1. NAME AND LOCATION OF PROPERTY

Historic Name: **University of Wisconsin Arboretum**

Other Name/Site Number:

Street and Number (if applicable)**:** **1207 Seminole Highway**

City/Town: **Madison** **County:** **Dane** **State: WI**

Designated a National Historic Landmark by the Secretary of the Interior January 13, 2021.

2. SIGNIFICANCE DATA

NHL Criteria: **1**

NHL Criteria Exceptions: **n/a**

NHL Theme(s): **VI. Expanding Science and Technology**
1. **Experimentation and Invention**
2. **Technological Applications**
3. **Scientific Thought and Theory**

VII. Transforming the Environment
2. **Adverse Consequences and Stress on the Environment**
3. **Protecting and Preserving the Environment**

Period(s) of Significance: **1933-1966**

Significant Person(s) (only Criterion 2)**:** **n/a**

Cultural Affiliation (only Criterion 6)**:** **n/a**

Designer/Creator/Architect/Builder: **G. William Longenecker; Albert F. Gallistel; Aldo Leopold; Jens Jensen**

Historic Contexts: Conservation

3. WITHHOLDING SENSITIVE INFORMATION

Does this nomination contain sensitive information that should be withheld under Section 304 of the National Historic Preservation Act?

_x_ Yes

___ No

4. GEOGRAPHICAL DATA

1. Acreage of Property: 1200 acres

2. Use either Latitude/Longitude Coordinates or the UTM system:

Latitude/Longitude Coordinates (enter coordinates to 6 decimal places)**:**
Datum if other than WGS84:

Latitude: **Longitude:**

OR

UTM References:

	Zone	Easting	Northing
A:	**16**	**302260**	**4769880**
B:	**16**	**304060**	**4769860**
C:	**16**	**304680**	**4769390**
D:	**16**	**304200**	**4768060**
E:	**16**	**301070**	**4766190**
F:	**16**	**300450**	**4766340**
G:	**16**	**301240**	**4769200**

3. Verbal Boundary Description:

The boundary of the nominated property is delineated on Figure 1 by the polygon whose vertices are marked by the above-listed UTM reference points. The nominated boundary consists of all of the Arboretum lands owned by the University of Wisconsin as indicated on the attached figures. These are generally bounded by a line that begins at a point at the south intersection of the southeast right-of-way of Arbor Drive and the southwest right-of-way of Knickerbocker Street extended southeasterly to the northwest shore of Lake Wingra (and excluding

Wingra Park), then following the shoreline of Lake Wingra southwesterly, then southeasterly, then northeasterly to the south end of the Wingra Creek Dam (and excluding the dam). Then generally following the west bank of Wingra Creek to the South Mills Street Bridge (and excluding said bridge). Then southeasterly along the southwest right-of-way of Fish Hatchery Road to Carver Street. Then generally following the north right-of-way west along Carver Street (excluding Harvey E. Schmidt Park) to Balden Street. Then northeasterly along the southeast right-of-way of Balden Street (excluding all the lots in the Forest Park Addition on the northeast side of Balden Street) to Covall Street. Then northeast along the southeast right-of-way of Covall Street to Arboretum Drive. Then westerly and then southerly along the southerly right-of-way of Arboretum Drive to the southwest corner of the southwesternmost lot in the Forest Park Addition and following the south lot line (and south lot line extended) easterly to Carver Street. Then easterly and southerly along the southwesterly right-of-way of Carver Street to Martin Street. Then south along the west right-of-way of Martin Street, and east along south right-of-way of Martin Street to Irwin Place. Then south along the west and south lot lines of the properties on the south side of Martin Street to the northwesterly right-of-way of the former Chicago & North Western Railway (now the Cannonball Bike Path). Then southwesterly along said right-of-way to the east lot lines of the development along West Badger Road. Then northerly along said east lot lines to the northeast corner of said lots. Then west along the north lot lines of the development along West Badger Road to the west lot lines of said development. Then south along the west lot lines of the development along West Badger Road to the north right-of-way of the West Beltline Highway. Then west along said right-of-way to a point north of the west lot lines of the development on River Bend Road. Then south across the West Beltline Highway (and excluding said highway) and following the west lot lines of the development along River Bend Road, then east along the south lot lines of said development. Then continuing south along the west lot lines of the development along Kingston Drive, and then Leyton Lane, and then Westview Lane to the north right-of-way of the former Chicago & North Western Railway (now the Cannonball Bike Path). Then west-northwesterly along said right-of-way to the east right-of-way line of Seminole Highway. Then northerly along said right-of-way, across the West Beltline Highway (and excluding said highway) to the south lot lines of the development on Winslow Lane, then north along the east lot lines of said development, and west along said lot lines to the east right-of-way of Seminole Highway. Then easterly along the south lot lines of the development on Iroquois Drive, then north along east lot lines of said development. Then west along north right-of-way of Iroquois Drive to Country Club Road. Then north along east right-of-way of Country Club Road to the south lot line of the Nakoma Country Club Golf Course. Then following the south lot line of said golf course east, southeast, south, east, north, and then west to Manitou Way. Then north along the east right-of-way of Manitou Way to Nakoma Road. Then northeast along the easterly right-of-way of Nakoma Road to Monroe Street. Then east-northeast along the easterly right-of-way of Monroe Street (excluding the development on the east side of Monroe Street at Odana Road) to Arbor Drive. Then east and northeast along the south and southeast right-of-way of Arbor Drive to Knickerbocker Street and the point of beginning. The site is composed of a conglomeration of legal parcels that encompass 1200 acres.

4. Boundary Justification:

The boundary of the University of Wisconsin Arboretum encompasses all of the land historically associated with it. The boundaries have existed since 1966.

5. SIGNIFICANCE STATEMENT AND DISCUSSION

INTRODUCTION: SUMMARY STATEMENT OF SIGNIFICANCE

The University of Wisconsin Arboretum is nationally significant in conservation. The Arboretum was conceived as a laboratory for investigating methods of reclaiming and repairing damaged and degraded landscapes, primarily prairies, forests, wetlands, and savannas. The research and experimentation carried out in the Arboretum beginning in the 1930s was nationally significant because the work led to a better understanding of these ecosystems and contributed importantly to the development of standardized conservation, restoration and management practices, and ultimately helped define the field of restoration ecology. Ecological restoration is "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed."[1] The Arboretum embodies Aldo Leopold's "land ethic," of humanity taking responsibility for healing the land.

Leopold played a leading role in setting the purpose of the Arboretum and guided its development as the Arboretum's first research director. Speaking at the dedication in 1934, he emphasized the interdependence of humans, plants, and animals, and expressed alarm over the damage humans were causing to the environment.[2]

Leopold stated:

> Our idea, in a nutshell, is to reconstruct, primarily for the use of the University, a sample of original Wisconsin – a sample of what Dane County looked like when our ancestors arrived here during the 1840s. . . . Why study original Wisconsin? . . . Because we are just beginning to realize that along with the intentional and necessary changes in the soil and its flora and fauna, we have also induced unintentional and unnecessary changes which threaten to undermine the future capacity of the soil to support our civilization. … these changes threaten the actual physical existence of even the present social structure. . . . It will take time, geological time, to repair this loss. . . . This in a nutshell, is the function of the Arboretum: a reconstructed sample of old Wisconsin, to serve as a benchmark, a starting point, in the long and laborious job of building a permanent and mutually beneficial relationship between civilized men and a civilized landscape.[3]

The Arboretum's ecological communities have provided models for ecological restoration and sparked practical and applied research that has generated knowledge leading to theoretical and practical principles important in the development of ecological restoration. The two most important contributions of national significance were the necessity of prescribed fires for fire-dependent ecosystems (beginning with prairies and extending to other ecosystems), and the adaptive approach to the restoration and management of ecosystems (building experiments into the project, and adjusting the project based on the results).[4] The Arboretum is widely recognized as the site of the first experiments in prairie ecological restoration in the United States. The Curtis Prairie component

[1] Society for Ecological Restoration, "What is Ecological Restoration?" accessed July 11, 2019, https://www.ser-rrc.org/what-is-ecological-restoration/.

[2] "Owls Help 8 Speakers Dedicate U. Arboretum," *Wisconsin State Journal*, June 18, 1934, 2:I; Franklin E. Court, *Pioneers of Ecological Restoration: The People and Legacy of the University of Wisconsin Arboretum* (Madison: The University of Wisconsin Press, 2012), 74-79.

[3] Leopold's 'popularized version' of this speech, as he termed it, is attached to a note to Joseph W. Jackson, September 20, 1934, Arboretum Records, 38/3/1, University of Wisconsin Archives.

[4] Christian Lenhart and Peter C. Smiley Jr., eds., *Ecological Restoration in the Midwest: Past, Present, and Future* (Iowa City: The University of Iowa Press, 2018): 64-65, 68, 77.

(begun with experimental plots in 1935) is regarded as the oldest restored prairie in the nation.[5] The methodically planted and meticulously documented Greene Prairie (begun 1943) is considered one of the finest examples of a restored prairie in the United States.[6] The Arboretum is also significant as the site of important research in the conservation, management, and restoration of wetlands, forests, and savannas. The knowledge gained at the Arboretum has been disseminated nationally through technical journals and the academic and professional careers of University of Wisconsin graduates in conservation-related fields.

The Arboretum's period of national significance begins in 1933, with Aldo Leopold's attempt to establish a tamarack plant community (which combines characteristics of wetlands and forests),[7] and an experiment in reforestation with the planting of what is now known as the Leopold Pines, a grouping of red and white pines, and spruce typical of a northern Wisconsin pine forest.[8] Conservation experiments in Wingra and Gallistel woods, Curtis Prairie, and Gardner Marsh followed beginning in 1934 and 1935. Savannas were studied beginning around 1950. The period of national significance ends in 1966, with the retirement of G. William Longenecker and Henry Greene. Longenecker had served as executive director of the Arboretum since 1933. He was the last of the pioneers and held true to their vision of the Arboretum as a laboratory for repairing and restoring damaged landscapes.[9] Greene, appointed an instructor in the Botany Department at the University of Wisconsin in 1937, was critical to the development of several ecological communities. He planted Greene Prairie beginning in 1943 and served on the Arboretum Committee for 20 years (1946-1966).[10]

The University of Wisconsin Arboretum is nationally significant under NHL criterion 1, in conservation, which is part of both Thematic Framework VI. Expanding Science and Technology (topic 1, experimentation and invention; topic 2, technological applications; and topic 3, scientific thought and theory), and VII. Transforming the Environment (topic 1, manipulating the environment and its resources; topic 2, adverse consequences and the stress on the environment; and topic 3, protecting and preserving the environment).

PROVIDE RELEVANT PROPERTY-SPECIFIC HISTORY, HISTORICAL CONTEXT, AND THEMES. JUSTIFY CRITERIA, EXCEPTIONS, AND PERIODS OF SIGNIFICANCE LISTED IN SECTION 2.

Historical Context: The Conservation Movement

The conservation movement strongly influenced the establishment of the Arboretum as a laboratory for repairing and restoring degraded lands. This movement, dating back to the mid-nineteenth century and initially focused on forests, asserted that human activity was having a destructive impact on the environment and that

[5] Lenhart and Smiley, *Ecological Restoration in the Midwest*, vii.

[6] Court, *Pioneers of Ecological Restoration*, 140-42; Roger Anderson, "History and Progress of Ecological Restoration in Tallgrass Prairie," in *Canaries in the Catbird Seat: The Past, Present, and Future of Biological Resources in a Changing Environment*, ed. Christopher A. Taylor, John B. Taft, and Charles F. Warwick (Champaign, Illinois: Illinois Natural History Survey, 2009) chapter 13, 4.

[7] "University of Wisconsin Arboretum and Wild Life Refuge," undated (ca. 1934) manuscript, author unknown, Arboretum Records, 38/1/11, University of Wisconsin Archives; Franz A. Aust and G. William Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," in *The American School and University*, 8th ed. (New York: American School Publishing Corporation, 1936), 183.

[8] Nancy D. Sachse, *A Thousand Ages: The University of Wisconsin Arboretum*, (1965; repr., Madison: Regents of the University of Wisconsin, 1974); Court, *Pioneers of Ecological Restoration*, 31, 52-53; "Announce establishment of Wisconsin Arboretum," *Wisconsin State Journal*, August 28, 1932, 1 and 4.

[9] Court, *Pioneers of Ecological Restoration*, 68-70; and "Bill Longenecker: Far-Sighted Planner," *Wisconsin State Journal*, May 21, 1967, 4:3.

[10] Court, *Pioneers of Ecological Restoration*, 140-142.

humans were responsible for repairing that damage and for developing methods for the sustainable use of natural resources. A second, less pronounced influence on the establishment of the Arboretum came from the naturalistic mode of landscape design, particularly the prairie style landscapes of Jens Jensen, which sought to simulate the appearance of nature. A third influence on the Arboretum's development was the science of modern ecology, which studies the interdependence of living organisms and their environment and began to gain attention in the United States in the 1890s.

A catalyst that intensified the need for research and the development of best practices was the pattern of human activity that damaged land and diminished its productivity, as highlighted by two regional environmental disasters. One was the logging of the vast pineries of upper Midwestern and northwestern states, including those in northern Wisconsin, in the late nineteenth century. The deforested region of Wisconsin was known as "the Cutover." Lumber companies promoted and sold the Cutover as farmland, primarily to new immigrants. These families endeavored to farm acres of pine stumps, with very little success, and by the late 1920s, were losing their land to tax delinquency at an alarming rate.[11] A second catastrophic event was the "Dust Bowl", which came to a head in the 1930s, with the destruction caused by erosion from extensive plowing of the prairies. Extended drought resulted in extreme dust storms, economic disaster, and the abandonment of farmsteads, especially in the southern Great Plains.[12]

These developments set the stage for the collaboration of botanists, wildlife ecologists, biologists, foresters, and landscape architects who would bring science and design together to create something entirely new in the Arboretum: a laboratory for repairing and restoring damaged lands. The Midwest was an important region in the developing fields of conservation, landscape design, and ecology. Names that recur in the history of these fields appear in the history of the Arboretum. Jens Jensen, Franz Aust, William Longenecker, and Aldo Leopold were all influential in the realization of the University of Wisconsin Arboretum.

The Conservation Movement: The Interdependence of Humans and the Environment

In 1864, George Perkins Marsh published *Man and Nature*, becoming the first in the United States to assert that humanity and the environment are interdependent, that human activity could have a destructive impact on the environment, and that humans bear the responsibility for repairing the damage they cause. Marsh believed that forests were essential to a livable, productive environment. In *Man and Nature*, he described his observations of the effects of deforestation, outlined European scientific theories on the relationship between forests and floods, water supply, and climate, and promoted European reforestation and forest management techniques. No other work had greater influence on nineteenth-century scientific thinking about forests in the United States.[13]

Marsh recommended reforestation and forest management ("forestry"), which had developed in Europe beginning in the late-eighteenth century, not only for erosion and flood control, but also to ensure sufficient lumber for sustainable commercial use.[14] Marsh's belief in the importance of forests was soon widely accepted among American scientists and much of the public. His work inspired the scientific study of trees and forests, as

[11] Wisconsin Historical Society, "Logging and Forest Products," accessed June 28, 2019, https://www.wisconsinhistory.org/turningpoints/tp-027/?action=more_essay; Robert C. Nesbit, *Wisconsin: A History* (Madison: The University of Wisconsin Press, 1973), 469-71.

[12] Timothy Egan, *The Worst Hard Time* (New York: Houghton Mifflin Company, 2006), 88-92.

[13] Marcus Hall, *Earth Repair: A Transatlantic History of Environmental Restoration* (Charlottesville: University of Virginia, 2005), 6-9; Herbert A. Smith, "The Early Forestry Movement in the United States," *Agricultural History* 12, no. 4 (October 1938): 328-29, 340-41.

[14] George P. Marsh, *Man and Nature* (1864; repr., Seattle: University of Washington Press, 2003), 35, 44; Hall, *Earth Repair*, 6-8.

well as state and federal legislation to promote tree planting, forest preservation, and forest management. His influence also prompted the establishment of arboreta in the United States. An arboretum is defined as a place where a variety of trees and shrubs are grown for scientific research, display, and education. When arboreta began to be planted in the United States, they were typically designed by landscape architects in collaboration with scientists and were associated with a university or represented a partnership between private and public institutions. The first was the 1879 Arnold Arboretum, associated with Harvard University and laid out by Frederick Law Olmsted in cooperation with dendrologist and botanist Charles Sprague Sargent.[15]

State legislatures also answered Marsh's plea to plant trees and protect forests. Between 1869 and 1872, many Midwestern states, including Wisconsin, awarded tax exemptions to property owners who planted trees on prairie lands. This measure was based on the common misconception, inferred from Marsh, that foresting the plains would improve the climate, increase rainfall, and make farming the grasslands possible.[16] A number of states conducted surveys of forests and formed forestry commissions or bureaus in the 1860s and 1870s. Wisconsin established its first forestry commissions in 1867, in large part out of concern for the rapid and widespread logging of the pineries of central and northern Wisconsin, as highlighted in Increase Lapham's *Report on the Disastrous Effects of the Destruction of Forest Trees, Now Going on so Rapidly in the state of Wisconsin* (1867). Although the legislature approved a 760-square mile state forest in northern Wisconsin in 1878, stiff opposition from the timbering industry caused it to fail, and most of the land was sold to lumber interests.[17]

At the federal level, the United States Department of Agriculture (USDA), created in 1862, was the first agency to focus on forest issues. Frederick Starr Jr., United States Commissioner of Agriculture, advocated scientific research to establish forest cultivation practices.[18] In 1877, Franklin B. Hough completed an extensive survey on the forests of the United States, which led to the creation of the Division of Forestry of the USDA in 1881. Hough, the division's first chief, and Carl Schurz, then United States Secretary of the Interior, advocated that the federal government reserve timberlands and regulate their use to ensure their continued productivity.[19] This was eventually codified in the Forest Reserve Act of 1891, which allowed the president to set aside publicly owned lands as forest preserves to protect valuable timber from unlawful use. The first forest reserve created was the Yellowstone National Park Timber Land Reserve, adjacent to the national park. There were no provisions for protecting the reserves, which were placed under the administration of the Secretary of the Interior until the enactment of the Forest Management Act of 1897. The Secretary of the Interior tried unsuccessfully to prevent logging and livestock grazing in the reserves; the Forest Management Act permitted these activities, as well as mining, but prescribed regulations for controlling them.[20]

George W. Vanderbilt would accelerate the development of forestry in the U.S. in several ways at his Biltmore Estate in North Carolina. In 1888, the wealthy industrialist engaged Frederick Law Olmsted to plan the grounds

[15] Albert Fein, *Frederick Law Olmsted and the American Environmental Tradition* (New York: George Braziller, 1972), 31 and figure 41.

[16] Smith, "The Early Forestry Movement in the United States," 340-41; Eliot Zimmerman, *A Historical Summary of State and Private Forestry in the U.S. Forest Service* (Washington, D.C.: U.S. Department of Agriculture, 1976), 3. The persistence of this belief would contribute to the catastrophic environmental disaster known as the Dust Bowl.

[17] Christine L. Thompson, "One Hundred Twenty Years of Citizen Involvement with the Wisconsin Natural Resources Board," 1991, accessed August 22, 2019, https://dnr.wi.gov/About/NRB/documents/120-years-citizen-involvement-WNRB.pdf; and Wisconsin Historical Society, "The Conservation Movement," accessed July 2, 2019, http://www.wisconsinhistory.org/turningpoints/tp-033/?action=more_essay.

[18] Frederick Starr, Jr., *Report of the Commissioner of Agriculture* (Washington, D.C.: Government Printing Office, 1866), 218-26.

[19] Smith, "The Early Forestry Movement in the United States," 336, 341.

[20] Hall, *Earth Repair*, 7-9, 134.

of the new home he would build near Asheville, North Carolina. Vanderbilt wanted the grounds to be pleasant yet income producing. Olmsted recommended "forest plantations . . . kept and managed as a commercial forest."[21] Olmsted also advised creating an arboretum for public education in science and landscape design. Vanderbilt accepted both suggestions and enlarged the estate to 120,000 acres. Today, these resources are publicly owned, as a part of the Pisgah National Forest and the North Carolina Arboretum. The first school of forestry in the U.S. would also be established on the Biltmore Estate (1898-1909). Vanderbilt also took another suggestion from Olmsted: that he employ Gifford Pinchot, the son of a friend of Olmsted's, as the Biltmore forester. Pinchot was the first American-born professional forester in the United States and would be a key figure in the conservation movement.[22] Pinchot prepared a comprehensive plan for managing the Biltmore forest, the first ever prepared in the United States. His plan included measures for replanting, cutting, selective thinning to improve tree growth, and fire suppression.[23]

Pinchot's work attracted national attention and became a model for managing forests as renewable resources; it was also the first large-scale, scientific reforestation project in the country. It should be noted that his restoration of woodlands did not recreate the same mix or varieties of trees that had been present before Euro-American settlement, but rather was a "more [economically] valuable mixture of species and . . . more uniform forest."[24]

In 1898, Pinchot was appointed chief of the Division of Forestry. He systematically built the division's personnel and budget. In 1905, the agency became the United States Forest Service (USFS). In 1907, the reserves were renamed national forests. Pinchot outlined the practices and procedures for management of national forests in *The Use Book* (1906). [25] As the title reflects, the efficient use of the nation's forests for all citizens was paramount for Pinchot.[26] To this end, the USFS established the Forest Products Laboratory (FPL), a national center for testing wood and wood products, in 1909. The University of Wisconsin was selected to host FPL. Albert F. Gallistel, in the office of the University of Wisconsin Supervising Architect, designed the 1909 building (NRHP 1984). Research into wood preservation, timber tests, wood chemistry, wood physics, engineering, pulp and paper, pathology, and wood distillation were carried out in the facility.[27] FPL would also bring a key figure in the development of the Arboretum to Madison in 1924, when Aldo Leopold was named assistant (later associate) director of the facility.[28]

In 1910, Pinchot left the USFS. Under his direction, the number of national forests had expanded rapidly. By 1910, there were 150 national forests, encompassing 172 million acres. The idea and the goal of the USFS remained conservation of all natural resources, not only forests, in the sense of their wise ("conservative") use, a

[21] Quoted in Fein, *Frederick Law Olmsted and the American Environmental Tradition*, p. 56.

[22] M. Nelson McGeary, *Gifford Pinchot: Forester—Politician* (Princeton, New Jersey: Princeton University Press, 1960), 19; Gifford Pinchot, *Breaking New Ground*, (Washington, D.C.: Island Press, 1947), 49.

[23] Pinchot, *Breaking New Ground*, 49.

[24] Pinchot, *Breaking New Ground*, 49-55, quoted, p. 51; John M. Meyer, "Gifford Pinchot, John Muir, and the Boundaries of Politics in American Thought," *Polity* 30, no. 2 (Winter, 1997): 269.

[25] Meyer, "Gifford Pinchot, John Muir, and the Boundaries of Politics in American Thought," 270-72.

[26] Gifford Pinchot, *The Use Book*, (Washington, D.C.: Government Printing Office, 1906), 13.

[27] National Register of Historic Places, "Old Forest Products Laboratory," Madison, Dane County, Wisconsin, Reference #85002332, 8-1.

[28] Susan L. Flader and J. Baird Callicott, eds., *The River of the Mother of God and Other Essays by Aldo Leopold* (Madison: The University of Wisconsin Press, 1991), xiii-xiv.

concept that became broadly accepted during Pinchot's tenure.[29] For Pinchot, conservation meant "the greatest good to the greatest number for the longest time."[30]

The development of national forestry policy in the United States coincided with the closing of the country's western frontier, increasing urbanization and industrialization as the population continued to grow, water and air pollution and contributing to the destruction of natural landscapes, especially woodlands and prairies. Euro-American settlers had spread across the country, homesteading, mining, logging, and manufacturing without regard for the effect of their activities on the landscape. By the turn of the twentieth century, many people had become concerned about the environmental degradation they were witnessing and believed governmental controls were essential. At the same time, social scientists concluded that time spent in nature could positively affect many of the social problems of the period. These interests coalesced in advocacy for preserving the wilderness, creating public parks in urban areas, and beautifying the landscape. These movements contributed to the development of the fields of conservation and ecology and helped lead to the formation of the National Park Service.[31]

The event that catalyzed proponents of preserving the wilderness, such as John Muir, was the proposal to dam the Tuolumne River in Hetch Hetchy Valley to supply water to the city of San Francisco. This became a national topic of debate, and despite the opposition of many citizens, Congress enacted the Raker Bill in December 1913, permitting the city of San Francisco to dam the Tuolumne River and flood the Hetch Hetchy Valley. The loss of this battle inspired wilderness advocates to fight for the creation of a federal agency that would safeguard the scenic and natural character of parks for the public good and not be swayed by the vagaries of politics. The American Civic Association, a leader in this initiative, engaged Frederick Law Olmsted, Jr., to advise them. Olmsted pinpointed the lack of consistent and effective measures for protecting the parks as a principal issue for such an agency to address. Stephen T. Mather was another leader in the effort to form a national park agency. Mather, a wealthy industrialist, was an active member of the Sierra Club. He was based in Chicago and was a founding member of the Friends of Our Native Landscape (organized by Jens Jensen in 1913). Mather was appointed Assistant Secretary of the Interior and placed in charge of the national parks in 1915.[32]

The enactment of the National Park Service Organic Act (39 Stat. 535, 16 U.S.C. 1) in 1916 authorized the formation of the National Park Service (NPS). As stated in the enabling legislation, the agency's mission was "to conserve the scenery and the natural and historic objects and the wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."[33]

Mather became the first director of the NPS, serving from 1917 until 1929. The NPS enacted a policy of passive management of wilderness areas, leaving them untouched aside from elements designed to bring visitors into and through the parks, such as roads, trails, shelters, campgrounds, and lodging. Beginning in 1918, the NPS hired landscape architects to plan roads and trails, campgrounds, and other visitors' facilities, employing

[29] McGeary, *Gifford Pinchot*, 208-11. This definition originated with Theodore Roosevelt, according to Aldo Leopold. See Aldo Leopold, *Game Management* (1933 repr., Madison: The University of Wisconsin Press, 1986), 17.

[30] Gifford Pinchot, *The Right for Conservation* (New York: Doubleday, Page and Co., 1910), 48.

[31] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 13-14.

[32] Norman T. Newton, *Design on the Land: The Development of Landscape Architecture* (Cambridge: The Belknap Press of Harvard University Press, 1971), 528-37; William H. Tishler and Erik M. Ghenoiu, "Conservation Pioneers: Jens Jensen and the Friends of Our Native Landscape," *Wisconsin Magazine of History* (Summer 2003): 3-9. It should be noted that public reserves existed before 1915.

[33] Quoted in Newton, *Design on the Land*, 530.

naturalistic design. NPS landscape architects often included native plants in their plans. In 1930, the NPS prohibited the introduction of exotic vegetation in the parks.[34] These practices essentially set a national standard for the design and management of national and state parks.

The influence of the NPS on the University of Wisconsin Arboretum was largely indirect and in the person of Stephen T. Mather, through his connections with Jens Jensen, Henry C. Cowles, and Stephen Forbes, as outlined, below, under *Landscape Architects and Conservation*. The USFS had a direct influence on the Arboretum through Aldo Leopold, who worked for the agency from 1915 until 1928. A second, lesser USFS influence was Raphael Zon (Director of the USFS Cloquet Forest Experiment Station in Minnesota), who sat on the first Arboretum Advisory Committee.

Landscape Architects and Conservation

Landscape architecture evolved in the United States with a naturalistic design philosophy. Beginning in the 1840s, Andrew Jackson Downing's plans simulated the appearance of nature, using both exotic and native plants. Frederick Law Olmsted, Sr., and Calvert Vaux created designs that more closely mimicked the appearance of nature. Following the dissolution of their partnership, Olmsted created a body of work that included both naturalistic and formal plans, though Central Park and many other examples of the partners' work were similarly varied in form and intent.

In the early twentieth century, some landscape architects were intent on creating designs that more accurately reflected nature, with regional variations of naturalistic designs, using plants native to the region. O.C. Simonds used plants native to the Midwest in his naturalistic landscape designs in Chicago and the upper Midwest. Jens Jensen's early landscape designs were also in the naturalistic mode. His collaboration with Henry C. Cowles of the University of Chicago, a pioneer ecologist who described and categorized the plant communities of a range of landscapes of the upper Midwest, inspired Jensen to apply two major ecological principles to his designs. He placed plants from the same communities together to evoke the spirit of the landscape in which interconnected plant communities naturally grew. Jensen also favored the "plant association" concept of Cowles and Frederic Clements, which suggested that plant communities in nature reached a stable, mature state**.** Jensen turned to the historical record to help identify the mature state of the plant communities of the natural landscape he wished to represent. In so doing, Jensen could identify plants to use in what he termed "ecological design." Wilhelm Miller publicized Jensen's work and promoted ecological design through the popular, nationally distributed magazine, *Country Life in America.*

Jensen not only took inspiration from the native landscape, but over the long course of his career, he increased his use of indigenous species and their selection placement in groups based on plant ecology. This approach to design was predominantly the result of a network of friendship and collaboration among three men: Jensen, Henry C. Cowles, and Wilhelm Miller. Henry Cowles, professor of botany at the University of Chicago, established the science of plant ecology in the United States. Wilhelm Miller was a nationally prominent author who crusaded for an American style in landscape design and championed the Prairie Style (especially Jensen's work) and ecological design through his many articles and publications; Miller was also a professor of horticulture at the University of Illinois. [35] These three men shaped the views of one of the founders of the University of Wisconsin Arboretum, Franz Aust. G. William Longenecker, a student of Aust, who became the first executive director of the Arboretum.

[34] Newton, *Design on the Land*, 528-37; Linda Flint McClelland, *Presenting Nature: The Historic Landscape Design of the National Park Service, 1916 to 1942* (Washington, D.C.: Department of the Interior, 1993), 6-7, 155.

[35] Stephen F. Christy, "Jens Jensen: The Metamorphosis of an Artist," *Landscape Architecture* 66 (January 1976): 63.

In 1902, Jensen and Cowles began collaborating on a campaign to establish forest preserves in Cook County. As an outgrowth of continued efforts in that campaign, Jensen and Cowles established the Prairie Club, to sponsor excursions to areas of botanical and scenic interest around Chicago for recreation and to engender an appreciation for their unique beauty. Two other noted ecologists were involved in the Prairie Club: Stephen Forbes and Victor Shelford. Forbes was the director of the Illinois State Laboratory of Natural History (later the Illinois Natural History Survey), state entomologist, and a professor at the University of Illinois. Shelford, a graduate student of Cowles', began his career as a professor at the University of Chicago, transferring to the University of Illinois at Forbes' invitation. Cowles, Forbes, and Shelford were founding members of the Ecological Society of America (ESA), established in 1915. Each served as president of the organization in its early years. Their work helped lay the foundation of the science of ecology.[36]

Cowles, Miller, and Forbes were charter members of the second Chicago-area conservation group Jensen founded, the Friends of Our Native Landscape. Aust would organize the first branch in Wisconsin in 1920. Established in April 1913, the goals of the Friends of Our Native Landscape (Friends) were to educate the public about the native landscape and to fight to preserve it. Jensen began by inviting a small group of his most knowledgeable and influential friends, including Cowles, Miller, Forbes, and Mather.[37] By the time of the first annual meeting in June, membership had grown to nearly 200. The Friends engaged in cross-disciplinary educational efforts, promoting an appreciation of the natural environment of Illinois. The Friends also sponsored a survey to identify properties of scenic and scientific value, which Forbes directed. In 1921, the Friends published a report enumerating these and advocating that they be set aside as Illinois state parks; seven would be so designated by 1932.[38]

Ecology: Plant Communities and Ecological Succession

Two elements of Cowles' research affected designers of naturalistic landscapes, as well as forming a foundation for ecologists. The first was Cowles' application of Danish botanist Eugenius Warming's theory of "plant societies" to the natural landscapes around Chicago. Warming's theory postulates that in nature, plants form interdependent communities based on topography, soil, and climatic conditions. Cowles' book, *The Plant Societies of Chicago and Vicinity* (1901), lists the geographic features of the region (i.e., ravines, swamps, prairies, and dunes) and describes representative groups of plants native to each.[39] Beginning in the late 1910s, botanists would identify the geographic features of their areas, and describe the groups of vegetation found in each. Jensen conducted his own botanical studies, demonstrating Cowles' influence and a familiarity with plant associations and their relationship to landforms and soil type as early as 1904.[40]

[36] Lenhart and Smiley, *Ecological Restoration in the Midwest,* 15-20. In 1946, Shelford organized the Ecologists' Union, changing the organization's name to The Nature Conservancy in 1950.

[37] Tishler and Gheniou, "Conservation Pioneers," 7-9; Christopher Vernon, "Wilhelm Miller: Prairie Spirit in Landscape Gardening," in *Midwestern Landscape Architecture,* ed. William H. Tishler (Urbana: University of Illinois Press, 2000), 191.

[38] Grese, *Jens Jensen: Maker of Natural Parks and Gardens* (Baltimore: Johns Hopkins University Press, 1992), 122-24, 128, and 133; and Grese, "Jens Jensen: The Landscape Architect as Conservationist," in *Midwestern Landscape Architecture,* 125-26, 133.

[39] Henry C. Cowles, *The Plant Societies of Chicago and Vicinity* (Chicago: The University of Chicago Press, 1901), 7-8.

[40] For example, Jens Jensen, "Soil Conditions and Tree Growth Around Lake Michigan," *Park and Cemetery* 14, no. 2 (April 1904): 24-25, cited in Vernon, Foreword to *The Prairie Spirit in Landscape Gardening,* by Wilhelm Miller (1915; repr., Amherst: University of Massachusetts Press, 2002), xxvi.

Cowles' influence on Jensen is illustrated by Jensen's increasing use and promotion of ecological principles. By 1912, Jensen was firmly committed to an ecological approach, as his lecture to the Illinois Chapter of the American Institute of Architects that year testified. Titled "Let Nature Be Your Teacher," this lecture presented Jensen's recommendations for placing specific plants with specific geographic features and soil types.[41]

Miller had adopted and was promoting the principles of ecological design by 1912 as well, recommending that readers of his nationally distributed popular magazine, *Country Life in America,* "Ask the nearest botanist to help you evolve a consistent plant society."[42] In 1915, Miller elaborated on plant ecology as a basis for landscape gardening, incorporating Cowles' lists of plants by landform and soil type and recommending *The Plant Societies of Chicago and Vicinity* to his readers, as well as botanical surveys and the study of plant ecology to determine appropriate native plants for garden design.[43]

Cowles' landmark theory of ecological succession posited that plant communities changed over time, generally developing through several stages until reaching a stable climax. His research impacted landscape designers and plant scientists. The idea of plant groupings associated with particular landform and soil types, when applied to landscape design, prompted landscape architects to follow botanists and ecologists in their study of nature.[44]

The collaboration between Miller and Jensen enriched and articulated the principles of ecological design, as demonstrated in Miller's writing and his ideas. Evidence of the influence of Miller and Jensen and ecological design on Aust and the founding of the Arboretum as a laboratory of ecological restoration, also appears in Miller's and Aust's writings.

Miller first wrote about Jensen's landscapes in 1911. In *Country Life in America*, which he edited, Miller had been arguing for an American style of landscape architecture, with variations unique to each region of the country. Miller believed that regional diversity was best expressed in naturalistic gardening using native plants. Miller had lauded Simonds' work at Chicago's Graceland Cemetery as early as 1898 but had not viewed any of Jensen's designs until 1911. In Jensen's work, Miller found not only the regional expression he had been seeking, but the mode he believed was most appropriate to American democracy.[45] Miller identified Midwestern landscape architects as the trendsetters in a new American landscape architecture and highlighted Jensen's work (and that of Simonds, to a much lesser extent) in article after article in *Country Life in America*. Miller was the first to recognize, characterize, and champion the ideology of the Prairie Style, in a 1914 article, which he enlarged and published as a book with the same title, *The Prairie Spirit in Landscape Gardening* (1915). In that publication, Miller also advocated an ecological approach, presenting Cowles' plant societies, and their associated landform and soil types. Miller also wrote about the related "Illinois Way" of planting, a term he coined for "the use of as high a proportion of plants native to Illinois as is consistent with practical requirements and principles of design."[46]

Miller became an assistant professor of horticulture at the University of Illinois in the fall of 1912; Franz Aust joined him as an instructor in 1913. Miller, with Aust's assistance, took charge of the Division of Landscape

[41] Jens Jensen, "Let Nature Be Your Teacher," *Construction News* 33, no. 16 (April 20, 1912): 8-9, cited in Vernon, Foreword to *The Prairie Spirit in Landscape Gardening,* xiii.

[42] Wilhelm Miller, "What is the Matter with Our Water Gardens?" *Country Life in America* 22 (June 15, 1912): 54.

[43] Miller, *The Prairie Spirit in Landscape Gardening*, 18, 22-23.

[44] Frederic Clements, an ecologist at the Carnegie Institute of Washington from 1917 to 1941, independently developed the same theory of vegetation development. The theory is sometimes referred to as "Clementsian."

[45] Vernon, Foreword to *The Prairie Spirit in Landscape Gardening,* x; Wilhelm Miller, "Successful American Gardens VIII-The Higginson Garden at West Manchester, Mass.," *Country Life in America* (September 1, 1911): 38.

[46] Miller, *The Prairie Spirit in Landscape Gardening*, 5.

Extension (the first such program in the nation) in 1914.[47] He continued to write for *Country Life in America*, as well as authoring technical bulletins for Illinois state agencies and giving public slide lectures to stimulate interest in naturalistic landscape design, until his departure from the University of Illinois in 1916. [48]

Miller authored three bulletins on the "Illinois Way" of planting for various state agencies between 1913 and 1914.[49] Aust co-authored one of them. Aust and colleague L.E. Fogelsang also developed the list of plants native to Illinois that appear *The Illinois Way of Beautifying the Farm*.[50]

Aust was an admirer of Jensen, a member of Jensen's Prairie Club, and a member of Friends of Our Native Landscape. He shared Jensen's and Miller's commitment to an ecological approach to design. Aust maintained close ties with Jensen until the end of Jensen's life. Jensen also held Aust in high regard, recommending to his friend, Charles R. Van Hise, then president of the University of Wisconsin, that Aust be appointed professor of landscape design when the university created its program in that field in the Department of Horticulture in 1915.[51]

That Miller and Jensen had a profound impact on Aust is evident in Aust's work at the University of Wisconsin. Aust (1885-1963) became an instructor in landscape design at the University of Illinois under Miller's direction in 1913. Aust was Miller's chief designer and collaborator at the Division of Landscape Extension. Aust followed Miller's approach in his landscape extension program at the University of Wisconsin, explaining in "The State Program – Wisconsin," (1922) that the function of landscape extension was primarily education, carried out through research in landscape problems, demonstrations, lectures, and publications.[52]

Jensen's influence was evident in Aust's 1920 design for the Council Rock Spring Garden in the ill-fated Lake Forest planned community on the south shore of Madison's Lake Wingra (a site that would later be purchased for the Arboretum and is now known as "Lost City"). Aust's plan, which was never executed, proposed "restoration of the spring to its boiling, bubbling, untamed condition and restoration of the native plants and wildflowers found there before the advent of civilization."[53]

In February 1920, Jensen gave a speech in the Wisconsin state assembly on the beauty of the native landscape, which Aust attended. Taking advantage of the contagious enthusiasm Jensen's speech generated, Aust gathered a group of in one of the Capitol's parlors immediately after Jensen concluded and established the Wisconsin chapter of the Friends of Our Native Landscape (Wisconsin Friends). Michael Olbrich, then president of the Madison Parks and Pleasure Drive and later a major figure in the founding of the Arboretum, was a member of the first board of directors.[54] The stated purpose of the Wisconsin Friends echoed Miller and foreshadowed Leopold's 1934 speech at the dedication of the Arboretum "to secure and preserve examples of the native landscape types that existed in Wisconsin at the coming of the white man . . .."[55] Aust served as secretary from

[47] Quoted in Vernon, Foreword to *The Prairie Spirit in Landscape Gardening*, xx.

[48] Vernon, "Wilhelm Miller: The Prairie Spirit in Landscape Gardening," 184.

[49] "The Illinois Way of Roadside Planting," in *Fourth Report of the Illinois Highway Commission* (Springfield: State of Illinois, 1913), 341; "The Illinois Way of Foundation Planting," in *Illinois Arbor and Bird Days* (Springfield: State of Illinois, 1914): 7-19; *The Illinois Way of Beautifying a Farm* (Urbana: University of Illinois Agricultural Experiment Station Circular, no. 170, 1914).

[50] Miller acknowledged that Aust and Foglesong prepared the lists, in Miller, *The Illinois Way of Beautifying a Farm*, 32.

[51] Tishler and Gehniou, "Conservation Pioneers," 10.

[52] Franz A. Aust, "The State Program – Wisconsin," *Landscape Architecture* XII, no. 2 (January 1922): 69-73.

[53] *Lake Forester* (Madison), December 15, 1920, 2.

[54] "Is Scenery Farthest Away Always Most Beautiful? Jensen Says No," *The Capital Times*, February 23, 1920, 4; Tishler and Gheniou, "Conservation Pioneers," 10.

[55] Articles of Incorporation, March 13, 1920, Friends of Our Native Landscape Papers, Wisconsin Historical Society Archives, M2013-69, Box 1, Folder 1.

1920 until his retirement from the university in 1943 and edited the group's newsletter. The Wisconsin Friends would be the longest-lasting chapter, and highly successful in conservation action and promoting natural landscape appreciation. Their advocacy would be essential in establishing at least ten state parks.[56] Jensen's influence on Aust is further evident in that Aust and his student (and later, colleague) in the Department of Horticulture, G. William Longenecker (executive director of the Arboretum from 1933 until 1966), would frequently bring, or send, their students to study with Jensen at The Clearing, his folk school in Door County, Wisconsin.[57]

It was perhaps the combined influence of both Miller and Jensen that shaped Aust's perspective in the vision of the Arboretum as a laboratory of ecological restoration. In *The Prairie Spirit in Landscape Gardening*, Miller differentiated between a "wild prairie," a natural landscape of the pre-Euro-American settlement era, and a "cultivated prairie" -- a garden design using native plants to symbolize a prairie. He asked the question, "Can the prairie be restored?" Miller noted that the wild prairie has great sentimental appeal and that since people believed it gone forever, "it never occurs to them that any restoration of wild prairie is possible." Miller disagreed, but cautioned, "To re-create a big, wild prairie is a state-park proposition." Under the succeeding sub-heading, labeled, "Wanted – a Prairie Park," Miller quoted "one far-seeing citizen," likely Jensen, as predicting:

> Some day every middle-western state will make one prairie reservation before it is too late or re-create one wild prairie for the people to enjoy forever . . .. This can perhaps be done on 1,000 acres, if the land rolls enough . . ..[58]

Miller was referring to the as-yet undeveloped idea of ecological restoration when he asked the question, "Can the prairie be restored?" At the Arboretum, Aust, Longenecker, Aldo Leopold and others would answer Miller's question with a resounding "yes!"

The History of the University of Wisconsin Arboretum

John Nolen and the Madison Parks and Pleasure Drive Association: An Arboretum is Proposed

As early as 1910, nationally prominent city planner John Nolen had recommended that a large park be established around Lake Wingra. Nolen had also suggested an arboretum, patterned after the Arnold Arboretum in Boston and located west of the University of Wisconsin campus on Lake Mendota. Nolen's reference to the Arnold Arboretum makes clear that he had a traditional collection of trees and shrubs in mind.[59]

Nolen had come to Madison at the invitation of the president of the Madison Park and Pleasure Drive Association (MPPDA), John M. Olin. From its founding in 1894 until it dissolved in 1938, the MPPDA transformed Madison from a city with one three-1/2-acre public park into one with a wealth of parks, playgrounds, athletic fields, beaches, and open space. The MPPDA set high aesthetic standards, hiring the most talented landscape architects of the era to design these public improvements, most notably Nolen and O.C. Simonds.[60] The latter served as the MPPDA's consulting landscape architect from 1900 to 1906 and from 1911

[56] Tishler and Gehniou, "Conservation Pioneers," 15.
[57] Grese, *Jens Jensen, Maker of Natural Parks and Gardens,* 135-148; Tishler and Gheniou, "Conservation Pioneers," 12.
[58] Miller, *The Prairie Spirit in Landscape Gardening,"* 16-17.
[59] John Nolen, *Madison: A Model City*, 1911, http://digital.library.wisc.edu/1711.dl/History.NolenMadsn .
[60] David V. Mollenhoff, *Madison: A History of the Formative Years*, 2nd ed. (Madison: The University of Wisconsin Press, 2003), 221-22.

into the 1920s.[61] Two men who were leaders in the MPPDA, Michael B. Olbrich, and Joseph W. Jackson, would tirelessly promote the creation of an arboretum for the university.[62]

Michael Olbrich and the Madison Parks Foundation: Assembling Land for an Arboretum, Wildlife Refuge and Forest Preserve

Olbrich was a graduate of the University of Wisconsin, a prominent attorney, and a proponent of Progressive reforms. He was public-spirited, especially in conservation and the development of public parks, and sat on the board of directors of the Wisconsin Friends of Our Native Landscape. He was also recognized as an authority on Wisconsin wildflowers.[63]

Olbrich worked independently of the MPPDA to achieve one of Nolen's recommendation to "secure the most important lake frontages" on the shores of Madison's four lakes for public access.[64] In 1916, Olbrich obtained an option on 2,700 feet of Lake Monona's shoreline on either side of Starkweather Creek (part of present-day Olbrich Park) and offered it to the city of Madison. The city initially rejected the offer, but when Olbrich approached the city again in 1921, with a plan drafted by Simonds, the city of Madison agreed to buy the land on Lake Monona. Initially called Lake Monona Park, it was later named in honor of Olbrich. The $50,000 proceeds from its sale would purchase the first parcel in what would become the Arboretum.[65]

In February 1922, Olbrich and realtor Paul E. Stark incorporated the Madison Parks Foundation (MPF), with a capital stock of $100,000, to secure property on Madison's lakeshores for public parks.[66] Olbrich was especially interested in acquiring land on the south shore of Lake Wingra to fulfill Nolen's recommendation to establish a very large park there. Between 1922 and 1928, Olbrich made speeches to various organizations promoting the idea and raising funds toward this effort.[67]

Correspondence between Olbrich and Nolen beginning in 1923 suggest that it was Nolen himself who inspired Olbrich to propose an arboretum for the south shore of Lake Wingra.[68] In 1925, with Nolen's encouragement, Olbrich visited the Arnold Arboretum. Olbrich returned determined to create an arboretum on the Lake Wingra park site. The arboretum Olbrich imagined would be like Harvard's, a collection of trees and shrubs, but large enough to incorporate native wild flowers, a wildlife sanctuary, and a forest preserve. Olbrich's appointment to the University of Wisconsin Board of Regents later that year placed him in an excellent position to advocate for the idea.[69]

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[61] Mollenhoff, *Madison: A History of the Formative Years*, 309-11, 321, 450.

[62] Mollenhoff, *Madison: A History of the Formative Years* 325-334; M.B. Olbrich, "The Wisconsin Arboretum," *The Wisconsin Alumni Magazine* 29, no. 9 (June 1928): 313.

[63] Tishler and Gheniou, 10; "M.B. Olbrich Commits Suicide," *The Capital Times*, October 10, 1929, 1 and 6.

[64] Cited in Mollenhoff, *Madison: A History of the Formative Years*, 332.

[65] Court, *Pioneers of Ecological Restoration*, 7, 14; "Park Gift is Accepted by City Council: East Side Tract Donated by Olbrich and Other Citizens Accepted," *The Capital Times*, August 27, 1921, 1.

[66] Sachse, *A Thousand Ages*, 15.

[67] For an example of Olbrich's commitment to Nolen's plan, see "Remarks…June 15th, 1922," Michael B. Olbrich Records, Wis Mss UX Box 14, Wisconsin Historical Society Archives.

[68] John Nolen to M.B. Olbrich, January 30, 1923, Arboretum Records 38/4/8, University of Wisconsin-Madison Archives; and "Olbrich Urges Woman's Club Help in Creating Sentiment for Nolen Model City Plan," *Wisconsin State Journal*, March 25, 1923, 10.

[69] Court, *Pioneers of Ecological Restoration*, 8.

Olbrich conferred with his friend, botany professor Edward M. Gilbert, to learn what might be involved in creating an arboretum. Olbrich continued to educate himself on the subject while raising funds through the MPF and working with Stark to acquire more land. Olbrich and the MPF had begun assembling land along the south shore of Lake Wingra in 1922, with a 15-acre tract on the southwest edge of the lake (today the northwestern section of the Arboretum's Wingra Marsh, east of Manitou Way, figure 2A). That parcel was the first of four adjacent parcels that the Stark's Madison Realty Company would either sell or give to create the Arboretum and were offered to Olbrich in the early to mid-1920s.[70]

As early as 1922, Olbrich and the MPF had been trying to secure an option on the Charles Nelson farm. This was a 140-acre tract with Lake Wingra frontage (figure 3, east section of large parcel dated 1932). It became the heart of the Arboretum, where the Service Area is presently located. The MPF secured an option on the property but was unable to purchase it until it went into foreclosure in 1929.[71]

The final tract that Olbrich and the MPF secured for the Arboretum was a part of the Lake Forest development. The Lake Forest Land Company had platted the subdivision in 1916. The plat featured a circular civic center, a broad street running diagonally toward the Wisconsin Capitol, parkland along Lake Wingra, and one thousand residential lots. Aust prepared a landscape plan for one section of the plat (1918), as well as a scheme for Council Rock Spring Garden (1920).[72] When the Lake Forest development failed in 1925, the concrete roads in the west section of the subdivision gradually sank into the marsh, giving the area the name it has on figure 2A, "Lost City."[73] Olbrich arranged for the MPF to purchase a 50-acre parcel on the south shore of Lake Wingra just north of the Nelson farm, from the Lake Forest Land Company in 1927.[74]

The six tracts that Olbrich had assembled were contiguous and together formed a 245-acre parcel on the south shore of Lake Wingra (figure 3, large parcel marked 1932). Olbrich intended to enlarge the parcel to at least 1,000 acres. In 1927, Olbrich, still a member of the Board of Regents, offered to sell the 245 acres to the university. Olbrich urged the establishment of an arboretum that would not only preserve trees for the enjoyment of the public and for scientific study, but that would also be a wildlife refuge. The regents passed the following resolution on December 7, 1927:

> That the unpledged balance in the Tripp Estate, approximately $83,000, be appropriated to aid in the purchase of land adjoining Lake Wingra . . . for a Forest Preserve Arboretum and Wild Life Refuge . . .[75]

In early May 1928, Olbrich visited the Morton Arboretum in Lisle, Illinois, one of the few arboreta in the Midwest. He learned that Simonds was responsible for the landscape design.[76] Olbrich knew Simonds through the MPPDA and brought him to Madison on May 17, 1928. Olbrich reviewed his proposal for an arboretum with Simonds that morning and the two addressed the Madison Rotary Club over lunch. This address energized at least two men who played significant roles in the history of the Arboretum, Joseph W. Jackson and Aldo Leopold.[77]

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[70] Court, *Pioneers of Ecological Restoration*, 24.
[71] Court, *Pioneers of Ecological Restoration*, 25-26.
[72] *Lake Forester*, December 15, 1920.
[73] Mollenhoff, *Madison: A History of the Formative Years*, 345-46.
[74] Court, *Pioneers of Ecological Restoration*, 30.
[75] *Minutes of the Regular Meeting of the Board of Regents of the University of Wisconsin, December 7, 1927*, Board of Regents of the University of Wisconsin, 12, accessed August 31, 2014, http://digital.library.wisc.edu/1711.dl/UWBoR.Dec71927.
[76] Joy Morton to M.B. Olbrich, May 14, 1928, Arboretum Records, 38/4/8 Box 3, University of Wisconsin Archives.
[77] Court, *Pioneers of Ecological Restoration*, 14-15.

Leopold was so moved by the presentation that he wrote to Olbrich, expressing regret that he could not make a financial contribution, but offering to help work on the project. Jackson, who had previously written Olbrich with an offer of assistance, was said to have been "set on fire" by Olbrich's speech, and soon succeeded Olbrich in spearheading the effort to establish the Arboretum.[78]

Forestry was a focus of Olbrich's June 11 address to the Madison Kiwanis Club. Olbrich was knowledgeable about forestry issues, having been instrumental in the enactment of the "Forestry Amendment" to the Wisconsin Constitution in 1924, enabling state funding for forest preservation.[79] Forestry management, for sustainable use and to restore the productivity of Wisconsin's pine forests had been an important issue since at least 1898. That year, a federal survey of Wisconsin's northern forests noted:

> In almost every town in this region, logging has been carried on and 8 [million] of the 17 [million] acres of forest are 'cut over' lands largely burned over and waste brush lands, and one-half of it as nearly desert as it can become in the climate of Wisconsin.[80]

The situation gained urgency in the 1920s because as logging declined, lumber companies had promoted and sold acres of pine stumps in northern Wisconsin's Cutover as farmland. The Cutover proved unsuitable for agricultural use and by the late 1920s, many families had lost their land to tax delinquency.[81] Olbrich was well aware of this; it was widely known and had been a concern of the legislature and the governor for some time.

Speaking before the Kiwanis, Olbrich urged the creation of an arboretum "as an experiment ground to learn how to cope with problems of reforestation, [and] replenishing of game and fish."[82] Olbrich had consulted Raphael Zon, a distinguished forest researcher who had established the Forest Service's program of forest experiment stations in 1908, and was directing the Cloquet Forest Experiment Station, associated with the University of Minnesota, in 1928. Olbrich quoted Zon's facts and figures on the dwindling timber supply, which Zon predicted would run out within 12 years without intensive reforestation efforts. Calling the rapid deforestation a "social and economic tuberculosis," Olbrich exhorted,

> What we ought to have without delay is 1,000 to 2,000 acres of land in Madison. This tract along Lake Wingra . . . will furnish a laboratory for studying seed production, tree breeding and grafting, experiment in spacing trees and determination of the relation of soil condition to tree growth.[83]

Olbrich's vision of the Arboretum had several elements. It would be an outdoor laboratory for education and scientific study that would incorporate a collection of trees and shrubs hardy enough to thrive in Madison's climate, as well as native plants, especially wild flowers, and a wildlife sanctuary, particularly for waterfowl and game birds, and a forest preserve that could be managed sustainably. It would produce research that would support wildlife conservation and reforestation statewide. Although Olbrich's proposal did not include the restoration of a prairie or any other pre-settlement ecological community, the elements Olbrich envisioned

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[78] Court, *Pioneers of Ecological Restoration*, 16; "Arboretum is Real Need to State – Olbrich, Makes Urgent Appeal for Institution Before 200 Rotarians, Guests," *The Capital Times*, May 17, 1928, 1 and 6.

[79] Court, "Michael B. Olbrich's Role in the History of Wildlife Conservation," Unpublished manuscript, 2014, 7.

[80] U.S. Department of Agriculture, Division of Forestry, *Forestry Conditions and Interests of Wisconsin* (Washington, D.C.: Government Printing Office, 1898), 14.

[81] Wisconsin Historical Society, "The Conservation Movement"; Wisconsin Historical Society, "Logging and Forest Products"; Nesbit, *Wisconsin: A History*, 469-71.

[82] "State is Only 50% Efficient – Olbrich," *The Capital Times*, June 12, 1928, 5.

[83] "State is Only 50% Efficient – Olbrich."

supported the development of that idea. Despite Olbrich's efforts, the land for the Arboretum had not yet been transferred to the Board of Regents in the fall of 1929. Olbrich, embroiled in financial difficulties on the eve of Stock Market Crash of 1929, died by suicide on October 9, 1929. Without Olbrich's leadership, his dream of an arboretum stalled.[84]

Joseph Jackson Revives the Arboretum Proposal

In November 1931, Stark convinced Jackson to lead an effort to rekindle the arboretum project. They prevailed upon the MPF to support the initiative. Jackson also energized the secretary of the Board of Regents, Maurice E. McCaffrey, a staunch advocate of the project. Jackson and McCaffrey orchestrated meetings between the MPF and the regents. On April 26, 1932, the regents agreed to accept the deeds to the 245 acres the MPF had assembled. The official transfer took place in July.[85]

On August 27, 1932, the university announced the establishment of the University of Wisconsin Arboretum, "which will be devoted to the development of trees and plants, to the solution of reforestation problems, and the propagation of wild life . . .."[86] The announcement noted that the university hoped to substantially enlarge the Arboretum and listed the names of the faculty that President Glenn Frank had appointed to the Arboretum Committee, as well as the members of Arboretum Advisory Committee.[87]

The Arboretum Committee and the Arboretum Advisory Committee Convene

The Arboretum Committee (AC) was a cross-disciplinary team representing several University of Wisconsin disciplines and departments. It was chaired by Edward M. Gilbert (Botany), who had worked with Olbrich to plan the Arboretum. The other faculty members were James G. Dickson (Plant Pathology), Albert F. Gallistel (University Buildings and Grounds), L.J. Cole (Genetics), Chauncey Juday (Zoology), Norman C. Fassett (Botany), Fred B. Trenk (university forester, Agricultural Engineering), George Wagner (Zoology), and Franz Aust (Horticulture). Maurice McCaffrey (representing the Board of Regents) also sat on the AC.[88]

The Arboretum Advisory Committee (AAC) initially consisted of E.A. Birge (Limnology), Harry L. Russell (dean, College of Agriculture), C.P. Winslow (director, U.S. Forest Products Laboratory), Aldo Leopold (former associate director of the U.S. Forest Products Laboratory and then consulting forester and game management specialist), Paul D. Kelleter (Wisconsin Conservation Commission, now the Department of Natural Resources), Raphael Zon (United States Forest Service), and Joseph W. Jackson (included for his long-term dedication to establishing the Arboretum).[89] The task of the AC, with the assistance of the AAC, was to oversee the development of the Arboretum. Gilbert organized the first meeting of the two committees for November 26, 1932, at the University Club on the University of Wisconsin campus. There was one agenda item: "a general presentation of the entire situation with reference to the Arboretum, and the formulation of plans relating to the project."[90]

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[84] Sachse, *A Thousand Ages*, 15-18; "M.B. Olbrich Commits Suicide"; Court, *Pioneers of Ecological Restoration*, 17.
[85] Sachse, *A Thousand Ages*, 21-22; Court, *Pioneers of Ecological Restoration*, 18-21.
[86] "Announce Establishment of Wisconsin Arboretum," 1.
[87] "Announce Establishment of Wisconsin Arboretum," 4.
[88] "Announce Establishment of Wisconsin Arboretum," 4.
[89] "Announce Establishment of Wisconsin Arboretum," 4; Court, *Pioneers of Ecological Restoration*, 48-49.
[90] University of Wisconsin Arboretum, Minutes of Meetings of the Arboretum Committee, Meeting of November 26, 1932, Arboretum Records, 38/1/11, University of Wisconsin-Madison Archives.

The AC reviewed suggestions from its members, from the AAC, from the Board of Regents, and from the public. Although there was pressure to develop the Arboretum as a large, landscaped park, with recreational areas and picnic grounds, the AC was determined to establish an outdoor educational and research laboratory. In December 1932, the AC approved Gallistel's proposal for a road through the Arboretum. Gallistel's plan conformed to a naturalistic design philosophy, consisting of a narrow, graveled roadway through the tract following the grades and curves to be unobtrusive, and minimal parking (foot paths would provide additional access to research areas). In the spring of 1933, work on clearing the existing farm buildings and constructing the road began, supervised by G. William Longenecker.[91]

Longenecker also supervised the beginning of the first initiative in reforestation in the summer of 1933. This was the "pinetum," a planting of 13,000 red and white pines along with about 2,000 spruce on part of the 190-acre Bartlett-Noe parcel (figure 2A, labeled Leopold Pines), added to the Arboretum in April 1933.[92] Red pine (*Pinus strobus*) and white pine (*Pinus resinosa*) were the dominant species harvested in northern Wisconsin, creating the devastation that became known as the Cutover. Converting the Cutover to agricultural land proved untenable and re-establishing the pine forests was a consideration from economic and ecological perspectives. At the Arboretum, by 1941, the goals for this first reforestation initiative transitioned to a project to establish a "red and white pine association" and a "white spruce association," to include all of the plants in these plant communities.[93] Since 1953, this 21-acre pine plantation has been called "Leopold Pines."[94]

The Arboretum Committee (AC) agreed that a complete analysis of the property was needed to guide the master plan. Professors directed students in conducting many of the investigations, initiating the Arboretum's role as an educational and research laboratory. Botany professor Fassett had sent students in his classes to identify and catalog plants on the site as early as 1928 in anticipation of the regents' acceptance of the property. John T. Curtis, who became a student of Fassett's in 1934, may have participated in some of these studies. Beginning in 1933, students also conducted topographical, drainage and soil surveys. As part of the analysis, Charles E. Brown, curator and director of the State Historical Society of Wisconsin museum, also worked with students to map and mark the effigy mounds. Wildlife and insect censuses would follow.[95]

In August 1933, the regents approved the creation of a new chair in game management (Department of Agricultural Economics, College of Agriculture) and appointed Aldo Leopold as the first professor of game management. Operating under the impression that the AC had made the recommendation, the regents also named Leopold the director of the Arboretum. The AC was still debating the issue, however, and had no funds to employ a full-time director. By June 1933, Gilbert was advocating Longenecker as director; others, notably Jackson, proposed Leopold as director. Gilbert was concerned that if Leopold were named director, the focus of Arboretum research would be on wildlife and game management, to the exclusion of botanical and ecological research. The AC reached a compromise. In October 1933, at their request, the regents changed Leopold's title to research director and named Longenecker executive director.[96]

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[91] Sachse, *A Thousand Ages*, 26; Court, *Pioneers of Ecological Restoration,* 29-36.

[92] Court, *Pioneers of Ecological Restoration,* 52-53; "Announce Establishment of Wisconsin Arboretum," 4.

[93] G. William Longenecker, "Journal paper #1: University of Wisconsin Arboretum," *Parks and Recreation* (repr.; September 1941): 6.

[94] Court, *Pioneers of Ecological Restoration,* 155-56.

[95] "'U' Botany Students Make Plant Survey of Proposed Arboretum Site," *The Capital Times,* June 1, 1928, 2; Sachse, *A Thousand Ages,* 27; Court, *Pioneers of Ecological Restoration,* 50; Aust and Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," 183.

[96] Court, *Pioneers of Ecological Restoration: The People and Legacy of the University of Wisconsin Arboretum,* 57-59, and 63-64; "New U.W. Department to Apply Farm Methods to Raising Game, Leopold Will Direct Experiments, Arboretum," *Wisconsin State Journal,* August 15, 1933, 1; "Longenecker is Director of U. Arboretum, Regents Select Leopold for Research Chief," *Wisconsin State Journal*, October 15, 1933, 1.

Leopold, Longenecker, and the Special Committee on Arboretum Planning Set the Purpose of the Arboretum

Leopold and Longenecker, with their diverse backgrounds and successful working relationship and the assistance of the Special Committee on Arboretum Planning (SCAP, a subcommittee of the Arboretum Committee), would guide the development of the Arboretum and create something entirely new: a laboratory for repairing damaged and degraded lands.

Aldo Leopold (1887-1948) was born in Iowa and attended Yale University, completing a master's degree in forestry in 1909. He immediately joined the United States Forest Service (USFS), working as a forester in Arizona and New Mexico before taking charge of a new effort for the USFS in recreation and game and fish management in 1915. Leopold was subsequently in charge of operations for twenty million acres of national forests in the southwest. In 1924, he became assistant director of the United States Forest Products Laboratory, associated with the University of Wisconsin, and a lecturer on game management. Leopold left the USFS in 1928, conducting wildlife and game surveys and writing *Game Management* (published 1933). He briefly directed erosion control projects in 1933 as part of the New Deal administration before accepting the professorship in game management at the university later the same year. Leopold also served as adviser on the first soil conservation project in the nation, the Coon Creek Watershed in southwestern Wisconsin, initiated in 1933. As adviser, Leopold helped shape the project to encompass the restoration of the watershed, including hydrology, wildlife and game, agronomy, and scenic value.[97]

G. William Longenecker (1899-1969) was born in Wisconsin. A student of Aust, he earned a bachelor's degree in horticulture (1924) and later became the first to complete a master's degree in landscape architecture at the University of Wisconsin (1929). Longenecker combined extensive knowledge about plants and plant ecology with an artist's talent for landscape design. Longenecker worked for Gallistel in the Department of Buildings and Grounds from 1926 until his appointment as executive director of the Arboretum in October 1933.[98] In May 1933, as Longenecker was supervising the removal of buildings from the Arboretum and the beginning of construction on the road, he wrote to Raphael Zon (USFS, and member of the Arboretum Advisory Committee),

> I should like to see the Arboretum developed as you have suggested by the planting of fairly large naturalistic groupings. . . . Then it would be possible to develop natural ecological units of trees, shrubs and flowers compatible with each other.[99]

This is the earliest written reference that has been discovered that refers to placing plants by ecological groupings at the Arboretum. Leopold elaborated on this in his speech at the dedication of the Arboretum.

On December 2, 1933, the Special Committee on Arboretum Planning (SCAP) was appointed. It was composed of Franz Aust (chair), Norman Fassett, Fred Trenk, Leopold, and Longenecker.[100] The SCAP agreed that the restoration of examples of the flora of Wisconsin would be the primary purpose of the Arboretum.[101] The

[97] Flader and Callicott, *The River of the Mother of God*, xiii-xiv; Sachse, *A Thousand Ages*, 25; Court, *Pioneers of Ecological Restoration*, 71; Curt Meine, "Restoration and 'Novel Ecosystems': Priority or Paradox," *Annals of the Missouri Botanical Garden*, 102 (August 11, 2017): 221.

[98] Court, *Pioneers of Ecological Restoration*, 68-70; "Bill Longenecker: Far-Sighted Planner."

[99] G. William Longenecker to Raphael Zon, May 9, 1933, Arboretum Records, 38/3/1, Box 1, University of Wisconsin Archives.

[100] University of Wisconsin Arboretum, Minutes of meetings of the Arboretum Committee, meeting of December 2, 1933, Arboretum Records, 38/1/11, University of Wisconsin-Madison Archives.

[101] John T. Curtis, "Information Bearing on Arboretum Policy," 1948, University of Wisconsin-Madison Arboretum Archives.

collaboration of the SCAP, especially Aust, Fassett, Leopold, and Longenecker, brought together the perspectives that created the vision of the Arboretum. Edward Gilbert's role, as chair of the Arboretum Committee (1933-39) was likely also substantial, although research has not revealed the extent of his contribution. In Aust's background was Miller's 1915 challenge to re-create a prairie of the pre-Euro-American settlement era, as well as his preference for naturalistic landscape design employing ecological principles. Norman Fassett was a botanist and plant ecologist, who specialized in aquatic plants, and was certainly well-versed in plant societies and ecological succession.

In January 1934, Leopold proposed that Fassett supervise a project in the Arboretum in "prairie grass dissemination by planting sods in land now occupied by agricultural weeds and exotic grasses."[102] Exactly whose idea this was is unclear, although grassland was the habitat for several of the game birds that Leopold wanted to attract to the Arboretum.[103] On the other hand, Fassett's former graduate student John W. Thomson, asserted that Fassett did not get enough credit for the prairie planting experiments in the Arboretum. Thomson further stated the Fassett loved prairie plants and animals, and enthusiastically led several trips to collect prairie plants for the 1935 prairie planting experiments.[104] A lack of documentation makes it difficult to determine Fassett's exact role, but Fassett was certainly deeply involved in the development of the Arboretum.[105] AC member Fred Trenk was the campus forester and Leopold represented wildlife preservation and game management. Longenecker had been recommending grouping plants by their natural associations since at least May 1933, and appears to have been more interested in trees and shrubs, especially those suitable to Wisconsin's soil and weather conditions, than in prairies.[106] Leopold would weave these perspectives together in his speech at the dedication of the Arboretum, becoming the first to publicly articulate the purpose of the Arboretum as a laboratory for the restoration of degraded landscapes.

Leopold, Longenecker, and Aust Articulate the Purpose of the Arboretum

On June 17, 1934, the Arboretum was dedicated with a variety of speeches, held in the former Nelson barn. The Nelson barn (not extant) was located in the present Service Area of the Arboretum. Planner John Nolen attended the dedication, invited in recognition of the inspiration for an arboretum that *Madison: A Model City* had provided. Arboretum Committee chairman Edward Gilbert was the master of ceremonies, introducing speakers representing the regents, the Wisconsin Conservation Commission, the university, and in a rare recognition of the long-time presence and history of the Ho-Chunk Nation, Albert Yellow Thunder. The latter urged the audience to support the Arboretum, and "[T]ake care of those natural beauties." Longenecker also spoke. The newspaper reported that he described the extent of the Arboretum and its development to date, noting "A prairie was left in the center as a coordinating unit."[107] Leopold followed with a short address.

Leopold revised the speech and sent what he called the "popularized version" to Joseph Jackson in September 1934. This version clearly articulated what the Arboretum would become. Leopold observed,

> An arboretum is ordinarily . . . a collection of trees. Sometimes an arboretum also serves as an outdoor library of horticultural varieties . . . where one can compare all the apples, all the lilacs, all the roses. Some advanced institutions arrange their tree-collection as natural associations . . .. Such exhibits are

[102] Aldo Leopold to E.M. Gilbert, January 10, 1934, Arboretum Records, 38/3/1, University of Wisconsin-Madison Archives.
[103] Court, *Pioneers of Ecological Restoration,* 96-97.
[104] John W. Thompson, speech to the Friends of the Arboretum, June 5, 1982, transcription in Joy B. Zedler, "The Aldo Leopold Chair of Restoration Ecology at the University of Wisconsin-Madison," unpublished manuscript, 2019, Appendix 2.
[105] Court, *Pioneers of Ecological Restoration,* 96.
[106] Court, *Pioneers of Ecological Restoration,* 68-71.
[107] "Owls Help 8 Speakers Dedicate U. Arboretum."

> called 'ecological groupings' and represent 'advanced thought' in arboretum management. We want to have all these things, but they by no means represent the main idea which we are trying to express here. It is something new and different. . . . Our idea, in a nutshell, is to reconstruct, primarily for the use of the University, a sample of original Wisconsin – a sample of what Dane County looked like when our ancestors arrived here in the 1840s.[108]

Leopold observed that Dane County had changed markedly since the 1840s and asked, "Why try to discover the exact processes by which the Wisconsin of 1840 became the Wisconsin of 1930?" Echoing George Perkins Marsh and his USFS roots, Leopold answered,

> Because we are just beginning to realize that along with the intentional and necessary changes in the soil and its flora and fauna, we have also induced unintentional and unnecessary changes which threatened to undermine the future capacity of the soil to support our civilization.[109]

Aust's and Longenecker's vision of the Arboretum as a place that combined traditional arboretum (horticultural gardens), experimental forests, and a wildlife refuge with the new concept of ecological restoration was at least as well-developed as Leopold's. In 1936, Aust and Longenecker wrote, "[t]he Wisconsin Arboretum is created to restore at a point near the University, types of primitive Wisconsin landscape and its flora and fauna."[110]

Aust and Longenecker wrote that three types of landscapes had been set aside for restoration: woodlands, marshes, and prairie areas. They also indicated the Arboretum would include a display area with exotic plants (the horticultural gardens) carefully buffered from indigenous plantings. Aust and Longenecker noted that Leopold had established shelter and feeding stations for game birds and aquatic fowl, and that a recently-acquired parcel (the 190-acre Gardner Marsh, 1935, figure 2A) would be developed with lagoons and pools to improve the area as a wildlife refuge.[111] They concluded with the comment that committing to long-term planning and long-term research programs was essential, reflecting the estimation Leopold made in his address earlier in the program, "it will take 50 years to [reconstruct a sample of what Wisconsin looked like]."[112]

Planning and Implementing the Development of the Arboretum

Leopold drafted the first wildlife management plan for the Arboretum in October 1933. He dedicated himself to wildlife research, especially on migratory game birds, and the habitats that would attract them. Leopold hoped to increase their numbers in the state and show farmers how to create habitat for game as a conservation measure and as a "crop" that farmers could harvest. Leopold established feeding stations in the Arboretum, planned improvements to Gardner Marsh, and undertook annual censuses of wildlife populations.[113]

As executive director, Longenecker was responsible for developing and implementing the master plan, and for the daily management of the Arboretum. Using the data gathered in the studies, Longenecker and the Special Committee on Arboretum Planning identified soil and landform patterns, and the plant communities that fit ecologically in each area of the Arboretum, creating the master plan. The area for the prairie was the central organizing component and included a small remnant of original prairie. Longenecker also selected and designed the layout for the horticultural display garden (since 1967, the Longenecker Horticultural Gardens, figure 2A),

[108] Leopold's 'popularized version.' Note that Leopold used "Dane County" and "Wisconsin" interchangeably in his speech.
[109] Leopold's 'popularized version.'
[110] Aust and Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," 182.
[111] Aust and Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," 183-84.
[112] Leopold's 'popularized version.'
[113] Court, *Pioneers of Ecological Restoration*, 71-72.

where shrubs are grown for their beauty and to test their hardiness in the Wisconsin climate. Between 1933 and the 1950s, Longenecker directed the planting of nearly all the trees and shrubs in the Arboretum, often staking out their locations himself. He also designed and supervised the construction of all the stone walls, shelters, ponds and footpaths through the 1930s.[114] There was no funding for development, as the university was financially dependent on the state legislature, which had little money to allocate during the Depression. Labor for the construction projects came from a series of work relief programs.

In 1933, the main construction project was the road through the Arboretum, which Gallistel had designed. Dane County and the city of Madison operated a work relief program, funded by the federal Civil Works Administration (CWA) and assigned laborers to public works projects, including the Arboretum road. However, the laborers were mostly transients, quick to move on in search of better opportunities. By the time the CWA program ended in the April 1934, little progress had been made on the road, although the workers had helped Longenecker plant evergreens in the pinetum. At Leopold's direction, CWA laborers had also installed the first plants in the planned "tamarack association," the first apparent attempt at the restoration of a complete plant community, which ultimately failed. The tamarack association was composed primarily of tamarack trees, pitcher plants, orchids, and cotton grass.[115] The Federal Emergency Relief Administration (FERA) was launching a work program in Wisconsin, however, the Wisconsin Emergency Relief Administration (WERA), and Gallistel was able to negotiate an agreement for a camp in the Arboretum. The first group of men arrived in July 1934, pitching tents and erecting wooden buildings in conformance with Gallistel's camp layout. "Camp Arboretum" was set in the Service Area adjacent to the former Nelson barn, which served as the dining hall. By mid-October 1934, ten barracks (one is extant, photo 11) had been completed, each capable of housing 32 men. However, budget limitations prevented WERA from renting trucks or heavy equipment, so when "Camp Arboretum" closed in July 1935, the road was still incomplete. Further, the lack of heavy equipment and trucks for transport meant that other projects that had been proposed, such as Fassett's prairie sod planting experiment and the excavation of ponds and the creation of islands as part of Leopold's plan for Gardner Marsh and migratory waterfowl research had not even begun.[116]

By January 1935, disenchantment with WERA had inspired the Arboretum Committee to recommend to the regents that they secure a company of the Civilian Conservation Corps (CCC) for the Arboretum. The regents agreed, and the request was approved. From their arrival in August 1935 until their departure in November 1941, CCC Company No. 2670, "Camp Madison," provided disciplined manpower and the desperately needed equipment to carry out a host of projects, worth more than one million dollars and for which the university paid nothing. Camp Madison was the only CCC site in the United States that was associated with a university.[117] The Arboretum is locally significant for its CCC camp resources but does not retain a sufficient concentration of historic resources to be considered nationally significant in this category.

The CCC was part of a nation-wide relief program devised by the federal government in response to the tremendous economic and social problems of the Depression. In 1932, 20 percent of the American work force of 28 million were jobless and millions were homeless. Between 1929 and 1933, unemployment among young men between the ages of 15 and 24 rose from 3 percent to 25 percent. President Franklin D. Roosevelt introduced his New Deal relief program to Congress in early 1933. New Deal programs relieved financial

[114] Court, *Pioneers of Ecological Restoration,* 68-70; "Bill Longenecker: Far-Sighted Planner."

[115] "University of Wisconsin Arboretum and Wild Life Refuge," undated (ca. 1934) manuscript, author unknown, Arboretum Records, 38/1/11, University of Wisconsin Archives; Aust and Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," 183.

[116] Sachse, *A Thousand Ages,* 29-31; Court, *Pioneers of Ecological Restoration,* 38-43, and 83-88.

[117] Court, *Pioneers of Ecological Restoration,* 87; Sachse, *A Thousand Ages,* 32-33.

suffering, provided work to the unemployed, and launched a prolific public works and conservation program that left many tangible reminders on the nation's landscape.[118]

Initially known as the Emergency Conservation Work Program, the CCC was authorized by Congress in March 1933. It was intended to address both high unemployment and the long-term deterioration of public natural resources, by funding conservation and recreation projects in the nation's parks and forests.[119] The Army provided basic conditioning programs for enrollees and officers to oversee the building, organization, supply, and daily operation of the CCC camps. It transported, fed, clothed, and disciplined the men. The NPS and the USFS maintained general supervision in, respectively, the state and national parks and the state and national forests. Ninety percent of the enrollees in the CCC were between the ages of 18 and 23, unmarried, and from families on relief. By the program's end in July 1942, the CCC had enrolled a total of 75,000 men from Wisconsin, and 92,000 enrollees had served in Wisconsin.[120]

On August 16, 1935, a truck convoy carrying the 2670th CCC Company arrived at the Arboretum. The full complement of the 2670th consisted of 180 enrollees, under the supervision of 20 Army Reserve Officers. Harold Madden, a Madison man with a background in construction, served as superintendent of all the projects carried out in the Arboretum during the CCC's tenure.[121]

The Special Committee on Arboretum Planning, composed of Aust, Longenecker, Leopold, Fassett, and Trenk, planned the Arboretum's development, including the work of the CCC enrollees. CCC projects in the Arboretum fell into two categories: construction and environmental improvements. In the first category, the CCC built other encampment buildings in 1935 (figure 2C shows those that are extant). The remaining buildings are the Bath House, the Carpentry Workshop and Warehouse (photo 12), Machine Shed, Tool Shed (photo 13), Nursery Pumphouse, Root Cellar (photo 14, foreground), and Pumphouse (photo 14, background).[122] The CCC completed the Arboretum road (now McCaffrey Drive and Arboretum Drive) in late 1936, and erected the rustic style stone entrances and walls (figure 2E) of the Stevens Memorial Aquatic Garden (1936), Manitou Way (1937, photo 21), and Olbrich Memorial Entrance (1937-1940, photo 22).[123] In 1938, they quarried the stone for the Kenneth Jensen Wheeler Council Ring (figure 2A, photo 24), a memorial designed by his grandfather, Jens Jensen.[124] The CCC also laid footpaths, and built the rustic stone Wingra Woods Shelter (not extant) and Gallistel Woods Shelter (1937, photo 23, figures 2A and 2C).

The environmental improvements the CCC carried out were typically designed by Longenecker and/or planned by experts on the Arboretum Committee. For example, Longenecker designed the layout of the horticultural gardens and planted the first of the more than 200 lilacs himself in March 1935. The CCC would plant these and other shrubs and trees, not only in the horticultural gardens, but throughout the Arboretum. In 1937 alone, the CCC planted more than 75,000 trees and shrubs in the Arboretum.[125] The CCC also dredged the pond for the Stevens Memorial Aquatic Garden (1936), and installed water plants according to Longenecker's design (likely

[118] John Braeman and David Brody, *The New Deal* (Columbus: The Ohio State University Press, 1975), 1:124.

[119] John A. Salmond, *The Civilian Conservation Corps, 1933-1942: A New Deal Case Study* (Durham, North Carolina: Duke University Press, 1967), 8-11; Conrad L. Wirth, *Parks, Politics, and the People* (Norman: University of Oklahoma Press, 1980), 67-70.

[120] Salmond, *The Civilian Conservation Corps*, 32-37, 71-74.

[121] Court, *Pioneers of Ecological Restoration,* 85-88.

[122] "Plat Showing Arboretum Buildings," March 20, 1944, Arboretum Archives, University of Wisconsin Arboretum, Madison, Wisconsin.

[123] Court, *Pioneers of Ecological Restoration,* 92-93.

[124] Court, *Pioneers of Ecological Restoration,* 92, 124.

[125] Court, *Pioneers of Ecological Restoration,* 124.

developed with advice from Fassett). Longenecker and Leopold planned 14 acres of lagoons and pools (all extant) adjacent to Lake Wingra and Gardner Marsh, including Ho-Nee-Um Pond (1939), which the CCC excavated, expanding the bird refuge with nesting sites and cover.[126]

Ecological Restoration Begins

The CCC provided labor for the earliest surviving restoration projects, which took place in the woodlands, the marshes, and most famously, the prairie. The first ecological restoration project appears to have been Leopold's attempt to establish a "tamarack association," adjacent to Teal Pond. In his speech at the Arboretum's dedication, Leopold described the research Fassett and his students had carried out in the Wingra Marsh, which showed that a tamarack forest had existed alongside the marsh prior to Euro-American settlement.[127] Workers employed by the CWA had begun planting tamaracks, cotton grass, pitcher plants, orchids and other members of the tamarack plant community in 1933.[128]

As Longenecker noted, considerable research was needed to develop thriving plant communities and even so, "mistakes will undoubtedly be made." Through investigation and experimentation, successful techniques for establishing and managing various ecological communities were gradually established.[129]

The best-known ecological restoration in the Arboretum is Curtis Prairie, widely recognized as the oldest restored prairie in the nation. The procedures for establishing and maintaining an ecologically restored prairie (with as much of the composition, structure, and plants of a prairie ecological community as possible) were pioneered and refined at the Arboretum. Although proposed as early as January 1934, the first experiments in prairie restoration began in November 1935, when Fassett and his graduate student, John Thomson, worked with CCC laborers to transplant prairie sod and hay from prairie remnants in south-central and southwestern Wisconsin. The test plots included 40 species of prairie plants that lay within the 70-acre Curtis Prairie today. In 1936, Leopold hired ecologist Theodore Sperry, who had recently completed his dissertation at the University of Illinois on the root system of Illinois prairies. Sperry's research, which followed a similar protocol to University of Nebraska plant ecologist John E. Weaver's 1930s investigations of the root development and soils of western prairies, revealed Illinois prairies had taller grasses and shorter roots than their western counterparts. Leopold had written to Sperry proposing he take charge of "this prairie restoration work," elaborating, "We want to construct . . . a flat Wisconsin prairie, together with its 'oak openings.'"[130]

During the planting seasons (April to November) between 1936 and 1941, Sperry supervised CCC enrollees in planting seeds and transplanting plants and sods, representing 42 prairie species and covering the western and central sections of Curtis Prairie. During the 1940s and 1950s, more species were added to the prairie: 46 species between 1942 and 1946,and 156 species in 1951-54. In 1939, Sperry initiated burn experiments. Controlled burn experiments continued through the 1940s, guided by Sperry and Curtis (1940), Leopold and McCabe (1943-46), and Curtis and Max Partch (1948-50), demonstrating that fire was critical for a healthy prairie and establishing a regimen for prescribed burns, which today is considered best practice in prairie management.[131]

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[126] Court, *Pioneers of Ecological Restoration,* 68-69, 92, 124; Sachse, *A Thousand Ages*, 45-48.

[127] Leopold's 'popularized version.'

[128] "University of Wisconsin Arboretum and Wild Life Refuge"; and Aust and Longenecker, 183.

[129] Longenecker, "Journal paper #1: University of Wisconsin Arboretum," 6.

[130] Aldo Leopold to Ted Sperry, July 18, 1935, Theodore Sperry-Gladys Galliger Collection, Pittsburg State University Archives, Pittsburg, Kansas, quoted in Court, *Pioneers of Ecological Restoration,* 100-101.

[131] Court, *Pioneers of Ecological Restoration,* 107-08, 144-45; Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64-66. See John T. Curtis and Max L. Partch, "Effect of Fire on the Competition Between Blue Grass and Certain Prairie Plants,"

In 1941, Longenecker published a paper summarizing the history and progress of the Arboretum. By this time, the Arboretum encompassed 1,137 acres (figure 3), almost its current size.[132] The Special Committee on Arboretum Planning had been phased out and the Arboretum Committee (AC) was reorganized with Albert Gallistel as chair in 1940. Longenecker wrote that the following plant communities native to Wisconsin were under development in 1941: juniper knoll (begun 1936); tamarack bog (abandoned); oak-hickory (begun 1940); jack pine (begun 1933); hemlock ravine with red and white pine (begun 1933); white spruce, black spruce-balsam (1936); arbor vitae (1936); tall grass prairie; and upland prairie (both prairie sections are a part of Curtis Prairie, 1936).[133] Except for the tamarack bog, all of these Wisconsin plant communities survive today, many of them located in either Wingra or Gallistel woods, or Leopold Pines. Work carried out in Wingra Marsh (begun 1934), Gardner Marsh (begun 1936), and Teal Pond (begun 1940) attempted to preserve and restore existing remnant ecosystems. All the extant ecological restoration projects at the Arboretum have required long-term management, which is another facet of ecological restoration. Lack of sufficient funding and labor has made long-term, active management of all ecological communities in the Arboretum difficult, such that some areas are not currently actively managed. The acknowledgement and commitment of the Arboretum Committee and staff to prairie restoration, in particular, is reflected in Sperry's answer to the question, how long will it take to restore the prairie? "Roughly . . . a thousand years."[134]

These ecological restoration projects often did not involve introducing wildlife, but Leopold hoped that by creating the appropriate habitat with complete plant communities and providing feeding stations, surviving wildlife would flourish and species that had vanished would return.[135]

Leopold and his assistants recorded bird species in the Arboretum annually through 1946. In 1938, for example, they enumerated 204 different species of birds, including a wide range of songbirds, aquatic fowl, and raptors. Mink, weasels, rabbits, possums, raccoons, woodchuck, muskrat, and various species of fish were also counted. Attempts to re-establish some birds and fish were successful, while others were not. The wood duck and the woodcock were re-established; quail, present in the Arboretum in 1933, died out and their reintroduction in 1950 failed. In 1934, Leopold expressed the hope that the ruffed grouse and the prairie chicken could be brought back to the Arboretum; this could not be accomplished.[136] As research director, Leopold supervised these and other projects in botany, zoology, fish, game, and soils. In 1940, at Leopold's request, the research directorship was divided. Leopold continued as director of animal research, while John T. Curtis was named director of plant research.[137]

Curtis Arrives; Leopold Departs: the 1940s

John T. Curtis (1913-1961) earned a bachelor's degree in botany at Carroll College in Waukesha, Wisconsin, in 1934. He completed a doctorate degree in the field at the University of Wisconsin in 1937, as a student of Norman Fassett. Curtis served as a botany instructor at the university from 1937 through 1939. As director of plant research at the Arboretum, Curtis was tasked with accomplishing the Arboretum Committee's original goal of establishing all the plant communities native to Wisconsin within the Arboretum. His experience as a

American Midland Naturalist 39, no. 2 (1948): 437-443.

[132] Longenecker, "Journal Paper #1: University of Wisconsin Arboretum," 3.

[133] Longenecker, "Journal Paper #1: University of Wisconsin Arboretum," 6.

[134] *Wisconsin State Journal*, November 26, 1939, cited in Sachse, *A Thousand Ages*, 50.

[135] Leopold, "The Conservation Ethic," speech, Southwestern Division of the American Association for the Advancement of Sciences in Las Cruces, New Mexico, 1933, quoted in Flader and Callicott, *The River of the Mother of God*, 190-191.

[136] Robert Foss, "The Arboretum," *Wisconsin Alumni Magazine* 35, no. 5 (February 1934): 123.

[137] Court, *Pioneers of Ecological Restoration*, 115-118; Sachse, *A Thousand Ages*, 54-57.

student and later a colleague of Fassett's and his recognition of the need to describe vegetation because of its critical role in regulating stream flow, stabilizing water tables, and producing and maintaining soils likely contributed to the dedication with which he pursued this goal. Curtis and his students spent years identifying the plants that made up each of Wisconsin's plant communities and completing detailed studies of them. While some of this research and synthesis took place in the Arboretum, much of the investigation happened in remnant plant communities in other parts of the state. Curtis published the results of this monumental project as *The Vegetation of Wisconsin: An Ordination of Plant Communities* (1959, 1971; electronic version 2011), which became a classic in the field of ecology. Curtis also supervised the continuing innovation, development, and management of the Arboretum's restoration projects.[138]

Leopold continued to direct animal research projects at the Arboretum. Biologist Robert McCabe was appointed to assist Leopold in 1943.[139] McCabe would prove invaluable, not only for his own research projects, but also for his careful management of the prairie and the other plant communities, while Curtis served in the military in Haiti, working on *Cryptostegia* as a source for rubber (1942-1946).[140] McCabe studied with Leopold, completing a master's degree in wildlife management in 1943. He served as Leopold's assistant until 1946, when he became an instructor in the wildlife management department.[141] McCabe's able support and Curtis' appointment as director of plant research, reduced Leopold's responsibilities, giving him time to dedicate to writing.

In 1941, Leopold had decided to write a book for the general public, promoting conservation and his ideas on conservation ethics and the relationship between humans and the environment. A prolific writer, he had already penned many essays and delivered a number of public lectures in which he had presented his view that humans, animals, plants, and soils were mutually interdependent, and that it was the duty of the individual to prevent the deterioration of the environment. In 1933, Leopold called this the "conservation ethic," publishing an essay by the same title.[142] Leopold refined and clarified the concept through a series of writings in the 1940s, culminating in the 1948 essay, "The Land Ethic," a revision and expansion of the 1933 version. Leopold wrote,

> All ethics so far evolved rest upon a single premise that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in that community, but his ethics prompt him also to co-operate. . . . The land ethic simply enlarges the boundary of the community to include soils, waters, plants, and animals, or collectively: the land. . . . In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. . . . A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land.[143]

"The Land Ethic" and a number of other essays were published in *A Sand County Almanac* (1949), a year after Leopold's death. *A Sand County Almanac* was highly influential in environmental ethics, fundamental in the environmental movement of the late 1960s, and remains one of the most respected books ever published in the field. Leopold's writings were influenced by, and reflected, his work at the Arboretum, and at his weekend

[138] Court, *Pioneers of Ecological Restoration,* 126-29; John T. Curtis, *The Vegetation of Wisconsin: An Ordination of Plant Communities* (Madison, Wisconsin: The University of Wisconsin Press, 1959), 3.

[139] Court, *Pioneers of Ecological Restoration,* 93; Sachse, *A Thousand Ages,* 51, 54.

[140] Court, *Pioneers of Ecological Restoration,* 138; Dr. F. Stearns, "Resolution of Respect," *Bulletin of the Ecological Society of America* 42, no. 4 (December 1961): 168.

[141] Court, *Pioneers of Ecological Restoration,* 142-43.

[142] Leopold, "The Conservation Ethic," 183, 190.

[143] Aldo Leopold, *A Sand County Almanac with Essays on Conservation from Round River* (1966, repr., Oxford, England: Oxford University Press, 2001), 171, 186.

retreat in Sauk County, "the Shack" (acquired in 1935). The Shack was designated as a National Historic Landmark (2009) for its association with Leopold and his monumental contributions to conservation.[144] As an outdoor laboratory where the ecological communities of Wisconsin are restored, the Arboretum embodies Leopold's land ethic: humanity taking the responsibility for healing the land.

During the 1940s, work continued on the various research, restoration, and management projects. During World War II, with male personnel and students serving the war effort, some of the more labor-intensive efforts were constrained, such as tree planting, although on Arbor Day in 1943, some 300 female students planted the first trees in what is now Evjue Pines. The retirement of Aust in 1943 marked the first departure of one of the visionary founders of the Arboretum. Curtis returned to the Arboretum in 1946, as plant research director. Following Leopold's death in 1948, Curtis was named research coordinator.[145]

One project begun during World War II was planted entirely by hand, by one man: Henry C. Greene. Greene (1904-1967) was born in Indiana and educated at the University of Washington in Seattle, finishing a master's degree in botany in 1929, and completing a doctorate in the same field at the University of Wisconsin in 1933. Greene was hired as an instructor in the botany department in 1937. Although Greene was a mycologist (specialist in fungi), he became interested in prairie plant communities as a result of joining Curtis in searching for prairie remnants in the mid-1930s. Greene surveyed the Grady Tract (the acreage of the Arboretum that lies south of the Beltline, figures 2B and 3) in 1942, finding areas with remnant prairie plants, and began planning a prairie. He started planting what is now Greene Prairie in 1943. By 1951, Greene had planted more than 12,000 mature plants and seedlings (in addition to seeds), accounting for more than 133 species, completing the majority of the planting of his 50-acre prairie. Greene's methodically planted and meticulously documented prairie is regarded as one of the finest examples of a restored prairie in the U.S.[146] Greene's work also demonstrated that the most cost-effective method for establishing prairies and savannas was by planting seeds germinated through cold stratification, a finding of national importance that he published in 1950.[147]

In 1949, the Arboretum Committee prepared a status report, which described the Arboretum's three research functions: development research, "primarily concerned with the methods whereby natural plant and animal groupings may be established and maintained"; descriptive research, taking inventory and assembling records of "flora and fauna, soil types, water supplies, and microclimate"; and individual research in the Arboretum on land plants and animals, aquatic plants and animals, soils, and the water cycle.[148] The report noted that research carried out at the Arboretum had already made significant contributions by developing procedures for controlled burns that eliminated exotic species and allowed native prairie grasses to flourish. Studies had established the phases of several plant communities, such as the transition from oak opening to oak forest; and catalogued fluctuations in native, fur-bearing wildlife, such as muskrat and mink. Research to treat forest tree diseases such as oak wilt was also underway. The 1949 report reiterated the commitment to "continuous, long-time preservation of its plant associations and land...as they become more completely integrated and developed with each passing year." It also outlined its plans to establish those Wisconsin plant communities not yet present, and

[144] Curt Meine, *Aldo Leopold, His Life and Work* (Madison: University of Wisconsin Press, 1988), 408-11, 506-20; Court, *Pioneers of Ecological Restoration*, 130-33.

[145] Court, *Pioneers of Ecological Restoration,* 62, 138-40, 148.

[146] Court, *Pioneers of Ecological Restoration,* 140-42; Anderson, "History and Progress of Ecological Restoration in Tallgrass Prairie," 4.

[147] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64-66. See Henry C. Greene and John T. Curtis, "Germination Studies of Wisconsin Prairie Plants," *American Midland Naturalist*, 43, no. 1 (1950): 186-194.

[148] Arboretum Committee, "The University of Wisconsin Arboretum," January 1949, Arboretum Records, 38/1/11, 2-5, University of Wisconsin Archives.

further develop those that were only partially complete, to a "maximum approximation of truly natural areas…."[149]

Research on Plant Communities Intensifies: The 1950s

In 1951, Curtis prepared the first Arboretum Master Development Plan, focusing on the ecological communities.[150] The Arboretum Committee (still chaired by Gallistel) and Curtis followed the plan, maintaining and expanding the plant communities and the plant nursery, as well as pursuing research to support these efforts. By this time, in addition to the executive director (Longenecker) and the research coordinator (Curtis), the Arboretum staff consisted of a resident superintendent, a foreman, and ten part-time laborers. Since the 1940s, there had also been three, part-time graduate student research assistants: a botanist; a biologist; and a soil scientist. More than fifty research projects were conducted every year, involving soils, fish, birds, small mammals, and insects, as well as plants. Beginning circa 1950, planting began (with acorns) in Southwest Grady Oak Savanna and Grady Oak Savanna. The annual increase in the number of projects made the need for an on-site laboratory increasingly acute. In 1952-53, the former CCC Bath House (extant) was converted into the Arboretum Laboratory.

In 1952, Curtis launched a new initiative, the Seed Exchange, packaging some of the seeds of native Wisconsin plants Arboretum staff had collected for exchange with other arboreta and botanical gardens. The Seed Exchange raised the Arboretum's profile internationally and provided seeds to a number of institutions and organizations to start prairie and savanna restoration projects. In 1961, for example, more than 550 seed packets were sent to some 75 institutions. The Arboretum's technique of prescribed burns was widely publicized when Walt Disney Productions filmed the controlled burning of the Arboretum prairies in the spring of 1953 for the documentary, *The Vanishing Prairie.* The film won the 1954 Academy Award for a documentary.[151] The documentary also may have helped inspire other institutions to consider establishing a restored prairie. In November 1954, George Ward and Paul Shepard, biology professors at Knox College in Galesburg, Illinois, toured the Curtis and Greene prairies. Henry Greene offered seeds to get them started, and they went back to Galesburg intent on restoring a prairie. Planting of the 760-acre prairie (extant) at Green Oaks Field Study Center began in the spring of 1955.[152]

The Arboretum also faced challenges in the 1950s. The loss of Leopold deprived the Arboretum of its greatest wildlife advocate, and although animal research continued, the title "wild life refuge" gradually ceased to be used and was eventually dropped from the Arboretum's letterhead. This was also due to the Arboretum Committee's growing conviction that the Arboretum was too small to be a wildlife refuge, and the fact that wildlife populations in the Arboretum were becoming isolated by the Beltline (built as a two-lane roadway in 1949) and encroaching suburban development, which boomed after World War II. The Beltline initially took a 15-acre strip of land, including 12,000 plantings. When it was expanded to a four-lane facility in 1956, construction took another 15 acres and many mature trees. The Beltline and surrounding suburban areas impacted the ecological communities, as well. Runoff from the Beltline caused silting and soil erosion, a problem that endures today. Sewage from suburban development along Monroe Street draining into the Stevens Pond led to the installation of a sanitary sewer line through Arboretum land northwest of Lake Wingra in the mid-1950s. Storm sewers flushed lawn fertilizer and other nutrients into Stevens Pond and Lake Wingra,

[149] Arboretum Committee, "The University of Wisconsin Arboretum," 6-11; Court, *Pioneers of Ecological Restoration,* 166.

[150] J.T. Curtis, "Arboretum Master Development Plan," March 1951, Arboretum Archives, University of Wisconsin Arboretum.

[151] Sachse, *A Thousand Ages*, 98, 101, 116; Court, *Pioneers of Ecological Restoration,* 160, 163, 165, 166, 173, 182.

[152] Court, *Pioneers of Ecological Restoration, 236*; William R. Jordan III and George M. Lubick, *Making Nature Whole: A History of Ecological Restoration* (Washington, D.C.: Island Press, 2011), 108.

causing smelly algae blooms. Some animals were nuisances as well. The Arboretum's many rabbits were a perennial problem, eating small plants and shoots (the coyotes presently keep them in check). By 1958, the deer herd in the Arboretum had become large enough to cause serious damage to trees and shrubs, but efforts to shoot rabbits and deer created public relations problems.[153]

To gain support for the Arboretum in the face of highway construction, suburbanization, and other threats, the Arboretum Committee (AC) changed its position from protecting the Arboretum from the public, to one of active public outreach and education. Tours were offered to school groups, scouting organizations, and garden clubs. The number of visits increased to such an extent that Longenecker recommended including two full-time ranger-naturalists in the budget in 1954. The university did not fund a ranger-naturalist until 1965. Public relations efforts included the publication of *Arboretum News,* beginning in 1952, which Greene edited.[154] *Arboretum News* presented the history of the Arboretum, introduced key personnel, highlighted research projects and publications, informed the public about features to see in the Arboretum – from which wildflowers were in bloom, to when to expect migrating birds – and provided notification of events such as speakers, and dates of controlled burns. *Arboretum News* announced the retirement of Gallistel in 1959; he had served 20 years as chair of the AC and would continue as a member. Gallistel Woods were named in his honor that year.[155]

The End of an Era: The 1960s

When Gallistel retired in 1959, Curtis was named chair of the Arboretum Committee (AC). Curtis' untimely death in 1961 marked the beginning of a period in which no new ecological restoration projects were undertaken. Management practices such as the regular burning of the prairies continued and much of the research focused on monitoring and describing the progress of the ecological communities, rather than developing additional procedures in restoration or management.[156]

Following Curtis' death in 1961, Grant Cottam, professor of botany, became AC chair. Cottam (1918-2009) earned a bachelor's degree in botany at the University of Utah and completed a doctorate in ecology at the University of Wisconsin in 1948. Cottam had been an instructor in the botany department since 1949 and a member of the AC since 1950.[157] The position of managing director of the Arboretum was created in 1962 and David Archbald was appointed to the post. Archbald had studied with Curtis, completing his doctorate in 1954.[158]

During the 1960s, the Arboretum's primary mission remained managing its Wisconsin ecological communities, maintaining its horticultural gardens, and continuing soil, plant and animal research, as well as a plant nursery to support these efforts. There were about 30 projects a year, including a few new research initiatives, such as experimenting with fire as a management technique for fens and marshes, beginning in 1964. In 1965, 251 species of birds, 29 kinds of fish, 35 species of mammals, 26 amphibians and reptiles, more than 500 types of

[153] Court, *Pioneers of Ecological Restoration,* 160-67, 174-78; and Sachse, 68, 95.
[154] Court, *Pioneers of Ecological Restoration,* 168-173.
[155] Court, *Pioneers of Ecological Restoration,* 179; *Arboretum News* 8, no. 4 (October 1959), 1-2.
[156] Jordan and Lubick, *Making Nature Whole,* 105; Virginia M. Kline, *Long Range Management Plan for Arboretum Ecological Communities* (Madison: University of Wisconsin-Madison, 1992), 121-23.
[157] Court, *Pioneers of Ecological Restoration,* 183.
[158] Court, *Pioneers of Ecological Restoration,* 191-92.

plants, and over 15,000 insects were recorded in the Arboretum.[159] By 1970, Curtis and Greene prairies alone contained over 300 native plant species.[160]

The last six Lost City lots were added to the Arboretum in 1962 and 1963 and then a parcel just east of Lost City was acquired in 1966, bringing the property almost to its current size (figure 3).[161] The 1932 caretaker's residence was demolished in 1962 and replaced with the Security Residence (extant) in 1968. For the first time since its founding, the Arboretum got its own administrative office in 1961, in room 329 Birge Hall on the UW campus, in the botany department. The office would remain there until 1977.[162]

The Arboretum expanded its educational mission in two related public outreach initiatives: the creation of the Friends of the Arboretum (FOA) in 1962, an organization that still promotes and protects the Arboretum; and the development of a program of public education, beginning with the first ranger-naturalist, James Zimmerman, hired in 1965. The FOA began with two functions: to provide public support to help protect the Arboretum from the demands made by the rapidly encroaching urban development around it, including highways, utilities, and residential subdivisions; and to provide funds to improve the facilities for the public use of the Arboretum, such as preparing trail guides, and marking trails. The FOA supported the Arboretum's educational efforts by issuing trail guides and a map of Arboretum and placing trail markers. The FOA also largely funded the production of a 30-minute film about the Arboretum (1964) and the publication of a history of the Arboretum, *A Thousand Ages* (Nancy Sachse, 1965), as well as two identification guides, *Wisconsin Trees, a Picture Key* (F. Glenn Goff and Paul Zedler, 1964) and *Wildflower Families and How to Know Them* (James Zimmerman and Booth Courtenay, 1965).[163]

Zimmerman was hired as a part-time ranger-naturalist in the spring of 1965. It became clear immediately that there were more people interested in tours than Zimmerman could accommodate alone, so Rosemary Fleming was hired as tour coordinator in 1966. She developed a program of tours for school children and a guide-training program. According to Franklin Court, in 1967 Fleming became the first paid, full-time county naturalist in the nation. She initially supervised twelve guides, but more in time. In August 1969, the Arboretum offered its first summer program for children. The tours, programs, and classes in the Arboretum were highly successful and continue to be popular today.[164]

In 1966, the Arboretum lost the last of its pioneers with the retirement of William Longenecker. Longenecker had served as executive director of the Arboretum and on the AC since 1933. He was responsible for developing and implementing the master plan and for the daily management of the Arboretum in the 1930s and 1940s. Between 1933 and the 1950s, Longenecker directed the planting of nearly all the trees and shrubs in the Arboretum. He also designed and supervised the construction of all the stone walls, shelters, ponds, and footpaths through the 1930s. Longenecker provided public relations for the Arboretum, giving slide presentations around the state and representing the Arboretum at meetings of national organizations. Longenecker also bridged the early visionaries of what the Arboretum could be through his connections to Aust,

[159] Sachse, *A Thousand Ages*, 102; Grant Cottam, "Management of the West Marsh," *Arboretum News*, 13, no. 2-3 (April-July 1964): 1.

[160] Vivien Hone, "U.W. Prairies – Where Man-Tall Grasses and Brilliant Flowers Abound," *The Capital Times*, September 19, 1970, 27.

[161] Court, *Pioneers of Ecological Restoration,* 200.

[162] *Arboretum News* 8, no. 4 (October 1959): 2; Court, *Pioneers of Ecological Restoration,* 180, 186.

[163] *Arboretum News* 11, no. 1 (January 1962): 1; *Arboretum News* 11, no. 2-3 (April-July 1962), 1-4; *Arboretum News* 13, no. 2-3 (April-July 1964): 2; *Arboretum News* 13, no. 4 (October 1964): 2; *Arboretum News* 14, no. 2-3 (April-July 1965): 1-2; Sachse, *A Thousand Ages*, 104-106.

[164] Court, *Pioneers of Ecological Restoration,* 173, 186-190, 200-05.

Fassett, and Gilbert, all of whom were his teachers. Longenecker held true to the vision of the Arboretum as a laboratory for ecological restoration even as other leaders retired or departed, from Franz Aust (1943), Edward Gilbert (1946), Aldo Leopold (1948), to Norman Fassett (1950), and as other scientists important to the development of ecological communities came and went, including Ted Sperry (1941), John Curtis (1961), and Henry Greene (1966). Longenecker was also the creator of the horticultural gardens that bear his name and was chairman of the landscape architecture program in the Department of Horticulture for many years. [165]

Greene also retired in 1966. He had begun planting Greene Prairie in 1943, meticulously recording everything he planted. He created what is regarded as one of the finest ecologically restored prairies in the nation. Greene also served on the Arboretum Committee for 20 years (1946-1966) and edited *Arboretum News* from 1952 until 1963.[166] The departure of Longenecker and Greene marked the end of an era and the end of the period of national significance.

The Arboretum after the Period of National Significance: 1967 to Present

The Arboretum entered a period of administrative conflict as the modern environmental movement got underway. Social unrest and growing public awareness of environmental issues, especially pollution, energized the Arboretum's managing director, David Archbald. He argued that the Arboretum should actively counter environmental threats, help inform the public, and engage in protest. The Arboretum Committee (AC) disagreed and induced him to resign in 1970. His successor, Roger C. Anderson, was also a committed environmental activist. He quickly grew frustrated with the AC and resigned in 1973.[167]

Public education during this tumultuous period in the Arboretum's history generally continued existing programs of tours and classes, and publishing of the *Arboretum News* for the membership of the Friends of the Arboretum. Ranger-naturalist Jim Zimmerman and Elizabeth Zimmerman, his wife and a respected ecologist in her own right, undertook a new initiative, with the permission of the Arboretum Committee, writing a weekly nature column for the *Wisconsin State Journal*, beginning in 1970.[168] Their January 21, 1973 column, titled "UW Arboretum Tackles Ecosystem Restoration," may be the first instance of the use of the term "ecosystem restoration" with reference to the Arboretum. In it, the Zimmermans explained the long-term program to restore prairie, forest, and wetland communities in the Arboretum and noted "[l]etting lands go back to nature does not insure that the total ecosystem will return, at least not in a lifetime."[169] Jim Zimmerman also undertook the only new ecological restoration project initiated in the 1960s and 1970s: the Sinaiko Overlook Prairie (1969). This diminutive five-acre mesic to dry mesic prairie lies at the west edge of the Arboretum north of the Nakoma Golf Course and is too small to appear in the figures. With the exception of Zimmerman's efforts, management of the Arboretum's ecological communities focused on maintenance during this period, which Zimmerman criticized as a "passive 'caretaker' concept" of operation.[170]

In 1974, Katherine T. Bradley was named director of the Arboretum. She would serve until 1983. She forged a working relationship with the AC and increased the number of staff with the addition of a full-time ranger position and a full-time ecologist. Virginia Kline took the latter post. As part of her work, Kline compiled data and prepared a comprehensive plan for all the Arboretum ecological communities, *Long Range Management*

[165] Court, *Pioneers of Ecological Restoration,* 68-70; "Bill Longenecker: Far-Sighted Planner."
[166] Court, *Pioneers of Ecological Restoration,* 140-142.
[167] Court, *Pioneers of Ecological Restoration,* 211-13, 222.
[168] Court, *Pioneers of Ecological Restoration,* 212-13.
[169] James Zimmerman and Elizabeth Zimmerman, "UW Arboretum Tackles Ecosystem Restoration," *Wisconsin State Journal*, January 21, 1972, 3:8.
[170] Court, *Pioneers of Ecological Restoration,* 210.

Plan: Arboretum Ecological Communities (1992).[171]

With the completion of the McKay Natural Awareness Center in 1977 (now the Visitor Center), Bradley hired William R. Jordan III as a full-time public services coordinator to recruit and train volunteers and edit the *Arboretum News*. In 1979, Jordan proposed a new journal, *Restoration & Management Notes*, which would provide technical information and current thinking about ecosystem management and restoration. In addition to growing public interest in protecting the environment, the National Environmental Policy Act (NEPA) of 1969 required that any federal undertaking evaluate effects on the environment and land restoration was increasingly employed as a mitigation measure, making such a journal very useful.[172] One of the earliest examples of a land reclamation project in Wisconsin was a 1976 prairie restoration at the Jackson County Iron Company near Black River Falls, designed by a graduate student of Darrel Morrison, a professor of landscape architecture at the university.[173] Jordan believed that such a journal would not only fill a need, but could also highlight the groundbreaking research and accomplishments in the Arboretum and demonstrate its significance in the emerging field of restoration as a land management technique.[174] *Restoration & Management Notes* began publication in June 1981. It was well received regionally and distributed nationally by 1991. In 1999, it became *Ecological Restoration*, a quarterly with peer-reviewed articles presenting information from all over the world.[175]

Gregory Armstrong succeeded Bradley as director in 1983. Armstrong altered Jordan's position to give him more time for public relations and editorial work to promote the Arboretum as an international center for ecological restoration, as well as to publicize the important role of the Arboretum in the development of the field. Jordan pursued these goals energetically and enthusiastically. He organized conferences, symposia, and workshops in the 1980s and early 1990s, assisted by national and international restoration ecologists and Arboretum staff. Arguably the most important of these was the Restoration Ecology Symposium, held at the Arboretum in October 1984. The purpose of this symposium was to focus on restoration as research, linking theory and practice in constructing and reconstructing ecosystems and, in turn, leading to improved restoration techniques. Leopold, Sperry, Fassett, Curtis, Greene, and other Arboretum scientists had pioneered this "adaptive approach" in the experimentation, restoration, and management of their projects. Jordan used the term "restoration ecology" to describe this iterative process for the first time at this symposium.[176] In 1988 Jordan and the Arboretum were instrumental in the formation of the Society for Ecological Restoration (SER), providing the new association with office space in the Security Residence. SER quickly developed into an international organization. In 2010, SER moved to Washington, D.C. In 2019, it counted members in more than 70 countries and every state in the nation. These efforts, combined with scholarly research and understanding in the late twentieth and early twenty-first centuries have made clear the pivotal role of the Arboretum in the development of ecological restoration and have helped make the Arboretum a center for promoting practical techniques for restoring ecological communities.[177]

The Arboretum celebrated the 50-year anniversary of its dedication on June 17, 1984. Armstrong prepared a "Director's Report" for the occasion, which affirmed that while the Arboretum did have a collection of trees and shrubs as a traditional Arboretum might, what made the Arboretum unique and formed a larger part of the

[171] Court, *Pioneers of Ecological Restoration*, 220-240.
[172] Court, *Pioneers of Ecological Restoration*, 225, 232-36.
[173] Darrel Morrison, "Native Plants for Man-Made Moonscapes," *Arboretum News* 27 (summer 1978): 2.
[174] Court, *Pioneers of Ecological Restoration*, 237-39.
[175] Court, *Pioneers of Ecological Restoration*, 284.
[176] John D. Aber and William R. Jordan, III, "Restoration Ecology: An Environmental Middle Ground," *BioScience* 35:7 (July/August 1985): 399.
[177] Court, *Pioneers of Ecological Restoration*, 237-39, 242-44, 261.

resource, true to the vision of its founders, was the "collection of restored ecological communities representing the major ecosystem types of pre-settlement Wisconsin."[178] Armstrong reaffirmed the vision of the founders, stating,

> The idea here is that the value lies in the actual restoration and management of the ecological communities as opposed to an alternative notion that the end product or completely restored communities are the objective. This idea that the actual restoration *process* provides an important opportunity for basic ecological research has been a part of the Arboretum efforts for some time.[179]

Since the 1980s, the developing ecological communities in the Arboretum have been nurtured, their progress subjected to detailed scientific study, and to research to continue to develop effective management practices. Arboretum staff and trained volunteers continued to remove invasive species, cut brush, prepare areas for burning, collect seeds, and plant vegetation. New projects in the last thirty-five years include Marion Dunn Prairie (1983, four-acre ecological restoration adjacent to Monroe Street); Wingra Oak Savanna (1991, ecological restoration near Ho-Nee-Um Pond/Wheeler Council Ring, figure 2A); Wisconsin Native Plant Garden (2001, figure 2C); and an addition to the Visitor Center (2001, figure 2C, photo 15).[180]

During Armstrong's directorship (1983-2004), a 16,000-square-foot addition was built at the McKay Center and additional staff positions were created to support new public education initiatives. These included: an education coordinator (1984), in charge of classes, exhibits, tours, lectures, and grant-writing; five naturalists (1986); a native plant gardener (2002); a volunteer program coordinator (2002); and a horticulturist (2003). In 1997, after many years of effort, the Leopold Chair of Restoration Ecology was established, a research professorship housed at the Arboretum and primarily charged with guiding the research program at the Arboretum. The first to hold this post was Joy Zedler, who had completed a doctorate in plant ecology at the University of Wisconsin in 1968, and then served as professor of biology and creator and director of the Pacific Estuarine Research Laboratory at San Diego State University. Upon her appointment as Leopold Chair, the title of Arboretum Research Director was added. Zedler retired in 2016 after publishing 168 papers and books that advanced restoration science and the Arboretum legacy.[181] During Zedler's tenure, Kevin McSweeney served as Arboretum director (2004-2012), and Donna Paulnock as interim director (2012-2017). In 2017, Karen Oberhauser became director.[182]

Challenges continue to arise, due primarily to pressures from suburbanization. The Beltline, which was widened to six lanes with an interchange at Seminole Highway in 1969, took nearly 4 acres and some 1,500 trees and is perennially under consideration for expansion. Stormwater run-off from the Beltline and adjacent commercial and residential developments continues to threaten much of the Arboretum, despite the excavation of de-silting ponds along the west edge of the Arboretum and north of the Beltline between 1969 and 1984. Beginning in 2008, the retention ponds were rehabilitated, and a wetland basin was installed between the Beltline and the retention pond just north of the highway in 2009.[183]

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[178] Gregory Armstrong, "Director's Report to the Arboretum Committee," March 1984, 1, University of Wisconsin-Madison Arboretum Archives.

[179] Armstrong, "Director's Report to the Arboretum Committee."

[180] Court, *Pioneers of Ecological Restoration,* 246-60; Kline, *Long Range Management Plan for Arboretum Ecological Communities*, 2-6,117-123.

[181] Court, *Pioneers of Ecological Restoration,* 253-60.

[182] Natasha Kassulke, "Oberhauser Named Director of Arboretum," *University of Wisconsin News*, April 25, 2017, https://news.wisc.edu/oberhauser-named-director-of-arboretum/.

[183] Court, *Pioneers of Ecological Restoration,* 207-09, 246-48, 257-58.

National Significance of the University of Wisconsin Arboretum in Conservation

The University of Wisconsin Arboretum (Arboretum) is nationally significant under NHL criterion 1, in conservation. Both Thematic Framework VI. Expanding Science and Technology, and VII. Transforming the Environment, apply. The Arboretum retains a high degree of integrity to its period of national significance, 1933 to 1966.

The Arboretum was conceived as a laboratory for investigating how to reclaim and repair damaged and degraded landscapes, primarily prairies, forests, wetlands, and savannas. The research and experimentation carried out there beginning in the 1930s was nationally significant because the work led to a better understanding of these ecosystems and contributed importantly to the development of standardized conservation, restoration, and management practices, and ultimately helped define the field of restoration ecology. The Arboretum's ecological communities have provided models for ecological restoration, inspired other restoration projects (especially prairies), and sparked practical and applied research that has generated knowledge leading to theoretical and practical principles important in the development ecological restoration and restoration ecology. Although best known for its prairies, the Arboretum is also significant as the site of important research in the conservation, management, and restoration of wetlands, forests, and savannas. The two most important contributions were the necessity of prescribed fire for fire-dependent ecosystems (beginning with prairies and extending to other ecosystems), and the adaptive approach to the restoration and management of ecosystems.[184] The knowledge gained at the Arboretum is demonstrated in the ecological communities themselves and has been disseminated nationally through technical journals and the academic and professional careers of University of Wisconsin graduates in conservation-related fields. Examples of this influence follow.

[184] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64-65, 70.

Influence of the Arboretum's Ecological Communities as Models of Ecological Restoration

The Arboretum's ecological communities have served as models of ecological restoration. The prairies first inspired others to undertake ecological restorations. As early as 1940, for example, the commissioners of the Forest District Preserve of Cook County, Illinois, decided the Forest District Preserve should have a prairie, and wrote to Leopold asking to borrow the services of Ted Sperry for thirty days to create a prairie for them. The National Park Service, Sperry's employer, refused permission.[185] Prairie restoration projects were established at the University of Illinois near Urbana (Trelease Prairie, 1942, begun by Victor Shelford, then professor at the University of Illinois); at Knox College in Galesburg, Illinois (Green Oaks Field Study Center, 1955); at the Morton Arboretum in Lisle, Illinois (Schulenberg Prairie,1962); at the Boerner Botanical Gardens, Milwaukee (Wehr Nature Center Prairie, 1965); by the Milwaukee County Parks system (Whitnall Park Prairie, 1965), and at the University of Wisconsin-Milwaukee Field Station (Cedar-Sauk Prairie, 1966).[186] All these prairie restoration projects are extant and likely retain a high degree of ecological integrity.

All but the Trelease Prairie are documented to have been influenced by the Arboretum prairies. In November 1954, George Ward and Paul Shepard, biology professors at Knox College in Galesburg, Illinois, toured the Curtis and Greene prairies. Henry Greene offered seeds to get them started, and they went back to Galesburg intent on restoring a prairie. Planting of the 760-acre prairie (extant) at Green Oaks Field Study Center began in the spring of 1955.[187] Greene's offer of seeds was a reference to the Arboretum's Seed Exchange, which Curtis had begun in 1952, packaging some of the seeds of native Wisconsin plants Arboretum staff had collected for exchange with other arboreta and botanical gardens. Ray Schulenberg of the Morton Arboretum, who visited Curtis and Greene prairies in 1955 and corresponded with both Curtis and Greene, also obtained seeds from the Seed Exchange.[188] The Seed Exchange raised the Arboretum's profile internationally, and was nationally influential because it provided seeds to a number of institutions and organizations. In 1961, for example, more than 550 seed packets were sent to some 75 institutions.[189] Although these institutions have not been identified, some were likely establishing or managing prairie or savanna restoration projects. Planting of the Wehr Nature Center Prairie was begun in 1965 by Phillip B. Whitford, professor at University of Wisconsin-Milwaukee and former doctoral student of John T. Curtis, and Arthur Ode, botanist at Boerner Botanical Gardens, using seeds from the Arboretum.[190] Ode also established Whitnall Park Prairie in 1965, consulting with David Archbald, then managing director of the Arboretum. The Arboretum also donated seeds for the Cedar-Sauk Prairie, begun by Ode and Whitford in 1966.[191]

The first Midwest Prairie Conference, entitled "Symposium on Prairie and Prairie Restoration," was held in 1968, at Knox College. David Archbald was the keynote speaker. Ray Schulenberg, who had initiated the prairie restoration at the Morton Arboretum in 1962, presented the history of that project, noting that "the precedent, inspiration, and basic procedural information for prairie restoration came to us from the University of Wisconsin Arboretum."[192]

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[185] Court, *Pioneers of Ecological Restoration,* 109.

[186] Court, *Pioneers of Ecological Restoration,* 236; Jordan and Lubick, *Making Nature Whole,* 108-118.

[187] Court, *Pioneers of Ecological Restoration,* 236; and Jordan and Lubick, *Making Nature Whole,* 108.

[188] Dave Egan and Ray Schulenberg, "Old Man of the Prairie: An Interview with Ray Schulenberg," *Restoration & Management Notes* 15, no. 1 (Summer 1997): 41.

[189] Court, *Pioneers of Ecological Restoration,* 182.

[190] Brian Russert (Natural Areas Coordinator, Milwaukee County Parks), email to Susan Carpenter (Senior Outreach Specialist and Native Plant Gardener, University of Wisconsin-Madison Arboretum), July 1, 2019.

[191] Phillip B. Whitford, "Prairie Establishment at the Field Station," *Field Station Bulletin* 6, no. 2 (1973): 16.

[192] Peter Schramm, ed., *Proceedings of a Symposium on Prairie and Prairie Restoration: First Held on September 14 and 15, 1968, at Knox College, Galesburg, Illinois* (Galesburg, Illinois: Knox College, 1970), 45.

The first Midwest Prairie Conference took place against the backdrop of the environmental movement of the 1960s and 1970s. A growing body of scientific research increased public awareness of the damage humans were causing to the environment and led to the enactment of a raft of federal legislation. Major environmental laws included the Land and Water Conservation Fund Act of 1965, the National Environmental Policy Act of 1969 (NEPA), the Clean Air Act of 1970, the Clean Water Act of 1972, and the Endangered Species Act of 1973.[193] The environmental movement launched a second generation of prairie restoration projects, some of which looked to the Arboretum's prairies for guidance. This legislation also sparked the restoration of other habitats, especially wetlands.[194]

Ray Schulenberg (Morton Arboretum, quoted above) collaborated with Robert F. Betz, Northeastern Illinois University professor of biology, on two prairie restorations. The first was the Gensburg-Markham Prairie, near Chicago, Illinois. The Gensburg family donated a 60-acre remnant tallgrass prairie, overrun with invasive exotic plants, to Northeastern Illinois University in 1971. Schulenberg and Betz initially focused on cutting invasive shrubs and burning to allow native plants to spread. In 1973, Schulenberg and Betz planned a prairie restoration at Fermilab (Fermi National Accelerator Laboratory) in Batavia, Illinois. Planting there began in 1975.[195]

Since 1970, the ecological restoration of prairie communities has taken place throughout the North American mid-continent where prairies once dominated, and the influence of the Arboretum has expanded beyond the Great Lakes region. For example, Bill Whitney, regarded as a leader in prairie restoration in Nebraska, began planting his first restored prairie in 1979, inspired by a visit to the restored prairies at the Arboretum, and at the Morton Arboretum.[196]

It should be noted that the United States Department of Agriculture (USDA) and the United States Department of Interior (USDOI) also were involved in early prairie restoration efforts, notably through the United States Forest Service, the Soil Conservation Service, and the National Park Service. These efforts were intended to control soil erosion and return damaged lands to sustainable productivity of timber, water and forage, and were not attempts to restore native ecological communities. The influence of the Arboretum's prairies on the projects these agencies undertook has not been documented, but there are various connections between the scientists involved in these efforts, forming a network of circumstantial evidence, described below.

In 1912, the United States Forest Service (USFS) established the Utah Experiment Station (later the Great Basin Experiment Station) in the Manti Forest Reserve (now the Manti-LaSal National Forest). Plant ecologist Arthur W. Sampson was named the director. Sampson immediately initiated a project to reestablish grassland on the Wasatch Plateau, primarily for grazing and erosion prevention (to reduce flooding). He dug contour trenches to control erosion and planted both exotic and native trees and grasses. Another USFS project intended to restore the productivity of degraded land was the Shelterbelt Program, 1934-1942, proposed and directed by Raphael Zon, specifically as a response to the severe erosion of the Dust Bowl. Zon encouraged farmers to plant trees as windbreaks, and employ contour plowing or terracing.[197] The primary connection between the prairies of the

[193] Jordan and Lubick, *Making Nature Whole*, 124-129.

[194] Daryl D. Smith, "Prairie Restoration: Bridging the Past and the Future," *Proceedings of the North American Prairie Conference* 23 (2014): 62.

[195] Court, *Pioneers of Ecological Restoration*, 217; Fermilab, "Tallgrass Prairie," accessed July 5, 2019, https://ecology.fnal.gov/tallgrass-prairie/; and Ray Wiggers, "Classic Restorations," *Chicago Wilderness* (summer 2000): 5-7, accessed August 24, 2019, https://www.chicagowilderness.org/page/cwmag.

[196] Gerry Steinauer, *A Guide to Prairie and Wetland Restoration in Eastern Nebraska* (Aurora, Nebraska: Prairie Plains Resource Institute and Nebraska Game and Parks Commission, 2003), np.

[197] Hall, *Earth Repair*, 95-123.

Arboretum and the USFS is Aldo Leopold. Leopold joined the USFS in 1909 and served in a series of roles of increasing responsibility predominantly in the southwestern United States. He started at Apache National Forest in eastern Arizona, transferring to Carson National Forest in northern New Mexico in 1911, where he oversaw twenty million acres of national forests. In 1924, he relocated to Madison, Wisconsin, as associate director of the Forest Products Laboratory.[198] Leopold would certainly have been familiar with the research conducted at the Utah Experiment Station, as well as with subsequent investigations carried out by USFS staff. They would have been familiar with his work, as well. Raphael Zon was a nationally prominent forest scientist, who established and oversaw the Forest Service's program of forest experiment stations (as well as the Utah Experiment Station) from 1908 to 1923 and subsequently directed the Lake State Forest Experiment Station based in St. Paul, Minnesota, through 1944. Zon also supervised the Shelter Belt program from 1934 to 1942. In 1932, Zon was appointed to the University of Wisconsin Arboretum Advisory Committee.[199]

The Soil Conservation Service (SCS, initially, Soil Erosion Service) was established in the USDOI in 1933, part of the national soil conservation program developed by Franklin D. Roosevelt's administration as a response to the Dust Bowl. This agency was transferred to the USDA in 1935. The SCS traces its roots to the USDA Bureau of Soils through its first director, Hugh Hammond Bennett, a pioneer in the field of soil science. In 1903, Bennett began working for the Bureau of Soils as a soil surveyor, conducting field surveys that soon convinced him of the connection between soil erosion and soil productivity. By the 1920s, Bennett was recognized as the USDA soil erosion expert and had begun drawing national attention to the problem through his articles in scientific and popular journals. In 1928, Bennett campaigned for a national program to address soil erosion. When the 1930 Agriculture Appropriations Act provided funding for erosion research, Bennett was put in charge. He established erosion control experiment projects across the country. The first was Coon Creek Watershed, in southwestern Wisconsin, begun in fall 1933. Aldo Leopold served as an advisor and was influential in developing the project's approach to restoring the watershed, which was more than erosion control, incorporating hydrology, agronomy, wildlife and game, and scenic values. By that time, Bennett had been named director of the Soil Erosion Service. In 1934, the Land Utilization Program was created. This was another component of the national soil conservation program, which purchased degraded grasslands, primarily in the Great Plains. The SCS administered this program from 1938 until 1954. SCS scientists, with the assistance of CCC laborers, planted drought-resistant vegetation such as sudangrass (*Sorghum drummondi*) and Russian thistle (*Salsola tragus*) to stabilize the soil beginning in 1939. The SCS started seeding the lands with native grasses in the early 1940s, after planting test plots to identify which grasses would thrive, given site-specific hydrology and soil type. Under the direction of the USFS in the USDA since 1954, these lands were designated "National Grasslands" in 1960.[200] The primary connection with the SCS, again, was Aldo Leopold.

The first prairie restoration effort that the National Park Service (NPS) undertook was the 100-acre tallgrass prairie on the site of the Homestead National Monument in southeastern Nebraska. The NPS believes it to be the second-oldest prairie restoration in the nation (after the Arboretum's Curtis Prairie). Established in 1938, the Homestead National Monument encompasses David Freeman's homestead, some of the first acreage claimed under the Homestead Act of 1862. The landscape had been damaged by plowing and grazing. The restoration was prompted to combat erosion and to present visitors with a vista similar to what Freeman encountered when

[198] Flader and Callicott, *The River of the Mother of God*, xiii-xiv.

[199] Norman J. Schmaltz, "Forest Researcher: Raphael Zon, Part 1," *Journal of Forest History* (January 1980): 17-27; Jeremy Cameron Young, "Warrior of Science: Raphael Zon and the Origins of the Forest Experiment Stations," *Forestry History Today* (spring/fall 2010):7-11; Court, *Pioneers of Ecological Restoration,* 49.

[200] Sandra S. Batie, "Soil Conservation in the 1980s: A Historical Perspective," in *Agricultural History: The History of Soil and Water Conservation, A Symposium*, ed. Douglas Helms and Susan L. Flader (Oakland, California: The University of California Press, 1985), 6; Meine, "Restoration and 'Novel Ecosystems,'" 221; R. Douglas Hurt, "The National Grasslands: Origin and Development in the Dust Bowl," *Agricultural History* 59, no. 2 (April 1985): 246, 249, 253-255.

he arrived in 1863. NPS staff consulted with John E. Weaver, University of Nebraska professor of plant ecology, a noted expert on western prairie plant communities, in planning the restoration. Weaver recommended transplanting prairie sod from nearby remnant prairies slated for destruction, supplemented with a combination of native grass plants and seed mixes, which was the same approach taken to initiate Curtis Prairie. Weaver also expressed interest in conducting experiments during the process and offered the services of a graduate student to supervise the project. It is unclear whether Weaver had any further involvement in the Homestead National Monument Prairie, but work began with sod transplantation in late 1940 or early 1941. Since 1970, prescribed burning has been part of the management protocol.[201] The use of prescribed burns is likely a direct influence of the Arboretum prairies. John E. Weaver, professor at the University of Nebraska from 1917 until 1952, provides another connection between the Homestead National Monument Prairie and Curtis Prairie. Ted Sperry had conferred with Weaver in his doctoral research on the root systems of Illinois prairies in the early 1930s.[202] Weaver likely followed Sperry's experimentation and planting at Curtis Prairie with interest. His recommendations regarding the Homestead National Monument Prairie may have been influenced by Sperry's work. In addition, Leopold was familiar with Weaver's work on prairie soils and plants, citing him in a 1935 essay marking the establishment of The Wilderness Society.[203]

Although a direct connection between the Arboretum's wetland, savanna, and forest ecological communities and other restoration projects of these ecosystems has not yet been demonstrated, Franklin Court, the author of *Ecological Restoration in the Midwest: Past, Present, and Future* (2018) concluded:

> . . . the Arboretum prairie restoration efforts led to the development of fundamental theoretical and practical principles of ecological restoration *in general* and prairie restoration in particular.[204]

The environmental movement of the 1960s and the 1970s, with its dual aims of preserving natural areas and healing degraded land, came to value ecological restoration. NEPA and similar federal and state legislation added impetus to bringing ecological restoration into the mainstream, especially with regard to wetlands. In the 1930s, concern about declining numbers of waterfowl prompted conservation groups such as the Izaak Walton League (founded 1922) and Ducks Unlimited (established 1937) to advocate for the replacement of the tens of millions of acres of wetlands that had been drained in the United States. The Federal Aid in Wildlife Restoration Act of 1937 was the first major legislation to promote the restoration of wildlife habitat and provided funding to support it. This stimulated the construction of ponds and small marshes, generally created by removing or blocking drainage systems and re-flooding in areas that had been marshes but had been drained for croplands. The belief was that this process would restore the hydrology of a former wetland, and that, by so doing, native vegetation would regenerate, and marsh wildlife would return. This assumption persisted into the 1980s, when research began to provide evidence of the complexity of the composition, structure, and function of wetlands, and the inadequacy of re-flooding.[205]

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[201] Ray H. Mattison, "Homestead National Monument: Its Establishment and Administration," *Nebraska History* 43 (1962), 2-6, 21, 23-25; National Park Service, "Homestead National Monument of America: Nebraska," April 10, 2015, https://www.nps.gov/home/learn/nature/prairies.htm; Adolph Murie, "Restoration of Native Grassland at Homestead National Monument," Report to the National Park Service, November 23, 1940, 1-4, accessed August 23, 2019, https://www.nps.gov/home/index.htm.

[202] Court, *Pioneers of Ecological Restoration,* 100.

[203] Curt Meine, "Restoration and 'Novel Ecosystems': Priority or Paradox? *Ann. Missouri Bot. Gard.* 102 (August 2017): 221.

[204] Lenhart and Smiley, *Ecological Restoration in the Midwest,* 77. The italics are mine.

[205] Susan M. Galatowitsch and Arnold G. Van der Valk, *Restoring Prairie Wetlands: An Ecological Approach* (Ames: Iowa State University Press, 1994), 3-4; Jordan and Lubick, *Making Nature Whole,* 124-129.

As this understanding grew, the wetland communities in the Arboretum, with a history of research, experimentation, and management dating back to the 1930s, were ready to provide models in the ecological restoration of marshes. Leopold had initiated these efforts, which had gone beyond restoring the hydrology of the wetlands. The first ecological restoration project in the Arboretum appears to have been Leopold's attempt to establish a tamarack association adjacent to Teal Pond. Based on research by Norman Fassett and his students, Leopold had supervised the planting in 1933.[206] Leopold's plan for Gardner Marsh, prepared in June 1935, had included dredging to create islands for waterfowl nesting and landing sites, and planting cover.[207] His 1934 proposal for investigations in the Arboretum included a wild rice study (for Wingra Marsh).[208] Further, it should be noted that about one-fourth of Curtis Prairie is wetland and that the research done in Curtis Prairie wetland vegetation was published in *The Journal of Wildlife Management*, a national journal, particularly experiments in management practices.[209] In a column that appeared in the *Wisconsin State Journal* in 1973, Arboretum Ranger-Naturalist James Zimmerman and Elizabeth Zimmerman noted that, for 40 years, the Arboretum was "[t]rying to rebuild in a lifetime the five major ecosystems of Midwest . . .." These were prairies, savannas, wetlands, coniferous forests, and deciduous forests. The article closed with lessons learned from Arboretum restoration projects in the conifer forests (Leopold and Evjue Pines), the deciduous forests (Wingra and Gallistel Woods), and the sedge meadows of the wetlands (Gardner and Wingra Marsh).[210] The wetland, forest, savanna, and prairie communities in the Arboretum were also the subjects of master's and doctoral research, theses, and dissertations, available to other researchers nationwide.

Since the1980s, ecological restoration has come to be regarded an effective land management practice for both restored and natural landscapes. Governmental agencies employ techniques of ecological restoration to improve and maintain parks, recreational, and natural areas. The practice developed at the Arboretum that has had the greatest national influence in the maintenance of prairie, wetland, savanna, and forest ecosystems is the use of prescribed fire (explained in *Influence of Research into Establishing and Managing Ecological Communities*, below). The ecological communities in the Arboretum provide models of ecosystems maintained with prescribed burning.

Influence of Research into Establishing and Managing Ecological Communities

Research and experimentation carried out at the Arboretum during the period of national significance between 1933 and 1966 led to a better understanding of prairie, savanna, wetland, and forest ecosystems and made significant contributions to the development of standardized conservation, restoration, and management practices, which ultimately helped define the field of restoration ecology.

Research that took place in the Arboretum and likely had the greatest national influence demonstrated the importance of prescribed burns for maintaining fire-dependent ecosystems.[211] These ecosystems require fire for sustainability. Investigation into the use of fire to control undesirable and invasive plants in Arboretum ecological communities began with Curtis Prairie in 1939. This research led to the understanding that fire shaped prairie, savanna, some woodland (especially pine and oak barrens), and some wetland ecosystems prior

[206] "Aust and Longenecker, "The University of Wisconsin Arboretum and Wild Life Refuge," 183.

[207] Aldo Leopold and G.W. Longenecker, "Proposed Development for Lake Forest Marsh," June 1935, in Harriet A. Irwin, "Natural History Study of East Marsh of the University of Wisconsin Arboretum" (Master's thesis, University of Wisconsin, 1973), 10.

[208] Court, *Pioneers of Ecological Restoration,* 97.

[209] The earliest appears to have been John T. Curtis, "Use of Mowing in Management of White Ladyslipper," *Journal of Wildlife Management* 10 (1946): 303-308, presenting research that took place in Wingra Marsh.

[210] Zimmerman and Zimmerman, "UW Arboretum Tackles Ecosystem Restoration."

[211] Lenhart and Smiley, *Ecological Restoration in the Midwest,* 64-65.

to Euro-American settlement, especially by controlling woody plants in herbaceous communities (prairies and wet meadows). Research further showed that suppression of fire allowed invasive plants (especially woody shrubs) to overwhelm native species and change the structure and composition of a plant communities. These communities were then less habitable to many native wildlife species. Fire keeps these ecological communities open by removing encroaching shrubs, trees and thatch and clearing the soil for native seeds to germinate. As a result of the research in the Arboretum, controlled burns are routinely used as an important restoration and management practice in fire-dependent plant communities throughout the world.[212]

In 1938, at a meeting of the Arboretum Committee chaired by Leopold, the Arboretum directed Theodore (Ted) Sperry to begin experimenting with burning on limited areas of prairie in the spring of 1939. Controlled burn experiments continued through the 1940s, demonstrating that fire was critical for a healthy prairie, and establishing a regimen for prescribed burns, which today is considered best practice in prairie management. Burns are also used to manage other ecosystems, such as savannas as well as some woodlands wetlands.[213] The results of this research were published in *American Midland Naturalist* in 1948.[214] This nationally distributed, quarterly journal has been produced at the University of Notre Dame since 1909. *American Midland Naturalist* initially focused on biological science, particularly ecology, of the prairie states, but had expanded to include the whole country by the 1920s.[215]

Prescribed burning for prairie ecosystems was widely publicized through two nationally distributed documentaries: *The Vanishing Prairie* (1954); and a film that depicted the Arboretum's plant communities through the seasons (1965).[216] A program of prescribed burns continues in Curtis and Greene prairies today. Experiments in controlled burning in ecological communities other than the prairies began with Wingra Marsh in spring 1964.[217] However, the Arboretum is surrounded by urban residences and a hospital, where fire and smoke have become a public safety concern. Because it can be difficult to obtain permits for burning, at present, prescribed burns are primarily confined to the prairies, savannas, and Teal Pond Wetlands.[218]

The "adaptive approach" to restoration and management is another contribution of national significance that was developed at the Arboretum.[219] From the beginning, the planning and planting of the Arboretum's ecological communities were undertaken as field experiments to determine how to return native plants and animals to degraded lands. There were no guidelines yet formulated, so each project built in experiments, employed careful documentation, and used the results to the plan the next research experiments. This science-based framework of learning while restoring, is now known as the adaptive approach.[220] For example, the horse pasture that became Curtis Prairie was a research site from its very beginning in November 1935, when Norman Fassett and his graduate student, John W. Thomson, created test plots to compare five different methods to

[212] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64-65; and Wisconsin Department of Natural Resources, "Prescribed Fire," accessed July 5, 2019, https://dnr.wi.gov/topic/forestFire/prescribedFire.html.

[213] Court, *Pioneers of Ecological Restoration*, 107-108, 144-45; Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64-66.

[214] Curtis and Partch,"Effect of Fire on the Competition Between Blue Grass and Certain Prairie Plants."

[215] Robert P. McIntosh, "The American Midland Naturalist: The Life History of Journal," *American Midland Naturalist* 123, no. 1 (January 1990): 6-7.

[216] Court, *Pioneers of Ecological Restoration*, 166, 189-90, and 218; and "The Arboretum Movie," *Arboretum News*, 13, no. 4 (October 1964): 2.

[217] Cottam, "Management of the West Marsh."

[218] Joy Zedler, Aldo Leopold Chair of Restoration Ecology Professor Emerita, University of Wisconsin-Madison, discussion with Elizabeth L. Miller, July 10, 2019.

[219] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 67-70.

[220] Joy B. Zedler, ed., "Curtis Prairie: 75-Year-Old Restoration Research Site," *Arboretum Leaflet* no. 16 (August 2008): 1.

establish native plants: plowing, seeding, removing surface soil, transplanting sod, and prairie hay mulching.[221] These plots are part of Curtis Prairie today. When Theodore (Ted) Sperry started planting Curtis Prairie in 1936, he began transplanting sod, which Fassett and Thompson's experiments had shown to be the most effective method. By 1940, Sperry had meticulously documented his experimentation in Curtis Prairie with forty-two different prairie species, comparing success rates of establishment between strips of sod, seedlings, and seeds; tests of fertilizers; and methods of eradicating exotic species including mowing, chemical treatments, and controlled burning (in spring versus fall).[222] In the mid-1940s, John T. Curtis selected seeding as the most cost-effective way to establish native plants. Experiments continued in Curtis and Greene Prairie testing the best method for germinating the seeds of 91species of native plants, along with additional experiments for removing exotic plants.[223] By the late 1940s, the adaptive approach to restoration and management was firmly established in the Arboretum. In an 1973 article in the *Wisconsin State Journal*, James Zimmerman and Elizabeth Zimmerman described the Arboretum's adaptive approach to the public as "…proceed cautiously, a little at a time, and continually revise the plan as experience feeds back results."[224] William R. Jordan III described and promoted this approach in the journal *Restoration and Management Notes* beginning in 1981, first referring to it as "restoration ecology" in 1984. The adaptive approach has been carried forward to the present day and spread across the country and around the world through publications in national journals.[225]

Another investigation that has had national influence and was conducted in the Arboretum identified seeds as the most cost-effective method for establishing prairies and savannas, noting that the seeds of most prairie and savanna species germinated through cold stratification.[226] As mentioned above, the first plantings of the horse pasture that became Curtis Prairie were experiments conducted in 1935 by Fassett and Thompson, who determined that transplanting blocks of sod from remnant prairies (on sites slated for destruction) were effective. Years later, John T. Curtis thought it was too labor intensive and too expensive for a large-scale project, believing that planting seeds would be more affordable. He and Henry Greene carried out a series of experiments in the late 1940s that demonstrated that cold stratification was required for most prairie plants to achieve high germination rates.[227] They published their findings in *American Midland Naturalist* in 1950.[228] The use of seed mixes was widespread in later prairie restoration projects, which may be due in part to Curtis and Greene's research. The establishment of the Seed Exchange at Arboretum in 1952, packaging and distributing some of the seeds of native Wisconsin plants Arboretum staff had collected, raised the Arboretum's profile internationally, provided the seeds to start prairie and savanna restoration projects to a number of institutions and organizations.[229]

A review of the literature illustrates that it has taken until the twenty-first century to begin to identify and put into perspective the significant places and people in the history of ecological restoration and the field of

[221] Zedler, "Curtis Prairie: 75-Year-Old Restoration Research Site," 1; and Court, *Pioneers of Ecological Restoration*, 99-100.

[222] Court, *Pioneers of Ecological Restoration*, 129.

[223] Zedler, "Curtis Prairie: 75-Year-Old Restoration Research Site," 1.

[224] Zimmerman and Zimmerman, "UW Arboretum Tackles Ecosystem Restoration."

[225] Some examples: David Archbald, "Effects of Several Fertilizers on Mixed *Andropogon gerardii*, *Poa pretensis* Stand," *Bulletin of the Ecological Society of America* 33, no. 3 (1952): 59; R. A. McCabe and R.F. Labisky, "Leader Forking of Red and White Pines in Plantations," *Journal of Forestry* 57, no. 2 (1959): 94-97; W.C. Robocker, J.T. Curtis, and H.L. Ahlgren, "Some Factors Affecting Emergence and Establishment of Native Grass Seedlings in Wisconsin," *Ecology* 34, no. 10 (1953): 194-199. For a review of the extent of the adaptive approach globally, see Joy B. Zedler, "What's New in the Adaptive Management and Restoration of Estuaries and Coasts?" *Estuaries and Coasts*, 40 (2017): 1-21.

[226] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64, 77.

[227] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64.

[228] Greene and Curtis, "Germination Studies of Wisconsin Prairie Plants."

[229] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 64; Court, *Pioneers of Ecological Restoration*, 182.

restoration ecology in the United States. The earliest book appears to be Marcus Hall, *Earth Repair: A Transatlantic History of Environmental Restoration* (2005). This was followed by William R. Jordan III and George M. Lubick, *Making Nature Whole: A History of Ecological Restoration* (2011); Franklin E. Court, *Pioneers of Ecological Restoration: The People and Legacy of the University of Wisconsin Arboretum* (2012); and Christian Lenhart and Peter C. Smiley, Jr., editors, *Ecological Restoration in the Midwest: Past, Present, and Future* (2018). These books demonstrated that the investigation and experimentation carried out at the Arboretum in an effort to heal degraded prairie, wetland, forest, and savanna landscapes led to a better understanding of these ecosystems and contributed importantly to the development of standardized conservation, restoration, and management practices, and ultimately helped define the field of restoration ecology. The research conducted as part of restoring and managing the Arboretum's ecological communities has resulted in hundreds of papers publicizing innovations and methods developed in the Arboretum.[230] The reputation of the Arboretum as the center of ecological restoration research and practice in the United States was cemented in the 1980s, with the publication of the semi-annual newsletter, *Restoration & Management Notes* in 1981 (later the quarterly, *Ecological Restoration*) and the founding of the Society for Ecological Restoration in 1988. The Society for Ecological Restoration had office space in the Arboretum's Security Residence until 1998. These efforts raised the Arboretum's profile, publicized the Arboretum's commitment to restoring ecological communities and helped make the Arboretum a center for promoting practical techniques for restoring ecological communities.[231]

Influence of Graduate Students Associated with the Arboretum

The scientific research, investigative methods, and restoration and management techniques developed at the Arboretum that have had a national influence in the establishment of the field of restoration ecology have also been disseminated through the academic and professional careers of graduates of the University of Wisconsin who studied in the Arboretum. Students expanded the sphere of influence for the work that took place in the Arboretum. These include students of Aldo Leopold and John T. Curtis, as well as their students' students.

Aldo Leopold supervised one doctoral and twenty-five wildlife management master's degree students, most of whom participated in research and experiments in the Arboretum. Leopold's students had careers in a variety of academic and governmental institutions, including the University of Washington in Seattle (Dick Taber, master's degree, 1948); the University of Guelph in Guelph, Ontario, Canada (Antoon de Vos, master's degree, 1947, doctorate degree with Curtis, 1951); the North Dakota Game and Fish Department (Stephen Richards, master's degree, 1948); the Northeastern Wildlife Station in Fredericton, New Brunswick, Canada (Bruce S. Wright, master's degree,1947). Wright was an early researcher on the effects of synthetic chlorinated hydrocarbons such as the pesticide DDT; his work was referenced in Rachel Carson's influential book, *Silent Spring* (1962). A few of Leopold's students became professors at the University of Wisconsin. Joe Hickey (master's degree, 1942, doctorate degree at the University of Michigan, 1948) was a specialist in peregrine falcons, and studied the impact of the pesticide DDT on raptors. His research helped provide the basis for banning DDT, and his advocacy launched the modern raptor conservation movement (1965), which led to the prohibition of DDT in Wisconsin in 1970, and in the United States in 1972. Leopold supervised one female graduate student. Although she did not carry out her graduate field studies in the Arboretum, she deserves mention: Frances Hamerstrom (master's degree, 1940), who, with her husband, Frederick Hamerstrom (one of Leopold's nine doctoral students, 1941) went on to work for the Wisconsin Department of Conservation, where they became internationally recognized wildlife biologists for their research, which helped preserve the greater

[230] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 70.
[231] Court, *Pioneers of Ecological Restoration*, 237-39, 242-44, 261.

prairie chicken, an endangered subspecies in Wisconsin.[232]

John T. Curtis supervised thirty-six doctoral student, and nine ecology master's degree students. They brought their experiences in the Arboretum, as well as Curtis' research and investigative methods and his concept of vegetation as a continuum to their careers in public agencies and to their own students in academic institutions across the U.S.[233] Curtis supervised six women doctoral students. At least four of them went on to distinguished careers as pioneering women ecologists, in locations as far-flung as Florida Southern College in Lakeland, Florida (Margaret Gilbert, doctorate, 1954); the University of Alaska-Fairbanks (Bonita M. Neiland, doctorate, 1954); the University of Wyoming (Martha Christensen, doctorate, 1960), and at the Department of Scientific and Industrial Research, Palmerston North, New Zealand (Gwendolyn Struik, doctorate, 1960).[234] Struik's husband, J. Roger Bray (doctorate with Curtis, 1960), worked for the same organization and was a noted plant ecologist in his own right, having collaborated with Curtis in developing the continuum concept in vegetation.[235] Robert P. McIntosh (doctorate, 1950) was influential not only as a professor (Middlebury College, Vassar, and Notre Dame University), but as the editor of the national publication, *American Midlands Naturalist*, from 1970 until 2002.[236] Faculty and staff at the University of Wisconsin-Madison involved in the Arboretum have continued to promote the investigative methods, and to develop restoration and management techniques at the Arboretum that have helped define the field of restoration ecology, through supervising students and/or through their writing. These include Grant Cottam (doctorate 1948, faculty 1949 to 1986),[237] William R. Jordan III (doctorate 1971, staff at Arboretum 1977 to 2001), Evelyn Howell (doctorate 1975, faculty 1976 to present), Paul H. Zedler (doctorate 1968, faculty since 1998 and now associate director of the Nelson Institute of Environmental Studies), and Joy B. Zedler (doctorate 1968, Aldo Leopold Chair of Restoration Ecology and Professor of Botany from 1998 to 2016).[238]

Analysis of Comparison Properties

The existing literature that reviews the history of the development of ecological restoration and the field of restoration ecology in the United States demonstrates that ecological restoration has changed over time from a concentration on the structure and composition of plant communities, to improving and restoring the function of

[232] Stan Temple, "Exploring the Legacy of Leopold's Students: Remembering Dick Taber," February 2, 2016, https://www.aldoleopold.org/post/exploring-the-legacy-of-leopolds-students-remembering-dick-taber/; Stan Temple, "Exploring the Legacy of Leopold's Students: Antoon de Vos," May 20, 2016, https://www.aldoleopold.org/post/exploring-legacy-leopolds-students-remembering-antoon-de-vos/; Stan Temple, "Exploring the Legacy of Leopold's Students: Stephen Richards," June 12, 2017, https://www.aldoleopold.org/post/stephen-richards/; Stan Temple, "Exploring the Legacy of Leopold's Students: Bruce S. Wright," September 7, 2017, https://www.aldoleopold.org/post/bruce-wright/; Stan Temple, "Filling Big Shoes: A Tribute to Joe Hickey," November 3, 2015, https://www.aldoleopold.org/post/filling-big-shoes-a-tribute-to-joe-hickey/; The Wisconsin Conservation Hall of Fame, "Frederick Hamerstrom and Frances Hamerstrom," 1996, https://www.wchf.org/inductees/hamerstroms.html.

[233] Evelyn Howell and Forest Stearns, "The Preservation, Management, and Restoration of Wisconsin Plant Communities: The Influence of John Curtis and His Students," in Fralish, McIntosh and Loucks, *John T. Curtis, Fifty Years of Wisconsin Plant Ecology* , 63.

[234] Jean H. Langenheim, "Early History and Progress of Women Ecologists: Emphasis Upon Research Contributions," *Annual Review of Ecology, Evolution, and Systematics* (1996):1-53. P. 20.

[235] Orie Loucks, "The Diverse Contributions of J. Roger Bray and Gwendolyn Struik," *The Ecological Society of America's History and Records*, January 12, 2013, https://esa.org/history/bray-j-roger/.

[236] "Robert P. McIntosh, 1920-2017," *The Ecological Society of America*, January 4, 2018, https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/bes2.1362.

[237] Grant Cottam, Obituary, May 20, 2009, https://www.legacy.com/obituaries/deseretnews/obituary.aspx?n=grant-cottam&pid=127465801.

[238] Court, *Pioneers of Ecological Restoration*, 233; Zedler, "The Aldo Leopold Chair of Restoration Ecology at the University of Wisconsin-Madison," 1.

ecosystems (much larger in scale).[239] With regard to ecological restoration as recreating or restoring the structure and composition of plant communities, the literature documents that there were two places where this was initiated before the Arboretum: the Dutchess County Botanical Garden at Vassar College, in Poughkeepsie, New York (begun 1922); and the Holden Arboretum near Cleveland, Ohio (established in 1931).[240] These efforts are discussed briefly below, but each has a focus different from the Arboretum. The Vassar site is much smaller, and until recent reclamation efforts, was poorly maintained, yet may still be nationally significant. The Holden Arboretum is also extremely important and may also be eligible for National Historic Landmark designation.

The prairies in the Arboretum inspired the recreation of other prairies and provided guidance in establishing them, as explained under *Influence of Research into Establishing and Managing Ecological Communities*, above. Most were associated either with arboreta, or colleges and universities. Among those that predate the environmental movement, the most influential is probably the Morton Arboretum in Lisle, Illinois (Schulenberg Prairie,1962). Ray Schulenberg was a tireless advocate of prairie remnants and restoration, generous with his time in collaborating and conferring with would-be prairie planters. Scientists at other arboreta, colleges and universities also provided expertise gained in their research in remnant environments and restoration projects to institutions and agencies prior to and especially in the wake of the environmental movement. John E. Weaver of the University of Nebraska was an early proponent of prairie restoration. Weaver was an expert on western prairie plants, especially their root systems. During the late 1970s, colleges and universities began offering courses in restoration ecology and ecological restoration, and several developed programs in the field.

In terms of ecological restoration in assisting the recovery of degraded ecosystems, the literature shows that the United States Forest Service (USFS) and the Soil Conservation Service (SCS) experimented with measures to restore the productivity of damaged landscapes, predominantly through erosion control, beginning in the early twentieth century. This effort accelerated in the late 1930s in response to the severe erosion on the Great Plains (the Dust Bowl), as explained under *Influence of Research into Establishing and Managing Ecological Communities*, above. The National Park Service (NPS) also initiated an early prairie restoration project at the Homestead National Monument in southeastern Nebraska in 1940-41. This project had two goals: erosion control and to recreate the view of the sweeping prairies that homesteaders encountered in the 1860s. Since the 1970s, the USFS, the SCS, and the NPS have expanded into ecological restoration projects, as explained below.

Other agencies, institutions and organizations became involved in ecological restoration in the years since the environmental movement and the enactment of federal legislation such as the National Environmental Policy Act of 1969 (NEPA). The United States Fish and Wildlife Service, and The Nature Conservancy are two that have been involved in ecological restoration over the past thirty years. Their projects likely built on work that took place in the Arboretum, at least indirectly, particularly in using fire as a management tool and taking an adaptive approach to management.

Dutchess County Botanical Garden

Edith A. Roberts established the Dutchess County Botanical Garden (now the Edith Roberts Ecological Laboratory) at Vassar College in Poughkeepsie, New York. Roberts was a student of Henry C. Cowles beginning in 1905, completing her doctorate in botany at the University of Chicago in 1915. In 1919, Roberts joined the faculty at Vassar. In 1920, the Vassar College Board of Trustees granted her request for four acres of

[239] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 5.
[240] Hall, *Earth Repair*, 173-74; Jordan and Lubick, *Making Nature Whole*, 63-76.

land to be developed as an ecological laboratory, where students could learn about the taxonomy, morphology, and physiology of native plants and the public could see the beauty of indigenous plants.[241] As Roberts explained,

> The project was to establish, on less than four acres of rough land, the plants native to Dutchess County, N.Y., in their correct associations, with appropriate environmental factors of each association in this region.[242]

Roberts began by taking students out into the field to conduct an ecological study of Dutchess County to identify the plant associations and catalog the plants in them. The study, completed in 1922, documented thirty plant associations (among them open field, juniper hillside, gray birches, pines, oak woods, beech-maple-hemlock woods, hemlock ravine, streamside, pond, and bog). Roberts planned the layout of the botanical garden, an irrigation system was installed, and students began propagating plants from seeds or cuttings and planting them in their associations. Over the course of ten years, through a series of student research projects, twenty-eight of the thirty plant associations had at least fifty percent of their plant members established.[243]

In 1929, Roberts collaborated with her colleague, landscape architect Elsa Rehmann, to publish *American Plants for American Gardens*. The book describes thirteen plant communities and the plants in each, along with extensive plant lists, based on research at what Roberts called the Dutchess County Outdoor Ecological Laboratory.[244]

At Roberts' retirement in 1948, close to 2,000 species of ferns, flowers, vines, mosses, shrubs, and trees native to Dutchess County were growing in the botanical garden. The garden was tended for a few years after Roberts' retirement, but by the 1960s had been entirely abandoned. In 2011, an initiative was undertaken to document the surviving plants, and remove invasive species. This effort has continued sporadically, as funding has permitted.[245] The Dutchess County Botanical Garden/Edith Roberts Ecological Laboratory is likely of national significance in conservation, for Roberts' innovative work, and for its association with Roberts herself, among the earliest female ecologists in the United States.

Holden Arboretum

In 1931, the Holden Arboretum was established on 100 acres near Cleveland, Ohio; it was guided by, and associated with, the Cleveland Museum of Natural History (CMNH).[246] Between 1931 and 1938, Arthur B. Williams, naturalist at the CMNH, and his colleagues labored to establish members of the beech-maple-hemlock, oak-hickory, river bottom forest, and swamp plant associations, as well as several aquatic plant communities, in the Holden Arboretum. Williams reported in 1936:

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[241] Vassar College, "The History of the Edith Roberts Ecological Laboratory," June 3, 2019, http://pages.vassar.edu/casperkill/the-history-of-the-edith-roberts-ecological-laboratory/ ; Darrel G. Morrison, foreword to Edith A. Roberts and Elsa Rehmann, *American Plants for American Gardens* (1929; repr., Athens: The University of Georgia Press, 1996), xiii.

[242] Edith A. Roberts, "The Development of an Out-of-Door Botanical Laboratory," *Ecology* 14, no. 2 (April 1933): 163.

[243] Roberts, "The Development of an Out-of-Door Botanical Laboratory," 163, 166, 170, 172-222.

[244] Roberts and Rehmann, *American Plants for American Gardens*.

[245] Vassar College; and Meg Ronsheim, "Restoration Ecology and Invasive Species Management," Vassar Undergraduate Summer Research Institute, 2019, https://ursi.vassar.edu/projects/2019/biol-ronsheim.html.

[246] Holden Arboretum, "The History of the Holden Arboretum," accessed July 11, 2019,.

> Eventually we hope to establish an outdoor ecological museum by reproducing as many of the plant communities of the temperate parts of the globe as we can. Each forest type will be made as complete in every detail as climate, soil and experience permit . . ..[247]

In 1938, Elmer Merrill, then director of the Arnold Arboretum visited the Holden Arboretum. After touring the site, Merrill criticized the limited presence of ornamental features, observing that it was the flowering plants that most impressed visitors, and translated into financial support for the institution. By 1940, the restoration projects had been superseded by plantings intended to appeal to the public. In the late 1970s, Holden staff rediscovered some of the early plantings, and attempted to revitalize them, but was hampered due to limited funding. In 2014, the Holden Arboretum merged with Cleveland Botanical Garden and became Holden Forests & Gardens (Holden). Presently, Holden has an active public education program and manages remnants and research/restoration sites representing a variety of ecosystems, including beech-maple forests, white pine-hemlock-northern hardwood forest, wetlands, and riparian and ravine environments. The Holden's staff of seven scientists collaborate with Case Western University, Kent State University, and Ohio State University, among others. The Holden has not been evaluated for national significance in conservation, but it is an important institution that may be eligible for National Register listing or National Historic Landmark designation in conservation.[248]

Ray Schulenberg and the Morton Arboretum

Ray Schulenberg (1921-2003) came to the Morton Arboretum (Morton) in Lisle, Illinois, in 1955, as an assistant plant propagator. A native of Nebraska, Schulenberg had a deep appreciation for prairies and immediately became interested in a remnant prairie on the grounds of the Morton. In the fall of 1955, he visited the University of Wisconsin Arboretum, took home seeds from the Arboretum's Seed Exchange, and began corresponding with John T. Curtis and Henry Greene. Schulenberg's primary responsibility at the Morton was to propagate woody plants, but he raised prairie plants in his spare time. In 1962, the Morton acquired an adjacent parcel of severely eroded farmland. Clarence Godshalk, the director, decided to try to restore it to prairie. Schulenberg was named Curator of Native Plants and given the task. Between 1963 and 1968, Schulenberg established a six-acre prairie with some 120 prairie species, which he largely planted by himself, by hand, with some assistance from staff and students during the summers. By 1968, the prairie at the Morton began drawing visitors, including some who were interested in undertaking prairie restoration projects. One such visitor was Bill Whitney, regarded as a leader in prairie restoration in Nebraska, who came in 1978, and began his first prairie restoration project the following year. Schulenberg also collaborated with Robert F. Betz, Northeastern Illinois University professor of biology, on two prairie restorations. The first was the Gensburg-Markham Prairie (initiated 1973), near Chicago, Illinois. The second was at Fermilab (Fermi National Accelerator Laboratory) in Batavia, Illinois. Planting there began in 1975. Schulenberg also taught classes on native flora. His classes and his work inspired a group of citizen volunteers to launch the North Branch Restoration Project in 1977. The goal was to restore small remnant prairies along the North Branch of the Chicago River in the Cook County Forest Preserves. The project has been very successful, and the prairies are thriving. In 1977, Schulenberg returned to his post as propagator of woody plants. He continued to help manage the Morton prairie. Following his retirement in 1987, it was renamed the Schulenberg Prairie.[249] The

[247] Arthur B. Williams, "The Cleveland Museum of Natural History, Holden Arboretum, Report of Progress for 1935," April 1936, quoted in Jordan and Lubick, 69; and Cleveland Metro Parks, "Our First Naturalist," May 2013, https://www.clevelandmetroparks.com/parks/learn/blogs/notes-from-the-field/2013/may-2013/our-first-naturalist.

[248] Jordan and Lubick, *Making Nature Whole*, 70; Holden Arboretum, "Research," accessed August 31, 2019, https://www.holdenarb.org/research/; and Holden Arboretum, "Visiting the Natural Areas," accessed August 31, 2019, https://www.holdenarb.org/horticulture/conservation/visiting-the-natural-areas/.

[249] Ray Schulenberg, "Summary of Morton Arboretum Prairie Restoration Work, 1963 to 1968," *Proceedings of a*

Schulenberg Prairie, representing the work of Ray Schulenberg, has not been evaluated for national significance in conservation. It is clearly of regional importance and may be of national importance.

Other Colleges and Universities

Scientists and professors at colleges and universities other than the University of Wisconsin Arboretum also carried out restoration projects, provided expertise gained in their research to institutions and agencies, and offered classes about native plants and wildlife, biodiversity, and ecological restoration. Beginning in the late 1970s, the University of Wisconsin began offering courses in ecological restoration, and it has one of the earliest academic programs in the field. As of 2016, thirty-one colleges and universities in the United States offered degree programs in ecological restoration or a closely related field, including the University of Wisconsin-Madison. Among these are several institutions involved in the study of ecology prior to the 1960s. These include Iowa State University, University of Illinois at Urbana-Champaign, and the University of Nebraska.[250]

Iowa State University's involvement in ecology grew out of its Department of Zoology and Entomology, established in 1919. In the mid-1920s, the department developed a program in fish and wildlife biology. The first ecology course, focused on animals, was taught in 1936. Iowa State University partnered with the Iowa Fish and Game Commission (now the Iowa Department of Natural Resources) and wildlife advocate and cartoonist J.N. "Ding" Darling to establish the Iowa Cooperative Wildlife Research Unit (ICWRU, now the Iowa Cooperative Fish and Wildlife Research Unit) in 1932. This was the first of nine research units formed across the United States. Paul L. Errington was the first director of the ICWRU, and a research professor at Iowa State University from 1933 until his death in 1962. Errington earned his doctorate at the University of Wisconsin in 1932, where he worked with Aldo Leopold (although Leopold was not yet a faculty member). Errington remained in communication with Leopold, and later collaborated with Frederick and Frances Hamerstrom on studies of the great horned owl. In 1958, Iowa State University established a major in fish and wildlife management within the newly formed Department of Animal Ecology. In 2002, the name was changed to the Department of Natural Resource Ecology and Management.[251] The contributions of Iowa State University and the ICWRU to conservation have not been evaluated, but the ICWRU in particular may have national significance in the field of wildlife conservation.

Victor Shelford (1877-1968) and Stephen Forbes (1844-1930) were both distinguished ecologists, long-time faculty at the University of Illinois at Champaign-Urbana, and staff of the Illinois Natural History Survey (also located in Champaign). Both were founding members of the Ecological Society of America (1916), and each served as president of the organization. They were collaborators with Henry C. Cowles and Jens Jensen in laying a foundation for applied ecology and ecological design in the Midwest, as outlined under *Landscape*

Symposium on Prairie and Prairie Restoration 3(1970): 45-46; Egan and Schulenberg, "Old Man of the Prairie: An Interview with Ray Schulenberg," 38-44; Court, *Pioneers of Ecological Restoration*, 217; Fermilab, "Tallgrass Prairie; Wiggers, "Classic Restorations," 5-7; Steinauer, *A Guide to Prairie and Wetland Restoration in Eastern Nebraska*; North Branch Restoration Project, "About Us," accessed August 30, 2019, https://www.northbranchrestoration.org/about.html.

[250] University of Wisconsin-Madison, Department of Planning and Landscape Architecture, "Restoration Ecology and Ecological Restoration," accessed September 1, 2019, https://dpla.wisc.edu/restoration-ecology-and-ecological-design/; and Society for Ecological Restoration, "Academic Programs in Ecological Restoration: Recommendations for Westfield State University," Prepared for Massachusetts Division of Ecological Restoration and Westfield State University, June 30, 2016, 35-36, accessed September 1, 2019, https://cdn.ymaws.com/files/ser_academic_programs_in_ecological_restoration.

[251] Gary J. Atchison, Joseph E. Morris, and Stephen J. Dinsmore, "A History of the Fisheries and Wildlife Programs, the Animal Ecology Department, and the Natural Resource Ecology and Management Department at Iowa State University," 2-7, October 23, 2018, https://www.nrem.iastate.edu/news; "Resolution of Respect: Paul L. Errington," *Bulletin of the Ecological Society of America* 44, no. 2 (June 1963): 55-58.

Architects and Conservation, above. Shelford also planted the six-acre Trelease Prairie in 1942. It was the first restored prairie in Illinois, and perhaps the third in the nation. Owned and managed by the Illinois Natural History Survey Prairie Research Institute, the Trelease Prairie encompasses almost 20 acres in 2019.[252] The influence of the University of Illinois and the Illinois Natural History Survey on the field of conservation, through its pioneering ecologists Shelford and Forbes, is monumental and merits evaluation for national significance. Trelease Prairie is one resource that could be evaluated for its association with Shelford. Other resources have yet to be identified.

John E. Weaver (1884-1966), noted prairie ecologist, was on the faculty in botany and plant ecology at the University of Nebraska from 1915 until retiring in 1952. Weaver was a student of Frederic Clements (1874-1945), earning his bachelor's and master's degrees under Clements at the University of Nebraska and following Clements to the University of Minnesota for his doctoral studies, which he completed in 1916. Clements is best known for developing the "theory of ecological succession," postulating that plant communities change over time and generally develop through several stages until reaching a stable climax (Henry C. Cowles independently developed this theory at about the same time as Clements). Weaver published many articles on the vegetation and ecology of western prairies beginning in the 1920s, collaborated with Henry C. Cowles on an ecology textbook, and co-authored *Plant Ecology* (1929) with Frederic Clements. Weaver provided recommendations for the restoration of the Homestead National Monument Prairie (begun 1940-41) and had advised Ted Sperry in his doctoral research on the roots of Illinois prairie plants. It was Sperry who, at Aldo Leopold's direction, had carried out the first experiments and plantings on the Arboretum's Curtis Prairie.[253] Weaver's work was extremely important in the development of early prairie restoration projects and may be nationally significant in conservation. Homestead National Monument Prairie may be an appropriate resource to evaluate for its association with Weaver. Other resources remain to be identified.

There may be other colleges and universities that have national significance in the field of conservation as well. University of Minnesota, University of Chicago (specifically, ecologist Henry C. Cowles) and Cornell University (site of one of the first forestry schools in the nation) are three that merit investigation.

United States Forest Service

United States Forest Service (USFS) efforts to re-vegetate and re-forest date to 1912, when the Utah Experiment Station was established in the Manti Forest Reserve. Plant ecologist Arthur W. Sampson, director of the Utah Experiment Station, was tasked with finding techniques to control erosion and develop the sustainable productivity of timber, soil, water, and forage on western rangelands damaged by logging and livestock grazing. Sampson's experiments to re-grass the Wasatch Plateau set the pattern that the USFS continued to follow in its re-vegetation projects into the late twentieth century. Sampson dug contour trenches to control erosion and planted both exotic and native trees and grasses. The native plants selected were not placed in the proportions, associations, or locations in which they occurred in pre-Euro-American-settlement, because the goals were stabilization and sustainable productivity. Since the early 1940s, planting of native species in national forests is preferred, but only the introduction invasive exotic species is prohibited. The 2016 guidelines for restoration do not specifically mention the use of contour trenches, but does note that restoration may include

[252] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 14-20; Illinois Natural History Survey, Prairie Research Institute, "Trelease Prairie," accessed September 1, 2019, https://www.inhs.illinois.edu/research/natural-areas-uiuc/trelease-prairie/.

[253] Court, *Pioneers of Ecological Restoration*, 100; Murie, "Restoration of Native Grassland at Homestead National Monument"; University of Nebraska-Lincoln, "Papers of John E. Weaver (1884-1956)," accessed September 1, 2019, https://digitalcommons.unl.edu/agronweaver/.

"manipulating…terrestrial and aquatic ecosystems," which could conceivably encompass contour trenches.[254] The potential for eligibility for the National Register or National Historic Landmark designation of USFS re-vegetation and reforestation projects has not been evaluated, although it seems likely that there are eligible sites.

Another USFS project intended to restore the productivity of degraded land was the Shelterbelt Program, 1934-1942, proposed and directed by Raphael Zon as a response to the severe erosion of the Dust Bowl. Zon encouraged farmers to plant trees as windbreaks and employ contour plowing or terracing. Civilian Conservation Corps enrollees were instrumental in planting trees for this program. An increased demand for wheat during World War II and the end of the drought conditions on the Great Plains prompted some farmers to uproot the windbreaks, but some were retained and still thrive.[255] Those remaining have not been evaluated for National Register listing or National Historic Landmark designation, but probably have some potential given their importance.

In 1992, the USFS officially adopted a policy of "ecosystem management," which focuses on the health of ecosystems (not just sustainable use of natural resources, or restoration of one type of ecological community) through adaptive management. This appears to have been an early example of management at the ecosystem level. In 1994, the USFS developed its first ecosystem management plan, the Northwest Forest Plan, which covered all the national forests in the Pacific Northwest. It quickly became clear that the USFS could not carry out ecosystem management on its own, so the USFS began collaborating with local communities, and other agencies and organizations, such as The Nature Conservancy (which raises funds to support ecosystem management, brokers stewardship contracts, and prepares educational materials about fire management). Prescribed fire ("fuels reduction") is a management tool used in the national forests, particularly since Congress enacted the Healthy Forests Restoration Act (HFRA) in 2003, which provided some funding for fuel reduction efforts.[256] By 2006, ecosystem management had been extended to the twenty National Grasslands, some four million acres, most of which had been administered by the Soil Conservation Service until 1954, as outlined under *Soil Conservation Service* below. The USFS recommitted to ecosystem management in 2015.[257]

Soil Conservation Service

The Soil Conservation Service (SCS, initially, Soil Erosion Service) was established in 1933, as part of the national soil conservation program developed by Franklin D. Roosevelt's administration as a response to the Dust Bowl. Another component was the 1934 Land Utilization Program (LUP), which purchased degraded grasslands, primarily in the Great Plains. The SCS administered the LUP from 1938 until 1954, intending to stabilize the soil and return the grassland to sustainable grazing. In 1939, Civilian Conservation Corps (CCC) laborers began planting exotic drought-resistant vegetation. The SCS started seeding the lands with native grasses in the early 1940s, after planting test plots to identify which grasses would best, given site-specific hydrology and soil type. Under the direction of the USFS in the USDA since 1954, these lands were designated

[254] Hall, *Earth Repair*, 95-123; U.S. Department of Agriculture, Forest Service, "Ecosystem Restoration Policy," *Federal Register* 81, no. 81 (April 27, 2016): 24785.

[255] Hall, *Earth Repair*, 117.

[256] Courtney A. Schultz, Theresa Jedd, and Ryan D. Beam, "The Collaborative Forest Landscape Restoration Program: A History and Overview of the First Projects," *Journal of Forestry* 110, no. 7 (2012): 381-391; The Nature Conservancy, "Restoring America's Forests," accessed July 10, 2019, https://www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/restoring-americas-forests/.

[257] U.S. Forest Service Restoration Framework Team, *Ecosystem Restoration: A Framework for Restoring and Maintaining the National Forests and Grasslands*, (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 2006), 8; U.S. Department of Agriculture, Forest Service, "Restoration," accessed August 21, 2019, https://www.fs.fed.us/restoration/.

"National Grasslands" in 1960.[258] The National Grasslands could very well be nationally significant in conservation but have yet to be evaluated.

National Park Service

The National Park Service (NPS) undertook the restoration of a 100-acre prairie on the site of the Homestead National Monument in southeastern Nebraska in 1940-41. This may be the second-oldest prairie restoration in the nation. Plowing and grazing had damaged the Homestead National Monument Prairie. The goals of this restoration were similar in some ways to those of the Forest Service and Soil Conservation Service projects, and to the University of Wisconsin Arboretum. The Homestead National Monument Prairie project was intended to reduce erosion, and it was intended to recreate the appearance of the broad prairie of pre-Euro-American settlement Nebraska. NPS staff consulted with John E. Weaver of the University of Nebraska in planning the restoration. He recommended transplanting prairie sod, supplemented with a combination of native grass plants and seed mixes, the same approach taken to initiate Curtis Prairie. It is unclear whether Weaver had any further involvement in the Homestead National Monument Prairie, but work began with sod transplantation in late 1940 or early 1941.[259] The National Homestead Monument Prairie is an important restoration effort with some parallels to the Arboretum, and may be eligible for National Register listing and National Historic Landmark designation in conservation.

With regard to wilderness areas, until the late twentieth century, the NPS maintained a policy of passive management for wilderness areas, leaving them untouched, except for roads and other accommodations to bring visitors into and through the parks, including elements such as trails, shelters, campgrounds, and lodging. Beginning in 1918, the NPS hired landscape architects to plan roads and trails, campgrounds, and other visitors' facilities, using principles of naturalistic design. NPS landscape architects often included native plants in their plans. In 1930, the NPS prohibited the introduction of exotic vegetation in the parks, although this policy was only partially implemented until the late twentieth century.[260]

Any departure from passive management focused on preserving popular animal species, such as buffalo, elk, or bears, and eliminating predators, to satisfy visitors. In the early 1930s, NPS biologist George Wright conducted a survey of wildlife in the national parks, which demonstrated that the number and proportion of wildlife in natural areas differed significantly from their historical condition. Wright's report, *Fauna of the National Parks: A Preliminary Survey of Faunal Relations in National Parks*, published in 1933, also recommended that the distribution of fauna in the parks should be restored to its natural balance.[261] However, NPS officials continued its policy of visitor-oriented management, without regard for science. Concerned about the state of the parks, Secretary of the Interior Stewart Udall (1961-1969) asked the National Academy of Sciences to review the management practices and policies of the NPS. Starker Leopold, son of Aldo Leopold, chaired the committee, which issued the *Leopold Report* in 1963. The *Leopold Report* initially met with resistance, but eventually resulted in a shift to active management of the ecological communities of the parks, and later, consideration of the larger ecosystem of which they are a part. It was revised in 2012 and continues to guide NPS.[262] By 2003,

[258] Batie, "Soil Conservation in the 1980s: A Historical Perspective," 6; and Hurt, "The National Grasslands: Origin and Development in the Dust Bowl," 246, 249, 253-255.

[259] Mattison, "Homestead National Monument: Its Establishment and Administration," 2-6, 21, 23-25; Murie, "Restoration of Native Grassland at Homestead National Monument," 1-4.

[260] Newton, *Design on the Land*, 528-37; McClelland, *Presenting Nature*, 6-7, 155.

[261] George M. Wright, Joseph S. Dixon, and Ben H. Thompson, *Fauna of the National Parks: A Preliminary Survey of Faunal Relations in National Parks* (Washington, D.C.: U.S. Department of the Interior, National Park Service, 1933), cited in Jordan and Lubick, *Making Nature Whole*, 57.

[262] Jordan and Lubick, *Making Nature Whole*, 97-98.

prescribed fire was a widespread management tool in the National Parks system; removing invasive species, as well as dams, paths, and drainage ditches, were also common land management measures.[263] The National Park Service has also been involved in the efforts to restore the Everglades, a monumental undertaking carried out in collaboration with the United States Army Corps of Engineers and other governmental agencies. The role of the National Park Service in that project has been to construct bridges in Everglades National Park and remove roads that impede water flow.[264]

United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) administers some 250,000 acres of mixed-grass and tallgrass prairie in National Wildlife Refuges in the "Prairie Pothole Region," which extends from western Minnesota into eastern South Dakota, into eastern and northern North Dakota, and northern Montana. In 2005, USFWS initiated the "Native Prairie Adaptive Management" program to inventory, monitor, and manage the grasslands in this region. The inventory phase showed that invasive exotic plants, particularly smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*), were found throughout the prairies. USFWS worked with the land managers of the 120 prairie sites to devise a management plan with a range of strategies. One of these was prescribed burning. Active management appears to have begun about 2011.[265] USFWS ecological restoration efforts are too recent to evaluate their significance at this time, but the monumental size of the agency's holdings suggests that it should be evaluated in the future.

The Nature Conservancy

The Nature Conservancy is a non-profit, non-governmental environmental organization with a global presence and Midwestern roots. It grew out of the Ecological Society of America (ESA), founded by Victor Shelford (University of Illinois), Henry C. Cowles (University of Chicago), Stephen Forbes (Illinois Natural History Survey) and other ecologists in 1915. In 1917, Shelford organized a committee for the preservation of natural areas within the ESA. Cowles and Forbes were members of the committee, too. By the mid-1940s, ESA leadership opposed the society's active involvement in conservation advocacy, prompting Shelford to disband the committee and establish the Ecologists' Union outside the ESA. The name was changed to The Nature Conservancy (TNC) in 1950. In 1955, TNC began purchasing and accepting donations of land and holding it in trust or placing a conservation easement on it. In 1970, TNC hired its first scientist, Robert E. Jenkins. In addition to creating the Natural Heritage Inventory, a database for prioritizing land conservation efforts, Jenkins guided the organization in managing its holdings, employing land stewards who experimented with prescribed burns and adaptive management. Today, TNC partners with agencies and organizations all over the world.[266] TNC's role varies, but its initiatives over the last 50 years are important, and merit evaluation for listing on the National Register or National Historic Landmark designation in conservation.

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[263] David M. Graber, "Ecological Restoration in Wilderness: Natural versus Wild in National Park Service Wilderness," *The George Wright Forum*, 20, no. 3, (September 2003): 35-36.

[264] U.S. Army Corps of Engineers, "U.S. Army Corps of Engineers Restores America's Everglades," March 31, 2019, https://www.army.mil/article/165191/us_army_corps_of_engineers_restoring_americas_everglades.

[265] Jill J. Gannon, Terry L. Shaffer, and Clinton Moore, *Native Prairie Adaptive Management: A Multi Region Adaptive Approach to Invasive Plant Management on Fish and Wildlife Service Owned Native Prairies: U.S. Geological Survey Open File Report 2013-1279* (Reston, Virginia: U.S. Geological Survey, 2013), 2-7; U.S. Fish & Wildlife Service Newsroom, "Saving Our Native Prairies: A Landscape Conservation Approach," March 5, 2019, https://www.fws.gov/midwest/news/nativeprairies.html.

[266] Lenhart and Smiley, *Ecological Restoration in the Midwest*, 19-20; Jordan and Lubick, *Making Nature Whole*, 99-101; Peter Kareiva, Craig Groves, and Michelle Marvier, "The Evolving Linkage Between Conservation Science and Practice at The Nature Conservancy," *The Journal of Applied Ecology* 51, no. 5 (October 2014): 1122.

Conclusion

The Arboretum complements the existing National Historic Landmarks that illustrate contributions of national significance to the field of conservation. Fountain Lake Farm (Wisconsin, NHL 1990), which was John Muir's boyhood home, and the John Muir House (California, NHL 1962) represent the contributions of John Muir, advocate for preserving the wilderness untouched for future generations. The Stephen T. Mather House (Connecticut, NHL 1966), home of the first director of the National Park Service, is also associated with the conservation of natural areas for their beauty. The Gifford Pinchot House (also known as Grey Towers, Pennsylvania, NHL 1963), where he lived from 1914 until his death in 1946, represents Pinchot's approach to conservation, the sustainable use of natural resources. The site is also associated with another aspect of conservation, the establishment of scientific forest management practices in the United States, as Pinchot was the first professional forester in the nation, and the first director of the United States Forest Service. The Aldo Leopold Shack and Farm (Wisconsin, NHL 2009) represents Leopold's contributions, particularly to the philosophy of conservation, as reflected in the 'land ethic.' The Rachel Carson House (Maryland, NHL 1991) is a resource associated with the environmental movement of the 1960s and 1970s. Carson's groundbreaking book *Silent Spring* (1962) altered the American public's view of pesticides and their impact on the environment, advocated a more balanced relationship between humans and nature, and helped launch the environmental movement.

The Arboretum demonstrates another lasting aspect of the history of conservation in the United States: systematic investigation and experimentation to develop practical, science-based methods of assisting the recovery of degraded ecosystems. The experimental research carried out in the Arboretum beginning in the 1930s was nationally significant because the work substantially improved understanding of several ecosystems and contributed importantly to the development of widely adopted conservation, restoration, and management practices. Ultimately, the Arboretum catalyzed and helped define the field of restoration ecology.

In a January 21, 1973, column in the *Wisconsin State Journal*, Arboretum Ranger-Naturalist Jim Zimmerman and Elizabeth Zimmerman, his wife and a respected ecologist herself, acknowledged the deteriorated condition of the environment. They wrote:

> Few are doing anything about this, but the University of Wisconsin Arboretum is. Unfunded and unnoticed, a long-range program is underway in the back reaches of the Arboretum: Ecosystem restoration. Begun with Aldo Leopold's belief in learning from nature, G. William Longenecker's discovery that beautiful landscapes also are ecologically correct, and the expertise of John T. Curtis who studied the small bits of undisturbed natural vegetation, the Arboretum is trying to put Humpty back together again.[267]

[267]Zimmerman and Zimmerman, "UW Arboretum Tackles Ecosystem Restoration."

6. PROPERTY DESCRIPTION AND STATEMENT OF INTEGRITY

Ownership of Property		Category of Property	
Private:		Building(s):	
Public-Local:		District:	X
Public-State:	X	Site:	
Public-Federal:		Structure:	
		Object:	

Number of Resources within Boundary of Property:

Contributing		Noncontributing	
Buildings:	10	Buildings:	3
Sites:	1	Sites:	0
Structures:	13	Structures:	11
Objects:	0	Objects:	0
Total:	24	Total:	14

PROVIDE PRESENT AND PAST PHYSICAL DESCRIPTIONS OF PROPERTY
(Please see specific guidance for type of resource[s] being nominated)

Summary Description

The University of Wisconsin Arboretum (Arboretum) is a laboratory of ecological restoration, founded to investigate approaches to reclaiming and repairing lands damaged by human activity.[268] It is not a traditional arboretum, in which horticultural collections are labeled and displayed, although it does have four small horticultural gardens. At the dedication in 1934, research director Aldo Leopold articulated the goal of re-establishing in the Arboretum the ecological communities of Wisconsin that predated Euro-American settlement for scientific research and education. As Leopold would later elaborate in his 'land ethic,' the purpose of this goal was to benefit both the environment itself, and future generations, by taking responsibility for healing the land. In the process of fulfilling this goal, the work of Arboretum scientists led to a better understanding of the environment and contributed importantly to the development of standardized conservation, restoration, and management practices, and ultimately helped define the field of ecological restoration.

The Arboretum is located south of the central business district in Madison, Dane County, Wisconsin. It is a 1200-acre tract of land that wraps around the south, east, and west shores of Lake Wingra and extends south past the Beltline Highway (figure 1). Along the shores of Lake Wingra, the topography of the Arboretum is low-lying, rising slightly through wetlands southeast and southwest of the lake (photo 1, looking south toward the Arboretum across Lake Wingra). Due south of the lake, the land rises a bit more steeply, through woodlands, prairie, and savanna. State Highway 12/14, known as the Beltline Highway (the Beltline) is a six-lane, divided highway running east-west, which separates the Arboretum into two sections: approximately 1,000 acres between the Beltline and Lake Wingra (figure 2A, and photo 2, showing the Beltline with the main

[268] The field known as "ecological restoration" may have been considered "ecosystem restoration" by some of the founders of the Arboretum. Both terms are used in this nomination. Source: Zimmerman and Zimmerman, "UW Arboretum Tackles Ecosystem Restoration."

portion of the Arboretum to the right/north), and about 200 acres south of the Beltline (figure 2B). Because of this interruption, the Arboretum is nominated as a discontiguous district, omitting the Beltline from the boundary. Today, the Arboretum is surrounded by urban residential and minimal commercial development.

The Arboretum encompasses fourteen major ecological communities, representing all four of Wisconsin's principal ecosystems – woodlands, prairies, savannas, and wetlands (figures 2A and 2B). Each ecosystem has several categories of ecological communities, composed of both plant and animal species, which are largely defined by soil, vegetation, and hydrology. The Arboretum also includes four horticultural gardens, twelve archaeological sites, a service area with a cluster of buildings and structures, a series of stone structures along the northwest boundary of the Arboretum, and two circulation systems (road and trail networks). The layout of these components appears in the description of the Arboretum site below, and a description of each component follows. The Arboretum retains a high degree of integrity to its period of national significance, 1933-1966.

The Site Prior to Development of the Arboretum

In 1834, federal land surveyors marked section corners in Dane County. Their notes provide the earliest descriptions of the vegetation patterns and natural features of the site prior to Euro-American settlement (hereafter, pre-settlement). The surveyors identified three plant communities in what would become the Arboretum: the low-lying area adjacent to Lake Wingra was labeled "marsh land"; the rising topography to the south was labeled "oak opening"; and a small area within the oak opening was identified as "swamp woods."[269]

The "marsh lands" of the Arboretum site were predominantly southern sedge meadow.[270] An "oak opening" is a type of oak savanna, which has the appearance of a tallgrass prairie with scattered oak trees. The "swamp woods" federal surveyors identified is now known as Teal Pond Wetlands, historically a combination of southern sedge meadow/wet-mesic prairie community.[271]

Prairies and savannas evolved with frequent fire; fire also maintained wetlands. Fire was sparked by lightning or set by American Indians following a regular cycle, to make hunting easier and for other purposes. Ho-Chunk people occupied the Madison area when European and non-native people arrived and may have been in the area for hundreds of years. Ho-Chunk people regularly burned the prairies and savannas. They fished, hunted, and raised corn, potatoes, pumpkins, watermelons, and tobacco in the vicinity of the Arboretum site. The Ho-Chunk also gathered wild rice that grew along the western shore of Lake Wingra and in Gardner Marsh. Their ancestors may have built effigy mounds, constructed sometime between 750 and 1000 C.E., four groups of which are located in the Arboretum (figure 4). These mounds may contain, or may have contained, burials.[272]

Euro-American settlement transformed the landscape on the south side of Lake Wingra where the Arboretum lies. Plowing and over-grazing destroyed prairie and savanna ecological communities, resulting in the erosion of topsoil, stripping nutrients from the soil, and leaving a landscape of pastures and farm fields dominated by non-native plants, with little diversity and poor habitat for wildlife. Fire suppression allowed invasive and non-prairie fire-intolerant tree species into former savanna and prairie ecological communities and to encroach in the

[269] Mollenhoff, *Madison: A History of the Formative Years*, 10-11.

[270] Curtis, *The Vegetation of Wisconsin: An Ordination of Plant Communities*, 57-58, 365, 367.

[271] Curtis, *The Vegetation of Wisconsin: An Ordination of Plant Communities*, 326; University of Wisconsin-Madison Arboretum, "Natural Areas," accessed July 10, https://arboretum.wisc.edu/visit/remnants/; Wisconsin Department of Natural Resources, *The Ecological Landscapes of Wisconsin: An Assessment of Ecological Resources and Guide to Planning Sustainable Management*, (Madison: Wisconsin Department of Natural Resources, 2015), T-vii.

[272] Patty Loew, *Indian Nations of Wisconsin* (Madison: State Historical Society of Wisconsin, 2001), 6; National Register of Historic Places, "Charles E. Brown Indian Mounds," Town of Madison, Dane County, Wisconsin, Reference #84003630.

wetlands adjacent to Lake Wingra. In 1916, some wetlands on the future Arboretum site were dredged and filled for the Lake Forest residential development. The Lake Forest Company failed in 1925, leaving concrete streets, sidewalks, and foundations, some of which sank into the wetlands giving the area the name, Lost City.[273] A portion of the subdivision remains, along and between Carver and Martin streets (figure 2A). The six houses that were built in the Lake Forest subdivision were erected in this portion in 1921-22 and are extant. A seventh house was erected at 2601 Balden Street (extant) in 1922, in the residential area presently known as Forest Park and surrounded by the Arboretum (figure 2A). The Lake Forest Company also owned this area, but the company did not complete construction of the streets prior to dissolution.[274] Changes in water levels as a result of Euro-American development and farming practices also made the wetlands vulnerable to invasive plants.

The first acreage the University of Wisconsin acquired for the Arboretum in 1932 included the former Charles Nelson farm. At that time, the 140-acre farm included a house, a barn, and several outbuildings, located in the vicinity of the Service Area (figure 2A, and in figure 3, the east section of the large parcel marked “1932”). The outbuildings were removed in 1932-33. The farmhouse was used briefly as the forestry office and was removed by 1939. The barn served as the dining hall for a federal transient camp, in the Arboretum from October 1934 until August 1935. The barn continued as a dining hall, as well as the headquarters for NPS and USFS staff, as part of the CCC camp until the spring of 1937, when the barn was destroyed by fire.[275]

The Arboretum Setting

The Arboretum is surrounded by urban residential and minimal commercial development and wraps around a small area that was a part of the Lake Forest and Forest Park subdivisions (figure 2A). The fairway of the Nakoma Golf Club lies adjacent to the Arboretum at the west entrance. The boundaries of the Arboretum are generally delineated by the shorelines of waterways (Lake Wingra, north; and Wingra Creek, east), a series of roadways (Fish Hatchery Road, Carver Street, Martin Street, the Beltline, Seminole Highway, Manitou Way, Nakoma Road, Monroe Street, Arbor Drive, and Knickerbocker Street), planted buffers, and a former railroad bed (now the Cannonball Bike Path). Where the Arboretum abuts privately-owned properties, the boundaries are generally marked with simple, metal fences.

Inventory of Resources

The Arboretum is composed of the components described in this inventory, which is organized according to ecological communities followed by other resource types (archaeological resources; buildings; and structures). The two sections of the discontiguous district are separated by the Beltline. Components of the south part of the district are marked with an asterisk.

[273] Mollenhoff, *Madison: A History of the Formative Years,* 344-46.
[274] Court, *Pioneers of Ecological Restoration,* 193-96.
[275] Court, *Pioneers of Ecological Restoration,* 22-29.

The Arboretum Site

The Arboretum (contributing site). The Arboretum as a whole counts as one contributing site. The University of Wisconsin acquired the first 245 acres of what would become the Arboretum in 1932 (figure 3). This acreage is located on what is now the northwest and center of the Arboretum and includes the Service Area (figure 2A). Inspired by John Nolen's recommendation to acquire as much lakefront land as possible for public access, Michael Olbrich had secured options on this land on the south shore of Lake Wingra. Olbrich proposed an arboretum for the site and collaborated with University of Wisconsin botanist Edward Gilbert to consider possibilities for its development. Both quickly realized the diversity and potential offered by the plant communities, soil types, and hydrology of the site, especially the abundant wetlands adjacent to the lake. Lake Wingra is shallow, with a maximum depth of thirteen feet, and occupies 339 acres of surface area. Additional marshlands were purchased for the Arboretum on the south shore of Lake Wingra during the 1930s. Other acquisitions followed and by 1941, the Arboretum had reached most of its current size.[276]

The fourteen major ecological communities, four horticultural gardens, and twelve archaeological sites are not counted separately from the Arboretum, which in its entirety is considered a contributing site, with some non-contributing buildings and structures. The plan for the Arboretum site and these resources was mostly developed between 1933 and 1943, driven by the research into contemporary and historical soil and vegetation types, hydrology, topography, and remnant plant communities. Between 1934 and 1943, most of the dredging in the wetlands was completed, and preservation, restoration and management measures had begun in the majority of the ecological communities and in the gardens.[277] Presently, some 1,000 acres are dedicated to the fourteen major ecological communities from prairie, wetland, forest, and savanna ecosystems, while the remainder is either in the four horticultural gardens, or in the Service Area (figures 2A and 2B).[278]

Figure 2A depicts the section of the Arboretum north of the Beltline, which is described in this paragraph. Wingra Oak Savanna is located in the northwest corner of the Arboretum, bounded on the north by Arbor Drive and a small graveled parking lot at Arbor Drive and Monroe Street. To the west, the savanna transitions into a four-acre tallgrass prairie (Marion Dunn Prairie, 1983, not described individually due to its small size) and is bounded by Monroe Street. Immediately east is Ho-Nee-Um Pond. As the land descends south and east toward Lake Wingra, the plant communities gradually transition to wetlands in Wingra Marsh. Wingra Marsh occupies the south and southwest shores of Lake Wingra. Along the west edge of Wingra Marsh, the land rises slightly to Spring Trail Pond and Stevens Aquatic Garden (west of Spring Trail Pond in Stevens Pond). Stone walls along Nakoma Road and Manitou Way create the west boundary of these resources, and a narrow stand of oak woods screens the area from the golf course to the south. South of Wingra Marsh, the topography rises and the plant communities transition to forest in Wingra Woods. Arboretum Drive forms a fixed south and east boundary for Wingra Woods, separating it from Longenecker Horticultural Gardens and Gallistel Woods on the south, as well as from the residential area known as Forest Park on the east. West of Wingra Woods just north of Arboretum Drive the landscape transitions to a five-acre tallgrass prairie (Sinaiko Overlook, 1969, not described individually due to its small size). East of Forest Park, the topography drops, gradually transitioning into wetlands in Gardner Marsh. Gardner Marsh is bounded by Wingra Drive on the north and northeast, by Fish Hatchery Road on the east, and Carver Street on the south. Carver Street is a part of the former Lake Forest residential subdivision. South of this subdivision lies Southeast Marsh, with a firm boundary along the southeast composed of the fencing along the asphalt-paved, Cannonball Bike Path. West of Southeast Marsh, the grade rises and transitions into the woodlands of Lost City Forest. Fences form fixed boundaries north and south of

[276] Court, *Pioneers of Ecological Restoration,* 6, 8, 13, 21-30, 133.
[277] Sachse, *A Thousand Ages,* dates gathered from entire book.
[278] Sachse, *A Thousand Ages,* 16-22.

Lost City Forest, separating it from private property. Southwest of Lost City Forest, the topography gradually descends into Teal Pond Wetlands (sedge meadow and wet prairie). Unimproved trails form boundaries between Teal Pond Wetlands and Lost City Forest (east), and the wetlands and Gallistel Woods (north). Juniper Knoll separates Teal Pond Wetlands from the Service Area to the west. Gallistel Woods is bounded by Arboretum Drive on the north, and Longenecker Horticultural Gardens on the west. A strip of mown grass separates Longenecker Horticultural Gardens from woods to the east and south. The Visitor Center (south), Visitor Center Parking Lot (south), and Arboretum Drive (west and north) form the gardens' other boundaries. Southwest of Teal Pond Wetlands, the land rises slightly toward Curtis Prairie. The east part of Curtis Prairie near Teal Pond Wetlands is a wetland (wet/mesic prairie). McCaffrey Drive, the Visitor Center, and the Visitor Center Parking Lot create the north boundary. Mowed trails form boundaries to the south, east and west. Leopold Pines is situated south of Curtis Prairie, its boundaries formed by unimproved trails (north and west) and fencing along the Beltline (south). Leopold Pines gradually transitions to oak woods to the west (Noe Woods), and the east. Noe Woods is bounded by McCaffrey Drive (north) and fencing along the Beltline (south) and private property (west). Oak woods form a buffer north and west of McCaffrey Drive, screening the Arboretum from the Nakoma Country Club golf course.

Figure 2B illustrates the Arboretum south of the Beltline. Evjue Pines is found at the north end of this section, with fenced boundaries along the Beltline (north), private property (east), and Seminole Highway (west). South of Evjue Pines, the topography slopes downward, the pines transition to oak woods, and then to Southwest Grady Oak Savanna and Grady Oak Savanna, which includes West Knoll and East Knoll. Southwest Grady Oak Savanna and Grady Oak Savanna possesses fenced boundaries along Seminole Highway (west), private property (east), and the Cannonball Bike Path (south). Unimproved trails separate Southwest Grady Oak Savanna and Grady Oak Savanna from Greene Prairie, which occupies the southeast portion of this section of the Arboretum. A fenced boundary encloses Greene Prairie on the south (along Cannonball Bike Path), and the Knollwood Conservation Park (east).

Prairie Ecological Communities

Curtis Prairie (contributing, photo 3). Curtis Prairie is an irregularly shaped, relatively flat, 70-acre area just south of the Visitor Center, on the south edge of the Service Area (figure 2A). Named for John T. Curtis, director of plant research at the Arboretum from 1940 to 1961, it is the most famous ecological community in the Arboretum. Curtis Prairie is widely recognized as the nation's oldest restored prairie, and the "first-ever attempt of ecological restoration in America."[279] It is a tallgrass prairie, with dry soil conditions to the west and south, and wetter soil to the east (this section is technically wetland). The dominant plant of the tallgrass prairie is big bluestem (*Andropogon gerardii*), which can grow up to eight feet tall. Other grasses characteristic of the tallgrass prairie are Indian grass (*Sorghastrum nutans*, which can reach 6 feet in height), switch grass (*Panicum virgatum*), little bluestem (*Andropogon scoparius*), and prairie dropseed (*Sporobolus heterolepis*). The tallgrass prairie also features a wide variety of forbs, such as prairie dock and other *Silphium* species, lead plant (*Amorpha canescens*), prairie coreopsis (*Coreopsis palmata*), prairie sunflower (*Helianthus pauciflorus*), rattlesnake master (*Eryngium yuccifolium*), bee balm (*Monarda fistulosa*), prairie coneflower (*Ratibida pinnata*), and spiderwort (*Tradescantia ohionsis*).[280] Flowers of Curtis Prairie include compass-plant (*Silphium laciniatum*), prairie dock (*Silphium terebinthinaceum*), ox-eye (*Heliopsis helianthoides*), several species of goldenrod (*Solidago* spp), pale purple coneflower (*Echinacea pallida)*, and three species of *Rudbeckia*. Approximately sixteen acres in the eastern section of Curtis Prairie is wetland, with shrub-carr and southern

[279] Lenhart and Smiley, *Ecological Restoration in the Midwest: Past, Present, and Future*.
[280] Wisconsin Department of Natural Resources, "Mesic Prairie," accessed January 2, 2019, https://dnr.wi.gov/topic/endangeredresources/communities.asp?mode=detail&Code=CTHER074WI.

sedge meadow vegetation.[281] The shrub-carr wetland community generally includes shrubs such as red-osier dogwood (*Cornus sericea*) and Canada bluejoint grass (*Calamagrostis canadensis*).[282] Southern sedge meadow vegetation is described under the description of Wingra Marsh.

A network of trails circumnavigates and crosses Curtis Prairie. Most are mowed. Margaret's Council Ring (1999), a rustic style structure, is located along a trail in the northwest corner of Curtis Prairie (figures 2C and 2D, photo 26). A council ring is a low stone wall or bench, encircling a central space, intended as gathering place for small groups in outdoor places. It is a feature of the designs of noted Prairie Style landscape architect, Jens Jensen. Its rustic style is compatible with Curtis Prairie, and it does not impair the excellent integrity of the prairie. An identification sign is found just north of Curtis Prairie, at the edge of the Visitor Parking Lot. Identification signs in the Arboretum, like this one, are typically vertical metal cutouts on metal posts and were designed and fabricated by Madison artist Mike Burns in the early 2000s. The Curtis Prairie identification sign was installed in 2004. An information sign is set along one of the trails in the eastern part of Curtis Prairie. Most of the information signs in the Arboretum are flat-topped, the size of a small table, and present historical information. The Curtis Prairie table-top sign dates to 2014.[283] These signs, and all the signs in the Arboretum, are too small in scale to be counted separately from the Arboretum site. The Arboretum's signage and markers, although non-contributing, do not affect the high level of integrity of the ecological communities in the Arboretum.

Planting of the Curtis Prairie began in 1936, following experimental plots tested in 1935 (and incorporated into Curtis Prairie in the 1950s). Most of the site had been used as a horse pasture and was dominated by Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*Poa pratensis*), and other non-native species. There was a remnant (area mostly undisturbed by human activity) of prairie near the center of Curtis Prairie, but most of it is a restoration. The men of the CCC carried out experiments in prairie planting techniques, as directed by botany professor Norman Fasset and his graduate student John W. Thomson in 1935. Under the direction of Ted Sperry, the CCC planted the majority of the 70 acres (1936-1941) and conducted the first controlled prairie fire burn experiments beginning in the spring of 1939. The management phase of Curtis Prairie began in earnest following World War II. This has involved continued planting, prescribed burns, and removing invasive plants through cutting, mowing, pulling and the application of herbicide. Curtis Prairie has been carefully monitored since the beginning of its restoration, and its plant species composition sampled intermittently. For example, a 2002 vegetation survey identified 265 plant species in the prairie, 230 of which were native.[284] Curtis Prairie retains excellent integrity as a tallgrass prairie community, with a wetland component.

***Greene Prairie (contributing, photo 4)**. The irregularly shaped, gently-sloping, 47-acre Greene Prairie was planted largely by hand by Henry C. Greene from 1943 to 1951. It is located south of the Beltline, along the southern boundary of the Arboretum (figure 2B). Formerly a cornfield, it is now a tallgrass prairie, with many of the same plants as Curtis Prairie. Greene Prairie is highly diverse, with more than 220 native species of wildflowers and short grasses, such as little bluestem and prairie dropseed. Rattlesnake master, blue-joint grass (*Calamagrostis canadensis*), mountain mint (*Pycnanthemum virgnianum*), spiderwort, and saw-tooth sunflower (*Helianthus grosseserratus*) are also abundant. Greene also planted white ladyslipper (*Cypripedium candidum*),

[281] University of Wisconsin-Madison Arboretum, "Natural Areas," accessed July 10, 2019, https://arboretum.wisc.edu/visit/remnants/.

[282] Wisconsin Department of Natural Resources, "Shrub-carr," accessed July 10, 2019, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CPSHR050WI.

[283] Dates for signs from Molly Fifield-Murray (Outreach and Education Manager, University of Wisconsin-Madison Arboretum, retired), email to Elizabeth Miller, January 16, 2019.

[284] Court, *Pioneers of Ecological Restoration*, 101-108; University of Wisconsin-Madison Arboretum, "Natural Areas"; Lenhart and Smiley, *Ecological Restoration in the Midwest*, 62-69.

downy phlox (*Phlox pilosa*), cream wild indigo (*Baptista bracteata*), showy blazing star (*Liatris ligulistylis*), compass plant (*Silphium laciniatum*), prairie dock, and bottle gentian (*Gentiana andrewsii*). The soil is sandy, and conditions range from wet in the southwest to dry in the northeast. Mowed and unimproved trails follow the north, east, and west borders of Greene Prairie, and cross the prairie's eastern section. Short stretches of boardwalk, about two feet wide, carry the trails over damp soils in southern Greene Prairie. The management and monitoring plan for Greene Prairie is similar to the one for Curtis Prairie. Stormwater runoff from adjacent residential development is endangering the southern edge of this prairie, enabling invasive reed canary grass (*Phalaris arundinacea*) to gain a foothold.[285] Despite this, Greene Prairie retains a high degree of integrity as a tallgrass prairie community.

Wetland Ecological Communities

Wingra Marsh (contributing). Wingra Marsh is an irregularly shaped, 72-acre wetland situated along the south and west shore of Lake Wingra (figure 2A). It possesses remnants of southern sedge meadow. The southern sedge meadow is an open wetland, with persistent shallow water. It is typically dominated by Tussock sedge (*Carex stricta*), and Canada bluejoint grass. Other sedges (*Carex diandra*, *Carex sartwellii*), marsh wild timothy (*Muhlenbergia glomerata*), swamp aster (*Symphyotrichum punicem*), spotted Joe-Pye weed (*Eutrochium maculatum*), marsh fern (*Thelypteris palustris*) and swamp milkweed (*Asclepias incarnate*) are also characteristic of the southern sedge meadow. Tussock sedge, bluejoint grass, and the native common reed (*Phragmites australis*) are still found in Wingra Marsh, but invasive plants such as cattails (*Typha* spp.) are present as well. The southeastern part of this area is a fen, where peat accumulates and groundwater discharges constantly. The land rises rapidly south of Lake Wingra and an unimproved footpath leads north downhill into the wetland from the Arboretum Drive parking lot to Big Springs. A table-top information sign is situated in the parking lot at the south end of the footpath; it was installed in 2014. [redacted] Management in Wingra Marsh is currently primarily limited to the removal of invasive plants, although controlled burning has been used.[286] Wingra Marsh retains good integrity as a southern sedge meadow and as a fen.

Southeast Marsh (contributing). This marsh is located in the southeastern section of Arboretum (figure 2A). Roundish in shape, it is a 71-acre wetland with remnant southern sedge meadow. It contains plants typical of that ecological community, as well as invasive reed canary grass and cattails. A pond for filtering stormwater runoff from Fish Hatchery Road is situated east of the marsh. [redacted] Management in Southeast Marsh is currently limited to the removal of invasive plants.[287] Southeast Marsh retains good integrity as a southern sedge meadow.

Gardner Marsh (contributing, photo 5). Gardner Marsh is a roundish-shaped, 186-acre wetland in the Arboretum's northeast section (figure 2A). Prior to becoming a part of the Arboretum, it was dredged to create canals for the Lake Forest subdivision, altering its hydrology. Leopold planned the development of Gardner

[285] University of Wisconsin-Madison Arboretum, "Natural Areas"; Virginia M. Kline, "How Well Can We Do? Henry Greene's Remarkable Prairie," *Restoration & Management Notes* 10, no. 1 (Summer 1992): 36-37; Bradley Herrick, "Research Update: Monitoring the Vegetation of Greene Prairie," August 30, 2017, https://arboretum.wisc.edu/news/arboretum-news/research-update-monitoring-the-vegetation-of-greene-prairie/.

[286] University of Wisconsin-Madison Arboretum, "Natural Areas"; Sachse, 45-48; Bradley Herrick (Ecologist/Research Program Manager, University of Wisconsin-Madison Arboretum), email to Elizabeth Miller, March 8, 2019.

[287] University of Wisconsin-Madison Arboretum, "Natural Areas"; and Herrick, email to Elizabeth Miller, March 8, 2019.

Marsh to provide habitat for migratory waterfowl and transform the marsh into a bird sanctuary. CCC laborers initiated Leopold's plan in 1936. The work involved re-dredging to create two small islands for nesting birds, and one large island where birds could land. The larger of the two small islands remains (the other is under water), and the large island is also present. Leopold had tamaracks (*Larix laricina*), white ash (*Fraxinus americana*), American elm (*Ulmus americana*, mostly gone), and river birch (*Betula nigra*) planted to screen the marsh from Fish Hatchery Road; many remain. Other foliage was installed in Gardner Marsh for cover for birds, and native flowers, such as yellow ladyslipper (*Cypripedium parviflorum*), were also planted. However, the effort to attract migratory birds was initially not very successful. No further planting took place after the mid-1940s, although investigation and experimentation has been on-going. Presently, a variety of waterfowl and other birds visit Gardner Marsh, as described in *Wildlife in the Arboretum* below. Remnants of southern sedge meadow, with many of the plant characteristic of that community, as well as native flowers, are present in Gardner Marsh, but cattails, reed canary grass and other woody vegetation are prevalent. Management in Gardner Marsh is currently limited to the removal of cattails and other invasive plants.[288] At the north end of Gardner Marsh, connected boardwalks run east from opposite the parking lot, and south from Arboretum Drive to a platform with rails overlooking the wetlands. [redacted] Gardner Marsh retains a high degree of integrity to Aldo Leopold's physical and plant layout, and good integrity as a southern sedge meadow.

Teal Pond Wetlands (contributing). This is an oblong, twelve-acre site combining southern sedge meadow and wet and wet-mesic prairie plant communities adjacent to the Visitor Center (figure 2A) and transitioning west-southwest into the wetland portion of Curtis Prairie. Wet-mesic prairie plants are dominated by tall grasses, such as big bluestem, Canada bluejoint grass, and cordgrass (*Spartina pectinata*), and include flowers such as azure aster (*Symphyotrichum oolentangiense*), Eastern shooting star (*Primula meadia*), prairie blazing star (*Liatris pycnostachya*), and prairie coneflower. In contrast, wet prairie communities have a higher concentration of wetlands plants, such as Joe-Pye-weed, boneset (*Eupatorium perfoliatium*) and swamp milkweed.[289] Remnants of these communities remained, but the resource was not actively managed until 2013, when a project began to remove woody invasive plants, such as buckthorn (*Rhamnus cathartica*).[290] Teal Pond Wetlands is currently maintained with prescribed burns, wood brush mowing, and herbicide application.[291] A short boardwalk runs east from the western edge of the wetlands to a platform overlooking Teal Pond. A vertical identification sign was placed near the west end of the boardwalk in 2016. Teal Pond Wetlands retains good integrity in its southern sedge meadow and wet/wet-mesic prairie communities.

Forest Ecological Communities

Noe Woods (contributing). Noe Woods is a rectangular, 41-acre remnant oak woodland at the west end of the Arboretum, adjacent to a residential neighborhood off Seminole Highway (figure 2A). The gently rolling upland site rises to the west-southwest and was once an oak savanna. Black oaks (*Quercus velutina*) and white oaks (*Quercus alba*) survive, many of which are more than 150 years old. Historically, the understory was prairie, dominated by big bluestem, and including grasses such as little bluestem, Indian grass, and prairie dropseed, as well as a diverse layer of forbs, such as lead plant and rattlesnake-master. Although Noe Woods was never

[288] University of Wisconsin-Madison Arboretum, "Natural Areas"; Sachse, *A Thousand Ages*, 45-48; Herrick, email to Elizabeth Miller, 8 March 2019.

[289] Wisconsin Department of Natural Resources, "Wet-Mesic Prairie," accessed July 1, 2019, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CPHER076WI.

[290] University of Wisconsin-Madison Arboretum, "Natural Areas"; and Joy Zedler, ed., "Adaptive Restoration of a Former Wet Meadow," *Arboretum Leaflet* no 33 (April 2014).

[291] Herrick, email to Elizabeth Miller, 8 March 2019.

plowed, Euro-American settlers suppressed fire, which allowed fire-intolerant shrubs, saplings, and trees that are not a part of the savanna ecosystem to colonize the understory, driving out many of the native prairie plants. As a result, Noe Woods has evolved into a closed-canopy oak woodland, in which canopy cover exceeds 50 percent. Understory plants that grow in oak woodlands can include Eastern shooting star, violet bush-clover (*Lespedeza violacea*), and Short's aster (*Symphyotrichum shortii*). Experiments are conducted in Noe Woods, including a long-term investigation into succession in oak woodlands, which involves an annual assessment of changes in the occurrence, size, and density of trees. This survey has been carried out since 1956.[292] A major focus of management currently is the removal of invasive species such as garlic mustard (*Alliaria petiolata*), dames rocket (*Hesperis matronalis*), Oriental bittersweet (*Celastrus orbiculata*), and buckthorn.[293] Unimproved footpaths meander through Noe Woods, and along the woods' north and east edges. Noe Woods retains very good integrity as an oak woodland.

Leopold Pines (contributing). These were the first plantings in the Arboretum (figure 2A). This narrow, irregularly shaped, 21-acre pinetum began as a reforestation effort in 1933, with trees characteristic of a northern dry forest. This type of woodland was abundant in northern Wisconsin but had been clear cut during the logging era of the late nineteenth century. Leopold Pines had become a project to create a complete northern dry forest ecological community by 1941, with the planting of understory shrubs and forbs typical of this type. The installation of some 30,000 red pine (*Pinus resinosa*), white pine (*Pinus strobus*), and jack pines (*Pinus banksiana*), along with 2,000 white spruce (*Picea glauca*), which are the dominant trees of the northern dry forest, began in 1933 and continued through 1937. The CCC planted many of these trees, as well as some red maple (*Acer rubrum*) and white birch (*Betula papyrifera*). Between 1949 and 1951, the pinetum was expanded into the area between Noe Woods and Curtis Prairie with red and white pines. During the same period, trees were lost to the Beltline expansion along the southern boundary of Leopold Pines. While the trees in Leopold Pines have grown well, establishing understory plants common in pine forests has not been as successful. [294] The removal of invasive species such as garlic mustard, dames rocket, Oriental bittersweet, and buckthorn are presently the major focus of management in Leopold Pines.[295] Unimproved footpaths criss-cross Leopold Pines and run along much of it northern edge adjacent to Curtis Prairie, and its western boundary with Noe Woods. Leopold Pines retains good integrity as a northern dry forest, in terms of its trees, and fair integrity in the understory layer.

***Evjue Pines (contributing)**. Evjue Pines is a narrow, rectangular, 22-acre forest composed of red, white, and jack pines, with some red maple and white birch located just south of the Beltline (figure 2B). The topography of Evjue Pines is gently rolling, descending toward the south. First planted in 1943, additional planting in Evjue Pines took place between 1952 and 1960. The plant composition of Evjue Pines is very similar to Leopold Pines, and its management focus is also on removal of invasive species. [296] Unimproved footpaths traverse

[292] University of Wisconsin-Madison Arboretum, "Natural Areas"; Wisconsin Department of Natural Resources, "Oak Opening," accessed December 30, 2018, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=ctsav004wi; Wisconsin Department of Natural Resources, "Oak Woodland," accessed December 30, 2018, https://dnr.wi.gov/topic/endangeredresources/communities.asp?mode=detail&Code=CTFOR010WI; University of Wisconsin-Madison Arboretum, "Ecological Monitoring at the Arboretum," accessed January 2, 2019, https://arboretum.wisc.edu/science/monitoring/; and Curtis, 87-95.

[293] Herrick, email to Elizabeth Miller, March 8, 2019.

[294] Court, *Pioneers of Ecological Restoration,* 53; University of Wisconsin-Madison Arboretum, "Natural Areas"; Wisconsin Department of Natural Resources, "Northern Dry Forest," accessed December 30, 2018, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CTFOR030WI; and Curtis, 203-213.

[295] Herrick, email to Elizabeth Miller, March 8, 2019.

[296] *Arboretum News* 1 (October 1952): 3; "Master Plan for the University of Wisconsin Arboretum," November 14, 1948, University of Wisconsin-Madison Arboretum Archives, Madison, Wisconsin; University of Wisconsin-Madison Arboretum, "Natural

Evjue Pines, and slightly broader fire lanes run along its west and north boundaries. There is a small, graveled parking lot with chain-link fencing at the northwest corner of Evjue Pines. A vertical identification sign (2015) and a table-top information sign (2014) are found at the southeast end of the parking lot. Evjue Pines retains good integrity as a northern dry forest in terms of its trees.

Wingra Woods (contributing). Wingra Woods (photo 6) is a rectangular, 52-acre forest on land that rises toward the south from the wetlands along the south shore of Lake Wingra (figure 2A). It was an oak savanna with open grown oaks (some of which remain) but has been planted to create a northern Wisconsin mesic forest, also called a northern sugar maple forest. Between 1943 and 1964, more than 3,000 trees were planted to prompt this evolution, including sugar maple (*Acer saccharum*, the dominant tree species of this forest type), red maple, white ash, American basswood (*Tilia americana*), beech (*Fagus grandifolia*), hemlock (*Tsuga canadensis*), and yellow birch (*Betula alleghaniensis*). Subcanopy trees typical of northern sugar maple forests are ironwood (*Carpinus caroliniana*), and American elm. Shrub species can include alternate-leaved dogwood (*Cornus alternifolia*), and maple-leaved arrow-wood (*Viburnum acerifolium*). Spring-blooming flowers such as trillium (*Trillium grandiflorum*), yellow trout lilies (*Erythronium americanum*) and Dutchman's breeches (*Dicentra cucullaria*) are often a part of the ground layer. The removal of invasive species is the focus of management in Wingra Woods.[297] The Arboretum Mound Group (figure 4, described more fully in *Archaeological Resource* below) are located in the south section of the woods. Above ground, this site has the appearance of a group of twelve, low, earthen mounds. This site was listed in the National Register of Historic Places (NRHP) in 1984. Unimproved footpaths cross Wingra Woods and run along its north and west edges. A stretch of boardwalk extends along the north trail, incorporating the Skunk Cabbage Bridge (non-contributing). Wingra Woods retains very good integrity as a northern sugar maple forest.

Gallistel Woods (contributing). Gallistel Woods (photo 7) is an irregularly shaped, gently-rolling, 28-acre forest on the south side of Arboretum Drive, south of Wingra Woods (figure 2A). The west section of Gallistel Woods was logged in the early 1900s, while the eastern section was partially oak woods and partially orchard. Gallistel Woods is evolving into a southern Wisconsin mesic forest, also called a southern sugar maple forest. Southern Wisconsin mesic forests are dominated by sugar maple, closely followed by American basswood. Between 1941 and 1961, more than 1,000 seedlings typical of mesic forests of southern Wisconsin were planted in Gallistel Woods. These included sugar maple, red maple, basswood, beech, and ironwood. The understory is generally open and features flowering plants that bloom in the spring such as white trout lilies (*Erythronium albidum*), spring beauty (*Claytonia virginica*), trillium, bloodroot (*Sanguinaria canadensis*), and may apple (*Podophyllum peltatum*). Management of Gallistel Woods is focused on the removal of invasive species at the present time.[298] The Gallistel Woods Mound Group (NRHP 1984, figure 4, described more fully in *Archaeological Resource* below) are located in the northwest area of the forest. Above ground, this site has the appearance of a group of four, low, earthen mounds largely obscured by forest growth. Unimproved footpaths travel through the woods and run along its eastern edge. The stone Gallistel Woods Shelter (figures 2C and 2D, described more fully in "Service Area", below) stands along a footpath in the southwest part of the forest. A 2014 table-top sign is found along the same trail. A short length of boardwalk carries the path into a wetter area

Areas"; and Herrick, email to Elizabeth Miller, March 8, 2019.

[297] University of Wisconsin-Madison Arboretum, "Natural Areas"; Wisconsin Department of Natural Resources, "Northern Mesic Forest," accessed December 30, 2018, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CTFOR034WI; Curtis, 184-193; and Herrick, email to Elizabeth Miller, March 8, 2019.

[298] University of Wisconsin-Madison Arboretum, "Natural Areas"; Wisconsin Department of Natural Resources, "Southern Mesic Forest," accessed December 30, 2018, https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CTFOR016WI; Curtis, 104- 117, and 192-193; and Herrick, email to Elizabeth Miller, March 8, 2019.

of Gallistel Woods to the south near Teal Pond Wetlands. A broader, mowed fire lane abuts the western edge, along Longenecker Horticultural Gardens. Gallistel Woods retains very good integrity as a southern sugar maple forest.

Lost City Forest (contributing). Lost City Forest (photo 28) is a 108-acre, rectangular site of mixed woodland, located in the east-central portion of the Arboretum (figure 2A). The vegetation is primarily buckthorn with some large oaks and planted pine.[299] Lost City Forest is not presently actively managed, although invasive shrubs were cleared from a three-acre area in the 1980s, and sugar maples, white ash, red oak (*Quercus rubra*), and basswood were subsequently planted there.[300] Lost City Forest was the site of a portion of the Lake Forest residential development, platted in 1916 and bankrupted in 1925. By that time, six houses (extant) had been built in that part of Lake Forest that lies between Carver and Martin street, east of Lost City Forest. The development had been primarily sited on wetlands and, despite extensive dredging to drain the marsh, the concrete streets, sidewalks, and foundations soon sank into the wetlands, giving the area the name, "Lost City."[301] The sunken concrete elements are present, and some are still visible. [redacted] A gravel parking lot is situated in the eastern part of the forest, adjacent to Martin Street (figure 2A). There is a 2015 vertical metal identification sign, and a 2014 flat-topped information sign at the southwest corner of the lot, adjacent to an unimproved trail that leads west-southwest through the woods, connecting with other footpaths crossing the site. Lost City Forest retains good integrity as a mixed woodland.

Savanna Ecological Communities

***Southwest Grady Oak Savanna and Grady Oak Savanna (contributing)**. When the Arboretum acquired acreage south of the Beltline in 1941 (figure 2B), much of the site was becoming a closed canopy oak woodland. During the 1950s, work began to restore Southwest Grady Oak Savanna and Grady Oak Savanna (which are not considered separate ecological communities) by planting acorns. Restoration intensified under the direction of Virginia Kline in the 1970s. An oak savanna has the appearance of a tallgrass prairie, with scattered oak trees. Black and bur oaks dominate this site. Southwest Grady Oak Savanna and Grady Oak Savanna include West Knoll and East Knoll, two remnants of oak savanna on steep hills (figure 2B). East Knoll (four acres) and West Knoll (nine acres) are too small to describe separately.[302] Southwest Grady Oak Savanna and Grady Oak Savanna is an irregularly shaped, 53-acre site, situated on rolling terrain with grades sloping down toward the south. This was the last large restoration project undertaken during the period of national significance.[303] Southwest Grady Oak Savanna and Grady Oak Savanna, as well as the East and West knolls, are actively managed through removal of invasive species, mowing, prescribed burning, and herbicide. Mowed fire lanes pass along the north, east, and west edges of the site, and narrower footpaths cross and travel downhill to the south toward Greene Prairie.

Wingra Oak Savanna (non-contributing). The restoration of Wingra Oak Savanna, along the northwest edge of the Arboretum next to Monroe Street (figure 2A), was begun in 1991. It is a rectangular, 14-acre parcel on gently rolling upland with bur oaks and an understory of wildflowers and grasses. It is managed with prescribed

[299] Herrick, email to Elizabeth Miller, March 8, 2019.
[300] University of Wisconsin-Madison Arboretum, "Natural Areas."
[301] *Lake Forester* (Madison), December 15, 1920; Mollenhoff, *Madison: A History of the Formative Years*, 345-46.
[302] Virginia M. Kline, *Long Range Management Plan Arboretum Ecological Communities* (Madison: University of Wisconsin Press, 1992), 100, 129.
[303] Sachse, *A Thousand Ages*, 105.

burns, removing invasive plants through cutting, mowing, pulling, and the application of herbicides.[304] [redacted] There is a small, gravel parking lot at the north edge of the savanna (P, figure 2A). A 2014 table-top information sign is located at the southeast corner of the lot, adjacent to a trail. The trail runs southwest through the savanna and along the edge of Wingra Marsh. Boardwalk and stepping stones (photo 19) form part of the trail next to Ho-Nee-Um Pond. An asphalt-paved bike trail, nine to ten feet wide, crosses Wingra Oaks Savanna on the south and northwest sides of the site (figure 2A). Kenneth Jensen Wheeler Council Ring (photo 24, further described in *Stone Structures* below). Wingra Oaks Savanna displays very good integrity as a savanna.

Juniper Knoll (contributing). Juniper Knoll is an eight-acre cedar glade between the Service Area and Teal Pond Wetlands (figure 2A). A cedar glade is a type of savanna, dominated by the eastern red cedar (*Juniperus virginiana*). Juniper Knoll is too small to describe as one of the principal ecological communities. It was planted under Curtis' direction, probably during the 1950s.[305] Juniper Knoll is actively managed along with Teal Pond Wetlands, through prescribed burns, and removal of invasive species by cutting, mowing, pulling, and herbicide.[306]

Horticultural Gardens

The horticultural gardens, for the most part, date to the period of significance, but they do not contribute to the national significance of the Arboretum and, therefore, have been evaluated as non-contributing.

Longenecker Horticultural Gardens (non-contributing). Longenecker Horticultural Gardens (photo 8**)** are located near the center of the Arboretum (figure 2A). The first plantings in the Longenecker Horticultural Gardens were lilacs, many of them planted by CCC enrollees in 1935. The first crabapple was planted in 1942. The gardens were shaped by both Longenecker and subsequent curator Edward R. Hasselkus over many years. The irregularly shaped, 35-acre gardens include approximately 4,000 trees, shrubs, and vines composed of over 2,600 taxa in a park-like setting. New specimens are planted every year. The gardens were named in honor of Longenecker, the designer and original curator, in 1967.[307] Longenecker Horticultural Gardens is managed through removal of invasive species, mowing, and herbicide. The Longenecker Horticultural Gardens Entrance (2012) stands at the south end of the site, at the edge of the Visitor Center Parking Lot (figure 2C). It is composed of a metal arch, flanked by low, stone walls (further described in *Service Area* below). The arch was designed and produced by artist Mike Burns, who also created the Troia Arch (2012, in the southwest section of the gardens) and the Fifield Arch (2015, at the southeast corner of the gardens, adjacent to the Wisconsin Native Plant Garden). Both are more fully described under *Service Area* below. Burns also designed and fabricated 17 metal benches, each exhibiting a segmental arched back with a cutout of a tree. One was installed in 2011 and the remainder were placed in 2013.[308] Most are located in the Longenecker Horticultural Gardens. A vertical board sign describing the collection (2015) is also found in the southeast portion of the gardens. Longenecker

[304] University of Wisconsin-Madison Arboretum, "Natural Areas"; and Herrick, email to Elizabeth Miller, March 8, 2019.
[305] Fifield-Murray, email to Elizabeth Miller, January 16, 2019.
[306] Kline, *Long Range Management Plan Arboretum Ecological Communities*, 100; University of Wisconsin-Madison Arboretum, "Planning," accessed September 6, 2019, https://arboretum.wisc.edu/land-stewardship/planning/.
[307] Sachse, *A Thousand Ages*, 49; Edward R. Hasselkus, "The Longenecker Horticultural Gardens," in *Our First Fifty years: The University of Wisconsin-Madison Arboretum, 1934-1984*, ed. William R. Jordan III (Madison: The University of Wisconsin, 1984), 20-21.
[308] Dates for benches from Fifield-Murray, email to Elizabeth Miller, January 16, 2019.

Horticultural Gardens retains a high degree of integrity in its plan and as a traditional horticultural garden.

Stevens Aquatic Garden (non-contributing). This is a small, roundish garden, within and immediately adjacent to Stevens Pond, in the northwest section of the Arboretum, southeast of Monroe Street (figure 2A). Designed by Longenecker with the assistance of botanist Norman Fassett, it was completed in 1936 by the CCC.[309] The pond is composed of a small, central island surrounded by a lagoon. West and south of the pond, the area is mowed and features scattered deciduous and evergreen trees. Stevens Pond Entrance and Walls (figure 2A, described further under *Stone Structures* below) separate the area from Nakoma Road to the west. To the southeast, the terrain slopes down into Wingra Marsh. Stevens Aquatic Garden is not currently actively managed and appears overgrown. Its integrity is undetermined, but is likely only fair given its lack of management.

Viburnum Garden (non-contributing). The small, roundish, three-acre Viburnum Garden is located in the northwest section of the Arboretum, just south of the intersection of Manitou Way and Nakoma Road (figure 2A). Begun in 1954, based on a design by Longenecker, it contains over 80 varieties and species of viburnums, and some 110 varieties and species of arbor vitae, tightly placed together.[310] Manitou Way Entrance and Walls (figures 2A and 2E, described more fully under *Stone Structures* below) are situated just west of the garden. The Viburnum Garden is maintained through removal of invasive species. It retains very good integrity to its design and plant composition.

Wisconsin Native Plant Garden (non-contributing). The four-acre Wisconsin Native Plant Garden, begun 2001, was designed by Darrel Morrison, landscape architect and former professor of landscape architecture at the university. This garden is laid out around the Visitor Center and is composed of fifteen small plots, interspersed with curvilinear, asphalt-paved walkways. The plan incorporates the Visitor Center Council Ring and the Pergola (figure 2C, described further under *Service Area* below). The garden contains over 300 species and demonstrates how to incorporate native plants into residential landscapes, sustainable practices that minimize water use and pesticides, rain gardening, and pollinator conservation.[311] A vertical metal sign (2004) identifies the garden, and one of Burns' metal benches (2013) sits northeast of the Visitor Center. Wisconsin Native Plant Garden is maintained by weeding and it retains a high degree of integrity to its original plant composition and design.

Wildlife in the Arboretum

The Arboretum's ecological communities attract abundant wildlife, especially birds. Some are migratory, while others are year-round residents. The wetlands commonly draw Canada goose, wood duck, gadwall, mallard, green-winged teal, bufflehead, hooded merganser, great blue heron, green heron, pied-billed grebe, eastern phoebe, eastern kingbird, warbling vireo, and redwing blackbird. The prairies and savannas attract American woodcock, ruby-throated hummingbird, willow flycatcher, tree swallow, barn swallow, song sparrow, Baltimore oriole, common yellow throat warbler, yellow warbler, indigo bunting, and raptors such as red-tailed hawk, Cooper's hawk, and turkey vultures. A pair of sand hill cranes nest in Curtis Prairie. The woods draw barred owl, great horned owl, scarlet tanager, brown creeper, northern flicker, eastern wood peewee, great crested flycatcher, yellow-throated vireo, red-eyed vireo, and several varieties of woodpecker, nuthatch, and warbler. Wild turkey, blue jay, and American crow are found throughout the Arboretum, including in the

[309] Court, *Pioneers of Ecological Restoration,* 25, 92.
[310] Court, *Pioneers of Ecological Restoration,* 25.
[311] University of Wisconsin-Madison Arboretum, "Gardens," accessed September 4, 2018, https://arboretum.wisc.edu/explore/gardens/.

gardens. Mammals in the Arboretum include vole, field mouse, long-tailed weasel, mink, chipmunk, squirrel, ground squirrel, rabbit, fox, coyote, raccoon, and white-tailed deer. Ten of Wisconsin's twelve frog species and all eleven turtle species live in Arboretum wetlands. American toad, another frog species, lives in Curtis Prairie. Butterflies, dragonflies and many other insects are also common in the Arboretum.[312]

Some animals have been a nuisance. Rabbits were a perennial problem, eating small plants and shoots, until red foxes and coyotes began frequenting the Arboretum in the early 2010s. Since the late 1950s, the Arboretum deer herd has been causing serious damage to trees and shrubs, particularly in the Longenecker Horticultural Gardens. Each fall, wire cages are installed around the susceptible plants, and fencing is placed around trees and shrubs that deer are prone to eat.

Archaeological Resources

Intermixed among the ecological communities and the horticultural gardens described in the foregoing sections, the Arboretum also includes [redacted] They do not contribute to the national significance of the Arboretum, because all twelve fall outside the period of significance and are not related to conservation. The locations of the Arboretum Woods Mound Group, the Gallistel Woods Mound Group and Lost City have been made public and are well known to visitors. The locations of the remaining archaeological resources have not been made public.

Arboretum Woods Mound Group (ASI #47DA-152, non-contributing, NRHP 1984, site known to public). This archaeological resource was constructed by effigy mound-building American Indians sometime between 750 and 1000 C.E., and is located in the area currently named Wingra Woods, south of Big Spring, (figure 4). This group occupies one acre and is composed of twelve mounds. There are six linear mounds, four dome-shaped mounds, a bird effigy and a water spirit effigy mound. Charles E. Brown recorded the dimensions of the mounds in 1915, as follows: length of five of the linear mounds are provided as 85 feet, 100 feet, 110 feet, 150 feet, and 220 feet, respectively; the diameters of the dome-shaped mounds were estimated at about 30 feet; the wingspread of the bird is 200 feet; and the length of the water spirit (which Brown described as a panther) is 150 feet. These measurements were confirmed when the mounds were mapped in 1978. In 1934 and 1935, Brown directed CCC enrollees in clearing brush from both the Arboretum Woods and Gallistel Woods mound groups. Brown then excavated in the bird and water spirit mounds, finding fragments of a burial in the latter.[313] Above ground, they appear to be low, earthen forms. The Arboretum Woods Mound Group was listed in the National Register in 1984 (designated collectively with the Gallistel Woods Mound Group, under the name Charles E. Brown Indian Mounds). [redacted] It is possible some of the mounds were created by other ancestral American Indian tribes.[314] This resource retains very good integrity.

Gallistel Woods Mound Group (ASI #DA-576, non-contributing, NRHP 1984, site known to public). This is also an archaeological resource constructed by effigy mound-building American Indians sometime between 750 and 1000 C.E. It occupies 0.17 acre and consists of one dome shaped, two linear mounds, and one water

[312] Michael Hansen (Land Care Manager, University of Wisconsin-Madison Arboretum), email to Elizabeth Miller, March 8, 2019; Charles Henrikson (Professor Emeritus, University of Wisconsin-Madison School of Veterinary Medicine), discussion with Elizabeth Miller, June 28, 2019.

[313] National Register of Historic Places, "Charles E. Brown Indian Mounds."

[314] Loew, *Indian Nations of Wisconsin*, 6.

spirit effigy mound. These, low, earthen forms are overgrown with forest undergrowth and trees.[315] This group is located in the Gallistel Woods (figure 4) and was listed in the National Register in 1984 (designated collectively with the Arboretum Woods Mound Group, under the name Charles E. Brown Indian Mounds). This resource retains very good integrity.

Lost City Site (AI #47DA-1424, non-contributing, site known to public). This site encompasses 6.33 acres and was a part of the 1916 residential Lake Forest subdivision that failed in 1922. It is set in the east-central portion of the Arboretum (figure 4). The boundaries are based on the historic extent of the western part of the subdivision. At the surface, the Lost City site retains the remains of concrete streets (photo 28), sidewalks, and foundations, most of which have sunk beneath the surface, but are still present. Forest has overgrown most of the surface. Its integrity as an archaeological site has not been evaluated; as a subdivision plan, its integrity is poor.

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Buildings and Structures (Twenty-three Contributing, Fourteen Non-contributing)

Service Area

The Service Area is a cluster of buildings and structures located near the Arboretum's center, north of the Beltline (figures 2A and 2C). All twelve buildings, and all eleven non-contributing structures in the Arboretum are located in the Service Area. Eight of the buildings served CCC Company No. 2670, including the Bath House, Barracks, Carpentry Workshop and Warehouse, Machine Shed, Tool Shed, Nursery Pumphouse, Root Cellar, and Main Pumphouse, all built between 1934 and 1935. All but the Barracks were built by CCC enrollees. [316] The other four buildings in the cluster support functions of the Arboretum, including the Visitor Center, Garage, Comfort Station and Security Residence, and were constructed after 1964. The structures in the Service Area cluster support Arboretum functions (Visitor Center Parking Lot, Utility Shelter), or enhance the visitor's experience (Margaret's Council Ring, Pergola, Visitor Center Council Ring, Longenecker Horticultural Gardens Entrance, Troia Arch, Fifield Arch).

As figure 2C illustrates, the Visitor Center Parking Lot is set at the west end of the Service Area, and connects to a twelve-foot wide, paved trail that passes south of the Visitor Center, connects with other trails and continues east as a narrower graveled path. This eight-foot wide path passes the Nursery Pumphouse and turns north. From there, the trail runs between the Security Residence and the Bath House, and then turns northeast and continues into the grouping of former CCC camp buildings. The trail widens into a parking area in the middle of the former CCC Camp. The Main Pumphouse, the Root Cellar, and the Machine Shed are clustered on the northwest side of the parking area. The Comfort Station is discreetly set to the west of these buildings. The Toolshed and the Utility Shelter are set to the northeast, and the Garage and Barracks are set southeast of the parking area. To the east, in Gallistel Woods, the Gallistel Woods Shelter is found. The Visitor Center is the only building in the Arboretum that is very visible; the rest are sited unobtrusively.

Longenecker Horticultural Gardens extend north of the former CCC camp, Visitor Center, and Visitor Center Parking Lot (figure 2C). The Longenecker Horticultural Gardens Entrance stands at the north edge of the Visitor Center Parking Lot. The Troia Arch is set slightly northwest, among magnolias and lilacs. Five-foot wide, black-topped walkways wind south, east and north of the Visitor Center, through the Wisconsin Native Plant Garden, leading to the Visitor Center Council Ring, the Fifield Arch (entering Longenecker Horticultural

[316] Court, *Pioneers of Ecological Restoration*, 90-92.

Gardens), and the Pergola. South of the Visitor Center Parking Lot, the trail into Curtis Prairie accesses Margaret's Council Ring (figure 2C).

Bath House (1935, contributing building, currently the Laboratory and Greenhouse). This one-story, rustic style, frame gable ell building faces west and rests on a concrete slab foundation. It originally housed a laundry, showers, and latrines, but has served as the Laboratory and Greenhouse since 1953.[317] The Bath House is clad with wood shingles and displays regularly distributed, wooden, six-pane hopper windows. A simple wooden door is set off-center on the west-facing façade. The original front door is still in place on the east-facing façade. Asphalt shingles cover the roof. A small, metal-and-glass greenhouse is appended to the south end of the building. A basement under the west wing houses the furnace. The Bath House retains a high degree of integrity to the period of significance.

Barracks (1934, contributing building, photo 11). This rustic-style building one of ten erected for the 300-some laborers employed by the Wisconsin Employment Relief Administration (WERA) at "Camp Arboretum."[318] It is a long, one-story, frame front gable, clad with wood shingles. The Barracks sits on a fieldstone-pier foundation and faces southwest. This narrow building exhibits an entrance composed of a simple, wooden door flanked by four-pane hopper windows. A board reading "TEACHING BARRACKS" appears over the door. Evenly spaced hopper windows are found on the side-facing façades. The roof is surfaced with asphalt shingles. The Barracks maintains a high degree of integrity.

Carpentry Workshop and Warehouse (1935, contributing building, known as the Shop and Garage, photo 12). This is a long, one-story, rustic style, frame side gable building. It is finished with wood shingles, trimmed with corner boards and set on a concrete slab foundation. A group of three garage doors is centered on the east-facing (front) façade. The entrance is located north of the garage doors and consists of a wood-and-glass door sheltered by a shed-roofed overdoor with knee braces. Wooden, six-pane hopper windows are irregularly spaced on this façade. Asphalt shingles cover the roof. A broad, gabled vent stack perches on the ridge of the roof. The Carpentry Workshop and Warehouse retains excellent integrity.

Machine Shed (1935, contributing building). The one and one-half story, rustic style frame Machine Shed is side gable in form and faces east. It is clad with wood shingles, trimmed with corner boards, and rests on a concrete slab foundation. Five garage doors occupy the front façade. Wooden, six-pane hopper windows light the side and rear façades. A garage door and a paneled wooden door are also found on the rear façade. The roof is surfaced with asphalt shingles. This building displays excellent integrity.

Tool Shed (1935, contributing building, known as Seed Storage, photo 13). The small, one-story, rustic style frame Tool Shed is clad with wood shingles, trimmed with corner boards and set on concrete block piers. The south-facing (front) façade is dominated by a centrally placed, paneled wooden door. Wooden, six-pane hopper windows flank the door and light the other facades as well. The side gable roof is finished with asphalt shingles. This building maintains excellent integrity.

Nursery Pumphouse (1935, contributing building). The Nursery Pumphouse is a small, one-story, frame, side gable, rustic style building. It exhibits a raised, poured concrete foundation, wood shingle finish, and asphalt-shingled roof. The entrance consists of a plain, wooden door, set off-center on the east-facing façade. A few, tiny windows ventilate this building. Asphalt shingles cover the roof. The Nursery Pumphouse maintains excellent integrity.

[317] Court, *Pioneers of Ecological Restoration,* 165.
[318] Sachse, *A Thousand Ages,* 30; Court, *Pioneers of Ecological Restoration,* 90.

Root Cellar (1935, contributing building, photo 14 foreground). The Root Cellar is a tiny, frame, rustic style, front gable building set into the hillside. It is finished with wood shingles, trimmed with corner boards, sits on a concrete foundation and displays an asphalt-shingled roof. A plain wooden door occupies the north-facing (front) façade. A board reading "ROOT CELLAR" appears above the door. It displays excellent integrity.

Main Pumphouse (1935, contributing building, photo 14 background). The Main Pumphouse is rustic in style and faces west. It is a small, one-story, frame front gable building finished with wood shingles and resting on a concrete basement. A paneled wooden door is centered on the west-facing (front) façade. A few wooden, six-pane hopper windows are found on the side facades. The roof is clad with asphalt shingles. The Main Pumphouse retains excellent integrity.

Gallistel Woods Shelter (1937, contributing building, photo 23). The Gallistel Woods Shelter was erected in 1937.[319] It was designed by Carl Riemenschneider and used as a stock plan by the National Park Service and the Wisconsin Department of Conservation. The CCC constructed the shelter under the supervision of Longenecker, who may have adapted the plan for the Arboretum. The shelter is constructed of rock-faced sandstone ashlar and capped with a side-gable roof and is rustic in style. In 1960, the northern end was shortened and the shelter was enclosed with windows and a door, creating a secure storage building.[320] The Gallistel Woods Shelter is located just east of the Service Area (Figures 2A and 2C), and retains very good integrity to the period of significance.

Garage (ca. 1965, contributing building, now Maintenance, photo 25). The Garage is a side gable building of concrete block on a concrete slab foundation, built ca. 1965.[321] Two garage doors are located in the north-facing (front) façade. A smaller, side-gabled office section attaches to the west gable end. A door is located in the west gable end of the Garage proper and in the north-facing façade of the office section. Single-pane windows light the office. The roofs are surfaced with asphalt shingles. This astylistic utilitarian building maintains very good integrity.

Visitor Center (1976/2001, non-contributing building, photos 15 and 29). The Visitor Center is a long, low, one-story contemporary building set on a raised basement. Originally erected in 1976-77 as the McKay Nature Awareness Center, it was enlarged and remodeled in 2001 in accordance with plans prepared by Tony Puttnam, of Taliesin Architects.[322] The influence of Frank Lloyd Wright is apparent in the building's horizontal emphasis, its siting on the hillside, its dominant and prow-like side gable roof, and its exterior finishes, which include rock-faced stone ashlar, stucco, and redwood-stained clapboards. The main entrance is offset on the southwest façade, overlooking Curtis Prairie, and consists of a pair of metal-and-glass doors. Small awning windows light the office, meeting and storage areas. On the main floor, large picture windows provide a spectacular view. Solar shingles and asphalt shingles cover the roof. The solar shingles are composed of photovoltaic cells and produce electricity to power the building. The wooden deck on the south facade, which was a part of the 1976 building, was rebuilt in 2013.[323] Although it is non-contributing, its appearance is compatible with the historic character of the Arboretum. There is a vertical board information sign (2008)

[319] Carl Riemenschneider, "Shelter," September 16, 1935, University of Wisconsin-Madison Arboretum Archives, Madison, Wisconsin; Court, *Pioneers of Ecological Restoration,* 68.

[320] *Arboretum News* 10 (January 1961): 2.

[321] Gregory Armstrong (Director of the University of Wisconsin-Arboretum, 1983-2003), discussion with Elizabeth Miller, January 23, 2002.

[322] "New House on the Prairie," *The Capital Times*, August 30, 2001, 2A.

[323]Fifield-Murray, email to Elizabeth Miller, January 19, 2019.

outside the front entrance with a map of the Arboretum and visitor's rules. One of Mike Burns' metal benches (2013) is set just outside the front entrance.

Comfort Station (1968, non-contributing building, photo 16). The Comfort Station is a small, frame contemporary building erected in 1968.[324] It is finished with redwood-stained clapboards and sits on a concrete slab foundation. The side-gabled roof is clad with asphalt shingles. A shed-roofed entrance porch with a single metal door is appended to each gable end. The Comfort Station retains its original appearance. Although it is non-contributing, its design is compatible with the Arboretum's historic character.

Security Residence (1968, non-contributing building, photo 17). The Security Residence is a low, one-story, shed-roofed, frame structure in the Contemporary mode. It is clad with redwood-stained clapboards, rests on a concrete slab foundation and dates from 1968.[325] The Security Residence faces south. The south-facing façade features a door set off-center, paired and single 1/1 windows and two picture windows. A broad, shed-roofed dormer perches on the south slope of the asphalt-shingled roof. The Security Residence maintains its original appearance. Although it is non-contributing, its design is compatible with the historic character of the Arboretum.

Visitor Center Parking Lot (1977/1991, non-contributing structure, photos 15 and 25). The Visitor Center Parking Lot (figures 2C and 2D) encompasses two paved two parking areas, separated by a broad strip of grass, set perpendicular to McCaffrey Drive (figure 2A). The south parking area has two aisles of parking flanking a central drive and dates to 1991 and overlays the original entrance to the former CCC Camp. The north parking area was laid out in 1977, accommodates one aisle of parking, and followed the original drive past the Nelson farm buildings (not extant).[326] There is a cul-de-sac at the east end of the parking lot, adjacent to the Visitor Center's entrance. A metal barricade north of the cul-de-sac prevents drivers from crossing from one parking area to the other, eliminating through traffic. The barricade was erected in 1991.[327] While this structure is not compatible with the Arboretum's historic character, it does not diminish the integrity of the Arboretum as a whole.

Utility Shelter (ca. 1983, non-contributing structure). The Utility Shelter is a very small, shed-roofed structure with slender metal posts, enclosed with chain-link fencing. It appears to date from ca. 1983. This structure is not compatible with the historic character of the Arboretum, but its placement at the east end of the Service Area renders it unobtrusive, such that it does not impair the Arboretum's integrity.

Margaret's Council Ring. (1999, non-contributing structure, photo 26). This council ring is a round, low, two-part structure of random, rock-faced sandstone ashlar, with a wide, rock-faced limestone cap. This rustic style council ring was designed by Darrel Morrison. Margaret Van Alstyne, a former Arboretum guide, funded its construction in 1999.[328] While this structure is non-contributing, its design is compatible with the historic character of the Arboretum.

Pergola (2001, non-contributing structure). The Pergola is a semi-circular structure composed of pairs of round concrete columns, supporting an open framework of wooden boards. The wooden framework is about ten

[324] "U.W. Renews Request for Ice Arena," *The Capital Times*, May 7, 1968, 32. Notes that final drawings for a security residence and restrooms in the Arboretum were approved by the Campus Planning Committee.
[325] "U.W. Renews Request for Ice Arena."
[326] Court, *Pioneers of Ecological Restoration,* 234; Fifield-Murray, email to Elizabeth Miller, January 19, 2019.
[327] Court, *Pioneers of Ecological Restoration,* 241-42.
[328] Court, *Pioneers of Ecological Restoration,* 254.

feet wide, and dates from 2001. It was installed as part of the design for the Wisconsin Native Plant Garden.[329] Although non-contributing, this structure is compatible with the Arboretum's historic character.

Visitor Center Council Ring (2001, non-contributing structure). This structure is a low, semi-circular wall of random, rock-faced ashlar with a broad stone cap. Flagstones and a round hearth lie within the semi-circle. This rustic style council ring dates from 2001 and was designed by landscape architect Darrel Morrison as part of the Wisconsin Native Plant Garden.[330] This structure, although non-contributing, is compatible in appearance with the Arboretum's historic character.

Longenecker Horticultural Gardens Entrance (2012, non-contributing structure, photo 27). This structure is composed of a pair of rustic style walls of random rock-faced stone, set on a concrete foundation. Each wall steps up toward the entrance, which features a gateway arch consisting of tall, square metal posts, surmounted by an arched metal cutout featuring trees. The wall was designed by Rhonda James, a landscape architect with the University of Wisconsin-Madison Division of Facilities Planning & Management. The arch was created and fabricated by metal artist Mike Burns. The entrance was erected in 2012.[331] While non-contributing, the appearance of this structure is compatible with the historic character of the Arboretum.

Troia Arch (2012, non-contributing structure). The Troia Arch is located in the Longenecker Horticultural Gardens. Erected in 2012, it was designed and produced by Mike Burns.[332] The Troia Arch is nearly identical to the gateway arch of the Longenecker Horticultural Gardens Entrance. Although this structure is non-contributing, its design is compatible with the Arboretum's historic character.

Fifield Arch (2015, non-contributing structure). The Fifield Arch, fabricated by Mike Burns and installed in 2015, is also situated in the Longenecker Horticultural Gardens.[333] Except for the metal cutout, it is identical to the Troia Arch. The Fifield Arch cutout features a pair of cranes, a tree, and several bunches of prairie flowers. While non-contributing, its design is compatible with the historic character of the Arboretum.

Stone Structures

A series of stone structures are found along the western boundary of the Arboretum north of the Beltline (figures 2A and 2E). Most were erected by the CCC and all are rustic in style.

Spring Trail Entrance, Walls and Steps (ca. 1927, contributing structure, photo 18). The Spring Trail Pond Entrance and Steps and the Spring Trail Pond Dam were built ca. 1927 for Spring Trail Park, part of the Madison Realty Company's development of the Nakoma subdivision. Frank Lloyd Wright is reputed to have designed these structures.[334] This may be true, although the evidence to date attributing the design to Wright is circumstantial.[335] Franz Aust supervised their construction.[336] Three walls and two staircases, all

[329] Court, *Pioneers of Ecological Restoration,* 254-55.
[330] Court, *Pioneers of Ecological Restoration,* 254-55.
[331] Fifield-Murray, email to Elizabeth Miller, January 19, 2019: University of Wisconsin-Madison Arboretum, "News: New Entrance for Longenecker Horticultural Gardens," August 3, 2012, https://arboretum.wisc.edu/news/arboretum-news/new-entrance-lhg/.
[332] Fifield-Murray, email to Elizabeth Miller, January 19, 2019.
[333] Fifield-Murray, email to Elizabeth Miller, January 19, 2019.
[334] Sachse, *A Thousand Ages*, 47.
[335] Mary Jane Hamilton (distinguished architectural historian and noted Wright scholar), discussion with Elizabeth Miller, July 27, 2018.
[336] Court, *Pioneers of Ecological Restoration,* 24.

interconnected, make up the entrance. Two more walls are found at ground level on the north side of the pond. The walls and steps are of rock-faced, sandstone ashlar. The staircases descend from street level, one on either side of the pond. This resource retains very good integrity, although one of the walls alongside the pond is showing cracks and splitting along a series of vertical mortar joints. There is a small, graveled parking lot just north of Spring Trail Pond. A flat-topped information sign at the edge of the parking lot was installed in 2014.

Spring Trail Pond Dam (ca. 1927, contributing structure). The dam is very similar to the walls in scale and appearance, and is also constructed of rock-faced, sandstone ashlar. It is set between the staircases at ground level and exhibits shallow stone buttresses. The Spring Trail Pond Dam maintains very good integrity.

Stevens Pond Entrance and Walls (1936, contributing structure) consists of two low walls of rock-faced sandstone ashlar, erected in 1936. It was designed by Longenecker and built by CCC enrollees.[337] This resource displays very good integrity.

Manitou Way Entrance and Walls (1937, contributing structure, photo 21). This resource is also composed of two walls, which match those of the Stevens Pond Entrance in height, materials, finish, and appearance (photo 21). It was designed by Longenecker and built by the CCC in 1937.[338] In August 2018, floodwaters washed the sandy soil from in front of the north Manitou Way Wall, exposing the foundation, but causing no apparent damage to the wall. In the same flood, a ten-foot section at the north end of the south Manitou Way Wall tipped over. It has been set upright and re-mortared into place. Despite this, the resource retains very good integrity.

Olbrich Memorial Entrance and Walls (1937-40, contributing structure, photo 22). Albert Gallistel, an architect and the university's superintendent of buildings and grounds, designed the rock-faced, sandstone ashlar Olbrich Memorial Entrance and Walls at the Seminole Highway entrance (figure 2A). The CCC completed its construction in 1940.[339] This resource consists of two walls. A broad pier with a stepped silhouette anchors each wall at McCaffrey Drive as it runs easterly into the Arboretum. Both walls are low and exhibit a stepped profile. A bronze plaque inset in the south wall pier dedicates the entrance to Olbrich and quotes him, THE UNIVERSITY ARBORETUM WILL BRING BACK INTO THE LIVES OF ALL SOMETHING OF THE GRACE, COLOR AND BEAUTY WHICH NATURE INTENDED ALL TO SHARE. The north wall zigzags, turns the corner, and runs easterly along Manitou Way to the next intersection (Iroquois Drive). The Olbrich Memorial Entrance and Walls displays excellent integrity. A vertical metal sign identifying the Arboretum stands on the north side of McCaffrey Drive just west of the north wall. The sign dates to 2012.

Kenneth Jensen Wheeler Council Ring (1938, contributing structure, photo 24). This structure is located in the northwest corner of the Arboretum, southeast of Monroe Street and west of Arbor Drive (figure 2A). It was designed by Jens Jensen, nationally prominent landscape architect famed for his Prairie style creations.[340] Wheeler was his grandson and had been a student of landscape architecture at the University of Wisconsin at the time of his death. A low wall of rock-faced limestone ashlar, dry-laid, encircles a raised stone campfire platform. Flagstones form a floor within the circle and create paths leading to the Council Ring from two directions. A naturalistic outcropping of dry-laid limestone ashlar sits just outside the circle. A bronze plaque attached to this outcropping reads, THIS COUNCIL RING IS DEDICATED BY HIS PARENTS TO THE

[337] Sachse, *A Thousand Ages,* 48.
[338] Court, *Pioneers of Ecological Restoration,* 68-70.
[339] Sachse, *A Thousand Ages,* 43.
[340] Sachse, *A Thousand Ages,* 48.

EVERLASTING MEMORY OF KENNETH JENSEN WHEELER, CLASS OF 1938. The Kenneth Jensen Wheeler Council Ring retains excellent integrity.

Road, Trail System Components, and Parking Lots Outside the Service Area

McCaffrey Drive and Arboretum Drive (1933-36, contributing structure, photos 9 and 10). This is a three-mile long road that winds through the Arboretum and provides access to the Service Area (figure 2A). From the west entrance at Seminole Highway to the Service Area, the road is called McCaffrey Drive (photo 9, view of roadway). From the east entrance at South Mills Street to the Service Area, the road is named Arboretum Drive (photo10, view of roadway). Gallistel designed the road in 1933, planning the grades and curves in such a way as to make the drive an invisible element in the vista of the Arboretum. CCC enrollees carried out most of the construction of McCaffrey Drive and Arboretum Drive, completing it in 1936. It was originally graveled but was paved with asphalt in 1937.[341] The roadway is composed of two 10-foot lanes, much of which has no shoulder. In some sections, there are earthen shoulders up to 2 feet in width. One small graveled parking lot (Curtis Lot) is found north of McCaffrey Drive near Leopold Pines, and another appears north of Arboretum Drive opposite Longenecker Horticultural Gardens (Wingra Springs Lot) (both figure 2A). These lots are described under **Parking Lots** below.

Trail System (1935-1941, contributing structure, photos 7, 19, and 20). The Trail System is composed of some 17 miles of narrow footpaths, broad fire lanes, and wooden boardwalks traveling through woods and savannas, and over wetlands and prairies (figures 2A and 2B). The Boardwalks are counted separately from the Trail System, as are the Skunk Cabbage Bridge and the Bike Trail. These elements are described below. Most of the trails were blazed by the CCC between 1935 and 1941.[342] The 1948 "Master Plan for the University of Wisconsin Arboretum" shows the trail system substantially the same as it is currently.[343] Low, wooden posts were placed at trail intersections to mark the trails beginning in the early 1960s.[344] Each is labeled with a number, which corresponds to the Arboretum's trail map. Most of the trails are unimproved footpaths (photo 7, in Gallistel Woods, figures 2A and 2D), and are no more than five feet wide. In prairie and savanna areas, these may be mowed. Fire lanes are generally about eight feet in width and are maintained primarily through mowing.

Boardwalks (late 1990s, non-contributing structure, photo 20)
Boardwalks have been installed in or near wetlands or springs, to allow access without harm to plant communities (photo 19, near Kenneth Jensen Wheeler Council Ring, figure 2A). The boardwalks range in width from three feet to five feet, and account for less than one mile of the trail system. The boardwalk near Big Spring incorporates a tiny, wooden bridge, known as Skunk Cabbage Bridge (described below). The boardwalk overlooking Gardner Marsh has wooden rails and terminates in a small platform (photo 20, figure 2A). The oldest of the current wooden boardwalks date to the late 1990s.[345]

Skunk Cabbage Bridge (late 1990s, non-contributing structure)
Skunk Cabbage Bridge straddles the boardwalk that traverses the skunk cabbage wetlands north of Arboretum Drive and just south of Lake Wingra (figure 2A). It is a wooden structure with a short flight of steps on either

[341] Court, *Pioneers of Ecological Restoration,* 43, 88, 92; Sachse, 26-33.
[342] Sachse, *A Thousand Ages*, 50.
[343] "Master Plan for the University of Wisconsin Arboretum."
[344] *Arboretum News* 13, no. 2-3 (April-July 1964), 1-4.
[345] University of Wisconsin-Madison Arboretum, "On the Trails: Arboretum Boardwalks," September 29, 2017, https://arboretum.wisc.edu/news/arboretum-news/arboretum-boardwalks/.

end of a platform with simple board handrails. The footprint of the platform is octagonal. Skunk Cabbage Bridge dates to the late 1990s.[346]

Bike Trail (between 1995 and 2000, non-contributing structure)
One short section of asphalt-paved bike trail, nine to ten feet wide, crosses Wingra Oaks Savanna in the northwest corner of the Arboretum (figure 2A). It was installed sometime between 1995 and 2000.[347]

Parking Lots (pre-1948 to pre-1957, five contributing structures)
The Arboretum has five small gravel parking lots. The Curtis Lot is located on the north side of McCaffrey Drive opposite the Leopold Pines (figure 2A). It measures about 90 feet by 30 feet and was installed prior to 1948. The Wingra Springs Lot is the largest, measuring approximately 200 feet by 60 feet. Located on the north side of Arboretum Drive opposite Longenecker Horticultural Gardens (figure 2A), it predates 1948. The Arbor Drive Lot is situated at Monroe Street and Arbor Drive in the northwest corner of the Arboretum (figure 2A). The dimensions of this parking area, installed before 1948, are about 60 feet by 35 feet. The Martin Street Lot is found at the west end of Martin Street and the eastern edge of Lost City Forest (figure 2A). It was in place by 1957, and measures about 45 feet by 40 feet. The Grady Tract Lot is set at the northwest corner of Evjue Pines (figure 2B). It is about 50 feet square and predates 1957.[348]

Summary of Arboretum Resources

Contributing Resources	Date of Construction	Type	Count
Arboretum	1933-1961	site	1 site
Bath House	1935	building	
Barracks	1934	building	
Carpentry Workshop and Warehouse	1935	building	
Machine Shed	1935	building	
Tool Shed	1935	building	
Nursery Pumphouse	1935	building	
Root Cellar	1935	building	
Main Pumphouse	1935	building	
Gallistel Woods Shelter	1937/1960	building	
Garage	1965	building	10 buildings
Spring Trail Pond Entrance, Walls and Steps	1927	structure	
Spring Trail Pond Dam	1927	structure	
Stevens Pond Entrance and Walls	1936	structure	
Manitou Way Entrance and Walls	1937	structure	
Olbrich Memorial Entrance and Walls	1937-1940	structure	
Kenneth Jensen Wheeler Council Ring	1938	structure	
McCaffrey Drive and Arboretum Drive	1933-36	structure	
Trail System	1935-1941	structure	
Curtis Lot	pre-1948	structure	
Wingra Springs Parking Lot	pre-1948	structure	

[346] University of Wisconsin-Madison Arboretum, "On the Trails: Arboretum Boardwalks."
[347] Dane County (Wisconsin), "DCiMap," aerial images, 1995 and 2000, accessed September 6, 2019, https://dcimapapps.countyofdane.com/dcmapviewer/.
[348] "Master Plan for the University of Wisconsin Arboretum"; and Dane County (Wisconsin), "DCiMap," aerial image, 1957, accessed September 6, 2019, https://dcimapapps.countyofdane.com/dcmapviewer/.

Arbor Drive Parking Lot	pre-1948	structure	
Martin Street Parking Lot	pre-1957	structure	
Grady Tract Parking Lot	pre-1957	structures	13 structures

Non-contributing Resources

Visitor Center	1976/2001	building	
Comfort Station	1968	building	
Security Residence	1968	building	3 buildings
Visitor Center Parking Lot	1977	structure	
Utility Shelter	1983	structure	
Margaret's Council Ring	1999	structure	
Pergola	2001	structure	
Visitor Center Council Ring	2001	structure	
Longenecker Horticultural Gardens Entrance	2012	structure	
Troia Arch	2012	structure	
Fifield Arch	2015	structure	
Boardwalks	1990s	structure	
Skunk Cabbage Bridge	1990s	structure	
Bike Trail	1995-2000	structure	11 structures

Evaluation of Integrity

When the University of Wisconsin acquired the first acreage for the Arboretum in 1932 there were several farm buildings on the site, located in the vicinity of the Arboretum's present Service Area. Most of the farm buildings were removed in 1932-33. The farmhouse was removed by 1939 and was used briefly as the forestry office. The barn served as the dining hall for a federal transient camp, in the Arboretum from October 1934 until August 1935. The barn continued as a dining hall, as well as the headquarters for NPS and USFS staff, as part of the CCC Camp until the spring of 1937, when the barn was destroyed by fire. Despite the fact that the barn was used briefly by those who were laboring to create the Arboretum, the barn's strongest association is with its earlier agricultural use, and not with the national significance of the Arboretum in conservation. Therefore, the loss of those buildings does not affect the historic character of the Arboretum or reduce its excellent integrity.

At its peak, the CCC camp had twenty-eight buildings, all concentrated in what is now the Arboretum's Service Area. These included a small office, a kitchen, a mess hall, officers' quarters, a canteen, two pumphouses, a root cellar, a paint shed, a bath house, ten barracks, a carpentry workshop and warehouse, a machine shop, a repair shed, a tool shed, an oil house, a blacksmith shop and two additional garages.[349] Only the bath house, the pumphouses, the root cellar, the carpentry workshop and warehouse, the machine shop, the tool shed and one barracks remain. However, CCC buildings were intended to be temporary, for the use of the men who helped build the roads, buildings, and structures in the Arboretum during the Works Progress Administration (WPA) and the Public Works Administration (PWA). The loss of the majority of the CCC buildings does not diminish the excellent integrity of the Arboretum; the roads, buildings, and structures that the CCC erected to serve the Arboretum were intended to be permanent and represent the CCC's contribution to its development. However, one of the resources the CCC built has been demolished: the Wingra Woods Shelter. A rustic style structure of rock-faced sandstone ashlar construction similar to the Gallistel Woods Shelter, the Wingra Woods Shelter was

[349] "Plat Showing Arboretum Buildings," March 20, 1944, Arboretum Archives, University of Wisconsin Arboretum, Madison, Wisconsin.

severely altered in 1962, and later demolished. Fourteen buildings and structures erected by the CCC remain, outweighing the loss of the shelter, and leaving the integrity of the Arboretum undiminished. Further, the CCC-built resources are ancillary to the Arboretum's national significance in conservation.

The fourteen non-contributing resources represent alterations to the Arboretum since the end of the period of significance (1966). However, the form, natural materials, and siting of the non-contributing resources show sensitivity to the environment and an intention on the part of the designers to make the resources compatible with the historic character of the Arboretum. These are the Arboretum Visitor Center, the Comfort Station, the Security Residence, Margaret's Council Ring, the Pergola, the Visitor Center Council Ring, the Longenecker Horticultural Gardens Entrance, Troia Arch, Fifield Arch, Boardwalks, and Skunk Cabbage Bridge. The Utility Shelter is not compatible with the Arboretum's historic character, but its location, down the hill from the Arboretum Visitor Center and behind the other contributing buildings, renders it unobtrusive. The Visitor Center Parking Lot has been expanded since 1977 and the installation of a barricade preventing motor vehicles from traveling through the Arboretum is a noticeable alteration, but does serve to make the Arboretum more accessible to visitors while protecting it from those who would cut through it. The Bike Trail, installed sometime between 1995 and 2000, is not compatible, but it is situated on the northwestern edge of the Arboretum, minimizing its impact. The non-contributing resources do not impair the abundant integrity elsewhere in the Arboretum.

Physical features of the land in the Arboretum have not been altered since the period of national significance. Design elements have been constructed since 1966, including the Viburnum Garden (1976), Wisconsin Native Plant Garden (2001), and all the non-contributing resources enumerated above. Signs and benches have also been installed, and none date from the period of significance. The signs provide identification and information. They do not detract, but rather, help visitors to understand the history and significance of the Arboretum. The benches are primarily located in the Longenecker Gardens, which does not contribute to the Arboretum's national significance in conservation. These design elements do not impact the excellent integrity of the Arboretum to its period of national significance.

The resource of greatest significance in the Arboretum is the site itself, with its fourteen major ecological communities. Plants have been added and others removed as part of the restoration, investigation, and maintenance of ecological communities. The integrity of these communities cannot be measured by a lack of change, but rather, in their evolution toward the vision of restored ecological communities articulated by Leopold at the dedication of the Arboretum in 1934. Leopold and other founders of the Arboretum recognized the long-term commitment of restoration ecology, even as they carried out research and developed practices that would help pioneer the field, and they envisioned that the ecological communities would change over time as the land healed. Although some of these changes have been unexpected, and the research and experimentation in restoring and managing ecological communities have required adjustment and revision, change in the Arboretum reflects the process of restoration ecology. The Arboretum possesses excellent integrity as a laboratory for ecological restoration.

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Previous documentation on file (NPS):

_x_ Previously listed in the National Register (fill in 1 through 6 below)
__ Not previously listed in the National Register (fill in **only** 4, 5, and 6 below)

1. NR #: 16000518
2. Date of listing: January 28, 2019
3. Level of significance: National and local
4. Applicable National Register Criteria: A_x_ B__ C_x_ D__
5. Criteria Considerations (Exceptions): A__ B__ C__ D__ E__ F__ G__
6. Areas of Significance: Conservation (national), Education, Architecture, Politics/Government, Landscape Architecture

_x_ Previously Determined Eligible for the National Register: Date of determination: 2003
__ Designated a National Historic Landmark: Date of designation:
__ Recorded by Historic American Buildings Survey: HABS No.
__ Recorded by Historic American Engineering Record: HAER No.
__ Recorded by Historic American Landscapes Survey: HALS No.

Location of additional data:

State Historic Preservation Office: Wisconsin Historic Preservation Office
Other State Agency:
Federal Agency:
Local Government:
University:

Other (Specify Repository): University of Wisconsin-Madison Arboretum

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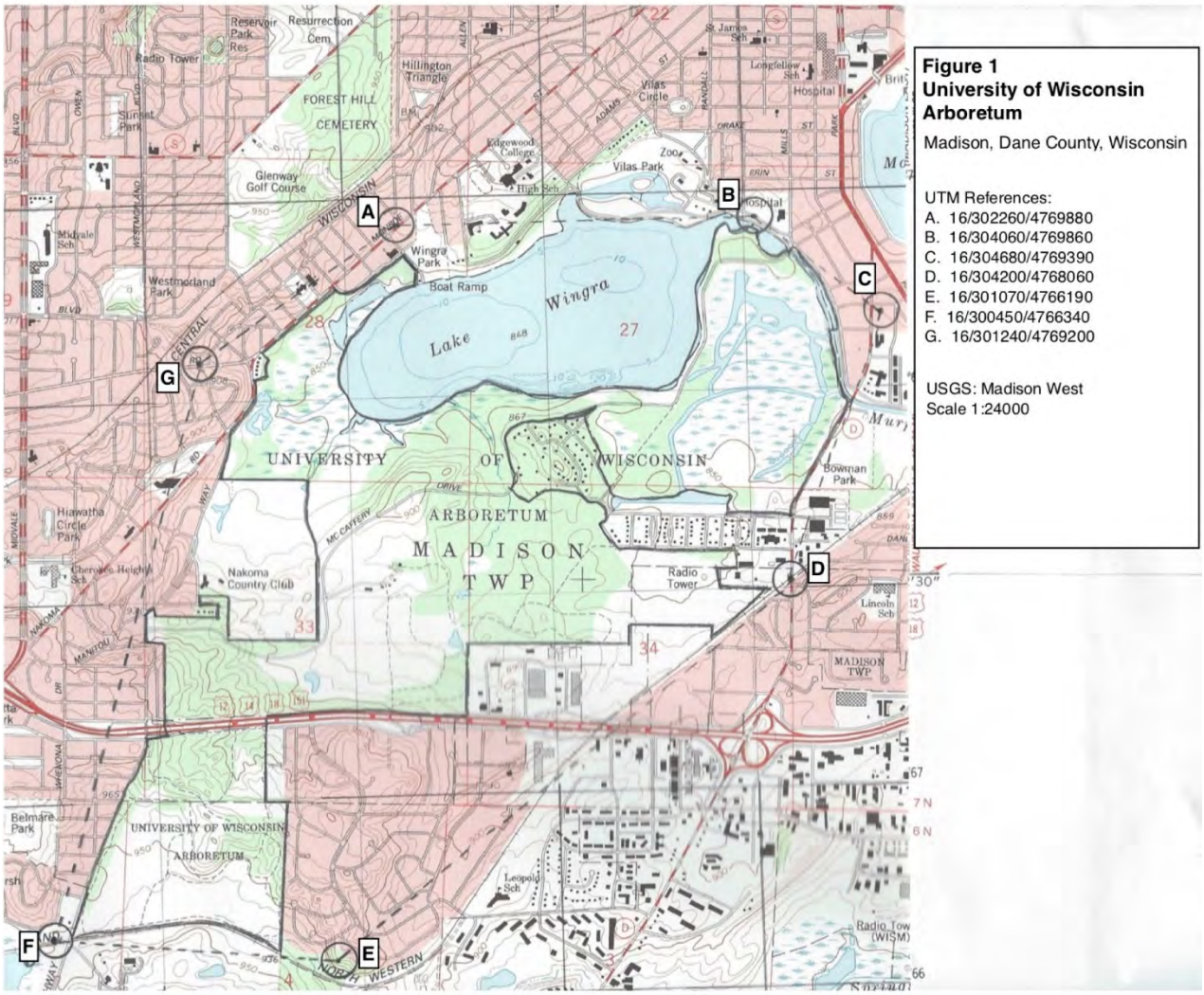

Figure 1
University of Wisconsin Arboretum
Madison, Dane County, Wisconsin

UTM References:
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Scale 1:24000

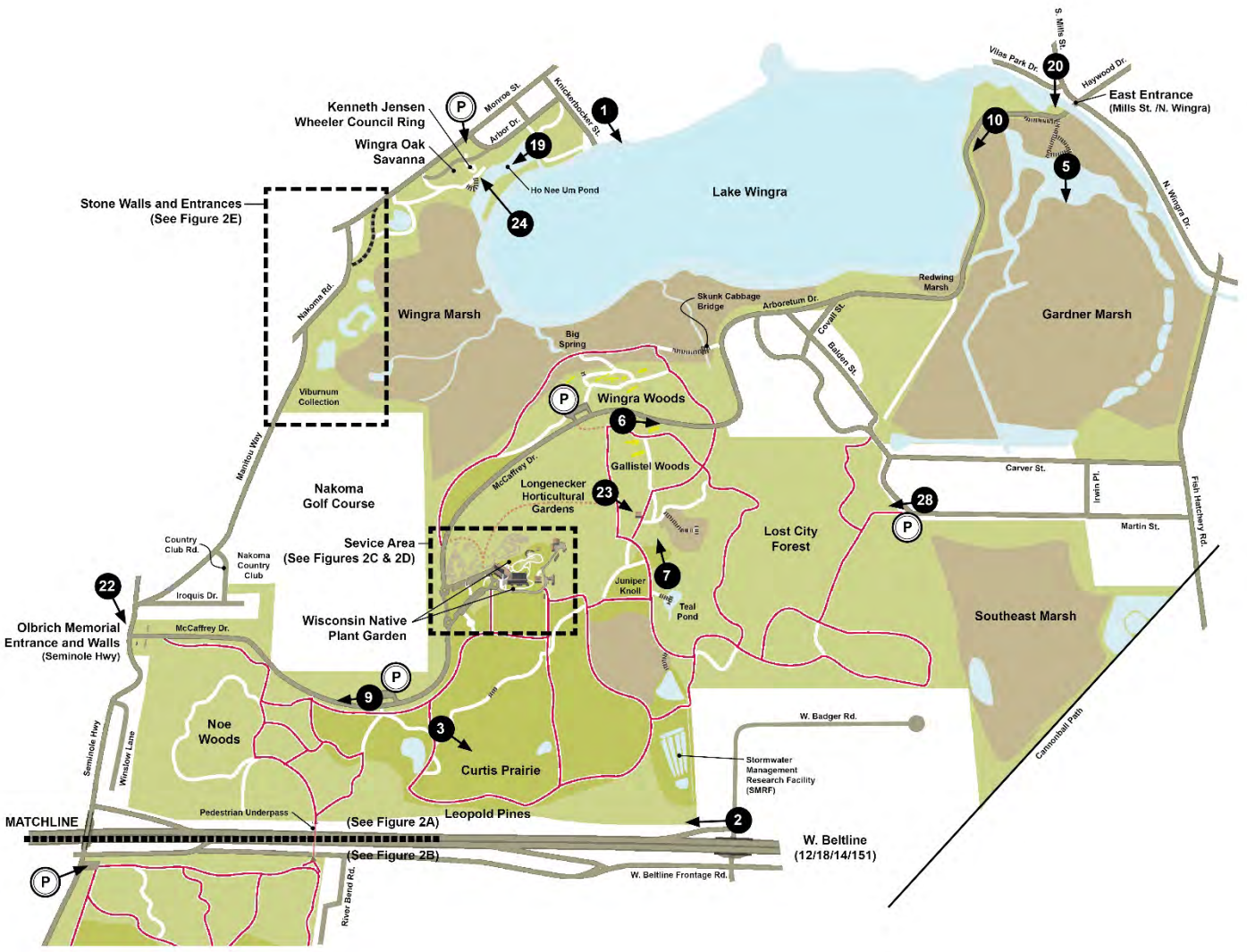

Photo Number and Direction
Hike only
Hike / ski / snowshoe
Boardwalk
Boundary (shading)
Matchline
Parking

University of Wisconsin Arboretum
Site Plan with Boundary and Photo Key - North of Beltline Highway
September 2019

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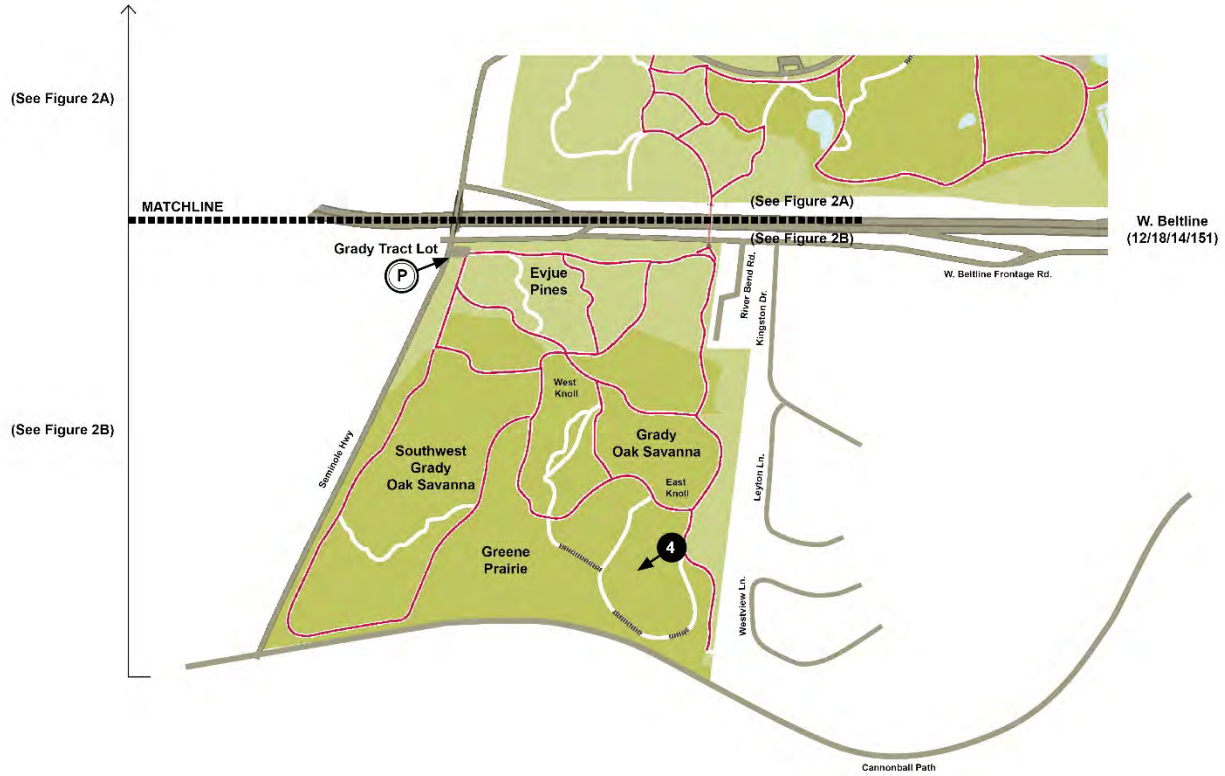
N

0' 2,640'
(1/2 mile)



X Photo Number and Direction
Hike only
Hike / ski / snowshoe
Boardwalk
Boundary (shading)
Matchline
P Parking

University of Wisconsin Arboretum
Site Plan with Boundary and Photo Key - South of Beltline Highway
September 2019

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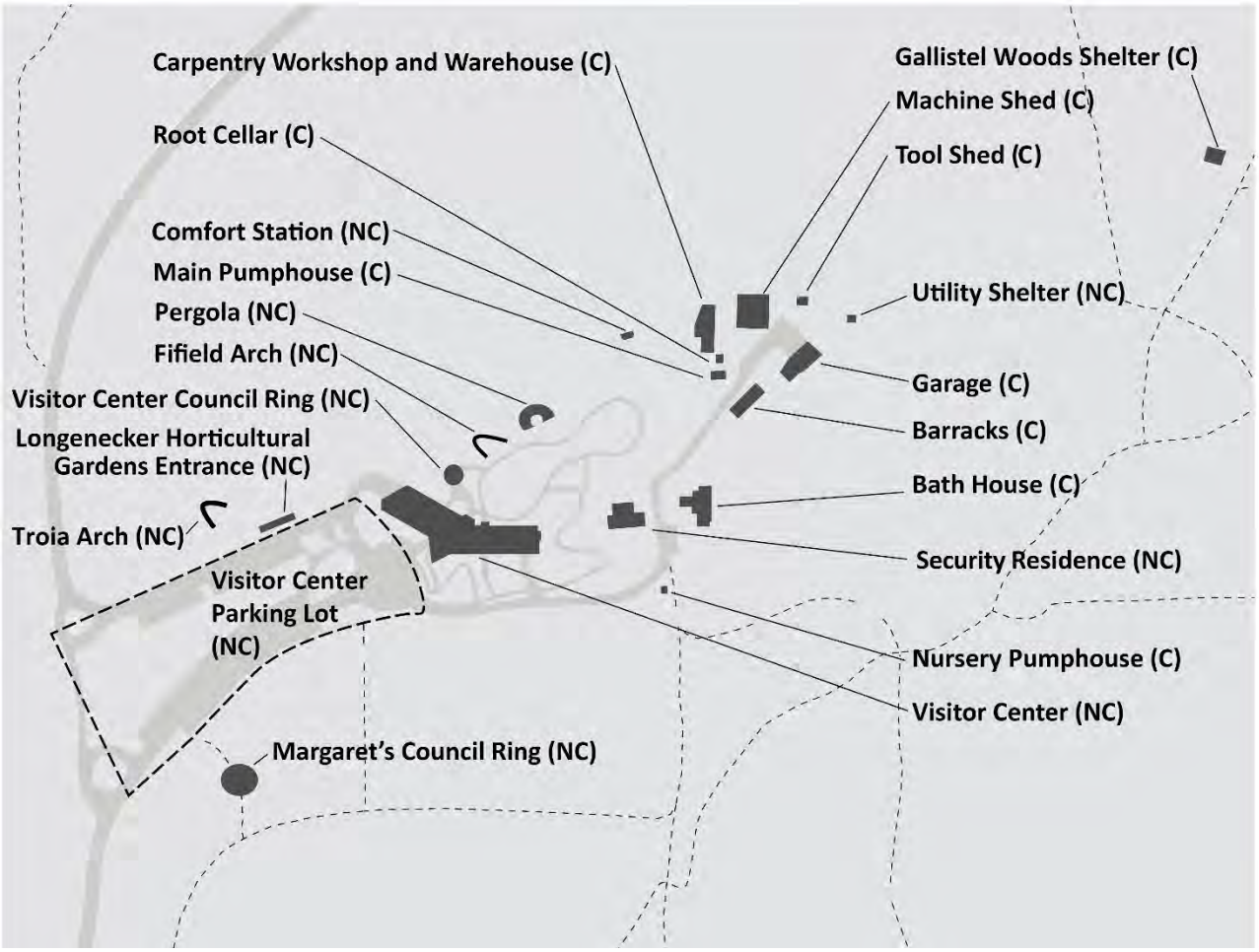
0' 2,640'
(1/2 mile)


Carpentry Workshop and Warehouse (C)
Root Cellar (C)
Comfort Station (NC)
Main Pumphouse (C)
Pergola (NC)
Fifield Arch (NC)
Visitor Center Council Ring (NC)
Longenecker Horticultural Gardens Entrance (NC)
Troia Arch (NC)
Visitor Center Parking Lot (NC)
Margaret's Council Ring (NC)
Gallistel Woods Shelter (C)
Machine Shed (C)
Tool Shed (C)
Utility Shelter (NC)
Garage (C)
Barracks (C)
Bath House (C)
Security Residence (NC)
Nursery Pumphouse (C)
Visitor Center (NC)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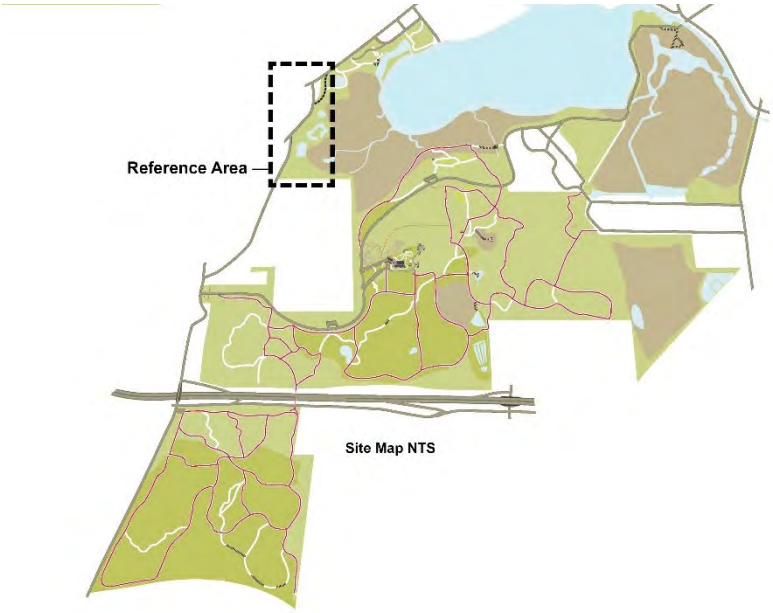

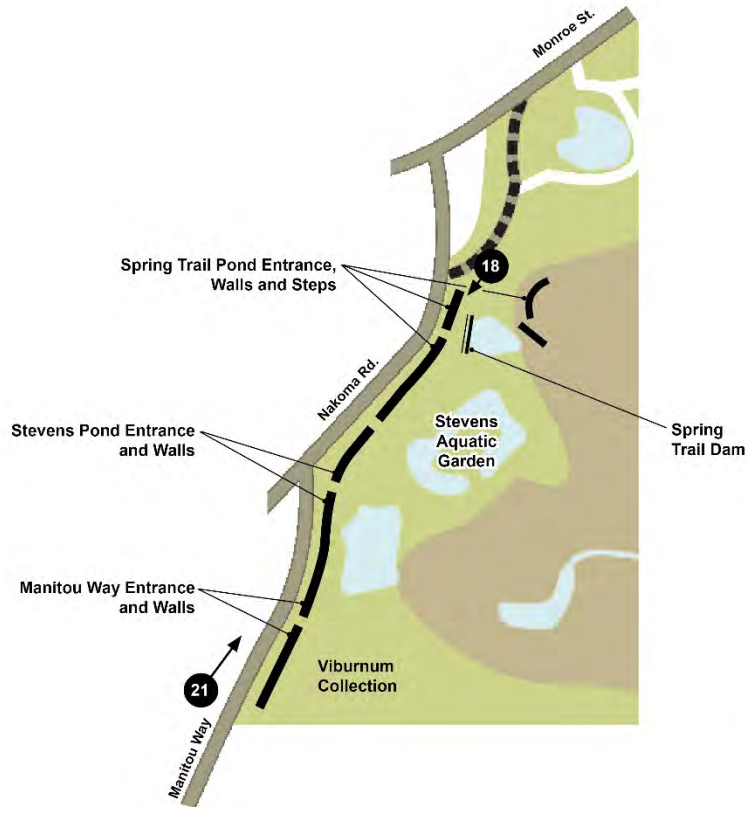

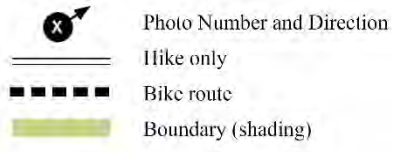

University of Wisconsin Arboretum
Stone Structures with Photo Key
July 2019

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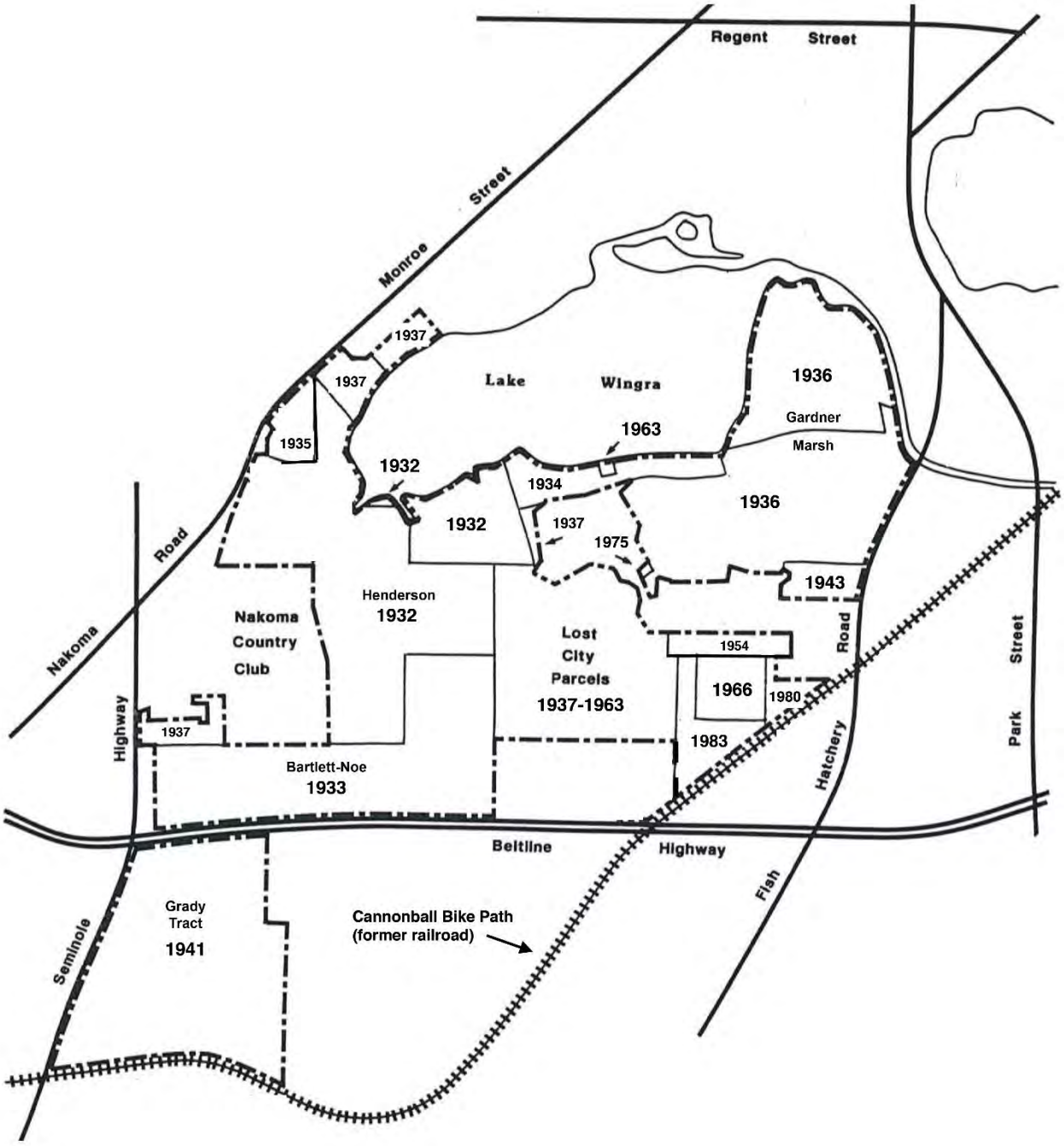
Regent Street
Monroe Street
1937
1937
Lake Wingra
1936
Gardner Marsh
1935
1963
1932
1934
1936
1932
1937
1975
1943
Henderson
1932
Nakoma Road
Nakoma Country Club
Lost City Parcels
1937-1963
1954
Road
Park Street
1966
1980
Highway
1937
1983
Hatchery
Bartlett-Noe
1933
Beltline Highway
Fish
Grady Tract
1941
Cannonball Bike Path
(former railroad)
Seminole

National Historic Landmarks

Property Name: **UNIVERSITY OF WISCONSIN ARBORETUM**

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Figure Number: **8**

Some information about this property is restricted under law:

National Historic Preservation Act of 1966, as amended, section 304, 16 U.S.C. 470w-3(a)
- *Confidentiality of the location of sensitive historic resources*

Section 304

[16 U.S.C. 470w-3(a) – Confidentiality of the location of sensitive historic resources]
(a) The head of a Federal agency or other public official receiving grant assistance pursuant to this Act, after consultation with the Secretary, shall withhold from disclosure to the public, information about the location, character, or ownership of a historic resource if the Secretary and the agency determine that disclosure may –
(1) cause a significant invasion of privacy;
(2) risk harm to the historic resources; or
(3) impede the use of a traditional religious site by practitioners.