



Heartland Science

Ohio's Legacy of Discovery & Innovation



Historic Barns

The Barn, a Symbol of Ohio

Topics: Crib Barns - German Bank Barns - Three Bay Threshing Barn - Raised or Basement Barns - Side Hill Barns - Ohio Saxon Barns - Transverse Frame Barns - Dairying Changes Barn Form - Wisconsin Dairy Barns - Other Traditional Barns - Pole Barns - Preservation and Conservation - Photo Gallery - References - Other Resources

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Barns, just as any other building, can be examined scientifically. They can be measured, their functions analyzed, their ethnic connections, if any, can be determined, and the evolution traced. They often can be classified by type and their distribution plotted to reveal their relationship to agricultural patterns, economic conditions, and settlement history.

Another equally important reason to examine barns exists. Today, most Ohioans are born in cities, large or small, live most of their lives in urban environments, and have little experience of farmstead and countryside. Learning about barns helps us to keep alive our Ohio traditions. It is not just coincidence that the Ohio bicentennial logo, placed in every county of the state, celebrates a barn. The barn speaks to Ohio's long time position of prominence in agricultural productivity. Even today, although less than 10% of Ohioans gain their primary income from farming, agriculture is still one of the major economic forces in the state.

Sadly, the great late 19th century barn structures, which most people think of when they think of agriculture, are rapidly decaying and disappearing. While this loss is lamentable, it is part of a natural process. All buildings decay and wood structures decay faster than structures of many other materials.



Of course, this deterioration can be arrested or even reversed by the careful work of a timber framer. The average farmer, however, often would prefer to let the old barn go and substitute a new one. The reasons are not difficult to find. The cost of a new barn may be no greater expense than fixing up an old one. Furthermore, the old barn is often built on two levels with doors too small to accommodate present-day agricultural machinery. Thus, the new, single story, structure is more efficient.

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Because Ohio farms, although shrinking in total numbers, are steadily getting larger in size, in many instances, several buildings are required to adequately house the diverse functions of the farms. Built over time this hodgepodge of structures can be replaced by a single new, large barn. In some instances, by doing this, yearly maintenance, real estate taxes, and other costs can even be reduced. Finally, a new barn sends a message that this farmer is successful, progressive and forward looking, all indications satisfying to the ego.

Unfortunately, as the great timber frame barns of the late 19th and early 20th centuries disappear, they are replaced by a less aesthetically interesting series of structures. As geographer Alvar Carlson noted almost a generation ago, the architecture of new farm buildings increasingly reflects "mere function and the range of items available from catalogs of implement and building dealers. Each barn's disappearance represents the loss of a major form of the material landscape based upon ethnicity and individuality" (Carlson 1978, 22, 32). The cultural component of the countryside becomes less interesting. Standardization of form of these

"neo-barns" as Carlson dubbed them, replaces individualistic timber frame structures with box-like, metal or plastic-clad, single level, metallic frame pole buildings, which appear, as Carlson observed, much like rural factories.

The various regions of Ohio appear different from one another, in large part because the great barns which dominate the countryside are distinctive. To understand these differences one needs to look carefully at the form, function and other characteristics of those barns which are most typical and which make up the majority of the barns of each region. Here we are venturing into the realm of vernacular architecture. We must examine how and why a group built as they did, why some techniques were accepted, and why others were not. The first permanent settlers in an area usually establish their culture so effectively that it becomes "the base of reference for all subsequent change" (Kniffen 1965, 551). Later coming groups often borrow ideas about buildings from earlier settlers. This is one of the major ways ethnic structures change, through contacts with other peoples.



Crib Barns

In southeastern or Appalachian Ohio, the initial settlement group was the Scots-Irish. Although they were relatively small in numbers and their settlements widely scattered, they did introduce both Single and Double Crib barns. A thin veneer of these still remains in the region. These barns were formed of square or rectangular cribs or pens made of rough hewn logs laid horizontally and held together by notched corners. Shed or gable roofs were formed of riven boards. Sixteen feet by sixteen feet were typical plan dimensions for the largest ones. However, because little level land existed in this region and all of it needed to be hand cleared, Crib barns of smaller dimensions served the earliest settlers well. The initial cribs were multi-functional, sheltering livestock, housing hay, storing equipment or holding ears of corn.



In contrast to log houses, these barns were only roughly chinked, or in some instances, not chinked at all. Not only was much valuable labor saved, if hay was to be stored good ventilation was critical to reduce the danger of spontaneous combustion. As farms gradually expanded and more barn space was necessary small specialized buildings were attached, or a second crib, pen, or shed was added, or perhaps a Double Crib structure with a roof runaway or aisle between was built from scratch as a replacement.



Double pen barns have been classified into at least four sub-types depending upon size and plan of the cribs and how access to them was gained, from a center aisle or directly from outside (Noble 1984, 2:2).

Later on, as settlement matured, and especially after saw mills became common, transverse frame barns replaced the original double pen log ones. Doors of these later barns are always on the gable end of the structure. The ground plan of the barn may provide for one, two or three aisles, with a corresponding number of doors on each gable. The Transverse Frame barn normally is longer than wide.

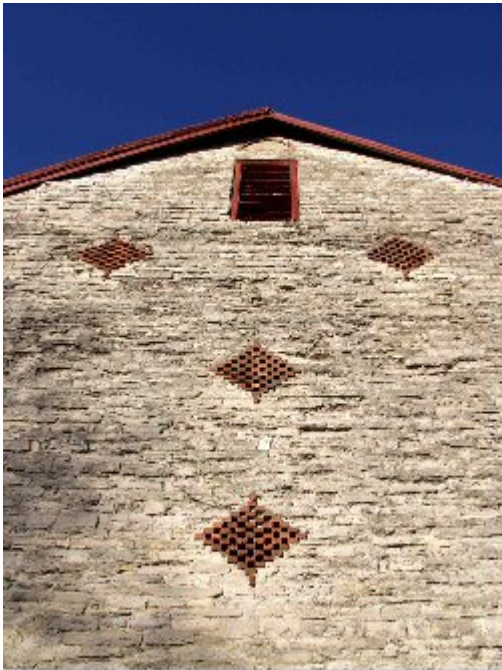


Dimensions of 24-30 feet by 36-45 feet are not unusual. The ground level is given over to sheltering livestock, grain storage, and equipment housing and the loft provides space for hay. Multi-function barns are the norm in most of Ohio's agriculture areas.

German Bank Barns

A large region diagonally draped across the middle of Ohio from Columbiana county in the east to Van Wert county and the Miami valley in the west has barns of quite different types. Here, Germanic influence established the parameters for barn building. Migrating westward along the line of the National Road from which the Germans moved somewhat north as well as somewhat south, but always westward, they introduced a number of banked barns whose design had been worked out earlier to the east in Pennsylvania.

These barns had two full stories plus a half story loft and were partly excavated into the bank of a hill slope. The lowest level entered



from the downslope side was primarily for housing animals and because it was partly below ground, it was warm in winter and cool in summer. The upper floor was cantilevered on one, two or three sides over the basement story. The downslope cantilever was the most distinctive characteristic of the structure. Referred to as the forebay or vorschuss, the overhang often contained grain bins which could be emptied directly into the feeding lot below. Access to the upper floor was gained directly from upslope on the opposite side of the barn, allowing wagons to be driven into the structure for unloading. Hay mows were located on either side of the central driveway which also functioned as a thrashing platform. In order to create sufficient draft for winnowing, the barn had two large threshing doors which opened out over the downslope feeding lot. Looked at from outside, these doors were high and suspended in air. No one ever came in or out of these doors.

Although not all German derived barns have a forebay, most do and can be recognized by it. Geographer Robert Ensminger has identified almost twenty sub-types and variants of the basic German barn. They are classified primarily on the basis of form, including number of stories, location and type of forebay, and most important, the characteristics of framing. German banked barns are among the most easily identifiable of barn types, primarily because of the overhanging forebay. These barns have proven to be suitable both for general or mixed farming, as well as for small and medium-sized daily operations.



One of the most delightful features of many German barns, and a feature picked by many other farmers, is cutting out of small decorative openings high up on the gable wall. Often called owl holes, they also offer nesting openings for barn swallows. These decorative openings, which have diamond cross, heart, half moon, star, and triangle shapes, are a vestige of German barn design imported to Ohio.

Three Bay Threshing Barn

The northernmost third of Ohio is the location of barns derived from New England/New York settlers, who brought earlier English building traditions into the state. The earliest of these ethnic barns was the Three Bay Threshing Barn, also sometimes called the New England Barn, the Connecticut Barn, the Yankee Barn, or the English Barn. It has a floor plan ratio of about 3:2, although additional bays may be added to the gables in later versions. Side bays function as a storage place, grain bins, stabling areas and sometimes as hay mows. The central section was the threshing area originally. Wagon doors gave access on the front side, and a second set on the back side provided the winnowing draft, as well as an easy exit for the wagon. Hay was normally stored under the gable roof in the loft.



Many Three Bay Threshing barns boast of decorated doors consisting basically of a painted "rounded arch entirely within the space of the door." "The design is usually duplicated on both sections of the main door to form the arch, and is replicated on smaller doors (Noble 1993, 26). Northwestern Ohio, with extensions into both Indiana and Michigan, accounts for the greatest number of barns with

decorated arch doors.

Siding consisted of some planks or boards nailed to sills and plates or girts. They were spaced a bit apart to allow ventilation. By placing the boards vertically rain water would run off quickly and not collect on the top edge as it would on horizontally affixed siding, which would then increase rot.

Another feature found on many types of barns, but especially common on Three Bay Threshing barns, is the pent roof, a largely unsupported triangular roof structure projecting from a wall of the barn. The small English three-bay barn has a higher incidence



Ohio areas of decorated door barns. Core areas contain over 25% decorated door barns to total barns. Based upon Beck and Webb as modified by field traverses.

than others of gable wall pent roofs, which may be related to the pent roof's function of extending the rather limited interior, and thus, protected area of the barn. "As farm operations grew in the later 19th Century, adding a pent roof may have been an economically alternative to building a larger barn" (Noble 1993, 29).

The careful observer will note the similarities in form and function between the Three Bay Threshing barn and the upper parts of the German Bank barn. In both, hay was stored in the loft and grain was threshed by hand, using wooden flails. After separation of the grain from the straw and its removal, the grain and husks (chaff) were tossed together into the air. The heavier grain settled back down into the winnowing basket or a pile on the floor, and the lighter chaff was blown a bit away where it was saved for animal food. The draft provided by the second set of doors in both types of barn was necessary for easy separation of grain and chaff.



Raised or Basement Barns

As agriculture prospered and farms grew larger in size, the old English barns became more and more obsolete. This was especially true in those parts of northern Ohio where dairying became ever more important, requiring barns to be capable of housing large numbers of dairy cattle. In northwestern Ohio dairying did not challenge grain farming until quite late. Hence, it is here that one finds the greatest number of Ohio's surviving Three Bay Threshing barns, even though the threshing process has been radically changed by mechanization.



Those farmers who moved toward dairying throughout northern Ohio needed a larger structure. This need was met by the development of the Raised or Basement barn, a building quite like the German barn except for its lack of cantilevering and forebay. The Raised or Basement barn is essentially an English barn raised up, with a basement at ground level inserted beneath. Originally thought to have originated in upstate New York, or perhaps an idea borrowed after contact with Pennsylvania Germans, subsequent research has revealed probable antecedents in the Pennine region of the U.K.



Entry to the basement is usually through doors on the gable ends of the structure, another difference from the downslope-side entrance of the German Bank barn. Entry to the upper floor of the Raised barn is by means of a ramp or barn bridge. This, of course, meant that the Raised barn could be readily built on level lands, which predominate in the western half of Ohio.

A closely associated feature both on some Three Bay Threshing barns and some Raised or Basement barns, which may indicate an English origin, is the covered porch entry. This is by no means found on all such barns, but at the same time, it rarely occurs on other types. Northeastern Ohio possesses the greatest concentration of entry porches (Noble 1993, 24).



Side-Hill Barns

English derived settlers did contribute an English Banked barn which has been given the designation of Side-Hill barn (Fink 1987, 137-150). In almost every particular the Side-Hill barn resembles the German Bank barn. It is two and a half stories high, and partially excavated into a hill slope so that both floors are entered directly, the lower floor from downslope and the upper from upslope. The barn has inaccessible-from-the-outside threshing doors, and performs basically the same agricultural functions as the German Bank barn. It is not easily confused with the German Bank barn because it does not have an overhanging forebay. Its original antecedents are to be found in northwestern England (Brunshill 1978, 82-86; Hughes 1985, 173-174). In humid England, this barn almost always survives only in stone or brick construction. In Ohio, the Side-Hill barn has a stone foundation, but otherwise is in wooden construction.



The axis of the Side-Hill barn lies along the slope of the land. A few somewhat similar, two and a half story barns have their long sides athwart the slope and doors are on the gable ends. These barns seem to have originated near the Welsh-England border area. They have been given the designation of Welsh Gable-Entry barns (Noble and Cleek 1995, 84). In any event, they represent a small minority of banked barns in both the British Isles (Williams 1986, 167-170) and even less in Ohio.

All of these log and timber frame barns together represent the golden age of Ohio barn buildings. As the 19th century waned, more and more of the new barns were constructed of sawn lumber rather than log or hewn timber. Also, the types of barns changed because agriculture was changing, becoming more specialized. Farming in northwestern Ohio steadily focused on cash grain operations and livestock feeding.

Ohio Saxon Barns

The barn of choice in these situations was derived from the north German plain, where it has been described as the Saxon barn (Wilhelm 1992, 70). Germans from Lower Saxony migrated to Mercer and Auglaize counties of western Ohio in the 1830s. In Ohio, the barn which they erected differed considerably from the housebarn they had built in Germany. First, the house and barn parts were separated. Second, the internal arrangements of the barn were changed reflecting the structure of other Ohio barns of Germanic origin. Finally, the door shifted from the gable end to the side, a position common to all the barns thus far discussed. What was retained from the original type was squarish plan, a gentle roof pitch, and a three window configuration on the gable wall. With floor plan dimensions of up to 50 or 100 feet, the roof must be of large size. Its extent is further accented by low side walls. The gable wall is perforated by three small, square or rectangular windows located high up, a feature of the original Saxon housebarn. The interior is usually subdivided into three to five bays, including straw or hay mows, threshing floor, cow stanchions, storage and feed preparation area, and horse stalls (Wilhelm 1981, 8). Barns of this type are relatively few in number and restricted to the extreme western fringe of the state.

Transverse Frame Barns

As time passed, the Ohio Saxon barn incorporated modifications which enabled it to perform differing agricultural functions better. Additional aisles were added, accessed by smaller doors on the gable. If used primarily for crop storage and processing, the structure is usually termed the Transverse Frame barn, or sometimes the Midwest Three Portal barn.



A threshing floor occupies the center and the other interior features of the Ohio Saxon barn are peripheral. The major difference from the Ohio Saxon barn is the orientation of the entryway. If used mostly for livestock, the structure is termed a Feeder barn, with a row of cow stanchions on either side of the central aisle. A connection with transverse frame barns brought into Ohio from Appalachia cannot be discounted (see Crib barns).

Dairying Changes Barn Form

Dairying continued to expand and the form of buildings accommodated the change. The most profound modification toward the end of the 19th century was the development of the tower silo. These sentinel-like structures enabled green fodder to be stored and fed out during the winter months. Previously, cows had to be fed on dry grain and hay with the result that they dried up and could not be milked. Feeding green fodder



permitted milking all year long, satisfying the growing demands of expanding urban populations.

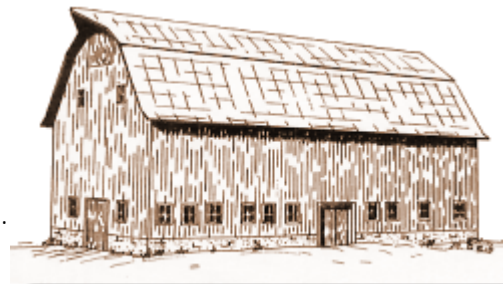
Another barn addition was the milk house, a small, sanitary building to house freshly produced milk in cool environment, and running water to cleanse empty containers. The first milk storage facilities were inside barns, but by the 1940s state regulations required an outside and separate structure. These small, rectangular barn appendages have become standard features of all barn types.



Finally the Raised or Basement barn itself was modified by the addition of a two floor straw shed at right angles to the existing barn (Noble 1974, 14). The basement level permitted herds to grow by offering additional stanchion space. In the early decades of the 20th Century different roof types were popularized in order to increase the loft capacity to store even more hay and straw for growing herds. The gambrel roof became most widely adopted. Round roof or Gothic types were tried, but never became widely popular because they required expensive rafter systems of curving design. Many farmers, however, continued to employ the gable roof, even in new construction.

Wisconsin Dairy Barns

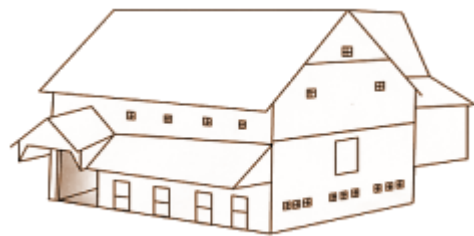
As dairying continued to prosper, a barn type worked out at the Wisconsin Experiment Station became widely popular on dairy farms in the northern and central parts of Ohio. The structure, termed the Wisconsin Dairy barn, is an example of the scientific approach to agriculture which typified the new 20th century. The great advantage of this elongated plan, end-entry, barn was the ease with which it could be further expanded as dairy herds grew.



In addition to its extended length, large loft for hay storage, and gambrel or round roof, it is characterized by a large number of small windows which allow light to penetrate inside. This feature reflects another aspect of the scientific approach to agriculture, a recognition that expanded sunlight not only made milking and other chores easier, but it also increased sanitation by reducing bacterial growth. The work of the Wisconsin Agricultural Experiment Station was matched by other scientific improvements in agriculture at the Ohio State Agricultural Experiment Station facilities.

Other Traditional Barns

Not all barns fit neatly into the classification systems of cultural geographers, folklorists, anthropologists, or other scholarly observers. Some barns employ a combination of features perhaps derived from several types, but put together by innovative builders. Others are true

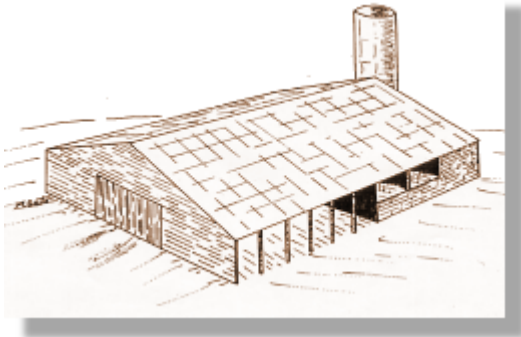


examples of ethnic structures, but because the group was so few in numbers, these barns are rare and always highly localized. A few one story, gable-entry, timber frame barns still stand in the Welsh settlement areas in Allen county (Noble and Cleek 1995, 84-85), and at least one Dutch barn has been identified by Hubert Wilhelm (1995, 75) in Mercer county. Amish-Mennonite farmers built a different barn in the area around Madison county (Wilhelm 1976). These structures are unusual in having a pent roof on one side, sheltering stock access doors, and an off-center wagon door beneath a cantilevered hood. Unlike most other barns employed by other Germanic groups, this structure is not banked.

In some other areas, the agricultural system which emphasized certain products in restricted areas resulted in unusual barns specifically designed for these conditions. In southwestern Ohio, especially in the Miami valley, and further south in Brown and Adams counties are a few, transverse frame barns, relics of the tobacco raising era of the turn of the century. These "rather flat-roofed tobacco barns" also often have roof-mounted ventilators and movable side panels (Wilhelm 1983, 20). Often these barns have a small, attached building called a stripping shed in which the tobacco leaves are removed from the coarse stem. The shed is recognizable by its chimney flue, required to vent the gasses from the stove. Boiling water is necessary to raise the humidity and facilitate the stripping.

Pole Barns

Pole barns and other modern structures increasingly make up the agricultural scene in dairying regions. With at least one open side, these low, factory-like sheds offer a milking parlor and windbreak in inclement weather. To the west, where cash grain production is concentrated, the barn often has disappeared altogether, replaced by a wide-doored, single story, equipment shed and a series of huge, metal grain bins and filling pipes.



A few round and other non-orthogonal barns, relics of the late 19th Century vogue for such structures, can be found here and there in Ohio. These are oddities, interesting but not important in the history of barn structures in the state. Much more important are the timber frame details of the larger range of barns.

Preservation and Conservation

Background for Ohio Timber Framing

As we have learned from earlier sections, Ohio's rich soils, favorable climate and abundant water sources attracted farmers from very diverse ethnic backgrounds. This provided Ohioans with a rich variety of historic barn types; possibly the richest in the land. Although the different forms of barns represent many diversified farming approaches, the way in which the barns in the early 19th Century were constructed was actually quite consistent, represented two basic modes of building; log and timber framing. This is understandable since over 95% of Ohio was climax forest when settlers first arrived (Ohio's Natural Heritage, 1980, 9).

Although forests varied in species, the trees chosen by the early carpenters indicate their knowledge of those trees which were the best for barn building. Today, Ohio's virgin forest can be viewed in very few places other than in Ohio's barns. In areas where it was available (primarily southeastern Ohio) American chestnut was the tree of choice. It is extremely strong, works well with hand forged edge tools and has great resistance to rot. Where chestnut was not available, white oak was chosen for the same qualities, but was slightly less rot resistance. White oak was readily available in south central, eastern and central western Ohio, but was less available in north, west, or central areas of the state. In these areas barns can be found built with beech, elm, sycamore, hemlock and red and black oak. When the best types of trees were available you used them, but if not, you built with what you had. As the renowned Ohio Amish barn builder Jose Miller once said: "The best wood for building a barn is green."

Important to understand when studying early barns is who built them. When the American frontier opened up, the systems of log and timber frame construction were well developed from long standing traditions in Europe and other areas of the world. Today, wonderful examples of timber frame barn and cathedral construction still exist and have been surveyed and documented dating back to the 13th Century in England (Hewett, 1980).

One needs only to study the histories of England, France or Germany to realize that the evolution of timber frame construction was paralleled by the development and maintenance of trades education. This was carried out through Guilds for many centuries and today healthy trades education systems in France and Germany produce highly qualified "companion" and "zimmermen." These were the sources of the skilled builders who came to the New World and brought with them the knowledge and tradition that built the wood framed churches, meeting houses, bridges, farm houses and barns of Colonial America. Studying timber buildings in the Old World and comparing them to those built in the New World quickly shows how these centuries-old traditions arrived with the early builders and were put to use for the most part unchanged.

As one might imagine, these ancient building traditions could only survive unchanged in the New World for just so long. By the time the rich lands of Ohio were beginning to be settled, new forms of barn building had evolved. The majority of barns built in Ohio were built based on traditional forms, but the timber framers were using a system of layout and framing patterns that was truly of American origin. Understanding this evolutionary process can contribute significantly to the process of identifying and dating Ohio's historic timber barns.

Siding and Roofing

To study historic timber barns, the simple systems used to enclose them are a tremendous aid in seeing all of the various parts. Since barns are typically unheated storage buildings, the enclosure of the walls is accomplished by simply nailing boards to the exterior surface of the frame. In Ohio these boards are much more often vertical than horizontal. In some cases narrow strips of wood called "battens" are nailed over the vertical seams to further weatherproof the barn. The roof is covered in a similar fashion by either applying continuous horizontal boards referred to as "sheathing" or narrow horizontal boards spaced several inches apart, referred to as "skip sheathing."

In early 19th century barns the roof sheathing was covered with wooden shakes. These "shake shingles" were split from white or red oak billets using wedges and clubs to form sections that were then carefully "riven" with a froe to a consistent size and thickness. By the early 20th Century, more durable roofing was provided using "standing seam" galvanized steel or thin slates. The steel roofing was supplied by the mills that had grown up in the big industrial cities of the Great Lakes, while the roof slates were transported by rail from the Vermont-New York, and Eastern Pennsylvania quarries. These "stone shingles" were hand split from larger quarried blocks. The use of slate in America can be traced to the colonial period, but in Ohio its popularity was dependent on improved transportation, first by canal and quickly thereafter, by rail freight. By the 1880s slate had established itself as a competitive roofing material (Stephens 1995, 246).



A heavy and durable roof material slate's thickness is the critical factor in determining weight. "A modest-sized barn having thirty squares of standard three-eighths-inch slate shingles would require, at a minimum, nine tons of roofing material (Stephens 1995, 247). Where farmers could afford the additional expense, decorated patterns produced by different colored slates, or dates, names, or initials were incorporated in the roof. The pattern of decorated slate roofs shows that most of them were erected in the northern half of the state, reflecting the greater agricultural productivity and prosperity in that area. Many beautiful slate roofs on Ohio barns are now over a century old and bear the date to prove it.

The Barn Frame

To identify the way in which the carpenter converted the trees (logs) to timbers and then marked out the timbers in the frame in order to cut the "joinery" or wooden connections that secure the various parts of the frame, enables one to understand Ohio's historic barns. Interior timbers often can be viewed on all four sides, while those against the exterior can be viewed from at least two or three. This allows for close inspection to reveal clues as to how the barn was built. Furthermore, evidence still remains that reveals how the timbers were converted from logs to square "cants," as well as how they were marked out by the carpenter shaping them into the various pieces that make up the structural frame work. Looking closely at the surfaces or faces reveals how the timbers were "squared up" from logs. This was done by either "hewing" the logs square with an axe, riving them with wedges and froes, or sawing them square. Although the technology to saw logs using water power had long existed in Europe, in the earliest periods of Ohio's settlement sawmills did not exist, nor the infrastructure needed to transport the timber from the mills to the areas being settled. This meant the earliest barn builders had to hew their logs. Since the timbers were typically cut from the trees on the homestead, the hewing was done either in the woods or at the site where the barn was to be raised. This worked well for the larger timbers such as posts, sills or tie beams, but hewing smaller trees to make the rafters, wall girts (for nailing siding) and braces was not

practical. Instead these were split or riven similar to the way shakes were created. For the rafters simple "poles" or small diameter trees that grew in the forest understory were used. They were typically hewn flat on the upper face and framed up with the tree bark still on them. Wall girts were often done the same way, although just as often they were converted (as were the braces) by riving them.

Barns framed completely of hand converted scantlings are not common today in Ohio. They represent the earliest or first period settlement structures, which for most of Ohio is the first half of the 19th Century. They were often small, although one full size Pennsylvania forebay barn built this way has been recorded in Ashland County (Ensminger, 1980) so their utility was compromised as farming operations changed. Barns this age in Ohio would all have been built with wooden shake roofs that were prone to letting in water soon after they were applied, causing the barn timbers eventually to rot. When these barns are discovered still surviving, they deserve not only careful study, but effective stewardship.

Saw Mills and Sawn Timber

Soon after the first settlers arrived, entrepreneurs who knew the value of sawing timber and boards, as well as milling flour, built water powered mills along many of Ohio's rivers, streams and creeks. This quickly changed the way barn timbers were converted. Since sawyers knew they could sell large amounts of small scantlings for rafters, girts and braces, they began sawing these materials to standard sizes. Timber framers found it very practical to transport material that was small on even the earliest wagon paths. Traveling to the mill by oxcart to purchase 4x4 brace stock was also something that could be done by young apprentices, while the experienced framers set about the business of hewing the larger timbers. As roads improved larger timbers could be hauled, and in some cases even large girts, posts and ties were framed from sawn stock.

The early water-powered mills were an asset to barn builders, but they were slow and limited to relative short logs. Thus, the barns built in these times exhibit hand-converted timbers for most of the principle members. The early mills were built on a principle called "up and down" sawing, also known as frame or sash sawing, since the saw blade was a straight piece of heavy steel mounted in a wooden frame. This frame would move up and down, while the carriage mechanism slowly moved the log through the frame. This method of milling left easily identifiable "saw tracks" that run straight, but slanted, across the face of the timbers as coarse parallel lines. Discovering barns that have both hewn and sash sawn timbers usually means they were built after the first sawyers arrived, but probably before the Civil War when a major change in saw milling technology occurred.

Developing enough horsepower to run a circular saw large enough to mill logs was difficult using water wheels or water driven turbines, but steam engines developed in the mid-19th Century were capable of running large blades at high speeds. These new mills could cut large diameter logs at higher feed rates and often were built to handle logs of greater length, although usually limited to 18' to 30' or so. Circular saw mills quickly replaced vertical mills in the mid-19 Century. A major change in barn construction resulted, since improved mills and improved roads meant timber framers could build barns more quickly and completely with sawn materials. This was done by making longer timbers from shorter sawn pieces "scarfed" together end to end. Some timber framers still chose to hew the longest pieces from logs 30' long and greater. The saw tracks from circular mills imprint large arcs across the faces of the

timber. These are easily distinguished from those left by the up and down mills. Finding barns that include timbers exhibiting curved saw marks indicates they were built after the Civil War.

Timber Framing Systems

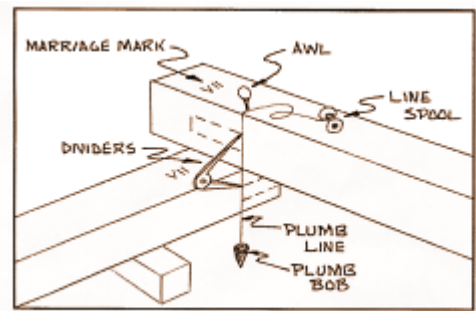
Squaring up the timber, whether by hand or with a sawmill, is of course only the first step in building a timber-framed barn. The next step the master builder took was to begin the process of "laying out" the joinery. Since timber framing is a system of building with wooden timbers held together with wooden pegs or connections (joinery), nearly every piece of wood in the frame needs to have mortices and tenons laid out and cut into it. The care and accuracy with which this work was done was not only the mark of a fine craftsman, but an important



part of insuring all the hundreds of parts of the timber frame would fit together properly on raising day. To the lay person this appears an amazing feat indeed, but generations of timber framers have refined and passed on the knowledge that makes it all a system that could be easily repeated from one barn frame to the next.

Laying out timbers has evolved as framing systems and conversion methods have changed, and learning how to read the information left behind by the timber framers who built Ohio's barns can be quite enjoyable and enlightening. The information comes in various forms that begin to make sense when one learns to think like a barn builder. This might appear to be a challenge, but the methods used by early timber framers were both logical and direct. Once you begin to understand the logic, the evidence left by the builder is not difficult to interpret.

In the late 18th and early 19th Centuries building a large wooden barn was of course, very challenging. The builder's approach to meeting this challenge was to make things work as simply as possible. There were no tape measures, power tools or even drawings, so the builder had to employ methods and patterns that worked with primitive tools, were easy to understand and communicate, and still produced joinery cut to very exacting tolerances. The process wasn't made any easier by the fact that the



hewn timbers were often irregular in both size and shape. To overcome these defects the builder used a system that involved stacking the timbers to be cut one on the other in such a way that if you looked straight down on top of them it would look like the section of the frame he was trying to build. The frame, of course, would be stood up after it was pegged together. During the stacking process he would carefully level each timber in both directions so that he could use a "plumb" and a divider to transfer the information he needed to lay out the mortices and tenons from one timber to the next. In so doing he could "scribe" each joint to fit exactly, even if the timbers were odd sizes and shapes. This process was known as "scribe rule" layout.

The individual interested in studying Ohio's historic timber barns need not learn the intricacies of scribe rule, but should be able to understand why barns built in this way are easy to identify. This method of cutting timbers makes each piece unique, meaning it can only fit in the location for which it was scribed. Thus, it was necessary for the timber framer to mark the timbers with carpenter or "marriage" marks so that the timbers could be set aside before the raising, and be correctly located again or "married" during construction. These marks most often look like Roman numerals, but may include arcs and triangles to help the framer find the piece in three dimensions. The marriage marks are usually cut in pairs at the locations of the joints, but are sometimes actually scribed across the connection so they only are complete when the frame is assembled. Typically they are cut with chisels or a race knife which had a blade formed to a "V" shape at the tip.

Scribe rule barns are not very common in Ohio, but do represent some of the earliest barns. The reason for their rarity is a change in the way barns were laid out that began around 1800 in New England, and spread to Ohio by the 1820's. This new system called "square rule" layout, did not require stacking the timbers in mock assemblies to align the joinery. Instead the carpenter would snap "chalk lines" on the faces of the hewn timbers that indicated where a smaller timber would be placed inside it. In this way he could work all of the timbers to a known size by removing the wood at the joints that was beyond the chalk line. The fact that each timber only had to be handled once meant much less work was involved, so the new system quickly replaced the old. Another advantage to square rule was that the standard frame patterns it produced, used pieces that were identical or "standardized" and the use of carpenter's marks was quickly eliminated.

Identification of square rule framed barns is straight forward since the timbers have housings at the connections. Housing is the term timber framers used to describe the area of wood removed from the morticed timber back to the chalk line. This area is typically sized to match the tenoned timber. It also becomes obvious, once a square rule barn is discovered, that there are no marriage marks. The standardized patterns used in the square rule system meant common parts like braces and wall girts were often interchangeable and larger parts could be easily identified by the joinery they contained. Finding a square rule barn means it cannot be earlier than 1800 and is probably newer than 1820.

One last change occurred in the way timber barns were built in Ohio right around the turn of the 20th Century. Although this system was not identified or named in early carpenter's manuals, this author has chosen to identify it as "mill rule" layout. The premise of this system of layout is the assumption that the timbers supplied by the sawmill are all exactly the right size and squarely cut. In fact by the turn of the twentieth century, sawmills were very precise, barn framing patterns had changed and hewing timbers was no longer necessary. Ohio's road system had improved considerably so transporting timbers relatively long distances was quite practical.

At first glance, mill rule and scribe rule barns look similar. They have simple mortice and tenon joints with no housings. In Ohio, however, all scribe rule barns were built with hewn timber and mill rule barns are built completely of circular sawn timber. Mill rule barns are also most often quite tall because beginning around 1880 the hay track began to be used for loading hay into the mows. This meant that much taller hay stacks could be created and barns were constructed from then until the end of timber frame barn construction, around WWI, to accommodate these tall stacks.

Identifying a barn as mill rule means it was built in the very late 19th or early 20th Century.

Barn Conservation

An undeniable truth about Ohio's barns is that many have been lost. Even a short trip down most rural roadways reinforces the fact that many more will be lost in the years to come. As stated earlier, the reasons for this ongoing attrition are numerous and understandable, but the ways and means needed to save them are much less obvious. Part of the reason this is true is a general lack of understanding of barns and their needs. For the most part barns seem to take care of themselves and due to their massive nature appear almost indestructible. This unfortunately is far from true.

Jim Askins, the creator of the National Preservation Training Center, once said "There are three things that will destroy a building: water, water and water." This is true for barns more than any other building. Since barns are built for storage and housing animals, not people, many times water getting into them goes unnoticed for long periods, as does the damage it causes. More often than not the damage has become extensive before any attention is given to it and far too often the costs involved in repairing this serious damage are considered prohibitive by the barn's owner. Had the problem been detected early, a remedy would likely have been simple and inexpensive.

The first step in conserving Ohio's barns is to understand what their maintenance requirements are. Barns are basically large open storage buildings. Depending on their age, they are likely to have had their roof coverings and siding repaired or replaced, repairs made to their foundation, and had significant modifications or additions done. These "improvements" were often done by craftsmen with lower skill levels than the barn's original builder, or with a general lack of understanding of historic building techniques. At best this complicates proper building maintenance and at worst it accelerates the decline of the structure.

Foundations and Sills

Most historic barns were constructed using stone for their foundations. Early ground level barns were often built with single large stones at the corners and post locations, while some had rough dry-laid stone walls around their perimeter. A common problem with these foundations is the close proximity of the sill timbers to the soil. Very often the problem is made worse by the ground level around the barn being raised by the slow accumulation of sediment and manure. This condition inevitably causes the sills to deteriorate. Replacement normally is not difficult, unless the barn has had additions or major modifications.

It is common to find makeshift repairs done in barns that have suffered sill deterioration. One such "fix" is pouring concrete along the front edge of the drive bay (where the main barn doors are) or threshing floor allowing equipment access where the sill is missing. The unfortunate result is accelerated rot of the timbers that are in contact with the concrete due to moisture being trapped. The correct repair in this situation is to replace the sill with a



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rot resistant material such as white oak. Sill replacement is accomplished by "jacking and cribbing" the barn. The jacking is usually done with steel beams which are then cribbed up with stacks of wooden beams called "blocking". In the photo to the right, a ground barn is cribbed up and ready for sill and or foundation repair.

Problems of Posts

Another common problem, closely related to sill deterioration is rot at the bottoms of posts. This can be caused by rot in the sill traveling into the post, but it can also be caused by water getting through damaged or missing siding and trim boards. The natural tendency of water is to flow downward and it accumulates where the post meets the sill. This causes the post to rot from the bottom up. Often this is not discovered until sill replacement is undertaken and the post bottoms are exposed showing missing tenons or hollowed out posts. Often the post appears to be intact and undamaged but is found to be rotted as far as four to five feet up on the inside depending on the age of the barn and the species of the timber. In the worst cases the post is rotted from top to bottom due to water coming in through the roof or along the eave. This condition is typically visible from inside the barn without removal of siding or connecting timbers.

Post repair or replacement is often somewhat complex. With the exception of interior posts, the timber framer will most likely have to deal with mortice and tenon connections at the top and bottom of the post, as well as connections along its length for siding girts, tie beams and braces. It is not uncommon to find eleven or twelve mortice and tenon joints in a corner post. Dealing with these connections is a matter of analyzing the situation and designing a repair well suited to it. Post bottom repairs can be done by simply stabilizing the upper part of the post and scarfing on a new section at the bottom. If the damaged area includes wall girts or braces, free tenons may be required (see photo to right). If the entire post needs to be replaced it may be necessary to jack and crib the corner of the barn which allows the walls to be spread enough to remove the post and insert a replacement.



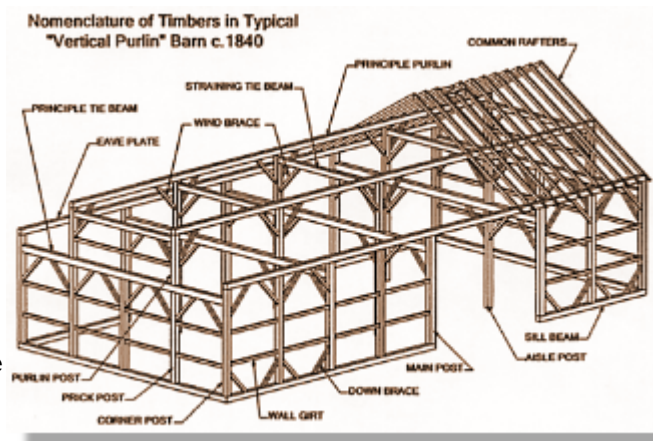
Repair or Replacement of Plates

Often the most difficult repairs to accomplish in historic barns are the repair or replacement of the wall plates where the rafters meet the wall frame. Unfortunately this is a common area of failure in historic barns where roofs have been allowed to leak for extended periods of time. Most timber frame barns have rafter connections that incorporate a rafter "seat". The cutting of the rafter seat joint typically involves the removal of a portion of wood on the top of the plate timber creating a perfect place for water to collect. The trapped water causes rotting commonly not detected until the plate has suffered severe deterioration. To make matters worse, the rot often extends into the rafters themselves and can travel into the posts, braces and tie beams that are connected to the plates.

Plate repair involves lifting sections of roof frame in order to allow the damaged timber to be removed and the repair timber to be inserted. Depending on the frame type this can be a predictable and controllable procedure or a precarious and

dangerous one. The problem comes in how the loads are being transferred from the rafters to the frame.

In large barns the rafters are supported by timbers called purlins. These horizontal timbers typically are placed midway between the wall plate and the ridge. In early barns it is common for these purlins to be supported by vertical posts that transfer the load of the roof into the tie beams. The figure above shows this type of frame. Provided the roof frame has not been modified, the rafters will be "birds mouthed" at the purlins which provides a stable connection. If however the "straining beams" have been removed (a common practice when hay tracks were added) the frame may require stabilization before the work proceeds.



Importance of Regular Inspection and Maintenance

It can easily be seen, based on the potential difficulty and related high costs of repair that the best practices of barn conservation are those based on good maintenance. Good stewardship involves regular inspections, securing skilled professionals to do the required work that is beyond the abilities of the barn owner, and a budget for the needed labor and materials. These are common practices for homes and vehicles, but all too often not for barns and outbuildings. This usually results in extended periods of time during which little or no investment is made in them. The results are slow but steady deterioration. Eventually major repairs are required to save them. Even worse the neglect may result in partial or total collapse and the loss of a century or more old structure.

The decision as to what a barn owner should do first, after he has decided to break the cycle of neglect and deterioration, will be based on the barn's current condition. In some instances barns survive being neglected quite well. If the roofing and siding are entirely intact, careful inspections should be made of the gutters, downspouts, doors and window openings. Leaking gutters and damaged downspouts can concentrate water in small areas causing serious problems. It is also crucial that rain water collected in downspouts be conducted away from the foundation. Plugged or defective drainage lines can quickly damage foundations by undermining walls or causing them to fail due to hydraulic and freezing pressure.

Windows and Doors

A common problem with large barns is damaged window glass in the gable end windows. They are often over 20 feet above the barn floor and broken glass is left unrepaired allowing rain water and snow to enter. Over time this rots out the principle tie beam in the end wall. Replacing a broken gable end window as soon as it gets broken can easily save thousands of dollars in structural repairs later. Leaking ventilators and doors cause similar problems in other areas of the barn. The main doors to the drive bay often are left open due to rusted tracks or damaged hinges. This allows water to saturate the drive bay floor and sill timbers which can quickly

rot. Damage to the threshing floor frame can also cause failure in the stone wall that supports the barn's "bank" by allowing the earth pressure to push the wall over.

Painting

Knowing if and when, let alone how, to repair or replace barn siding is often beyond the scope of the barn's steward. Some basic understanding of what to look for can be an important part of knowing when to call the carpenter of choice. Failing paint on wooden barn siding is rarely more than a cosmetic issue. This is because painting a barn usually involves little if any caulk due to the limited number of trimmed openings and the fact that sealing a barn against moisture transfer is not common. Rather, barns are normally designed to allow outside and inside air to move back and forth freely to aid in removing the moisture produced by livestock and feed. The one exception to failing paint being of little significance to maintenance is when paint begins to fail in a specific area, while the surrounding areas seem fine. This may indicate a leak is allowing water to find its way into the barn and the siding is getting wet from inside. This should be investigated and the problem remedied immediately.

Problems of Siding and Roofing

Being able to see light coming through siding may not be of any importance either. Many barns have been sided with green siding intentionally. When the siding boards shrink during drying, minor gaps appear along the edges that actually allow ventilation. Large areas of light, however, probably indicate something more. Larger openings (more than 1/4") can allow wind blown rain to enter and saturate timbers inside the barn. These openings need to be investigated. In some cases timbers may have moved due to damage at the joinery. In others, siding boards may become loose due to nails rusting or siding girts rotting. Often siding is "pushed" off the barn inadvertently while loading hay or moving equipment. These types of situations may or may not be within the scope of the owner, but need to be remedied expediently none the less.

Roofing failures are typically well beyond the capabilities or willingness of barn owners to undertake. In most cases this is a good situation. It is just as important, however, that the person chosen to do the work is well experienced and equipped. Again, the barn owner must be the sentry to prevent roof damage from causing expensive damage to the barn's structure. There are several types of roofing commonly found on barns. The oldest common roofing is wooden shakes, but in Ohio it is rare to see shakes on a barn except from the inside where they still show after being covered with a new roof that is usually metal. Shake roofs are nearly impossible to repair. If a barn still has a shake roof and it is leaking, it should be replaced immediately.

Metal roofs come in two forms in Ohio. The earliest, and still the highest quality metal roofs, are "standing seam" that are installed using concealed fasteners. These roofs can easily last 100 years, but do require repainting from time to time. The appearance of rust on a standing seam roof should not be ignored for any length of time. It will quickly penetrate the metal and weaken the roof, as well as shorten its life. When rust begins to show it's time to have the roof repainted with a paint designed specifically for that purpose. If the roof has been left rusting for years, it may have to be replaced. The other type of metal roof commonly found in Ohio is the exposed fastener or "ag panel" roof. These come in corrugated as well as ribbed patterns and are usually a lighter gauge than standing seam. Because they are

thinner, and the fact that the exposed fasteners can fail, these types of roofs are more prone to blow off in high winds. Any loose or missing panels should be immediately taken care of, but first the wooden slats or skip sheathing should be inspected for damage or rot and repaired.

Slate roofs are the most beautiful barn roofs in our state. Often they are decorated with dates and names as well as images of farm animals. When slate roofs are installed the barn's steward has chosen the best roof money can buy, but unfortunately this doesn't always translate into a long lived roof. The reason for this is slate roofs require regular maintenance. Unlike manufactured metal or shingle roofs, slates are made from quarried stone that often has unseen defects. These defects include minor fractures that may cause a slate to fail and slide off the roof. This can also be caused by movement in the barn, and more often by an uneducated roofer walking on the slates. Every slate that gets stepped on will be broken. The barn owner should inspect the roof every spring to see if the snow has dragged off any broken slates. It is also important to inspect areas where valleys are formed by the addition of straw sheds. These are often metal that rusts out after 80-100 years. These problems can easily be repaired by a roofer with experience in such work.

Asphalt or composition shingle roofing is more typically found on houses than barns in Ohio. Shingles are not well suited to high wind areas like barn roofs. They are also quite heavy and require a solid wooden nailing surface, which most barns do not have. The weight of a shingle roof can also cause damage to a timber frame barn. Since the frame members were most likely sized for a much lighter roof such as metal or shakes, the added weight can cause premature failing. For these reasons we do not recommend putting composition shingles on barns. We would also recommend their removal, if they are at the end of their useful life, and replacement with a more suitable material. Unfortunately, they will most likely end up in a landfill since they are so difficult to recycle.

Foundations and Basements

The final areas of significance in barn conservation are the foundation and basement areas. Since older barn foundations are stone, repairing them is well outside the barn owner's area of expertise and is likely to be something most masons are not prepared to deal with. This is due to a basic change in the way masonry work is done since the widespread use of Portland cement-based mortars began. Portland cement-based mortar is much easier to use than historic lime mortars and is actually significantly stronger. Unfortunately this is not a good thing when laying up or repointing sandstone foundations. Since the mortar is harder than the stone, repointing usually leads to the faces of the stones being sheared off during seasonal cycling. A bigger problem is when loosened or dislodged stones are re-bedded with Portland mortar. The eventual result is often concentrated loads causing the large foundation stones to break.

There are many variations in barn shapes and types, as well as many different types of additions and modification that have been made to them in the century or more of their use. Although these changes can complicate the maintenance and repair of barns the same basic principle of conservation applies. Barns require maintenance. Good stewardship of a barn that is well maintained is a simple matter of looking for problems and taking care of them when they are discovered. Saving a barn that has suffered from neglect can be a greater challenge, but the rewards of saving one of Ohio's great symbols are endless.

New Interest in Barns

Conserving Ohio's historic barns is obviously a matter of good stewardship. Barns that are still in use have a much greater chance of survival than those that are not, but farming methods have changed greatly since the 19th century, and many barns are no longer considered worth maintaining. Keeping these barns from being lost will either require support from community or governmental agencies or a change in perception by their owners as to their value. Neither of these goals is easily accomplished.

Governmental sources of funding are slow in coming but some states have realized the importance and significance of their barns and have established grant programs for barn conservation. New York State began a program in 2000 that made \$2,000,000 available for barn repairs. The program was set up on an application basis and roughly 50 barns are selected each year to receive funds based on their needs. Program administrator Randy Nash soon realized the dilemma created by the program. Although many more applications were received than could be accepted, finding the qualified contractors needed to do the repairs was impossible. Many of the original repair grants have yet to be fulfilled.

A similar form of legislation which passed at a federal level in 2002 also met a roadblock. Although the Historic Barn Preservation Program was accepted as part of the Farm Bill, the \$25,000,000 it made available has yet to be funded. If this funding were to become available it would be distributed through State Historic Preservation Offices and statewide non-profit organizations established with a focus on barn conservation. Many states have seen the establishment of these types of "grass roots" organizations. These include the New York State Barn Coalition, Michigan Barn Preservation Network and Friends of Ohio Barns. These types of organizations provide information through newsletters, workshops and conferences to barn owners as well as barn lovers about the history of barns and barn types as well as barn lore and maintenance guidelines.

On a national level the National Trust for Historic Preservation sponsored its first "barn tour" during the National Preservation Conference held in 2002 in Cleveland. The sold out bus tour visited several barns throughout Geauga County including a working Amish farm still using the barn to support their horse powered farming operation. Another successful program focused on barns is the **Barn Again!** program. This program has sponsored many workshops in various states, but has found a real home in Ohio, where Barn Again! workshops are held several times each year.

If Ohio's beautiful barns are to survive as a symbol of our great agricultural heritage, some basic changes have to occur. These changes can happen at many levels from owner awareness to state budget line items, but nothing will happen without public interest and support. The steady decline and loss of the barn as a symbol of Ohio does not have to be inevitable, but if it goes unchecked we will no longer have to suffer looking at barns collapsing along our roadways. They will all be gone.

References Cited

- Brunskill, R.W. 1978. *Vernacular Architecture of the Lake Counties*. London: Faber and Faber.
- Carlson, Alvar W. 1978. "Designing historic rural areas: A survey of northwestern Ohio barns" *Landscape* 22: 29-33.
- Ensminger, Robert F. 1992. *The Pennsylvania Barn: Its Origin, Evolution, and Distribution in North America*. Baltimore: Johns Hopkins University Press.
- Fink, Daniel. 1987. *Barns of the Genesee Country*. New York: James Brunner Publisher.
- Hewett, Cecil A. 1980. *English Historic Carpentry*. London: Phillimore.
- Hughes, Graham. 1985. *Barns of Rural Britain*. London: Herbert Press.
- Kniffen, Fred. 1965. "Folk housing: Key to diffusion", *Annals of the Association of American Geographers* 55: 4: 549-577.
- Lafferty, Michael (ed). 1979. *Ohio's Natural Heritage*. Columbus: Ohio Academy of Science.
- Noble, Allen G. 1974. "Barns and square silos in northeast Ohio," *Pioneer America* 6: 2: 12-21.
- Noble, Allen G. 1977. "Barns as elements of the settlement landscape of Ohio", *Pioneer America* 9: 1: 62-79.
- Noble, Allen G. 1984. *Wood, Brick and Stone: The North American Settlement Landscape, Vol 2*. Amherst: University of Massachusetts Press.
- Noble, Allen G. 1993. "Barn entry porches, pent roofs, and decorated doors of the eastern Midwest", *Journal of Cultural Geography* 14: 1: 21-34
- Noble, Allen G. and Richard K. Cleek. 1995. *The Old Barn Book: A Field Guide to North American Barns and other Farm Structures*. New Brunswick, NJ: Rutgers University Press.
- Noble, Allen G. and Hubert G. H. Wilhelm. 1995. *Barns of the Midwest*. Athens: Ohio University Press.
- Stephens, David T. 1995. "Midwest Barn Décor." Pp 237-258 in Noble, Allen G. and Hubert G.H. Wilhelm (eds.) *Barns of the Midwest*. Athens: Ohio University Press.
- Wilhelm, Hubert G.H. 1976. "Amish-Mennonite barns in Madison county, Ohio: The persistence of traditional form elements," *Ohio Geographers: Recent Research Themes* 4: 1-8.
- Wilhelm, Hubert G.H. 1981. "A lower Saxon settlement region in western Ohio," *P.A.S.T.-Pioneer America Society Transactions* 4: 1-10.
- Wilhelm, Hubert G.H. 1983. "Tobacco barns and pent roofs in western Ohio," *P.A.S.T.-Pioneer America Society Transactions* 6: 19-26.
- Wilhelm, Hubert G.H. 1992. "Germans in Ohio," Pp. 60-78 in Noble, Allen G. (ed.). *To Build in a New Land*. Baltimore: John Hopkins University Press.
- Wilhelm, Hubert G.H. 1995. "Midwestern barns and their Germanic connection," Pp. 62-79 in Noble, Allen G. and Hubert G.H. Wilhelm, (eds.), *Barns of the Midwest*. Athens: Ohio University Press.
- Williams, Eurwyn. 1986. *The Historical Farm Buildings of Wales*. Edinburgh: John Donald Publishers.

Other Resources

- Barn Again! (www.barnagain.org) is a national program that provides information to help owners of historic barns rehabilitate them and put them back to productive use on farms and ranches.

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