with display shelves and bins. One variation offered a lunch counter. Several markets had hinged doors and shutters that were hooked to the ceiling when the stand was open, but could be closed tightly during the off-season.

PREVALENCE

Farm roadside market stands were built along busy roads throughout the state. They may have been especially popular near the edges of towns and in recreational or tourist areas. Some are likely to have survived, although those built of strong materials may have been adapted to other uses, and those made of more flimsy materials may be in very poor condition.

See also

Orchards
Gardens (Vegetable)
Greenhouses, Hotbeds, Coldframes
Roads, Lanes, Tracks, Sidewalks

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An "attractively arranged" roadside market depicted in a 1951 text on farm management written by University of Minnesota faculty. From Boss and Pond's *Modern Farm Management* (plate 22).

■ ROOT CELLARS

- Essential for the storage of food for the kitchen, crops for sale, and livestock feed
- Located near the kitchen, near the livestock barn, or between the farmhouse and fields
- Several forms were popular
- Ventilation flues were important

On nearly all Midwestern farms, some form of "root" or vegetable storage cellar played a crucial role in family and business operations, particularly before the advent of electric refrigerators and freezers. Jaakkola and Frericks wrote that prior to electrification, "storing food was a major challenge" that involved canning, pickling, smoking, drying, and curing, as well as cold storage. Food needed to be preserved for home use, for cash sale, and for livestock feed. Root cellars were also known as "storm" or "cyclone" cellars because they could provide refuge during severe weather.

A 1999 study by Rivercrest Associates found "the root cellar was by far the most common" ancillary structure on farmsteads in Minnesota's cutover region [presumably after the outhouse] (Henning et al 1999: 54).

Farms that sold market produce could increase profits with a root cellar. Adequate storage meant farmers could time their sales and avoid glutting the market with too much produce when prices were low. (Some farms that raised apples or other fruit also had the option of paying to store their crop in a communal commercial facility.)

Root cellars stored a wide variety of produce and crops including apples, carrots, turnips, squash, potatoes (for eating and seed), salt pork, smoked meat, eggs, milk, cream, butter, and cheese (Noble 1984: 88). Eggs could be held for six weeks if conditions were correct. While sometimes used by necessity, the root cellar did not work well to store dairy products because the cream and butter picked up the taste of the stored vegetables (Jaakkola and Frericks 1996: 28).

The number of root cellars increased in the early 1900s as farms raised more livestock and used more root crops such as rutabagas, turnips, and mangels as livestock feed. This was especially common in areas like northeastern Minnesota where growing sufficient quantities of corn was difficult.

Some root cellars were built within or adjacent to a livestock barn. Some were located adjacent to the farmhouse foundation and accessible from either outside or from the basement. Others were located closer to the fields.

Borrowing from their ancestors' resourcefulness, Minnesota's earliest settlers constructed small cellars from the materials at hand including packed earth, logs, and fieldstone rubble. Those settlers near rivers used river bluff caves for the same purpose. Root cellars then became more elaborate.

See also

Potato Warehouses
Springhouses and Springboxes
Icehouses
Dairy Barns
Appendix: Focus on Minnesota Crops

A small cellar might be 8′ x 10′, and a large structure 20′ x′ 36′ (Midwest Farm 1937). To maximize their effectiveness, cellars needed to control temperature, humidity, circulation, and light (Structural 1941). All were low, windowless structures.

Air circulation was especially important during the first three to six weeks of storage. Vegetables during this time go through a "sweating" period during which they give off heat and excess moisture, and ventilation is crucial. Most cellars used passive flues to move the air. After World War II, some farms used electric fans (Hotchkins and Hunt 1943: 4; Moore et al 1920: 590).

Within the cellars, farmers used slatted wooden baskets or bins that allowed air movement through the produce (Kelley and Amundson 1933: 9). Some cellars also included racks, shelves, barrels, and boxes.

Root cellars were built in several common forms:

Pit Storage. Simple pit storage consisted of wooden barrels filled with produce placed into the ground and then covered with dirt and straw to maintain the proper temperature – neither freezing nor warm enough for sprouts and rot. Air intakes, long aluminum or steel pipes, were built into these pits to allow the movement of air (Hotchkins and Hunt 1943: 6).

Ground Cellars. Ground cellars were built into the ground but with an outside entryway, usually a door. Ground cellars used the cold already trapped in the soil and clay to cool the produce. They were often built into the sides of slopes to reduce digging and take advantage of natural drainage and air circulation. Southern and eastern slopes were preferred in order to protect the cellars from northwesterly winds (Pflughoeft 1914: 193).

The above-ground portion was often built of stone rubble. Some experts recommended hollow tile walls; the dead air in the tile provided "satisfactory" insulation. To prevent groundwater seepage through the tile, a cement wash provided a waterproof barrier (Moore et al 1920: 589). The upper portion of a ground cellar could also be built of curved wood covered with canvas and a cement wash.

Stand-alone Cellars. Stand-alone cellars emerged in the 1920s, but were uncommon in Minnesota. These above-ground structures had concrete foundations in areas where extreme cold temperatures might occur or, in warmer regions, concrete posts or piers to keep the produce off the ground and to aid air circulation. The raised platform could accommodate motorized vehicles for more convenient loading and unloading (Kelley and Amundson 1933: 9, 36). To prevent freezing, experts recommended that cellar walls and roofs be double-layered, leaving space in between to create insulating dead air (Midwest 1933). Some cellars were built with glazed tile and others were built of brick or clapboard. A stand-alone cellar illustrated by Carter and Foster had a width of 8′, a length of 8′ to 16′, and a ceiling height of 7′ (Carter and Foster 1941: 288).

Basement Cellars. Basement cellars in farmhouses offered farmers the convenience of storing produce close the kitchen. They were more challenging to use because ventilation could be difficult and furnaces, if located in the basement, could make conditions too warm. Experts recommended dropping interior shafts from a window to the floor. To avoid overheating from the furnace, farmers could partition a section of the basement, and seal the area with two layers of wood and insulation (Hotchkins and Hunt 1943: 8).

Outside Cellars Connected to the Basement. This type of cellar was built below ground outside the basement wall but accessed from the basement via a small door. As with other cellars, ventilation pipes and drains were crucial to maintain the proper environment for storage.

The use of root cellars for home use on Minnesota farms declined in the 1950s and 1960s. During this period fewer farmers fed root crops to cattle and hogs, the last farms were electrified, more farms could afford mechanical refrigerators and freezers, transportation had improved so that farmers made more trips to the store, and pre-made frozen foods became more popular.

PREVALENCE

Root cellars of various types were built throughout Minnesota. They were especially common in the cutover. The largest root cellars may have been built on farms that fed root crops to livestock or sold produce for cash. It is likely that some well-preserved examples are still standing.

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This ground cellar may have been built of canvas stretched over curved sticks and rough boards. Note the ventilation flues. Location unknown, circa 1910. (MHS photo)

Root cellar (a ground cellar type) of Finnish construction. John Kurnicki Farm, St. Louis County, 1937. (MHS photo)

Many root cellars were built of stone rubble. Some were dug into hillsides; others were partly excavated and then banked with earth and sod. Konristo Farm, Carlton County, 1918. (MHS photo by *St. Paul Dispatch*)

A ground cellar of at least part concrete construction, covered with sod and ventilated. Location unknown, circa 1910. (MHS photo)

■ SAUNAS

- Most saunas are found in northeastern Minnesota on the farms of Finnish immigrants
- The earliest saunas were smoke saunas, built from the 1880s-1920s
- Later saunas used steam created by sprinkling water over rocks heated on a wood stove
- Many saunas were rectangular structures built of logs

Large numbers of Finnish immigrants settled in northeastern Minnesota beginning in the last decades of the 19th century. While the landscape and climate of this area may have been appealing because of the "striking resemblance to their native Finland," the primary incentive to move to this part of the state were the jobs on the iron ranges which had begun shipping ore in the 1880s (Gudmundson and Winckler 1991: 11).

While some immigrants remained miners, others began to farm the marginal land. These Finns cleared the land and built farm buildings of rough hewn timber. The first structures were usually the house, cattle barn, hay barn, and smoke sauna (*savusauna*) – "the classic quartet of the rural Finnish farmstead as composed at the turn of the century on American soil" (Gudmundson and Winckler 1991: 14; Alanen 2000: 2.112-2.127).

Saunas or bathhouses are a distinctive feature of farms wherever Finnish immigrants settled (Lockwood 1988).

Finns took saunas to socialize, to bathe, and as an important ritual removed from everyday activities. Yvonne R. Lockwood wrote, "To Finnish-Americans, sauna . . . is more than a bathhouse. It links past and present, Finland and the United States, Finns and Finnish-Americans; it is an ancient tradition and a symbol of ethnic identity" (Lockwood 1988; see Lockwood for a description of sauna custom).

Farmstead buildings were often built many feet apart because of fire danger, but the sauna was frequently closer to the back door of the house than the other buildings.

The first Finnish saunas, built from the 1880s-1920s, were heated by wood fires. "The smoke from the fire that built up in the snug building was released by a small vent prior to bathing but nonetheless blackened the walls" (Gudmundson and Winckler 1991: 15)

Later saunas, most built in the early 1900s, had a wood stove upon which rocks were piled. Bathers put water on the hot rocks to create steam. Many of these saunas replaced earlier smoke saunas which were then abandoned, used for storage, or, in at least one instance, "converted to a diminutive two-stall livestock stable" (Gudmundson and Winckler 1991: 16).

Most Finnish saunas were rectangular structures built of rough-hewn logs varying in size from 10′ to 14′ in width by 18′ to 23′ in length. A few were square; one original smoke sauna, ca.

See also

Farmhouses
Housebarns

1897-1903, was 12′ square (Koop "Hill" 1989). One sauna was unusually large, roughly 16′ x 23′, and was probably planned to accommodate a big family "and possibly their friends, since it is a Finnish tradition to share sauna with neighbors" (Gudmundson and Winckler 1991: 28; Alanen 2000: 2.112-2.127).

The horizontal log walls of many early saunas have solid double-notched corner joints, logs rising from the sill to the ridge in each gable end, one small door and two windows. The wooden door was usually in a gable end and the structure most often had a brick chimney. Occasionally, larger saunas had three or four windows. Sometimes the logs extend only up to the eaves with corrugated metal covering the upper gable end. Frequently cheese cloth chinking was used between the tightly-fitting logs. Other variations featured walls sheathed completely or partially with drop siding. Some settlers covered log walls with asphalt shingles at a later date.

Some saunas rested directly on the ground, some had concrete foundations, and others had rubble stone and timber pier foundations. Gable roofs were usually covered with corrugated metal, wood or asphalt shingles, or rolled asphalt.

While the earliest smoke saunas usually had just one room – "people undressed in the house and streaked naked to the sauna" – most had two rooms separated by a log or board partition (Lockwood 1988). The changing room had a concrete or wood floor, benches, and pegs on the walls for hanging clothes. Sometimes the changing room had a small window through which light would shine from a kerosene lamp into the dark steam room.

Original saunas had one or two smoke holes, "narrow sliding wooden panel[s] on the back wall . . . used to ventilate the smoke and regulate the temperature" (Koop "Matson" 1989). Later saunas sometimes had a small window in the steam room. From one to four plank benches or platforms were placed along the walls. The sauna room usually had a concrete floor under wooden planks or pine boards over log joists.

One unusually large sauna had four rooms – a changing room, a chamber to store wood, a sauna wash room, and the steam room – no doubt to provide ample space for a large family and friends (Gudmundson and Winckler 1991; Koop "Nelimark" 1989; Alanen 2000: 2.112-2.127).

PREVALENCE

Although some saunas may be found on farms elsewhere in the state, they are primarily seen, and sometimes still in use, in northeastern Minnesota on farmsteads settled by Finnish immigrants and their descendants. They are likely to be rare.

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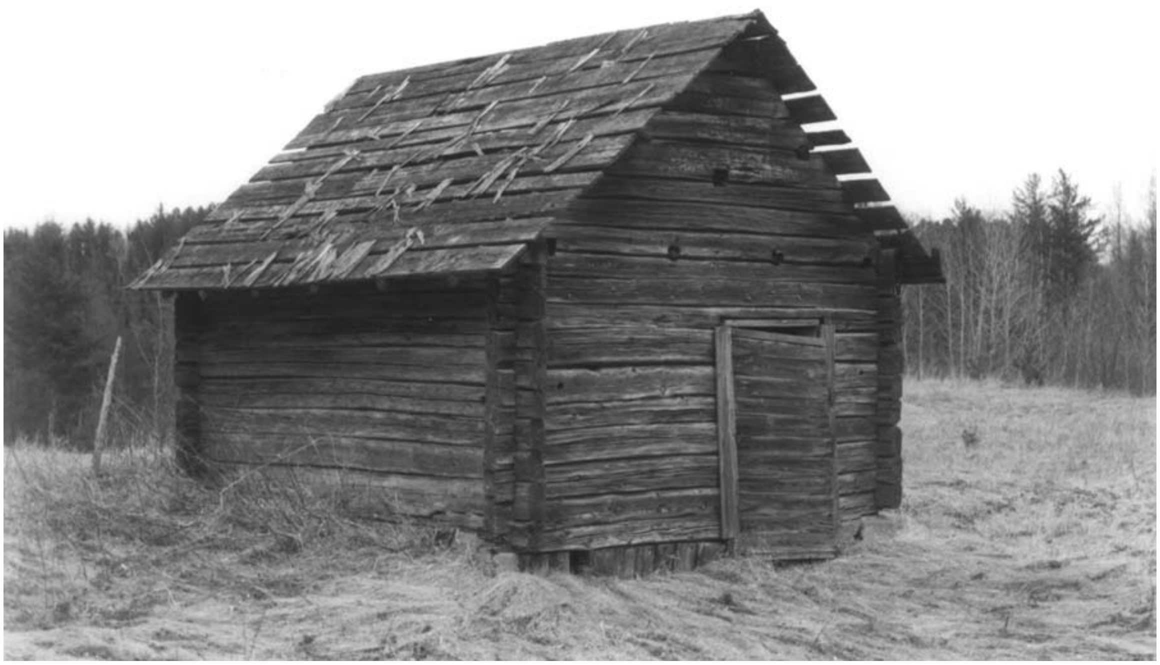

A 10′ x 18′ log sauna built circa 1920 by Finnish immigrants to northern Minnesota. Hill Farm, Pike Township, St. Louis County, circa 1988. (MHS photo by Michael Koop)

▪ SCALE HOUSES

- Small woodframe sheds built to shelter scales used to weigh crops or livestock
- Found primarily on large farms

Scale houses sheltered farm scales used to weigh products like crops and livestock. A National Plan Service catalog from circa 1950 that was marketed in the Midwest indicated, "Scales are becoming quite common on large farms" (National Plan Service ca. 1950).

Scale houses are especially associated with the rise of Minnesota livestock industries in 1900 through the 1940s. It is not clear how many Minnesota farms built scale houses, however. Rather than having their own on-farm scale, it is believed that most farmers had their crops weighed at the elevator and their animals at the stock exchange or slaughterhouse. However, producers specializing in livestock may have used scales in scale houses to help track weight gain and feeding regimes.

Geographers Noble and Cleek described a typical scale house as a "simple, tunnel-like structure with open gables" (Noble and Cleek 1995: 157). The scale house in the National Plan Service's circa 1950 catalog was a gable-roofed, woodframe structure that resembled a small garage with no gable end walls. The building measured 13.5' x 17.5' and was tall enough for a vehicle and wagon to be driven through it. The house sheltered a 3-ton capacity scale mounted in a below-grade pit. The plan suggested that moveable gates could be used to corral livestock onto the scale (National Plan Service ca. 1950).

PREVALENCE

It is suspected that scale houses were not prevalent on Minnesota farms. It is not known how many may be extant.

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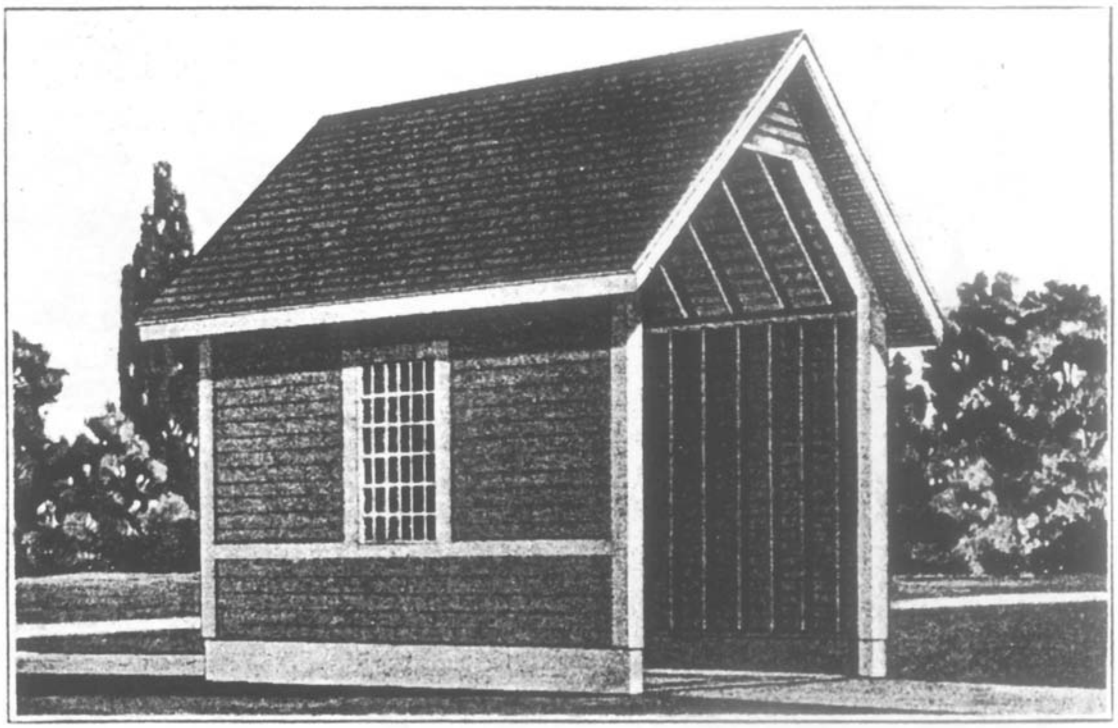
See also

Granaries, Elevators, Bins, Dryers
World War II & Postwar, 1940-1960



This woodframe scale house sheltered a scale on which crops or livestock could be weighed. From the National Plan Service's *Practical Farm Buildings* (circa 1950).

■ SHEEP BARNS

- Except when lambing, sheep needed little shelter and were often raised with only make-shift winter protection
- Sheep barns often resembled beef barns with open sides but with more interior partitions
- Two-story barns offered storage for hay and bedding, one-story barns often required a nearby storage structure
- Barns designed specifically for sheep were not common in Minnesota

In 1895 Minnesota had only a few hundred thousand sheep, despite having a climate well-suited for sheep husbandry (Shaw 1895). The number grew, however, as Minnesota farms diversified into mixed crop and livestock systems over a 30-year period that spanned the turn of the 20th century. A 1914 farm publication advised that "sheep, kept in small flocks on the average farm, are a profitable asset," and University of Minnesota experiment stations, educators, and extension agents promoted sheep raising. A 1914 publication counseled that the average Minnesota farm of 177 acres could add 30 to 50 breeding ewes to its operation (McKerrow 1914: 177). Before World War II experts also recommended that sheep be allowed to graze on the farmstead lawn to keep it neatly clipped.

Sheep, like beef cattle, tended to be durable animals that required only minimal shelter from rain, snow, and the most severe cold. In fact, sheep in an enclosed barn suffered more from overheating than from cold temperatures (Ashby 1916: 25). Spending time outdoors also stimulated the appetite and increased weight gain. Before the 1950s some Minnesota farmers kept their sheep in straw buildings which provided satisfactory, inexpensive shelter (Shaw 1900: 79-80; Morris and Zavoral 1943: 4). Some experts advocated that sheep barns have a good roof but were far less concerned with the quality of the walls (Gregg 1906: 242).

A barn built specifically for sheep was the exception on Minnesota farms (Johnston 2004). Even after the introduction of winter lambing in the 1960s to help capture Eastern markets, it was typical to house sheep in structures originally built for other purposes.

Sheep barns were often sited near other farm buildings or near the house to help deter constant threats from dogs and wolves. It was common to situate the barn with the openings facing south, or so that an adjacent building could serve as a windbreak. If a sheep barn did not include provisions for storing feed and bedding, another structure was needed for storage (White et al 1936: 11).

Many sheep barns shared characteristics with other livestock housing. For example, they were best sited on well-drained land downwind from the house. Ample natural light and good ventilation were important. Attached yards were needed to allow the animals to exercise and feed outdoors. Sheep barns often had vehicle openings wide enough for a wagon or manure spreader to enter.

See also

General Purpose or Combination Barns
Develop of Livestock, 1900-1940
Appendix: Focus on Minn Livestock

Well-drained earthen floors were satisfactory, but concrete floors were recommended for "service alleys, feed rooms, around water troughs and other critical areas" (Neubauer and Walker 1961: 78).

Like beef barns, sheep barns were often partly-open to keep the sheep cool and allow them to freely move about. Sheep barns often had more interior partitions than beef barns, however, in part because lambs were often born indoors during cold months, whereas beef often calved in the pasture. Farmers who used interior pens usually kept several sheep to a pen. Sheep barns often had moveable interior partitions for handling, sorting, and lambing. The yards outside could also have movable gates and fences to create smaller pens for breeding and sorting.

Sheep differed from cattle in that they bunched and crowded at doorways, rather than following one another in single file. Thus sheep barns had large animal doors – at least 8′ wide – to prevent sheep from being crushed and injured.

Some sheep barns had a central alley with feed troughs down each side, and many also had outside feed bunks. (Grains were often fed inside while hay was fed outside.) Creep feeders allowed lambs to reach the grain while keeping the larger ewes out. Interior pens often had individual feed boxes and water cups, and interior salt boxes were common until salt blocks or "licks" were introduced in the 1960s. Outdoor feed bunks were often 12′ long, allowing 2′ of feeding space per adult sheep. Some troughs were "reversible," meaning they could be turned upside down when dirty and be ready for instant use.

A common size for a Minnesota sheep barn was 24′ x 32′ – sufficient for 30 to 50 ewes. This typical barn, recommended over many decades, usually consisted of a single open room with a manger along one wall. There were often two fenced lambing pens in a corner and a large sliding door to keep the sheep inside during stormy weather (McKerrow 1914: 177-178; White et al 1936: 12; Midwest Farm 1937; Morris and Zavoral 1943: 3; National Plan Service ca. 1950; *Farm Building Plans* 1953).

A more elaborate barn from 1920 had two wings – one 36′ x 70′ and the other 30′ x 40′ – which were divided into individual pens, a horse stall, a feed room, and a shepherd's room. There was a silo linked to the feed room, and hay and grain were stored in the upper loft (Moore et al 1920: 575-576).

By the early 1950s pole-frame sheep barns with steel and aluminum siding were in use (National Plan Service ca. 1950; Reynolds 1953).

Shepherd's rooms and wool rooms were not often seen in Minnesota sheep barns, and usually only appeared in larger buildings. The wool room was the space in which sheep were sheared. It included a wool-sack holder that held the wool during shearing, and a wool box to store the wool until it was sold. On most Minnesota farms, sheep were sheared on a canvas or in a clean spot in the barn and no special room was used (Shaw 1895: 253).

Some sheep producers had outside vats or sheep "dips" in which the sheep were immersed in diluted insecticides to deter ticks and other pests. The dips were often elevated tanks approached by ramps, but could also be below-grade pits.

PREVALENCE

It is expected that barns built specifically for sheep will not be common in Minnesota. Some might be associated with pre-1940 diversified farming, and some may be associated with the rise of the state's more concentrated livestock industries.

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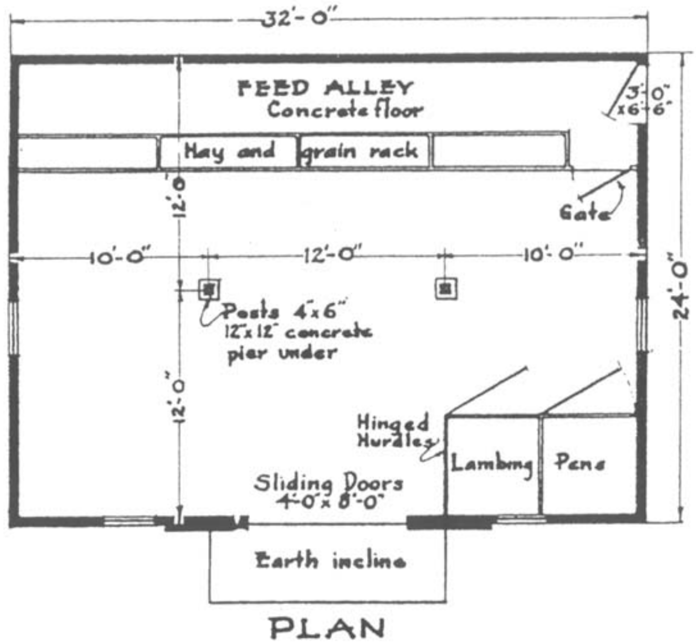
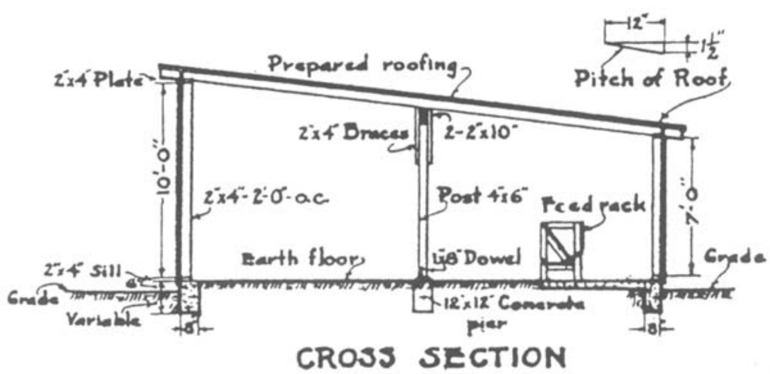
One of the advantages of keeping sheep on your farm was they could keep the lawn grass clipped. This practice was common through World War II. Location unknown, circa 1910. (MHS photo by Harry Darius Ayer)

Sheep, like beef cattle, were not particularly sensitive to the cold. Sheep barns and beef barns were often among the simplest animal shelters on the farm. Location unknown, circa 1925. (MHS photo)





This basic 24′ x 32′ sheep barn was recommended by the University of Minnesota in 1936, but is consistent with sheep barns recommended during many decades by several organizations. It consisted of an open room with two lambing pens, a dirt floor, and a concrete feed alley and manger along one wall. From "Barns", White et al (1936).

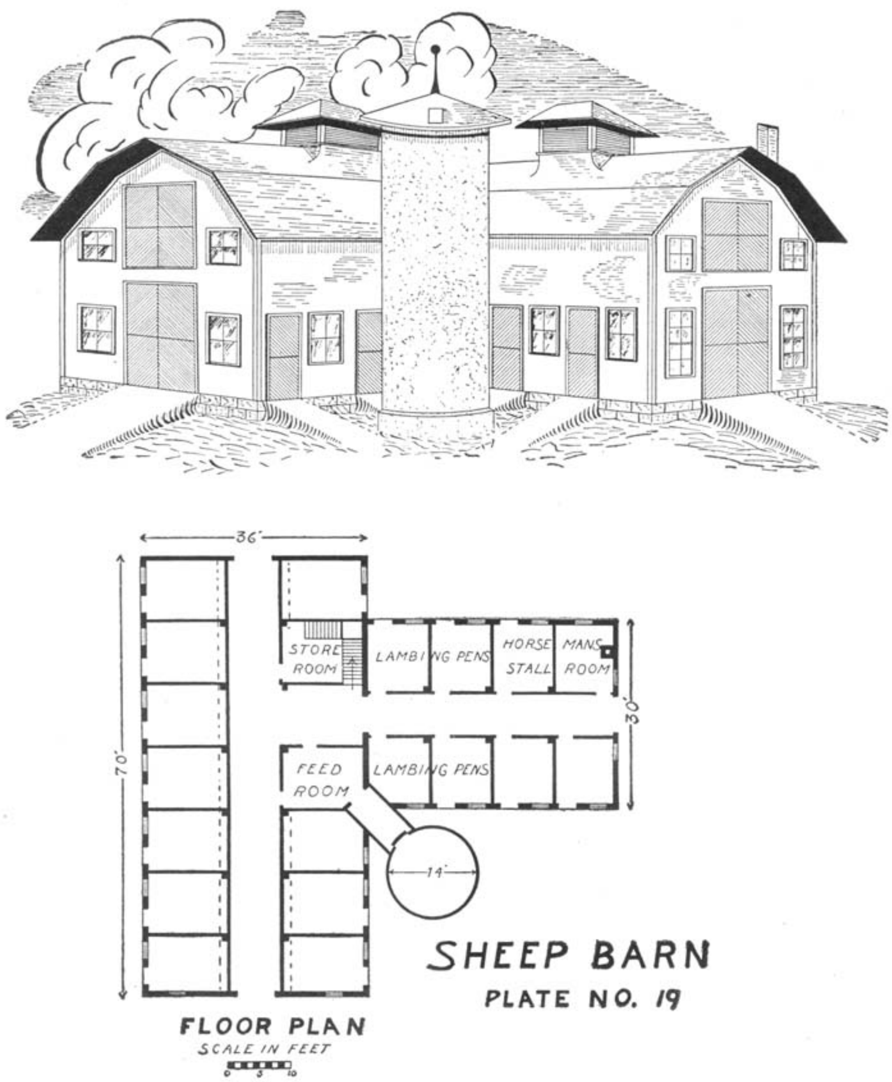


Fig. 1

A more elaborate sheep barn could have an attached silo, individual lambing pens, a feed room, and a shepherd's room. This plan was issued by the North Dakota Experiment Station and appears in a 1920 manual read by Midwestern farmers (Moore et al 1920).

▪ SHELTERBELTS

- Shelterbelts were planted perpendicular to the prevailing winds, and were usually a single row wide
- Many field shelterbelts in Minnesota were planted as part of 1930s conservation efforts
- Many mature field shelterbelts were cut down to accommodate large machinery and irrigation equipment

A field shelterbelt was a narrow barrier of plantings, often a single row of trees or shrubs, that protected farm fields and crops from wind damage and erosion. Field shelterbelts also increased soil moisture by trapping snow and reducing evaporative loss, provided wildlife habitat and shelter, reduced snow drifting on roads by acting as a living snow fence, and beautified the landscape (Stoeckeler and Williams 1949: 192-193).

They were often planted in prairie areas. An early farm expert from southwestern Minnesota, one of the windiest parts of the state, observed in the 1890s that farmers in that area were planting white willow for living fences and field shelterbelts (Ludlow 1894: 277).

Most field shelterbelts in Minnesota and throughout the Midwest, however, were planted after 1934 as part of federal conservation programs spurred by the severe droughts of the 1930s. The New Deal's Shelterbelt Program, for example, was created in 1934 and paid farmers to plant and cultivate trees to reduce soil erosion (Stoeckeler and Williams 1949: 192; Hanke 2004).

According to Stoeckeler and Williams, "The shelterbelt project, sometimes referred to as the Prairie States Forestry Project, was established in 1934, a time of serious drought, dust storms, and depression. Its purpose was to plant badly needed shelterbelts and at the same time provide work for people in the drought-stricken Great Plains" (Stoeckeler and Williams 1949: 192). Thousands of miles of field shelterbelts were planted in the 1930s and 1940s. Later, many of those shelterbelts in Minnesota were cut down to make way for large, modern implements and irrigation equipment (Hanke 2004).

Field shelterbelts were planted perpendicular to the prevailing winds. In Minnesota, primary field shelterbelts were usually oriented north-south. A modern farm conservationist explained that for best results, belts of trees were planted at intervals: "Since the zone of protection provided by a single shelterbelt is limited, a series of shelterbelts is required to protect the whole field. Two to four rows are commonly planted per quarter section. Erosion-prone soils may require as many as eight shelterbelts per quarter section" (Timmermans and Casement 2001). Demonstration shelterbelts planted by the University of Minnesota in the 1970s-1990s commonly ranged from a quarter-mile to one mile in length ("Agroforestry in Minnesota" 1999).

The width of field shelterbelts involved trade-offs. Farmers had to balance wind and erosion protection against loss of productive cropland. "While it seems apparent that wider belts add

See also

Erosion Control Structures
Fields and Pastures
Windbreaks
Woodlots

somewhat to the benefits, it is probable that the narrow belt yields the greatest return on the land occupied" (Stoeckeler and Williams 1949: 194).

In addition, multi-row field shelterbelts were more expensive to establish than single-row belts, and more work to maintain. For that reason most field shelterbelts planted on the prairies were single rows. Experts also advised that a field shelterbelt should be no wider than it was tall (Stoeckeler and Williams 1949: 194).

Successful shelterbelts had to be planted with native plant stock for maximum drought-resistance and hardiness: "It is extremely important that the planting stock be grown from seed produced in the general locality in which the trees are to be planted" (Stoeckeler and Williams 1949: 196).

Shelterbelts of trees eventually fell in disfavor with some farmers because they could cause snow to accumulate unevenly, take up an unacceptable amount of land, rob soil moisture from adjacent crops, and harbor weeds. In recent decades shelterbelts have been superceded by other erosion control methods including leaving stubble in the field during the winter, conservation tillage, and strip cropping or alternating strips of crops with strips of fallow land.

PREVALENCE

It is not known how many historic shelterbelts have survived on Minnesota farms, but they are likely found in prairie areas. Like all vegetative features, they are subject to natural change through plant reseeding, disease, and death. Shelterbelts were often superceded by other erosion-control methods, and many have been removed to accommodate large field equipment. A full, intact set of shelterbelts is likely rare.

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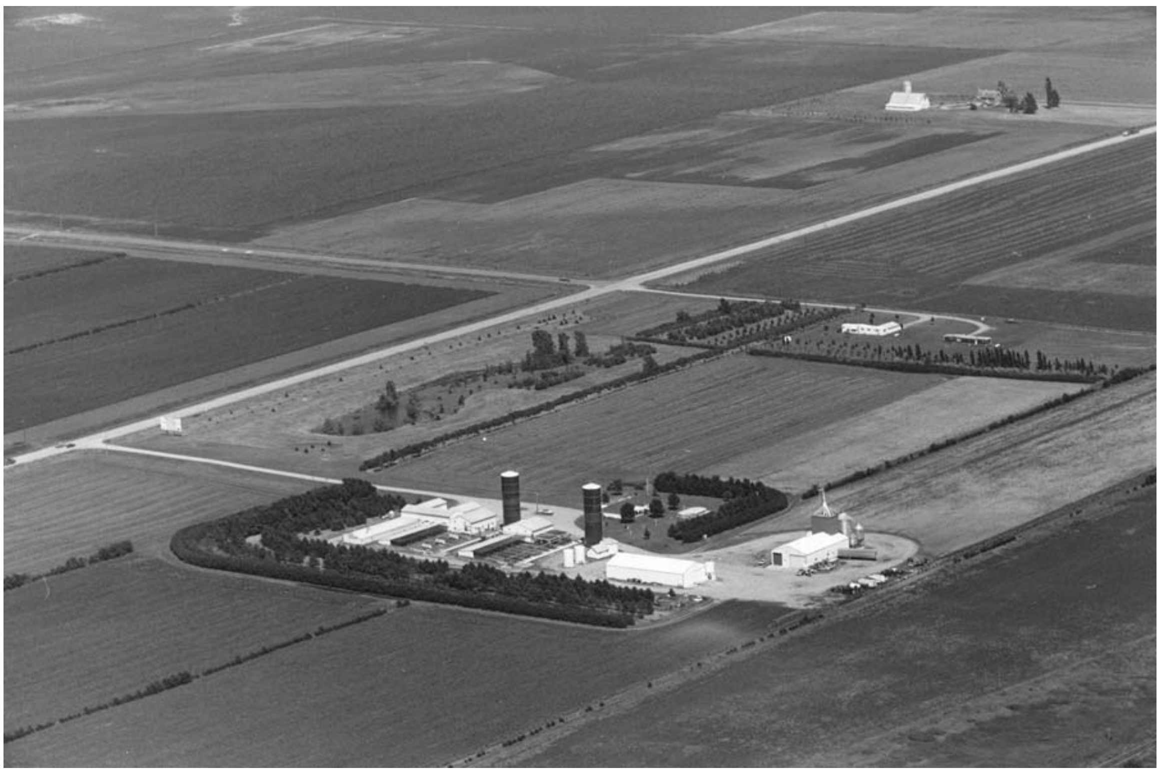

Shelterbelts, as well as a windbreak, are visible in this photo taken in 1983 near Lamberton in Redwood County. (MHS photo by Vincent H. Mart)