NINA'S LEGACY:

DESIGNING AN EDIBLE LANDSCAPE FOR THE ALDO LEOPOLD FOUNDATION

by

EMILY NYE HUNT

(Under the Direction of Alfred Vick)

ABSTRACT

The relationship between people and nature is widening, particularly through the disconnection of food production methods. Creating an edible landscape is a method to help close the bond between people and nature through personal food production, as tending the land invites a familiarity with the natural environment and encourages people to learn about landscape management and sustainability. In 1976, Nina Leopold Bradley, daughter of renowned conservationist Aldo Leopold, established a garden adjacent to the "Shack," made famous in Aldo Leopold's foundational environmental text *A Sand County Almanac*. From 1976-2011, Leopold Bradley documented the process of garden management, along with phenological details of the environment. This study uses an explanatory design to examine the journals to develop an edible landscape plan for an intern housing facility at the Aldo Leopold Foundation in Sauk County, Wisconsin.

INDEX WORDS: Aldo Leopold, Edible Landscaping, Garden, Landscape Architecture, Nina Leopold Bradley, Plant Species, Sustainability, The Aldo Leopold Foundation, The Shack

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MASTERS OF LANDSCAPE ARCHITECTURE

ATHENS, GEORGIA

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DEDICATION

I dedicate this thesis to my mentor Nina Leopold Bradley (1917-2011), who inspired this idea of developing a sustainable, edible landscape for interns at the Leopold Legacy Center. She planted this seed over a game of backgammon during my internship in summer 2005. Although my backgammon skills never fully developed, I hope Nina would be pleased to know that what she taught me about tending gardens and caring for the land will be passed down to future interns. It is my goal, with this thesis, to provide interns with the tools to tend to the land and develop a connection to nature through personal food production, just as Nina had intended.

ACKNOWLEDGEMENTS

I would like to thank those who have assisted in what has resulted in close to a ten-year project. First, Nina Leopold Bradley inspired the idea for this thesis. I am forever grateful to her for providing a summer internship in 2005. During this time, our conversations about gardening, landscape management and enjoyment of the natural world planted the seed for the creation and design of an edible landscape. I would also like to thank my committee, Alfie Vick, Jon Calabria and Scott Nesbit, for conversations and support during this experience. Buddy Huffaker, Trish Stevenson, and Janine Richards encouraged me to pursue this project and provided invaluable support in addition to sharing the archives of the Leopold family. To my professors and those at the CE+D, Shelley Cannady, Eric MacDonald, Umit Yilmaz, Jack Crowley, Brian LaHaie, Melissa Tufts, Donna Gabriel, and Audra Lofton, thank you for continuing my education. My family, all of whom are passionate about ecological restoration and conservation, provided countless hours reading and rereading my drafts while offering ecological and editorial perspectives. Finally, a special thank you to my friends Sig Sandzén, Renee Dillon, and Genna Mason for listening to ideas, frustrations, and joys (as well as late-night cookie breaks) throughout this process.

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Excerpt from "Good Oak"

"There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace.

To avoid the first danger, one should plant a garden, preferably where there is no grocer to confuse the issue.

To avoid the second, he should lay a split of good oak on the andirons, preferably where there is no furnace, and let it warm his shins while a February blizzard tosses the trees outside. If one has cut, split, hauled, and piled his own good oak, and let his mind work the while, he will remember much about where the heat comes from, and with a wealth of detail denied to those who spend the week end in town astride a radiator."

—Aldo Leopold, *A Sand County Almanac with Sketches Here and There* ([1949] 1968)

INTRODUCTION

A "garden" is the colloquial term for a designed landscape feature that helps connect people to nature. Edible landscape features, or vegetable/fruit gardens, offer an additional sustainable alternative to healthy eating that surpasses the climate controlled and energy-intensive indoor landscape of the supermarket. Decades ago famous environmentalist and conservationist Aldo Leopold voiced his concern that people were becoming increasingly disconnected from the land by "supposing that breakfast comes from the grocery," (*A Sand County Almanac with Sketches Here and There*, [1949] 1968). Considered nearly essential in population centers today, grocery stores break the direct link between people and nature. They often require vehicular transportation to access them, especially in the absence of neighborhood grocers, and often have exceedingly high "food miles" when produce is shipped from distant locations (ERS 2013). Alternatively, local fruit and vegetable production by individual consumers encourages a deeper connection with the land and the land community—soil, water, plants and animals, as first articulated by Leopold in the 1940s—by tending plants and caring for the environment ([1949] 1968). Personal food production and gardening have always been important to the Leopold family, including the food patch at the "Shack," where Leopold wrote many of his pioneering theories of ecology and land community ethics (Figure 0.1). The ethics of the land and local food production carried through to Nina Leopold's garden at the Bradley Study Center, which, along with the Shack, is now part of the Leopold Memorial Reserve (the Reserve), in Sauk County, Wisconsin.

Figure 0.1: Aldo Leopold's Shack. Located along the Wisconsin River in Sauk County, Wisconsin, the structure was originally a chicken coop. Photograph by author, 2010.

Working as an intern at the Bradley Study Center in 2005 for Nina Leopold Bradley, Aldo Leopold's eldest daughter, I explored the idea with Nina that the Aldo Leopold Foundation (ALF) interns ought to design, plant and tend their own personal edible landscapes on-site to promote a healthy and sustainable lifestyle. Nina kept extensive gardens and encouraged others to participate by cultivating and tending the gardens, and thus to enjoy the production of fresh fruits and vegetables, which Nina shared with all who visited. A champion of locally grown food, Nina strongly believed in sustainable food production and wanted to share this extension of the Leopoldian land ethic with visitors and family members, as well as the interns (Leopold Bradley 2005). Other than the fresh produce from Nina's gardens, food options for interns at the Shack were, and still are, limited. The closest grocery store is in Baraboo, Wisconsin, a twenty-minute drive. In low-income urban areas, such a location would be considered a "food desert." Nina was adamant that the land could provide sufficiently for people so that the drive to town and the further dependence on fossil fuels for both transportation and commercial food production could be significantly reduced.

Figure 0.2: The Leopold Legacy Center. Facility designed by the Kubala Washatko Architects (TWKA) and constructed in 2007. Photograph by author, 2010.

In the fall of 2014, ALF received a private donation to fund a new facility for intern housing. Inherent in its design was an edible landscaping component. Established in 1982 by Aldo Leopold's children to continue and promote environmental stewardship through his land ethic, ALF is a non-profit organization operating from the Aldo Leopold Legacy Center (Figure 0.2). The building was constructed from pines originally planted by the Leopold family during their time at the Shack. Using on-site resources, such as the pine boards, helped promote sustainability and green building techniques. Receiving the Platinum LEED ® Certification v2.1, the Leopold Center was one of the greenest buildings in the world. According to the Aldo Leopold Foundation, "The Leopold Legacy Center begins to demonstrate the many ecological, economic, and cultural harvests we may begin to reap when we commit to caring for land," and follows the philosophy of Aldo Leopold (2006). Yet the LEED v2.1 rating system overlooks an important yet poorly recognized component of sustainability: landscapes for on-site food production. The aforementioned donation with its edible landscape component will help realize a goal of the Leopold family, especially Nina, which was for ALF interns to sustain themselves

through local food production. Further, the interns, as part of their experience, would actively engage in all aspects of gardening in order to help allay the spiritual dangers of not owning a farm.

Nina Leopold Bradley grew up spending weekends with her family at the Shack and moved back to the area with her husband, Charlie Bradley, in 1976, establishing the Bradley Study Center. Together, Nina and Charlie selectively harvested pines, originally planted by the Leopold family in the 1930s and ‘40s, to build an environmentally friendly house/research center (Figure 0.3), which was surrounded by an extensive garden. Nina and Charlie documented this process in detail, and also kept extensive notes on phenology, hydrology, and climate data from 1976-2011. The journals, along with the original Shack journals kept by Aldo Leopold in the 1930s and ‘40s, have been used to

Figure 0.3: The Bradley Study Center, 1976. Photograph by Charlie Bradley from the Bradley Study Center journals.

help document climate changes for the natural environment. Little research, however, has been published specifically on Nina's gardens.

To that end, the aim of this thesis is to demonstrate an understanding of the historic research at the Reserve and its application to design and management. The edible landscape design is based on the available historic records, primarily journals, kept by Nina during the period from 1976-2011. The design includes a phased planting plan, seasonal garden management plans for interns to reference, and recommendations for specific plant types and species based on a matrix of ecological and cultural fitness for the site. The edible landscape and garden designs, once constructed and producing, will encourage interns to connect to their surroundings, provide healthy eating alternatives and carry on Nina's gardening legacy at the Leopold Legacy Center. This encompasses record-keeping in ongoing journal entries based on gardening observations and experiences, which will result in the individuals "letting their minds work the while," as Leopold penned in his essay, "Good Oak," ([1949] 1968).

A Conversation with Nina Leopold Bradley

In the summer of 2005, I interned with Nina Leopold Bradley. Nina invited me to live in her home, known as the Bradley Study Center. During my time there I helped her in the garden, cooked dinner, watched the BBC (British Broadcasting Corporation) news each night, and faced some spectacular losses in backgammon to Nina. Another aspect of my internship was helping the ALF interns. We spent long days working to control invasive species such as garlic mustard, which was prevalent within the Leopold Reserve. Other days were spent conducting prescribed burns or collecting prairie seeds at locations such as the International Crane Foundation. After a typical day's work, my hands might

be stained blue from collecting spiderwort seeds, but I was always excited to see what the next day's adventures would bring.

Waking up each morning, I would head out for a run along Levee Road, passing the Shack and then retracing my route back to Nina's house. During that time Nina had already taken her daily swim in the pond and would be waiting for me in the kitchen with a bowl of freshly picked raspberries and cream. The raspberries were straight from her gardens - a lush landscape Nina and Charlie had created since their return to the land (Figure 0.4). While building their house and excavating a pond, they transformed the barren sandy soil into an organically-rich and productive vegetable garden. Nina

Figure 0.4: Nina's garden. Photographed by Charlie Bradley from the Bradley Study Center journals, August 5, 1986.

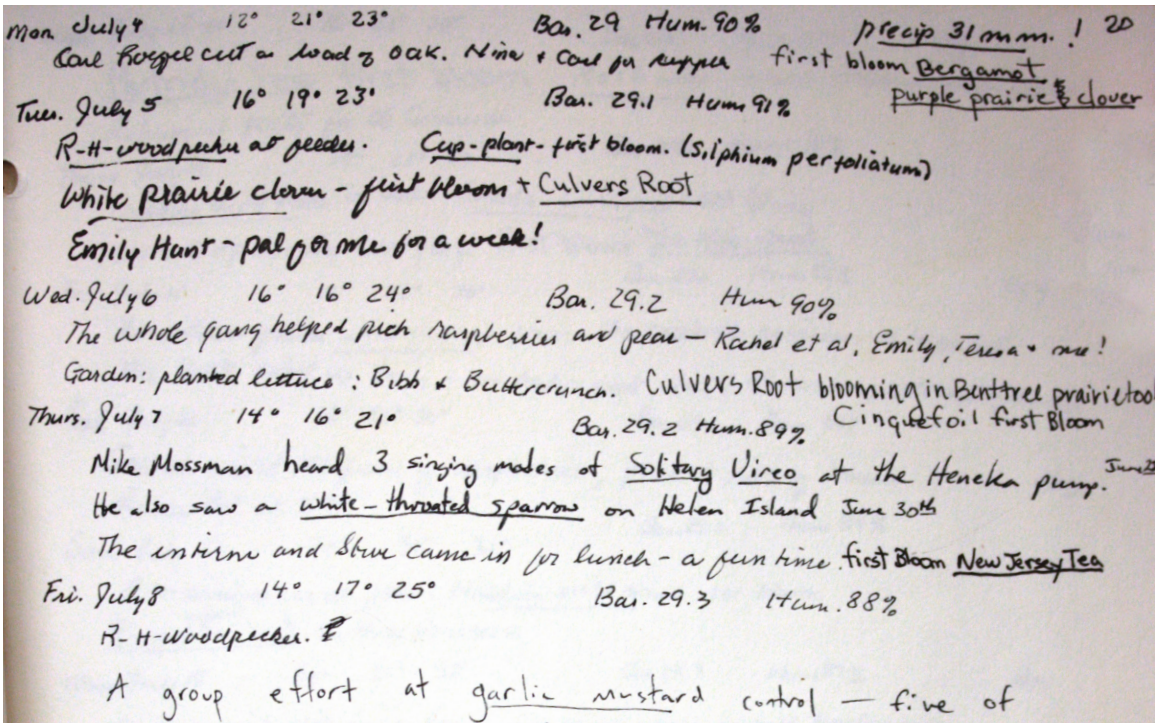


Figure 0.5: A page from the Bradley Study Center journals. The detailed records Nina kept over a 40+ year period include records of my internship. Photograph by author.

described how, after her swim each morning, she would pull handfuls of aquatic weeds that were threatening to choke the pond and then put them on the garden to help remediate the sandy garden soil. Adding the organic matter and nutrients contained in the aquatic weeds solved two problems at once: rebuilding soil while controlling the invasive species in the pond.

During breakfast we would discuss a myriad of topics as we watched the birds and wildlife at the feeders outside her kitchen window. Pointing out the grosbeaks, goldfinches, and many other songbirds that frequented the feeder, Nina would take descriptive notes in her journals about the arrival times of each species and would include dates of first blooming for native plants. Nina would also document the weather conditions and other activities happening at the Bradley Study Center and at the Shack

(Figure 0.5). One morning Nina mentioned the importance of growing a garden and how it connected a person to the land. Nina's garden provided for more than just us - she shared her produce with anyone who visited and often invited the interns in for lunch for freshly picked greens and a sandwich on homemade bread. Nina often remarked, "Wouldn't it be great if the interns had their own garden?"

I packed up on the last day of my internship, full of excitement thinking about all that I had learned from Nina, the interns and others at the Reserve. The next several years were spent studying environmental history and archaeology at the University of Wisconsin and working on my family's organic farm. However, Nina's idea of creating a garden for the interns stayed with me. I thought it curious that on a landscape with a history of gardening and food production, there was currently no on-site food source for the interns. Did this present an inconsistency considering the interns were practicing the values instilled by Aldo Leopold? Didn't Leopold's land ethic, at its fundamental level, value local, sustainable food patches for wildlife and people alike? Nina, a direct descendant who carried on the Leopold legacy, certainly valued the food patch as an aesthetic and functional means by which to realize a fundamental connection to the land.

Thesis Structure and Methodology

Exploring a history of food production on the landscape now occupied by the Leopold Reserve reveals a drastic change in management practices through time. Prior to the Leopold family, the land was farmed out to the point of exhaustion and ecologically exploited. Once Aldo Leopold and his family occupied the property, their value system resulted in a shift from using up the land to a focus on restoring ecological health of the land. This included reforestation, managing the land to promote prairie growth, and

sustaining the family on the weekend visits through a food patch located next to the Shack. Nina and Charlie reaffirmed these values when they built their house near the Shack, planted a native seed nursery, and established Nina's gardens. Therefore, using the past as a guide, the research question is: *"How can food production and agriculture around the Shack be documented and used as a model for future gardens and edible landscapes to increase on-site sustainability at the Aldo Leopold Legacy Center?"* The following subquestions will support the primary question:

- What is the primary literature that documents evidence of locally grown food at the Shack and in Nina's garden?
- How can Nina's garden and remnants of the Leopold family's food patch be established as a culturally significant landscape?
- How can Nina's garden provide a design guidelines for the edible landscape at the Leopold Legacy Center to promote ongoing sustainability?
- Will there be sustainability impacts by designing an edible landscape, and how will the changes in sustainability be measured at the Leopold Legacy Center?

To answer these questions, this thesis uses an explanatory design to examine the data. An explanatory design consists of two phases: (1.) collection of quantitative data, and (2.) a follow-up to give greater meaning to the numbers (Leedy and Ormrod 2013). This mixed-method research design uses both quantitative and qualitative data from the Shack journals and the Bradley Study Center journals to document the garden species and management activities quantitatively in a series of visualizations. The visualizations help convey guidelines to create an edible landscape design and management recommendations for the interns.

Chapter 1 chronicles the timeline of land practices at the Leopold Reserve, including the shift from intensive agriculture to the Leopold ownership and subsequent restoration practices, the origins of the Bradley Study Center and finally The Aldo Leopold Foundation. The area of interest (AOI) is mapped using ArcGIS 10.1 to produce a series of context maps showing (1.) the location of Sauk County in Wisconsin, (2.) the Leopold Reserve in Sauk County, and (3.) the spatial relationship of the Bradley Study Center, the Shack, and the Leopold Center, which includes the proposed building site for intern facilities. The intern site has been recorded using GPS (Global Positioning System) during a site visit with Buddy Huffaker, Executive Director, ALF, and Trish Stevenson, Nina's daughter (November 24, 2014). Huffaker provided an initial site plan with detailed architectural drawings of the proposed building from the Kubala Washatko Architects, Inc., located in Cedarburg, Wisconsin.

Historic maps are included to show the changes in the landscape from 1937-2015 using aerial photographs from the Wisconsin Department of Natural Resources (DNR) and U.S. Department of Agriculture (USDA) (Appendix A). Hand-drawn maps from the Shack journals and the Bradley Study Center journals also provide historic references to the food patch planted by Aldo Leopold and his family, along with Nina's garden at the Bradley Study Center (WI Catalog of Aerial Photography, WHAI 2014). Historic photos from both of these time periods will also help document the gardens from the 1930s-40s and 1976-2011.

Oral histories of Nina Leopold Bradley (Aldo's eldest daughter), Estella Leopold (Aldo's youngest daughter), Dr. Carl Leopold (Aldo's son), Trish Stevenson (Aldo's granddaughter), and Dr. Susan Flader (Aldo Leopold Scholar) will provide detailed

information about the beginning of the Bradley Study Center, along with history of the Shack. Conducted from 2003-2011, the interviews provide insight into the founding of the Leopold Reserve, along with the land management for The Aldo Leopold Foundation.

Chapter 2 addresses the questions, "What is the primary literature that documents evidence of locally grown food at the Shack and in Nina's garden?" and "How can Nina's garden and remnants of the Leopold family's food patch be established as a culturally significant landscape?" by establishing a research methodology to classify the data from the Bradley Study Center journals, focusing on the garden activities correlated to climate data recorded by Nina and Charlie Bradley. The Bradley Study Center journals will serve as the primary source to determine lists of suitable cultivated plant species and a seasonal management chart. This thesis will examine data from 1976-2009, including detailed records of weather, spring blooming times for native edible plant species, and activities at the Bradley Study Center including garden planting and maintenance. The journals document gardening activities based on plant species, which can inform the planting plan for the edible landscape and garden at the intern facility for the Leopold Legacy Center. Looking at the long-term data (previously documented in Nina's phenology study), climate change events have occurred, which will be essential to understanding long-term adaptive management strategies for the garden and designed landscape, including shifting planting and harvesting times.

Chapter 3 addresses the question, "How can Nina's garden provide a design guidelines for the edible landscape at the Leopold Legacy Center to promote ongoing sustainability?" by creating an edible garden design based on the cultivated species from Nina's journals, along with a plant matrix that evaluates native edible species to

determine suitable species from which to select plants. The plant selection is categorized into different garden zones based on similar requirements such as soil, moisture and sunlight, or the particular microclimates around the intern facility. Chapter 3 contains a brief literature review of sustainable building methods, which will be applied to meet the site conditions of the proposed intern facility. A set of goals adapted from *Designing the sustainable site: integrated design strategies for small-scale sites and residential landscapes* by Heather Venhaus (2012) will be adapted to meet ALF's sustainability goals, strategies and objectives.

To address the final question, "Will there be sustainability impacts by designing an edible landscape, and how will the changes in sustainability be measured at the Leopold Legacy Center?" Chapter 4 evaluates the goals, objectives and strategies of sustainability previously described in Chapter 3. Integrating Nina's philosophy with sustainable ideals, a preliminary adaptive management guide will be created for the interns to monitor and record observations and measure sustainability goals for the garden. The guide will address the primary question, "How can food production and agriculture around the Shack be documented and used as a model for future gardens and edible landscapes to increase on-site sustainability at the Aldo Leopold Legacy Center?"

Finally, Chapter 5 reviews the impact of the journal documentation and suggests future research opportunities. Using the process of adaptive management as a model, a management plan to monitor ongoing sustainability for edible landscaping can be implemented on future sites requesting edible gardens. The owner's manual allows future projects to document observations and daily activities, including site monitoring processes, similar to Nina's journals.

CHAPTER 1

A HISTORY OF CONNECTING TO THE LAND THROUGH FOOD

Locating "Sand County" in Wisconsin

Aldo Leopold wrote about the Shack on his Wisconsin farm in *A Sand County Almanac and Sketches Here and There* ([1949] 1968), documenting the natural history and restoration efforts during the 1930s and 40s. Set in rural south-central Wisconsin, Aldo refers to the location as "Sand County" due to the sandy soils along the Wisconsin River. In actuality, the property is located along Levee Road, a state-designated "Rustic Road" in Sauk County, Wisconsin (Figure 1.1), along the Wisconsin River in Township 13 North, Range 7 East, Section 33.

Figure 1.1: Leopold Memorial Reserve context map. Located in Sauk County, Wisconsin. Map by author, 27 February 2015. Data sources: Esri, ArcGIS online, Jaime Stoltenberg (Arthur H. Robinson Map Library, UW-Madison).

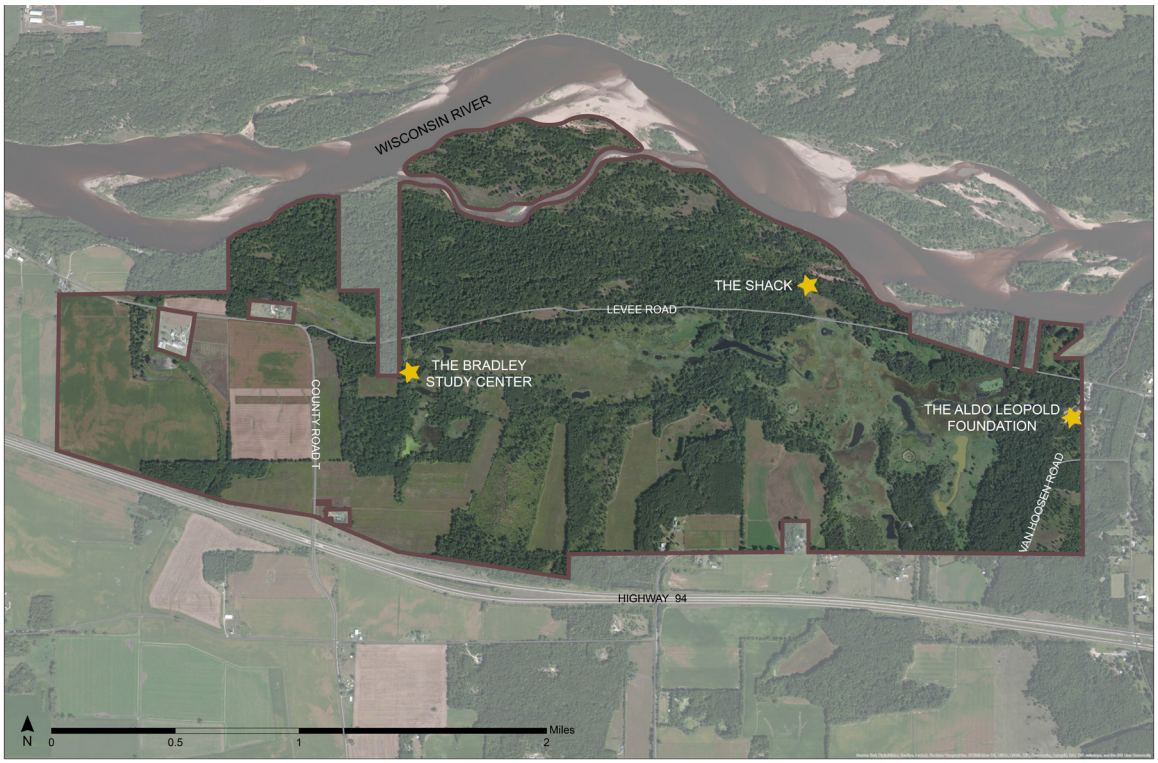


Figure 1.2: Leopold Memorial Reserve map. Located along the Wisconsin River. Map by author, 19 January 2015. Data sources: Esri, Jaime Stoltenberg (Arthur H. Robinson Map Library, UW-Madison), adapted from Laubach (2014).

His farm, now the Leopold Memorial Reserve (the Reserve) and the study area of this thesis, includes a wildlife preserve jointly owned by the Aldo Leopold Foundation (ALF) and Sand County Foundation. The reserve encompasses and buffers the original farm owned by Aldo Leopold and his family (Figure 1.2). Figure 1.2 shows the Leopold Reserve, which is home to the Shack, the Bradley Study Center, and ALF. The map is adapted from Dylan Moriarty, UW Cartography Lab, John Koenigs, Sand County Foundation, and Jen Simoni, Aldo Leopold Foundation (Laubach 2014).

A result of the Wisconsin-aged glacial stream and meltwater sediments, the site landform, due to its proximity of the Wisconsin River, is primarily recent sandy floodplain sediments composed of excessively drained to poorly drained soils. The Shack,

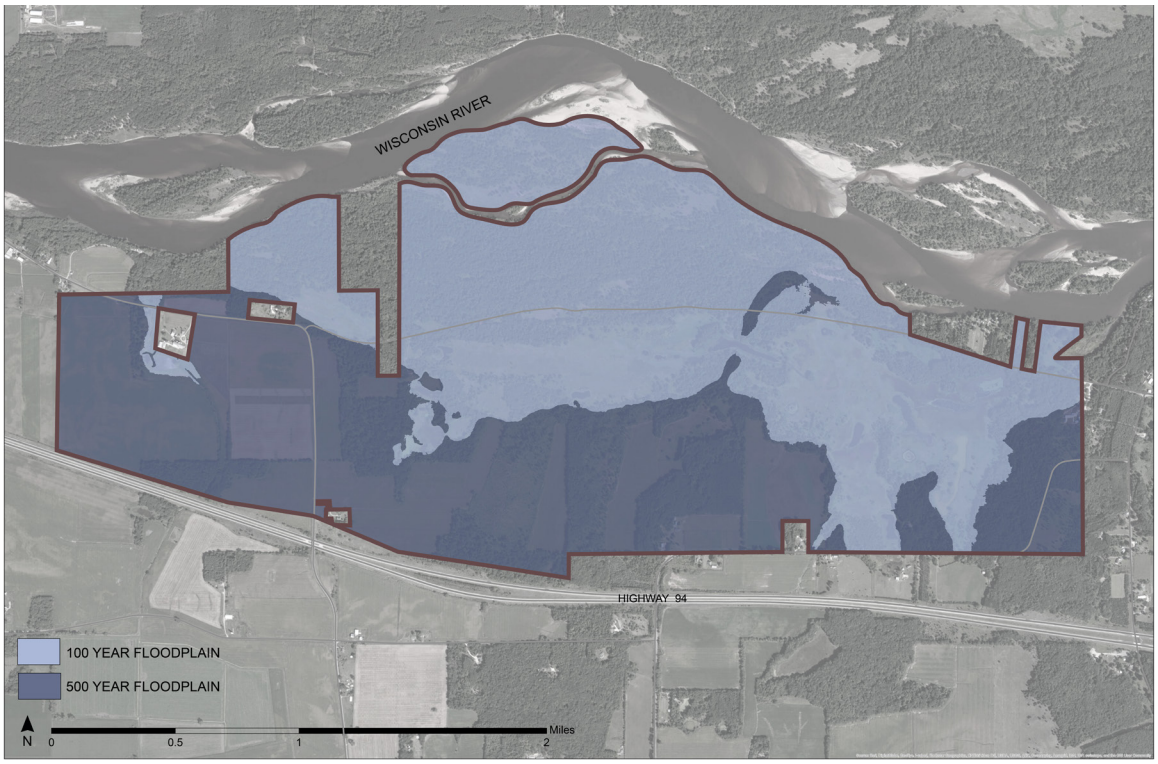


Figure 1.3: Floodzones in the Leopold Memorial Reserve. Map by author, 24 January 2015. Data sources: Esri, J. Stoltenberg, FEMA (2014), adapted from Laubach (2014).

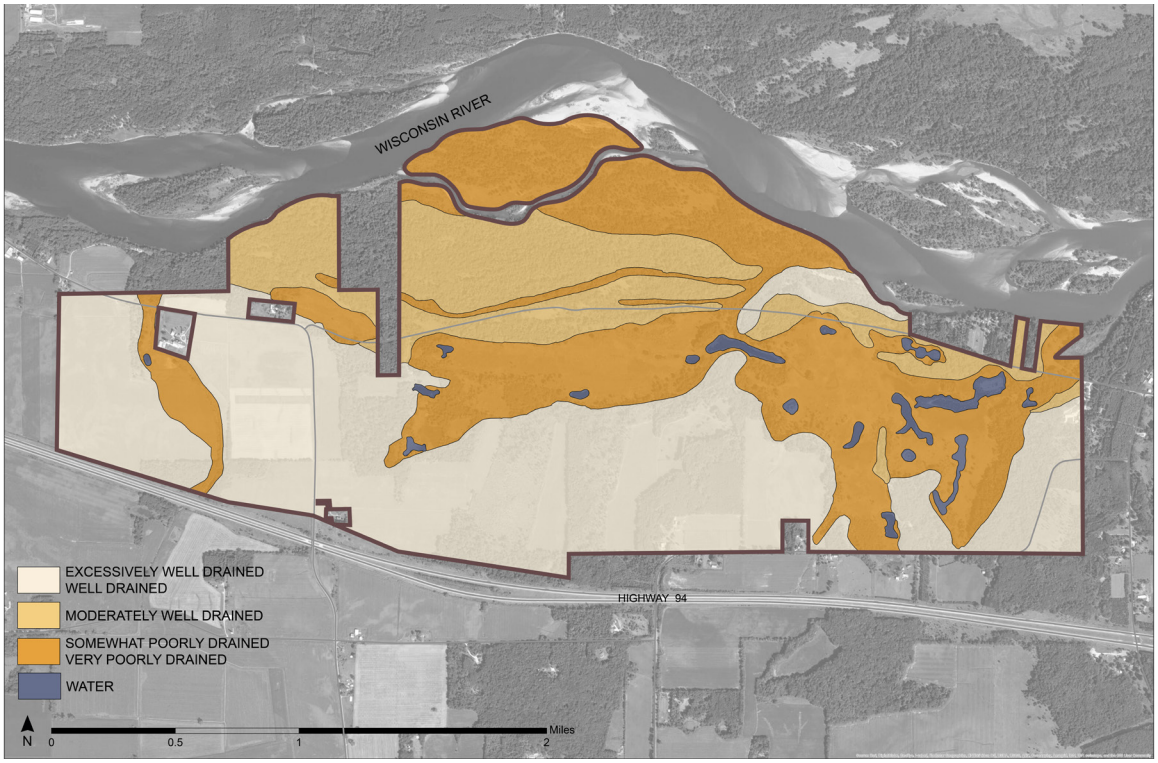


Figure 1.4: Soils in the Leopold Memorial Reserve. Map by author, 19 January 2015. Data sources: Esri, J. Stoltenberg, NRCS (2013), adapted from Laubach (2014).

situated above the 100-year floodplain (Figure 1.3), is located on an end moraine, or glacial deposit, which resulted from the ablation of the Green Bay Lobe approximately 12,000 years ago (Liegel 1982, 15). The predominant soil class is comprised of sandy loam and loamy sand soils (Figure 1.4, Appendix B). Throughout the reserve, many of the ponds are man-made, located within the marsh areas of poorly-drained, high water table soil classes. The Leopold Reserve soils have been mapped by categorizing the natural drainage classes into excessively well drained and well drained, moderately well drained, somewhat poorly drained and very poorly drained, and water.

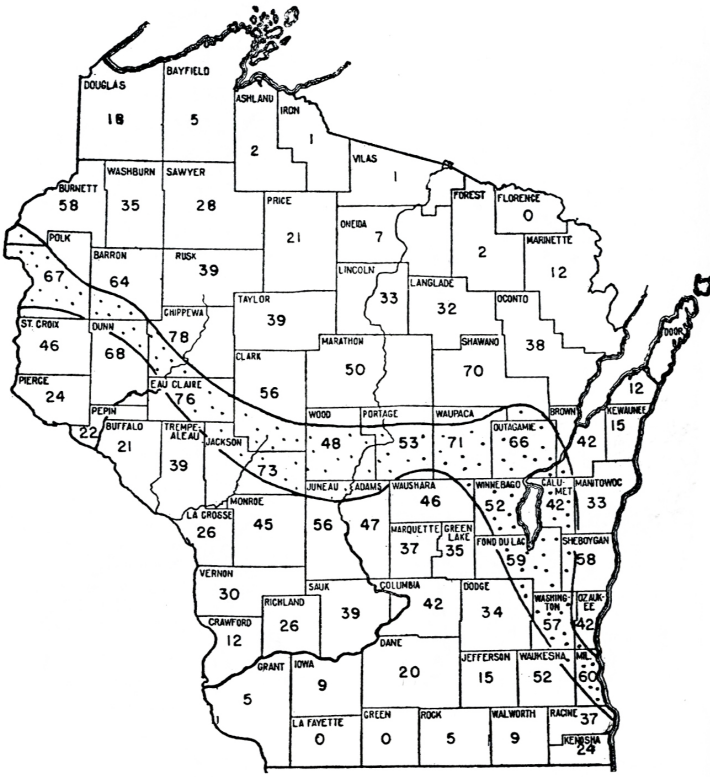


Figure 1.5: Wisconsin's tension zone. The zone delineates the range boundary band between northern and southern plant communities (Curtis 1959, 20).

Sauk County falls south of the "tension zone," which represents an overlap of two distinct floristic provinces in Wisconsin: southern prairie vs. northern boreal plant

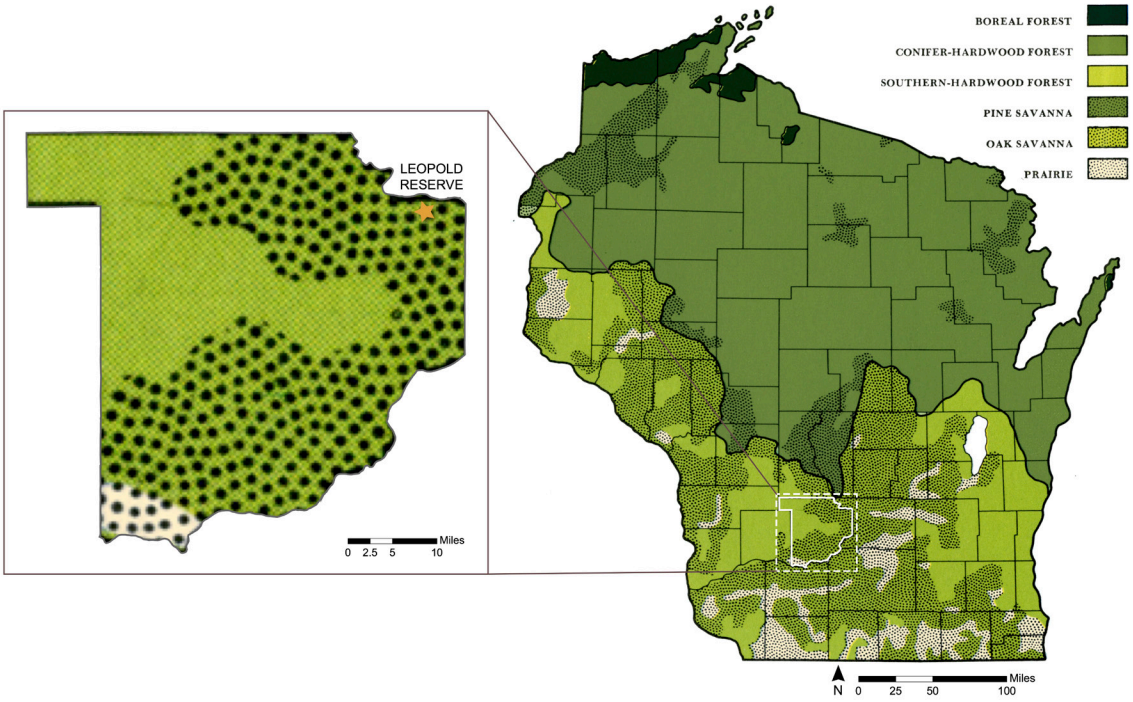


Figure 1.6: Plant communities of Wisconsin and Sauk County. Adapted from Curtis (1959). Map by author, 4 March 2015. Data sources: Esri, J. Stoltenberg.

communities (Curtis 1959, Figure 1.5). In *The Vegetation of Wisconsin* (1959), John T. Curtis defined plant communities of Wisconsin at the time of settlement using surveyors' maps and notes from land surveys in Wisconsin from 1833-1866, conducted as part of the 1785 Land Ordinance Act; historic botanical studies and maps; and ecological studies by the Plant Ecology Laboratory, or P.E.L., at the University of Wisconsin (Figure 1.6). According to Curtis (1959), Sauk County had a mixture of prairie, southern-hardwood forest, and oak savanna plant communities in the 1840s, shown on the end-paper maps, based primarily on the land surveys. The characteristic plant species represented in the lowland, or floodplain forests are due to the "frequent additions of silt from spring floodwaters… from actual submergence during flood times to nearly xeric conditions during mid-summer low-water stages," (Curtis 1959). Prior to European settlement and

early agricultural practices, the predominant vegetative communities were savanna, floodplain forest, marsh, upland forest, open water, and tamarack swamp, as identified by Konrad Liegel (1982, 15-16) in "The Pre-European Settlement Vegetation of the Aldo Leopold Memorial Reserve," (Tables 1.1, 1.2). Liegel's study identified pre-existing plant communities through the historic traveller and settler accounts, in addition to researching land surveys in Wisconsin from 1845-1851 for each township and range in Wisconsin, overlayed and coded with soil profiles.

Table 1.1: Plant communities in the Reserve. Relative area coverage of the pre-European settlement plant community types in the Aldo Leopold Memorial Reserve, Sauk County, Wisconsin. Adapted from Liegel (1982).

Community		% of Total Land Surface	
Savanna	Oak Opening	(26)	**31**
	Oak Barrens	(5)	
Floodplain Forest	Mixed Floodplain Forest	(23)	**25**
	Wet Floodplain Forest	(2)	
Marsh	Sedge Meadow	(8)	**17**
	Marsh (Emergent Aquatic/ Sedge Meadow)	(5)	
	Low Prairie	(4)	
Upland Forest	Dry Upland Forest	(15)	**16**
	Mixed Hardwood Forest	(1)	
Open Water	Open Water	(10)	**10**
Tamarack Swamp	Tamarack Swamp	(1)	**1**

Table 1.2: Soils and associated plant species. Characteristic species and soil profiles associated with plant community types in the Aldo Leopold Reserve, Sauk County, Wisconsin. Adapted from Liegel (1982) and Curtis (1959).

Plant Community Summary			
Community		**Major Dominants**	**Associated Soil Profile**
Savanna	Oak Opening	*Quercus macrocarpa and Q. alba*	Gotham, Wyocena, McHenry, Briggsville, Billett, and Rimer
	Oak Barrens	*Quercus velutina, Q. ellipsoidalis, Q. rubra*	Plainfield loamy sand and sand
Floodplain Forest	Mixed Floodplain Forest	*Betula nigra, Fraxinus spp., Quercus spp.*	Brems and Alluvial
	Wet Floodplain Forest	*Acer saccharinum, Populus spp., Quercus bicolor, Salix spp., Ulmus spp., Pinus strobus*	Wet Alluvial and Granby
Marsh	Sedge Meadow	*Carex spp., Calamagrostis canadensis, Spartina pectinata, Symphyotrichum lanceolatum, Asclepias incarnata, Eupatorium maculatum*	Adrian, Houghton, and Marshan
	Marsh (Emergent Aquatic/ Sedge Meadow)	*Typha spp., Scirpus spp., Carex spp., Sagittaria spp., Sparganium spp.*	Houghton
	Low Prairie	*Symphyotrichum novae-angliae, Gentiana andrewsii, Hypoxis hirsuta, Liatris pycnostachya, Silphium terebinthinaceum*	Marshan
Upland Forest	Dry Upland Forest	*Quercus velutina, Q. alba, Q. macrocarpa*	Plainfield, Gotham, Wyocena, and Briggsville
	Mixed Hardwood Forest	*Betula nigra, Fraxinus spp., Quercus spp., Larix laricina*	Shiffer
Tamarack Swamp	Tamarack Swamp	*Larix laricina*	N/A

Agricultural Abuse of the Land

The prairie and oak savanna communities that once dominated the landscape declined with the arrival of settlers in Wisconsin (A. Leopold [1949] 1968). Aldo Leopold describes the transition from a fire-dominated ecology to one of fire suppression and agriculture in his "Bur Oak" essay: "In the 1840's a new animal, the settler, intervened in the prairie battle. He didn't mean to, he just plowed enough fields to deprive the prairie of its immemorial ally: fire. Seedling oaks forthwith romped over the grasslands in legions, and what had been the prairie region became a region of woodlot farms."

After the Great Depression in 1929, multiple factors contributed to severe degradation of the landscape and eventual abandonment of the farm on the site that now houses the Reserve. Intensive agricultural use on the land, including a monoculture of row-crops, combined with a drought in the early 1930s created such poor soil conditions that the landowner eventually abandoned the property (Laubach 2014). Aldo Leopold describes the land's previous owner as, "…the bootlegger, who hated this farm, and skinned it of residual fertility, burned its farmhouse, threw it back into the lap of the County (with delinquent taxes to boot), and then disappeared among the landless anonymities of the Great Depression… The reign of the bootlegger ended sometime during the dust-bowl drouths of 1936, 1934, 1933, and 1930," ([1949] 1968). However, the farmer (or "bootlegger" according to Aldo), did leave a positive mark on the landscape - near the Shack are several old apple trees that predate the Leopold family, some of which are still in existence today (C. Leopold 2003, Stevenson 2014). The land would be transformed in the years to come after the arrival of Aldo Leopold and the Leopold family.

The Shack and the Land Ethic

Originally built as a chicken coop on the bootlegger's farm, the Shack was first rented and later purchased by Leopold in 1935 and renovated as a place for the family to stay when they visited their farm (Laubach 2014). Leopold and his family worked to restore the ecological health to the land by planting thousands of pine trees, restoring acres of prairies, conducting prescribed prairie burns, and establishing a garden. The food patch was primarily fed wildlife during the first few years of establishment but later became a landscape for food production, described in detail in oral history interviews with Aldo Leopold's children, Carl (2003), Estella (2011), and Nina (2009).

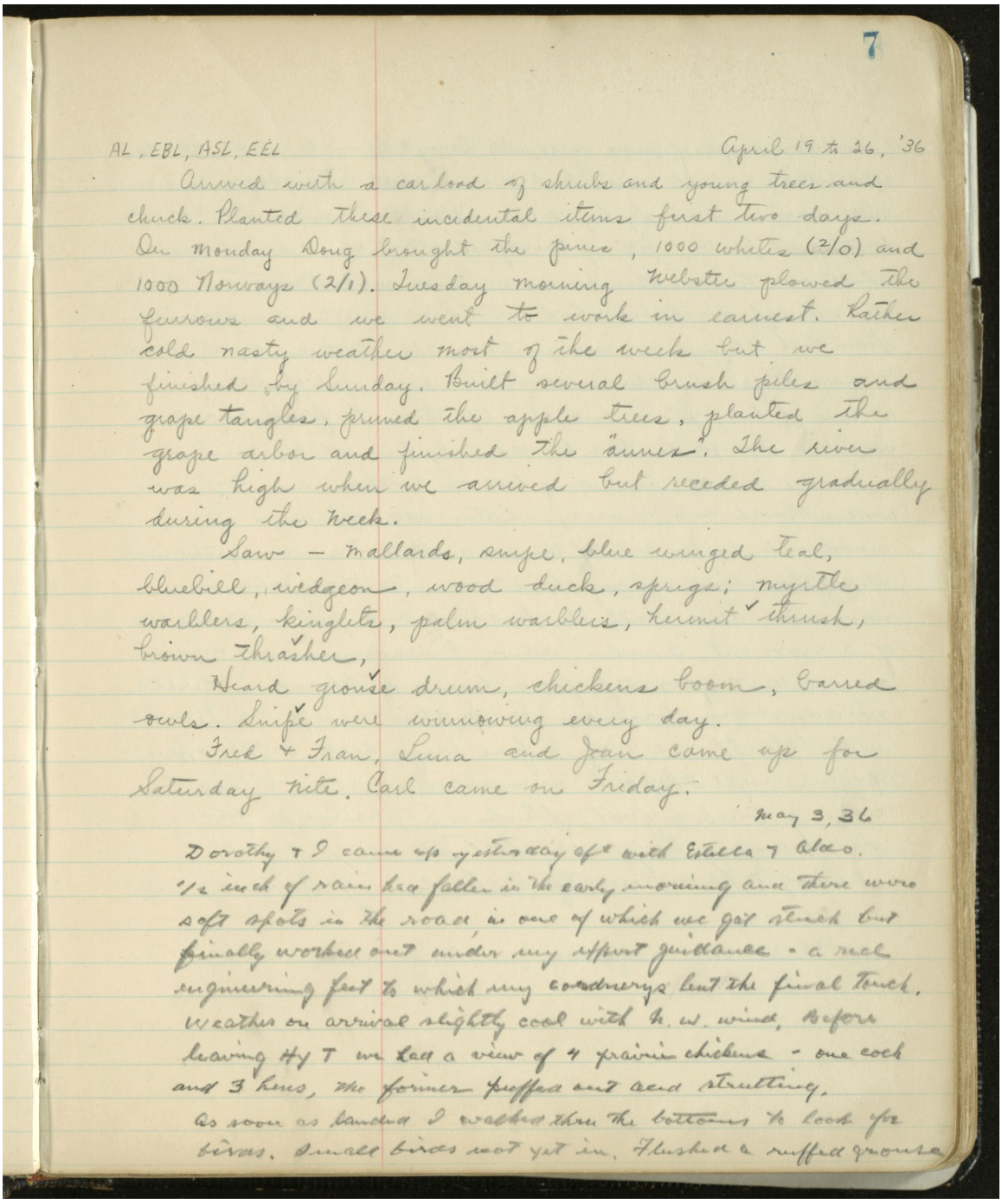
Figure 1.7: Plowing the first food patch at the Shack, 1936. Image courtesy of the Aldo Leopold Foundation and UW Archives. Series 3/1, Box 88, Folder 4, Aldo Leopold Shack; The Aldo Leopold Archives.

The iconic pines, still present today, help define pieces of Aldo's conservation work on the land. The pines dominate the views and frame the prairies Aldo and his family planted. Conservation, according to Aldo Leopold ([1949] 1968), "…is written not with a pen, but with an axe… A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of his land." Pines in Sauk County are not the dominant floristic species in the plant community, and Aldo mentions his preference for pine as, "The only conclusion I have ever reached is that I love all trees, but I am in love with pines." Planting the pines was a challenge and according to Carl Leopold (2003), "the first year when we planted there was a terrible drought in the summer. I think Dad said in his journal that we lost ninety-five percent of the plantings. But whatever it was, it was enormous. Why it didn't deter us, I don't know. But we were out there the next spring, planting pines and hardwoods."

Figure 1.8: Nina Leopold planting pines, circa 1940-1949. Image courtesy of the Aldo Leopold Foundation and UW Archives. Series 3/1, Box 88, Folder 3, Aldo Leopold Shack; The Aldo Leopold Archives.

Figure 1.9: The food patch at the Shack with Aldo and Estella Jr., circa 1940. Image courtesy of the Aldo Leopold Foundation and UW Archives. Series 3/1, Box 88, Folder 2, Aldo Leopold Shack; The Aldo Leopold Archives.

The family also established a food patch in the 1930s. Described by Carl Leopold, "The first garden was on the other side of the shack. That was a big garden that Dad planted for birdseed. There was nothing like tomatoes or anything like that. It was whatever the birds could use. That was very poor, the soil was terrible. The yield was pretty bad. After some time, we put a garden in here and it didn't do very well either. We had a rail fence around it and that didn't keep the deer out of course. Anything that tried to grow was removed by the deer." Yet the success of the food patch was revealed in a series of journals kept by Aldo, making notes of a variety of species including sorghum, millet, potatoes, peas, tomatoes, raspberries and grapes (A. Leopold 1935–48, Figure 1.10). The Leopold family also documented activities, events, and phenology in the journals, containing extensive notes and records from the 1930s and '40s. After Aldo Leopold's death, the family carried on the journal entries, but to a limited extent.



7

AL, EBL, ASL, EEL April 19 to 26, '36

Arrived with a carload of shrubs and young trees and chuck. Planted these incidental items first two days. On Monday Doug brought the pines, 1000 whites (2/0) and 1000 Norways (2/1). Tuesday morning Webster plowed the furrows and we went to work in earnest. Rather cold nasty weather most of the week but we finished by Sunday. Built several brush piles and grape tangles, pruned the apple trees, planted the grape arbor and finished the annex. The river was high when we arrived but receded gradually during the week.

Saw — mallards, snipe, blue winged teal, bluebill, widgeon, wood duck, sprigs; myrtle warblers, kinglets, palm warblers, hermit thrush, brown thrasher,

Heard grouse drum, chickens boom, barred owls. Snipe were winnowing every day.

Fred & Fran, Luna and Joan came up for Saturday nite. Carl came on Friday.

May 3, 36

Dorothy & I came up yesterday a.m. with Estella & Aldo. ½ inch of rain had fallen in the early morning and there were soft spots in the road, in one of which we got stuck but finally worked out under my expert guidance - a real engineering feat to which my coadjutors lent the final touch. Weather on arrival slightly cool with N.W. wind. Before leaving Hy T we had a view of 4 prairie chickens - one cock and 3 hens, the former puffed out and strutting.

As soon as landed I walked down the bottoms to look for birds. Small birds not yet in. Flushed a ruffed grouse

Figure 1.10: Page from the Shack journals, 1935-1948. Image courtesy of the Aldo Leopold Foundation and UW Archives.

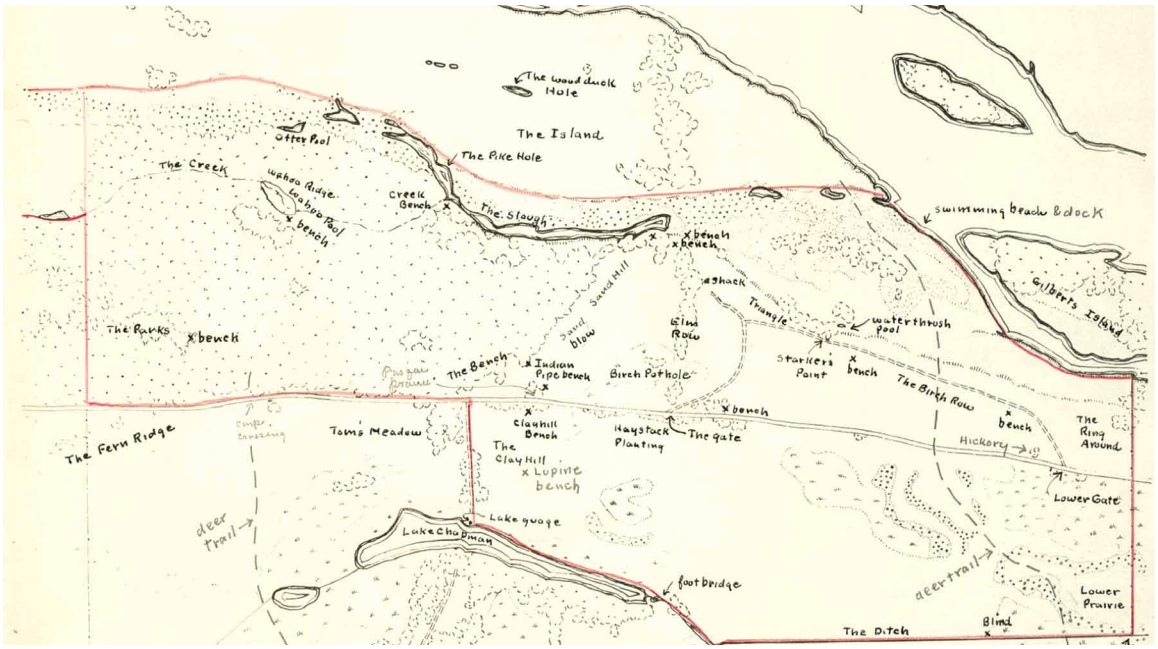


Figure 1.11: Place names map, from a Shack journal circa 1936-1948. Image courtesy of the Aldo Leopold Foundation and UW Archives.

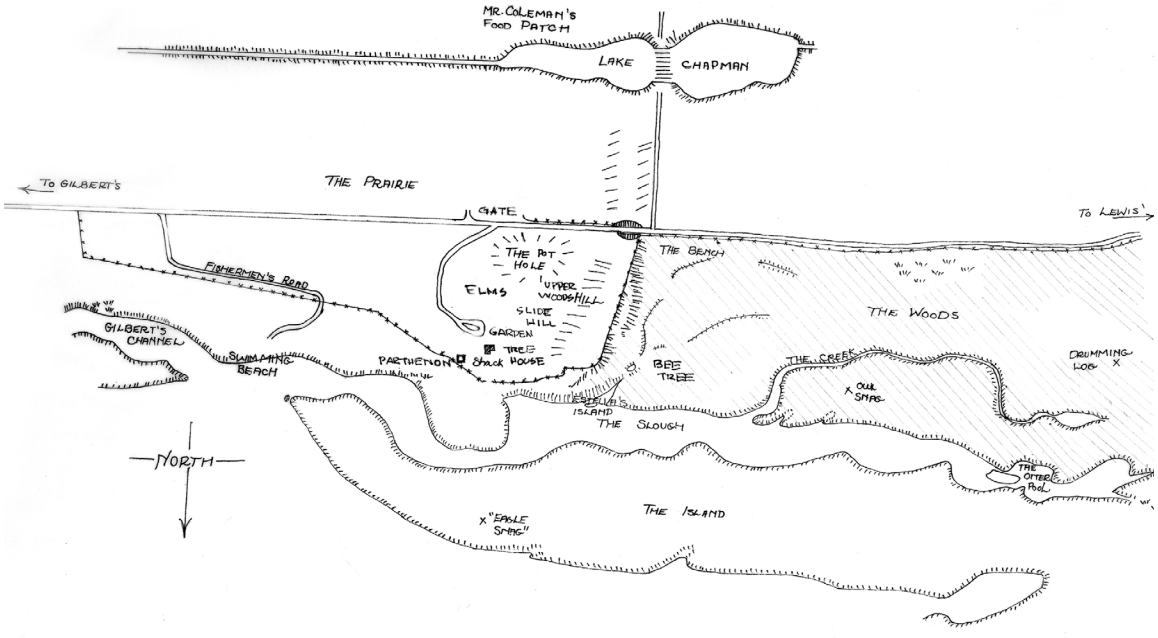


Figure 1.12: Map of the Shack by Carl Leopold (with added locations). Fom a Shack journal circa 1936-1948. Image courtesy of the Aldo Leopold Foundation and UW Archives.

During the ecological restoration activities at The Shack, Aldo began writing *A Sand County Almanac with Sketches Here and There* ([1949] 1968), where he introduced the concept of The Land Ethic. According to Aldo, "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 (perhaps in order that there may be a place to compete for). The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land," (A. Leopold [1949] 1968). Aldo never gave the land ethic a definition, but left it as a concept to be interpreted by future generations. "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. Health of the land is the capacity of the land for self-renewal," (A. Leopold [1949] 1968). According to Nina, "As dad said, you don't learn it all of a sudden; it is an evolution so you start learning about land health and land relationships and to me that has, that is the land ethic," (Leopold Bradley 2009). The interpretation of the land ethic is up to each individual - the relationship people have with the land is based on personal experiences. However the overarching principle according to Aldo Leopold is that "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise," (A. Leopold [1949] 1968).

The future of the land ethic can be interpreted based on the current situation and issues of the day, "evolving in the minds of a 'thinking community,'" (ALF 2006). According to Carl Leopold, the future of the land ethic is, "A transformation. I don't think we will ever outgrow the sense of ethical responsibility to the land. It's so basic to

our whole relationship to the natural world," (C. Leopold 2003). Therefore, the land ethic and values of Aldo Leopold can be applied across generations to continue to do what is right for the land.

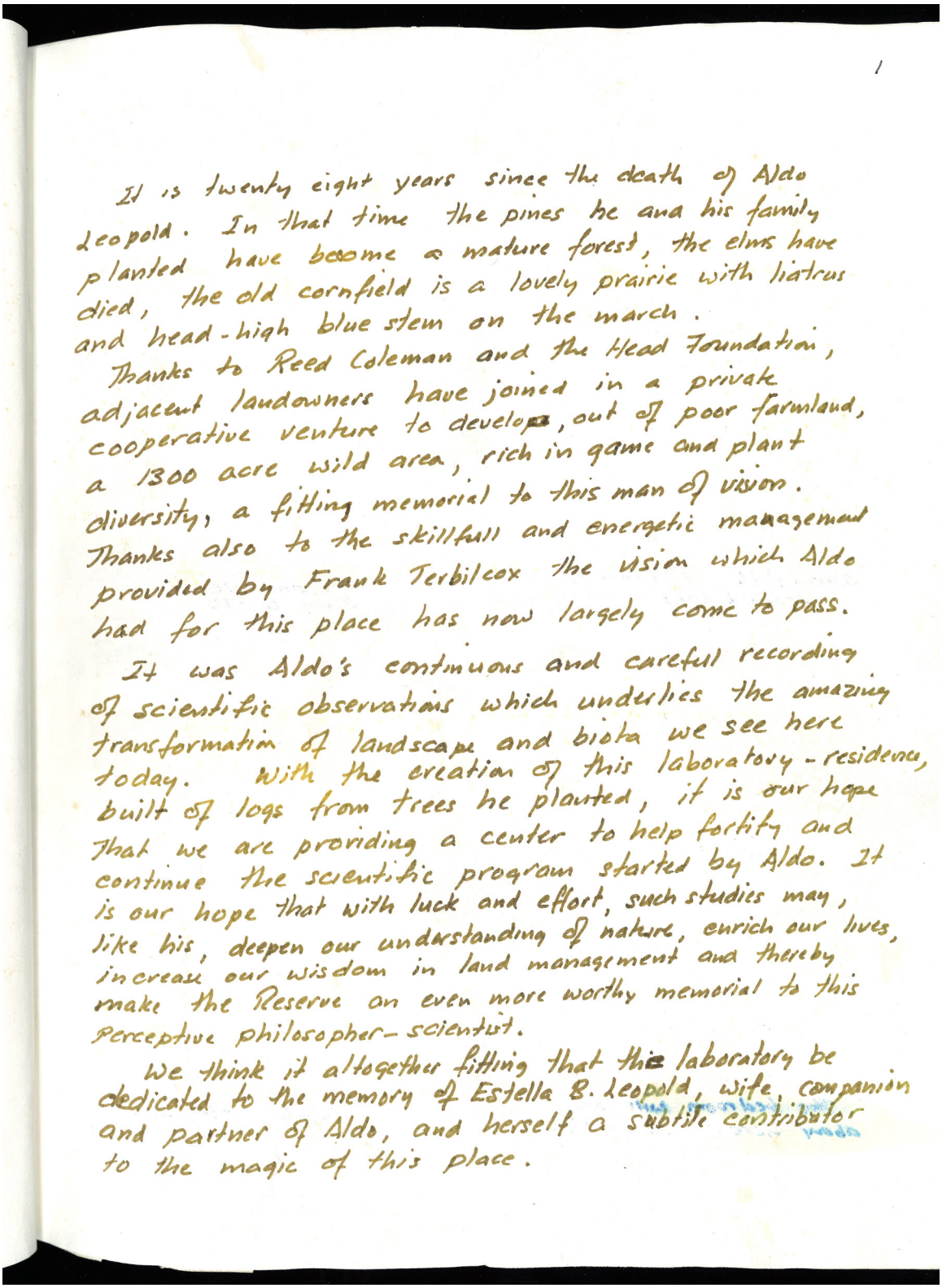
The Bradley Study Center and Nina's Garden

The Leopold Memorial Reserve, a privately owned, 1,600-acre land trust overseen by the Sand County Foundation and ALF, was established in 1967 to protect the land around the Shack from development (Laubach 2014). Charlie Bradley described it in the Bradley Study Center Journals as a "fitting memorial to this man of vision," (Bradley and Leopold Bradley 1976–2009). In 1976, Nina Leopold Bradley and Charlie Bradley returned to the land and built a new home, which also housed the Bradley Study Center. According to Nina, "Charlie Bradley was a geologist and taught at Montana State University and after we were married he said 'I want to retire early enough so we can do a major project.' Well two of his major projects failed so I said to him 'How would you like to retire at the shack'? End of conversation. So we did, so we moved here Charlie and I lived at the shack while we built this house. We cut down a few trees that we had planted to use in the construction… we found this great big open grown white oak, which is out here, which is an indication that this was oak savanna," (Leopold Bradley 2009).

At this time, the Bradleys restarted the process of keeping extensive documentation about the land, which included recording information about Nina's garden. According to Nina, "One of the things that affected my life, I guess, almost the most, was dad's maintaining phenological records, the arrival of birds and the first blooming of plants and all the natural events of the season. And as Dad kept records from '35 to '48, so when Charlie and I moved back we kept records from '76 to the

present… But it just becomes a part of your life, recognizing what plants are in bloom; all of a sudden you know the landscape a lot more intimately," (Leopold Bradley 2009). Charlie Bradley's first journal entry in 1976 begins by writing a tribute to Aldo Leopold and his influence on the land (Figure 1.14). Charlie describes the re-vegetation of native plant species, which helped restore the worn out farm to a functioning ecosystem. Most importantly, Charlie states, "It was Aldo's continuous and careful recording of scientific observations which underlies the amazing transformation of landscape and biota we see here today... It is our hope that with luck and effort, such studies may, like his, deepen our wisdom in land management and thereby make the Reserve an even more memorial to this perceptive philosopher-scientist," (Leopold Bradley 2009).

Figure 1.13: Nina and Charlie, circa 1992-1995. Image courtesy of the Aldo Leopold Foundation and UW Archives. Series 3/1, Box 85, Folder 8, Aldo Leopold (post 1948); The Aldo Leopold Archives.



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It is twenty eight years since the death of Aldo Leopold. In that time the pines he and his family planted have become a mature forest, the elms have died, the old cornfield is a lovely prairie with liatrus and head-high blue stem on the march.

Thanks to Reed Coleman and the Head Foundation, adjacent landowners have joined in a private cooperative venture to develop, out of poor farmland, a 1300 acre wild area, rich in game and plant diversity, a fitting memorial to this man of vision. Thanks also to the skillfull and energetic management provided by Frank Terbilcox the vision which Aldo had for this place has now largely come to pass.

It was Aldo's continuous and careful recording of scientific observations which underlies the amazing transformation of landscape and biota we see here today. With the creation of this laboratory-residence, built of logs from trees he planted, it is our hope that we are providing a center to help fortify and continue the scientific program started by Aldo. It is our hope that with luck and effort, such studies may, like his, deepen our understanding of nature, enrich our lives, increase our wisdom in land management and thereby make the Reserve an even more worthy memorial to this perceptive philosopher-scientist.

We think it altogether fitting that this laboratory be dedicated to the memory of Estella B. Leopold, wife, companion and partner of Aldo, and herself a subtle contributor to the magic of this place.

Figure 1.14: A tribute to Aldo Leopold. Page one of the Bradley Study Center journals, written by Charlie Bradley in 1976.

Figure 1.15: Bird's-eye view of the Bradley Study Center. Airplane shadow is on corner of Nina's garden. From the Bradley Study Center journals, October 7, 1979.

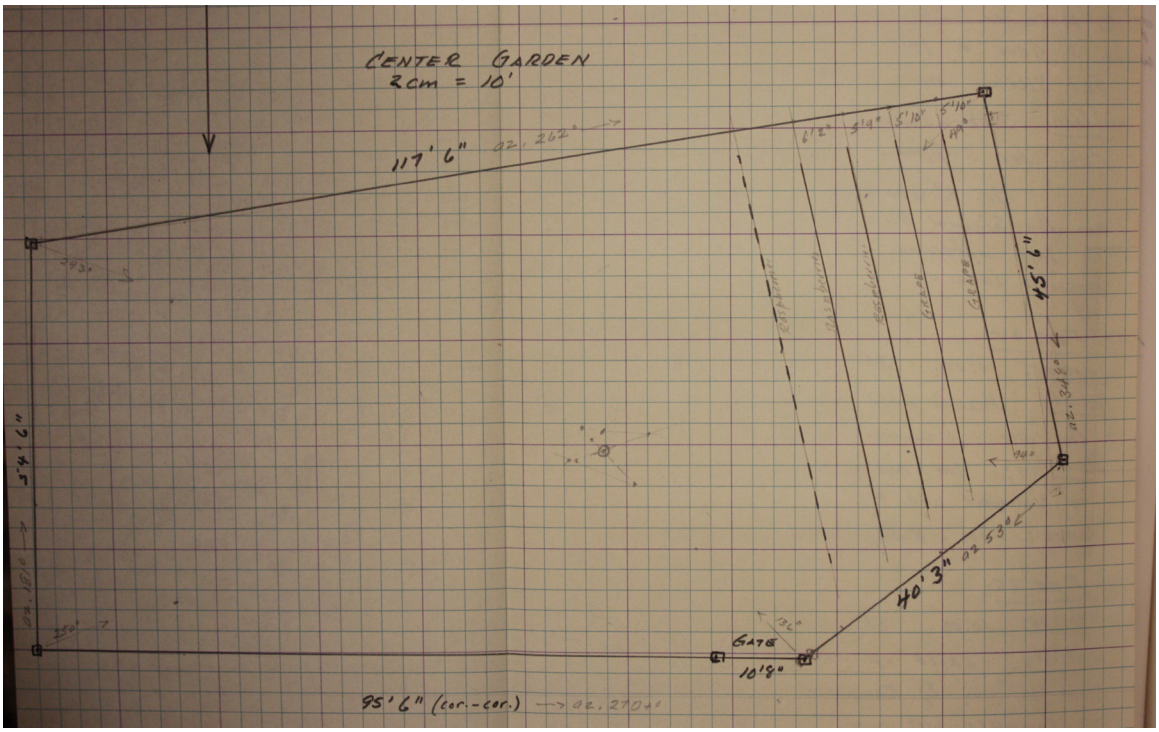


Figure 1.16: Hand-drawn map of Nina's garden. The location of perennials (raspberries and grapes) has been delineated. From the Bradley Study Center journals.

Figure 1.17: Hand-drawn map of the Bradley Study Center. Drawing includes the location the Center and garden (also the route of an otter). From the Bradley Study Center journals, April 6, 1982.

Figure 1.18: Nina in her garden with Charlie Bradley. From the Bradley Study Center journals, May 2001.

Not only did Nina and Charlie construct the eco-friendly house and research lab, but they also established a garden (Figure 1.18). The first garden note begins on July 6, 1976: "Decided to create pond 100 m. SE of [housing] site, use spoil around house, peat and muck for garden plot. Spent afternoon clearing around building site." The early journal entries do not yet mention weather conditions or first blooms, but focus on the activity involved with building the residence, which included soil surveys. "Thurs. Jul 8: w/Frank + Dean Steinhorst of S.C.S. to look at pond site. Soil auger showed water table 75 cm. deep at NW end. 50 cm deep SE end. 100 cm deep at garden site. Water table sits on top of moraine (?) clay. gravel. Top layer is well sorted sand," (Bradley and Leopold Bradley 1976–2009). Nina continued to garden and keep phenological notes throughout the remainder of her life at the Bradley Study Center.

The Aldo Leopold Foundation and LEED

In 1982 Aldo Leopold's children, Starker, Luna, Nina, Carl and Estella, established the Aldo Leopold Foundation (ALF) with a mission "to foster the land ethic through the legacy of Aldo Leopold," (ALF 2006). According to Nina's daughter Trish Stevenson, Starker wanted to give the land ownership to the University of Wisconsin-Madison as a research arboretum; however, the younger family members, including Trish and her cousin Susan, explained the importance of keeping the land (E. Leopold and Stevenson 2011). The foundation operates from the Leopold Legacy Center (the Leopold Center), located approximately one mile down Levee Road from the Shack. ALF, under the direction of Buddy Huffaker, not only manages the Shack property and part of the Leopold Memorial Reserve (the Reserve), but also provides education and outreach programs, including the Land Ethic Leaders program that gives participants a unique view into Aldo's land ethic and environmental values through discussions and activities. As a participant of the Land Ethic Leaders program in 2012, I was able to connect with individuals from across the nation to discuss environmental conservation topics, including the importance of sharing Leopold's commitment to protecting and enhancing the connection between people and nature. Through readings, discussions, and presentations, and outdoor restoration work, the Land Ethic Leaders program helped communicate the importance of Leopold's Land Ethic to a new generation who only know Aldo Leopold through his writing.

ALF continues to promote an "ecological conscience" through education and outreach activities. "As long as we care about people, land, and the connections between them, we have hope for sustainable ecosystems, sustainable economies, and

sustainable communities," (ALF 2006). Another form of outreach includes the Green Fire film. According to Dr. Susan Flader, a board member for ALF and professor emerita at the University of Missouri-Columbia, in an oral history interview in 2011, the film helps connect the Leopoldian legacy to a broader audience. For those who may not have previously heard of Aldo Leopold, the film allows viewers to become inspired to connect with environmental organizations locally to have a more positive impact on their community and environment. Flader states that the film provides an opportunity for people to connect in previously disconnected places, such as "inner cities. And the focus there might be community gardens. It would probably be the theme of food, and local food. And then the connection between the land health and human health is another one of those themes," (2011).

The Leopold Center educates not only through outreach programs, but also by example. The green building technologies implemented in the Leopold Center resulted in becoming certified as Platinum LEED ® (Leadership in Energy and Environmental Design) by the U.S. Green Building Council (USGBC) (ALF 2006). Originally developed in 1995, the ranking system was first implemented in 2000 (Kilbert 2013). The voluntary rating program ranks buildings based on energy performance and environmental impacts, with platinum as the highest obtainable level. Categories for LEED certification include sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation in design, and regional priority and ALF met many of the criteria. Using on-site, sustainable materials, such as the pines, geothermal heating, and a "net zero" energy consumption via solar panels, the Leopold Center earned 61 of 69 possible points in LEED's ranking system (ALF 2006). The Leopold

Center clearly reflects the legacy of Aldo Leopold through the green building initiative, which provides a starting point when considering implementing the land ethic for today; however, the revised LEED v.4 Rating System has only just begun to take into account any types of local food production in the LEED Neighborhood Development (ND) credit and LEED Building Design + Construction (BD+C) Open Space credit, with "a garden space dedicated to community gardens or urban food production," (USGBC 2015).

A Request for Edible Gardens

In 2014 ALF received a private donation to build a new facility under the stipulation of providing an edible landscape for the interns (Huffaker 2014). Currently, without a source of local food production, interns must drive at least 20 minutes to the local grocery store. Having a garden as part of the new intern facility will encourage a deeper connection with the land, which is a value from Aldo Leopold's land ethic. A term for the human connection to nature was coined by E.O. Wilson 1984, who states, "the elements from which a deep conservation ethic might be constructed include the impulses and biased forms of learning loosely classified as biophilia," (Wilson 1984). Carl Leopold (2003) touches on this idea, "As we become more and more urban our families are growing up in more and more isolation. Even getting your food in a basket. You push it around in the store and pick up the packages. That's very different than realizing that the corn that provides you with so much of your meals is a real product of the natural world. It's here, and it's a product of nature that is irreplaceable." Therefore, establishing an edible landscape and garden will not only help increase sustainability on-site by providing a source of local food, but also reestablish a deeper connection with nature.

The study area for this project is a proposed site within the Leopold Reserve located adjacent to the Leopold Center. The proposed site will include a new housing facility for the interns replete with an attached greenhouse and the surrounding landscape will be transformed into an edible landscape (Figure 1.19). The housing facility is designed to fit into the natural contours of the site. The site was selected in an area with lower quality vegetation with a dominant white pine vegetative tree cover. Mature oak trees and high quality prairie south of the site, along with a line of mature white pine trees north of the facility will be preserved from development activities (Huffaker 2014).

In this chapter, the influence of Aldo Leopold at the Shack, the history of the Reserve, the construction of the Bradley Study Center and the creation of the Aldo Leopold Foundation's Leopold Legacy Center have been presented. The next chapter will examine the historic records from 1935-1948 kept by Aldo Leopold at the Shack and records form 1976-2011 kept by Nina Leopold Bradley at the Bradley Study Center. The records will help determine suitable plant species for the edible landscape, along with maintenance strategies for different species.

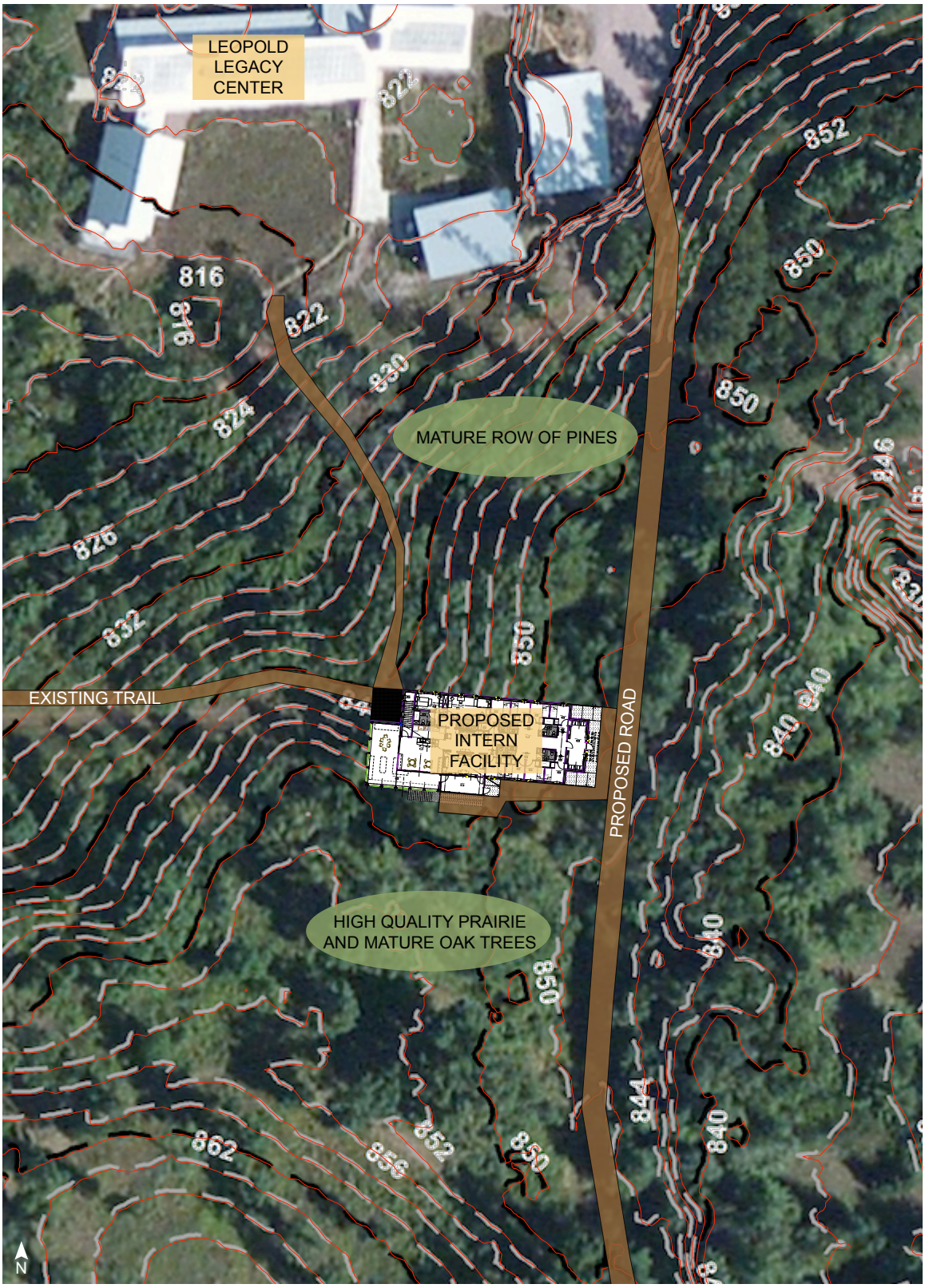


Figure 1.19: Site plan for the proposed intern housing facility. Map created by the Kubala Washatko Architects, Inc., for the Aldo Leopold Foundation, 2015.

CHAPTER 2

THE SHACK AND BRADLEY STUDY CENTER JOURNALS

Designing an edible landscape for the Aldo Leopold Foundation (ALF) requires an understanding of the historic cultivation, maintenance, and management of food production on the Aldo Leopold Memorial Reserve (the Reserve) from 1935 to 2011. Researching the history of garden establishment by the Leopold family at the Shack and the Bradley Study Center provides documentation of cultivated domestic plants. The Shack journals, historic photographs and maps, and oral history transcripts from Aldo Leopold's children document the early establishment of a "food patch" by Aldo Leopold and his family from 1935-1948. In order to provide a planting design and management guidelines for the edible landscape, data collection gathers information on successfully cultivated species within Nina's garden.

Investigating the Shack Journals

The Shack journals contain records of edible species existing prior to the Leopold ownership, along with species planted in the food patch located adjacent to the Shack, and other species planted on the Leopold Reserve. Prior to the Leopold family, the property contained an apple orchard, which was maintained by the family after the land purchase. The Leopold family developed a food patch to grow edible species, as listed in Table 2.1. The journals contain observations that include significant predation from both wildlife and domestic animals, such as the neighbor's cattle who consumed many planted species. The journals also mention frequent replanting due to late frosts. From 1936-

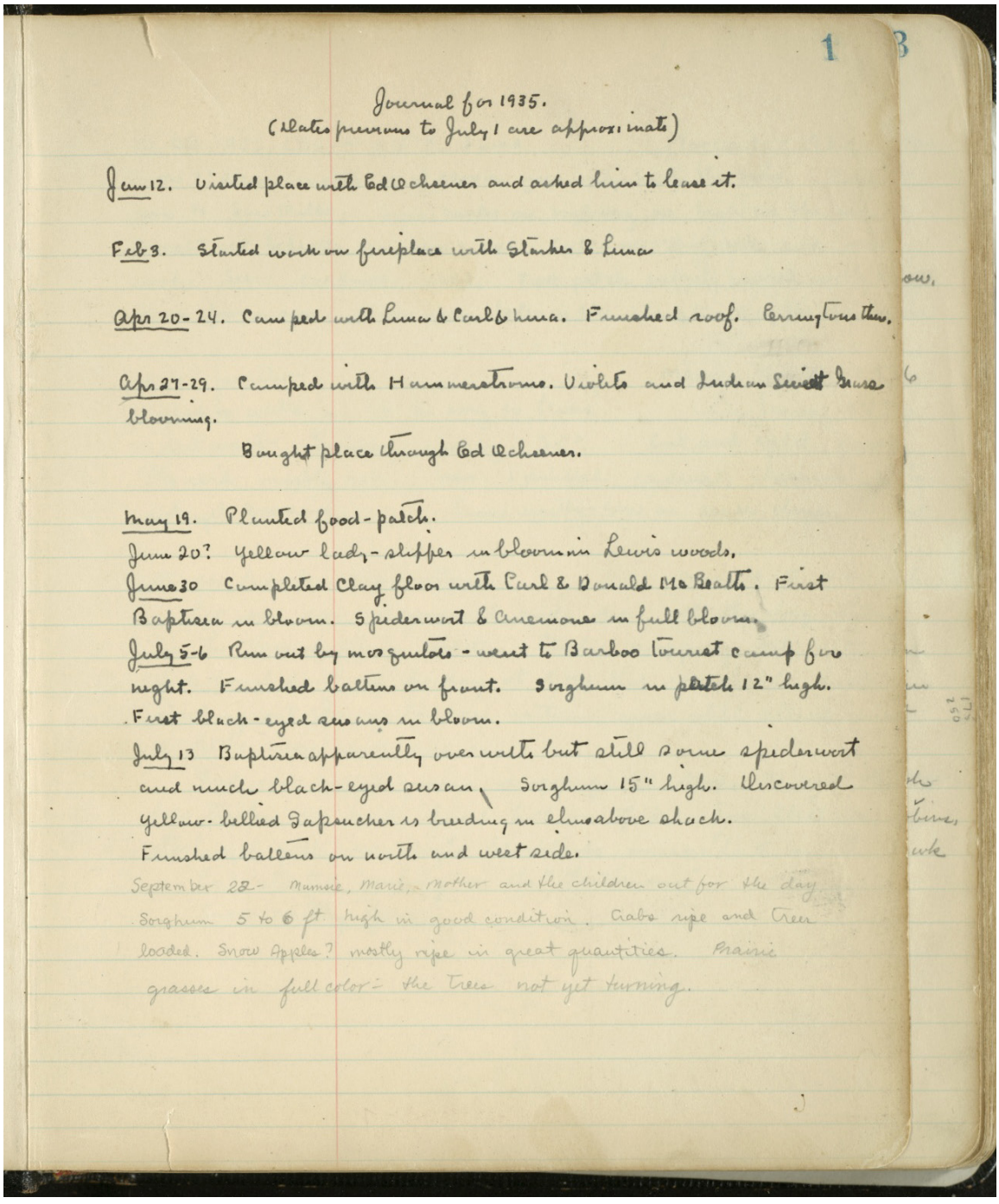
Table 2.1: Edible species recorded in the Shack journals (1935-1948). Locations include the food patch, farm orchard, and Leopold Reserve.

Scientific Name	Common Name	Location Grown
Acer saccharum	Sugar Maple	Leopold Reserve
Amelanchier spp.	Juneberry (Serviceberry)	Leopold Reserve
Cannabis sativa	Hemp	Food Patch
Citrullus lanatus	Watermelon	Food Patch
Corylus spp.	Hazel	Leopold Reserve
Fagopyrum esculentum	Buckwheat	Farm Orchard
Malus domestica	Apple	Farm Orchard
Malus spp.	Crabapples	Leopold Reserve
Pennisetum glaucum	Millet	Food Patch
Pisum sativum	Canada Peas	Food Patch
Prunus domestica	Plum	Leopold Reserve
Rhus spp.	Sumac	Leopold Reserve
Rubus spp.	Blackberry	Leopold Reserve
Rubus spp.	Dewberries	Leopold Reserve
Rubus spp.	Raspberry	Leopold Reserve
Solanum lycopersicum	Tomato	Food Patch
Solanum tuberosum	Potato	Food Patch
Sorghum spp.	Sorghum	Food Patch
Vaccinium macrocarpon	Cranberry	Leopold Reserve
Viburnum lentago	Nannyberry	Leopold Reserve
Vitis spp.	Grape	Food Patch
Zea mays	Corn	Food Patch

1937, the area suffered from drought and without permanent irrigation, several plant species suffered. As a result, the journals identify several management problems, such as permanent drip irrigation, that were later resolved by Nina. Therefore, the edible garden will encourage the usage of several historic plant species from the journals, but encourage maintenance activities that have been updated since the 1930s.

Suggested implementation for historic plants from the garden is based on success of planting, maintenance, and harvesting based on the Shack journals. Species have been organized into three location types. The first is presence in the food patch typified by intensive cultivation of annuals requiring yearly planting, weekly weeding/hoeing, and most severely limited by a lack of irrigation. The second is a presence in the farm orchard requiring moderate cultivation, where most trees were existing from the previous tenant, with some weeding/cutting, yearly pruning, but a significantly longer lifespan for the fruit trees. The third category in the Shack journals is listed as the Leopold Reserve - although this term is anachronistic because the journals predate the reserve establishment by approximately 20+ years, it defines the study area in general. The Leopold Reserve includes primarily native wild edible plants that require very little additional irrigation beyond establishment and primarily consist of trees, shrubs, and vines for nut, berry, and sap production (A. Leopold 1935–48, Figures 2.1, 2.2).

The plants in the food patch contained cultivars of domesticated plants; however, the journals often describe limitations based on the effects of wildlife predation and drought intolerance from a lack of irrigation. Although the food patch did have a fence, it was created from wooden slats that did not preclude deer, stray cattle, and birds, resulting in depredations on the food patch. 1936-1937 had a severe weather drought and without daily irrigation measures, the plants suffered in all three zones, especially in the food patch and a few of the newly planted native species in the reserve. Certain species, such as potatoes and apples, in both the food patch and farm orchard suffered from insect blight and predation. In addition, some of the plants popular in the 1930s and 40s are no longer commonly planted in Wisconsin, including hemp, millet, and sorghum.



Journal for 1935.
(Dates previous to July 1 are approximate)

Jan 12. Visited place with Ed Schoener and asked him to lease it.

Feb 3. Started work on fireplace with Starker & Luna

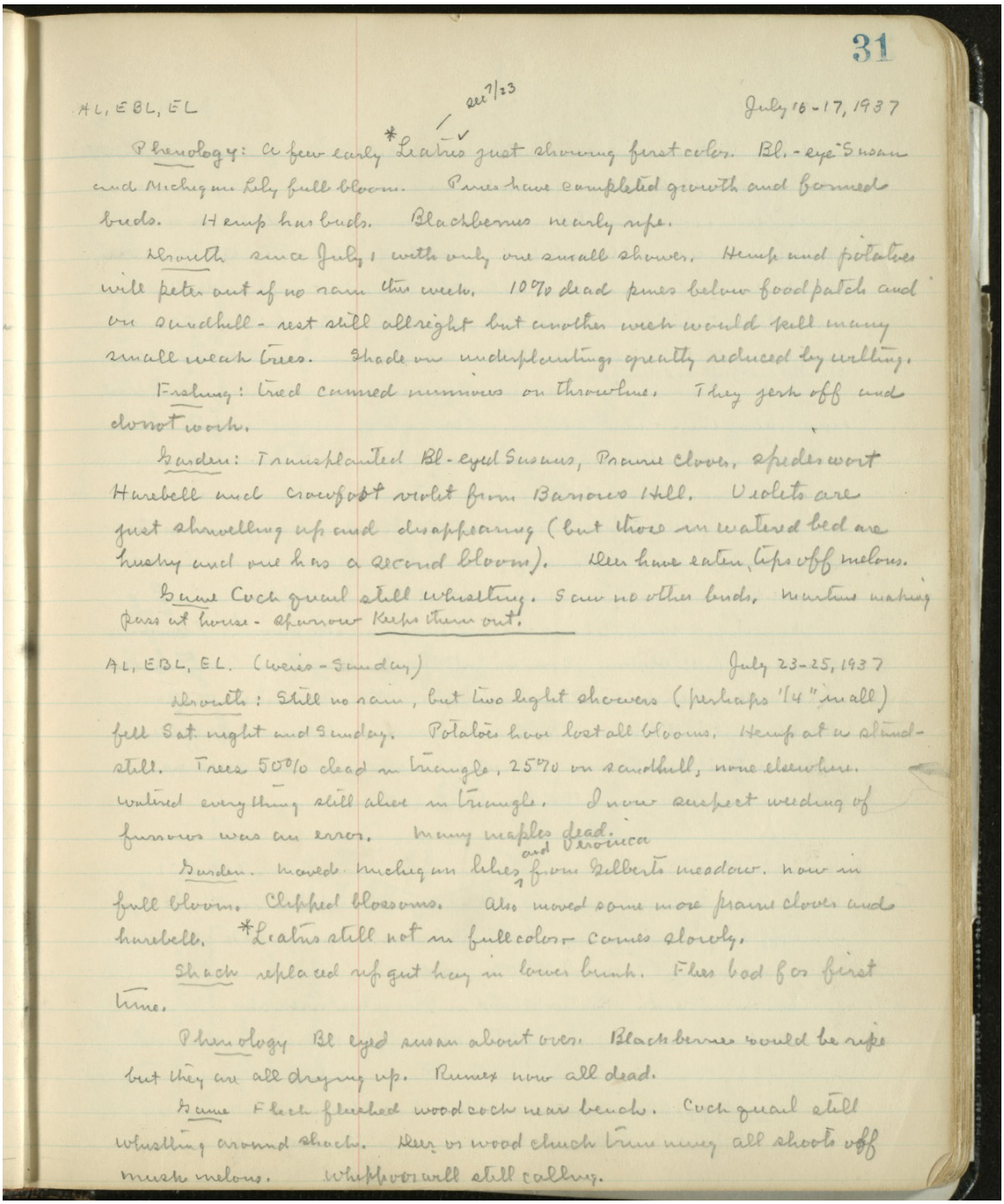
Apr 20-24. Camped with Luna & Carl & Luna. Finished roof. Pennyroyal thru.

Apr 27-29. Camped with Hammerstroms. Violets and Indian Sweet Grass blooming.

Bought place through Ed Schoener.

May 19. Planted food-patch.
June 20? Yellow Lady-slipper in bloom in Lewis woods.
June 30 Completed clay floor with Carl & Donald McBeath. First Baptisia in bloom. Spiderwort & Anemone in full bloom.
July 5-6 Run out by mosquitos - went to Barboo Tourist camp for night. Finished battens on front. Sorghum in patch 12" high. First black-eyed susans in bloom.
July 13 Baptisia apparently over with but still some spiderwort and much black-eyed susan. Sorghum 15" high. Discovered yellow-bellied Sapsucker is breeding in elm above shack. Finished battens on north and west side.
September 22 - Mumsie, Marie, Mother and the children out for the day. Sorghum 5 to 6 ft. high in good condition. Crabs ripe and Trees loaded. Snow Apples? mostly ripe in great quantities. Prairie grasses in full color - the Trees not yet turning.

Figure 2.1: Page from the Shack journals, 1935. Image courtesy of the Aldo Leopold Foundation and UW Archives. The journal page covers several months in 1935 and records planting the food patch on May 19th. Subsequent journal entries track plant growth, including sorghum.



31

AL, EBL, EL

July 16-17, 1937

Phenology: A few early *Liatris just showing first color. Bl.-eye Susan and Michigan Lily full bloom. Pines have completed growth and formed buds. Hemp has buds. Blackberries nearly ripe.

Growth since July 1 with only one small shower. Hemp and potatoes will peter out if no rain this week. 10% dead pines below food patch and on sandhill - rest still allright but another week would kill many small weak trees. Shade on underplantings greatly reduced by wilting.

Fishing: Tried canned minnows on throwlines. They jerk off and do not work.

Garden: Transplanted Bl-eyed Susans, Prairie Clover, spiderwort Harebell and Cranesbill violet from Burrows Hill. Violets are just shriveling up and disappearing (but those in watered bed are husky and one has a second bloom). Deer have eaten tops off melons.

Game Cock quail still whistling. Saw no other birds. Mourning doves at house - sparrow Keeps them out.

AL, EBL, EL. (Weis - Sunday)

July 23-25, 1937

Growth: Still no rain, but two light showers (perhaps 1/4" in all) fell Sat. night and Sunday. Potatoes have lost all blooms. Hemp at m standstill. Trees 50% dead in triangle, 25% on sandhill, none elsewhere. Watered everything still alive in triangle. I now suspect weeding of furrows was an error. Many maples dead. Veronica

Garden. Moved Michigan lilies and from Gilberts meadow. Now in full bloom. Clipped blossoms. Also moved some more prairie clover and harebell. *Liatris still not in full color - comes slowly.

Shack replaced upright hay in lower bunk. Flies bad for first time.

Phenology Bl eyed susan about over. Blackberries would be ripe but they are all drying up. Rumex now all dead.

Game Flock flushed woodcock near beach. Cock quail still whistling around shack. Deer on wood church trail now all shoots off musk melons. Whippoorwill still calling.

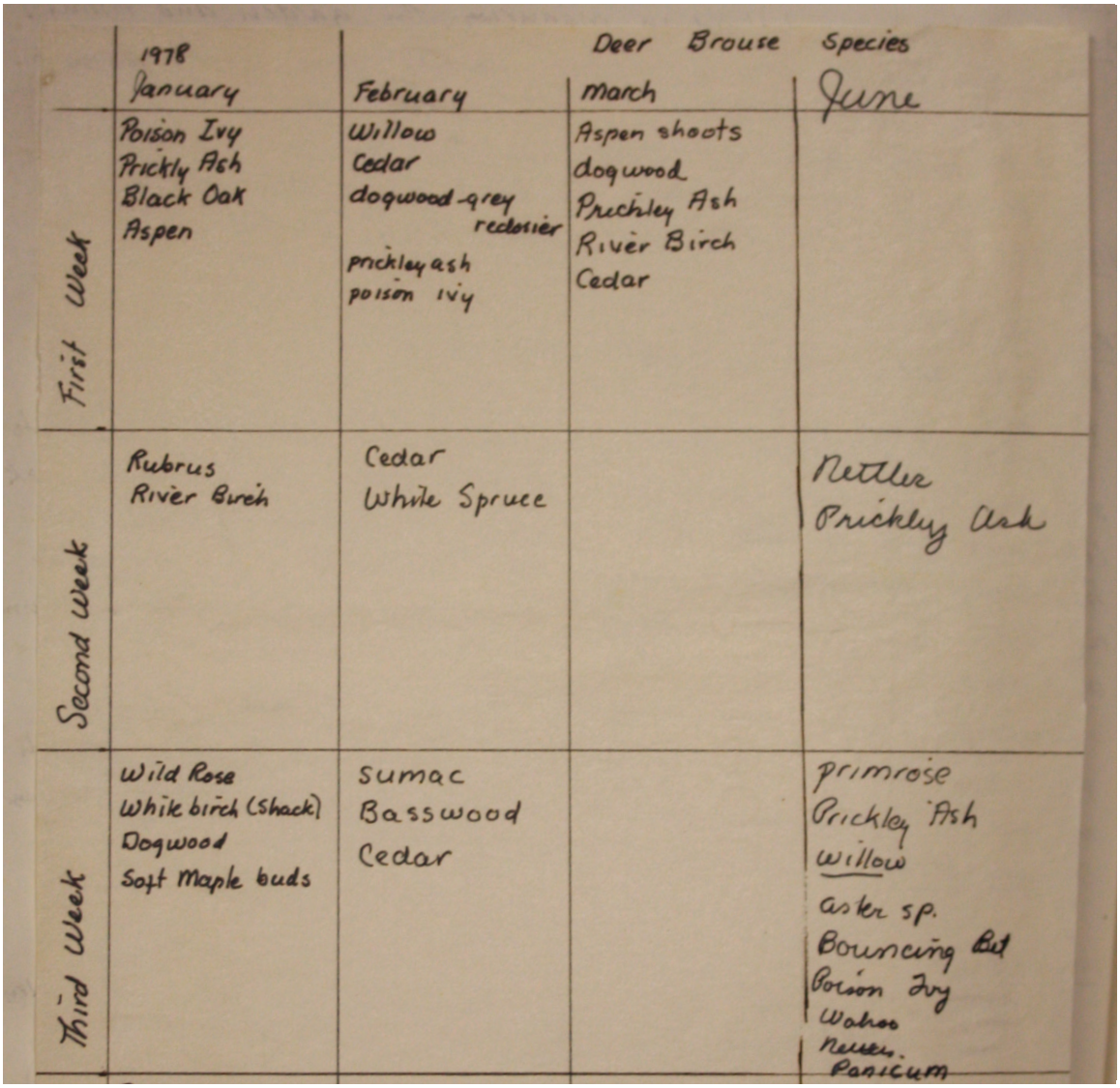
Figure 2.2: Page from the Shack journals, July 1937. Image courtesy of the Aldo Leopold Foundation and UW Archives. The journal entries are from July, 1937, and the journal style begins to record observations with subheadings (phenology, garden, and daily activities). Nina's journal at the Bradley Study Center follows a similar format.

The Bradley Study Center Journals

Although the journals do mention management issues similar to those experienced historically at the Shack, Nina and Charlie adapted the garden to include a stronger fence, soil amendments, permanent drip irrigation, and pest control measures (Figure 2.3). As might be predicted, Nina's garden had a higher success rate and was able to include a diversity of cultivars. Learning from Nina's garden management model, it shows that the food production area will require a fence, soil amendments, and permanent irrigation to sustain the annual and berry producing plants given the sandy soils and potential drought years. Unless the need should arise for such control measures, pest control measures, such as traps and sprays will be documented, but not recommended for interns to use

Figure 2.3: Nina's garden with permanent, deer-proof fencing. Drip irrigation, along with a hose connection, provide water during drought years. From the Bradley Study Center journals, July 1977.

due to some advanced knowledge and potential negative environmental and human health impacts. Any newly proposed cultivars may be added to the species list but will follow the criteria established so the plants will benefit both people and wildlife without exhibiting excessive aggressiveness.



Deer Browse Species

	1978 January	February	March	June
First Week	Poison Ivy Prickly Ash Black Oak Aspen	Willow Cedar dogwood-grey redosier prickley ash poison ivy	Aspen shoots dogwood Prickley Ash River Birch Cedar	
Second Week	Rubrus River Birch	Cedar White Spruce		Nettle Prickly Ash
Third Week	Wild Rose White birch (Shack) Dogwood Soft Maple buds	Sumac Basswood Cedar		primrose Prickley Ash willow aster sp. Bouncing Bet Poison Ivy Wahoo nettles Panicum

Figure 2.4: Record of deer browsing activities. Recorded by Nina and Charlie on the Reserve. Deer tolerant plants and a permanent fence are key elements to successful food production. From the Bradley Study Center journals, 1978.

Nina's garden was documented through the Bradley Study Center journals kept by Nina and Charlie from 1967-2011, photographs, and conversations and personal experience by the author with Nina in 2005. By virtue of the proximity between the study area for the proposed intern facility and Nina's garden, the plants grown in Nina's garden have high probability to be successful since the soils classes and climatic conditions are similar. Furthermore, the long-term nature of Nina's journals provide insight into those plant species that demonstrate plasticity to changing weather patterns, as shown by the earlier phenologic dates of spring blooming periods and migratory bird patterns gleaned from Nina's personal research (Bradley, Leopold, Ross, and Huffaker 1999).

Figure 2.5: The Bradley Study Center journals. The journals are currently housed at the Aldo Leopold Foundation. Photograph by author, December 2014.

The intended use of the design and guidelines is to provide a phased plan for establishing and maintaining edible landscaping and permanent vegetable gardens for the interns at the Aldo Leopold Foundation. Due to the variable backgrounds and temporary nature of those interning with ALF, plant knowledge and gardening skills will vary. ALF desires interns who have an interest in gardening and sustainable agriculture, however, previous experience is not a requirement. This study will use Nina's records on seasonality of various fruits and vegetables to create a learning tool in the form of management guidelines (referred to as an "owner's manual") which the interns can follow for many aspects of gardening from planting through harvest. The owner's manual will include a seasonal harvesting plan for the cultivars within the garden, based on Nina's observations and records.

This thesis examines primary reference material to inform the design of a vegetable garden located at the intern building study site. Garden species and management activities are documented using the Bradley Study Center Journals from 1976-2011 (Bradley and Leopold Bradley 1976–2009). Nina Leopold Bradley previously referenced the journals in the Proceedings of the National Academy of Sciences (PNAS), "Phenological changes reflect climate change in Wisconsin," (Bradley, Leopold, Ross, and Huffaker 1999) and PLOS ONE, "Record-Breaking Early Flowering in the Eastern United States," (Ellwood, Temple, Primack, Bradley, and Davis 2013). The first article uses the Shack journals and the Bradley Study Center journals to document a 61-year span of phenological events, or "the study of the cycling of biological events throughout the year," (Bradley, Leopold, Ross, and Huffaker 1999). The events include spring arrival times for migratory birds and first bloom dates for native plants in Wisconsin,

and some reflect the climatic warming events and an earliness for plants dependent on local temperatures (Bradley, Leopold, Ross, and Huffaker 1999). During the 61-year study through 2012, the mean flowering date shifted from May 7th, according to Aldo Leopold's records from 1935-1945, to a mean flowering date of May 1st during 2002-2012 (Ellwood, Temple, Primack, Bradley, and Davis 2013). 2012 was a record-breaking year with the earliest recorded mean flowering date of April 13 (Ellwood, Temple, Primack, Bradley, and Davis 2013). The data from Nina's research can be corroborated by the updated plant hardiness zone maps produced by the USDA in 2012. The 2012 map now depicts Sauk County falling into a range of zones 4b, 5a and 5b (USDA, NRCS 2015). Plant hardiness zones are defined by the minimum temperature based on data from 1976-2005, while the previous 1990 version of the map was based on temperature recordings from 1974-1986 (USDA, NRCS 2015).

Using Nina's data, this study will chart the daily maximum and minimum temperatures recorded using a minimum/maximum thermometer installed at the Bradley Study Center in 1977, along with daily garden activities recorded from Nina's garden. This study will stratify the data into 5-year increments: 1976, 1981, 1986, 1991, 1996, 2001, and 2006. The aforementioned years will be monitored from April to October to include the typical frost free period for the area, which provide optimal planting conditions for garden cultivation. Frost free days in the study area are defined as April 10 through May 16 as the last spring killing frost and September 27 through October 3 as the first fall killing frost according to the UW-Extension Cooperative Extension (UW-Extension Cooperative Extension 2015).

Using the data collected, the plant species have been charted showing seasonal management requirements related to seasonal temperatures to provide management recommendations (Appendix D). The categories for seasonal management of a specific species include planting, pruning, fertilizing, irrigating, weeding, first blooming date, controlling pests, harvesting, processing, and bed cleaning. General garden maintenance was also listed in the journals as activities including, "in garden," "mowing garden paths," or "weeding garden" but did not have a specific associated species. Therefore, these tasks were not charted with individual species, but considered general maintenance. However, irrigation was charted with each species since the irrigation process used within the garden was a drip-line irrigation system that included most garden beds. Each term has been defined below to incorporate the various activities pertaining to the category.

Defining Terms from the Bradley Study Center Journals

The following terms have been defined to create a seasonal management plan for the garden design based on Nina's journals (Bradley and Leopold Bradley 1976–2009).

Planting: Activities associated with direct seeding or sowing, planting plugs of plants started in the greenhouse or cold frame, or vegetative propagation by such means as separating bulbs and replanting as separate specimens thusly described in the Bradley Study Center journals. While many of the plants were directly seeded or grown in Nina's greenhouse, additional plantings came from Nina's daughter, Trish Stevenson, in Black Earth, Wisconsin. Nina refers to picking up plants from Black Earth in the journals.

Pruning: Primarily associated with grapes, raspberries, and fruit trees, this activity includes the removal of woody plant materials. Pruning is essential for plant health, which removes dead or weaker limbs to encourage stronger or newer growth. For

raspberries are a species which display biennial growth patterns. New canes require a growing season and will produce fruit the following year. By removing weaker or dead canes, the plant will focus energy production into fruit production on healthy canes.

Fertilizing: Refers to the act of spreading compost or chicken and/or cow manure on the garden. This addition helps increase nutrients in the soil, which are essential to plant growth. Fertilizer also helps amend the soil after each growing season, when garden plants remove certain nutrients from the soil.

Irrigating: The addition of water from the drip-irrigation system on site. The drip-irrigation system included black plastic pipes that connected to a control knob that could be turned on and off. Drip-irrigation controls the flow of water to the plants and allows a slower flow over a longer period of time and directs water to specific locations as a water-saving method. Irrigation is referenced in the journals and often mentions time intervals for turning on the drip-irrigation system, such as 2-4 hour increments, depending on the season and weather patterns.

Weeding: The activity of removing unwanted plant grow from garden beds. This can include weedy plant species that take advantage of newly disturbed garden soil and will directly compete with the cultivar for sunlight, soil nutrients, water, and additional resources. Weeds, once removed from the soil, can be added to compost piles as garden waste. As the weeds decompose, the nutrients are transformed into a usable form and can be added back to the garden.

First Blooming Date: This describes the record kept in Nina's journals for the first observed date when a plant species flowers. First bloom times were recorded as a sign of phenology, or seasonal occurrences, because plant bloom times are either temperature-

dependent or day-length dependent. For temperature-dependent species, tracking the first bloom time over a series of years can reveal a correlation to climate variation and change, as shown in Nina's research.

Controlling Pests: Primarily related to berry species, this term refers to deterring predation, such as covering blueberry plants with netting as a barrier for birds. Other pest control measures include trapping moles that dig through garden beds and disturb plant growth. Prior to installing a fence around the garden, it suffered from deer browse; however, the fence worked to ameliorate this issue.

Harvesting: Activities associated with picking, collecting, or harvesting fruits or edible portions of plant products as described in The Bradley Study Center journals (Figure 2.6). Harvesting records were often associated with quantities of fruit collected, such as 1 qt.

Figure 2.6: A tomato harvest from Nina's garden. From the Bradley Study Center journals, August 1978.

of raspberries. The quantities help reveal productive plants within the garden, or may relate unfavorable growing conditions if a limited harvest occurs in a season, such as a decrease in melons due to blight as mentioned in the Bradley Study Center journals.

Processing: Activities associated with cooking, canning, pickling, stewing, or altering the plant produce from a raw state (Figure 2.7). This may also be humorously referred to as "domestic activities" in the journals by Charlie Bradley. Species that were frequently associated with processing included cucumbers for pickling, eggplant cooked into eggplant parmesan and frozen for later use, and cabbage for sauerkraut, to name a few.

Bed Cleaning: The activity of removing plant waste from the raised bed after the growing season is over. This can include the removal of cultivars that are non-edible, such as stems and leaves after the last fruit has been harvested, in addition to removing weeds.

Figure 2.7: Processing grapes from Nina's arbor. From the Bradley Study Center journals, September.

Limitations and Delimitations

This study selectively reviews data stratified into five-year increments during the period from April to October, which encompasses the optimal growing season for vegetation in Sauk County, Wisconsin based on the frost free days. November through March typically are at risk of temperatures below 32 degrees, which are unsuitable for growing annuals. Outdoor garden care and maintenance is limited. During months vulnerable to frost, most garden activities are focused indoors in greenhouses or outdoors in cold frames, and are not specifically studied in this thesis.

The cultivated species recorded in the Bradley Study Center journals are more subject to natural and anthropogenic influences than the native wild species. Cultivated plants within the garden, especially annuals, or plants that complete a lifecycle in one season, were intentionally planted in the garden by people (i.e. did not occur naturally). Therefore, the planting times could vary based on several factors beyond natural climatic events. The Bradley Study Center journals document many daily activities and reveal that Nina and Charlie were very active in presenting papers and lecturing at the Shack and at universities nationwide (Bradley and Leopold Bradley 1976–2009). These cultural events, along with poor weather conditions, illness, and other activities, may have influenced the planting days by a margin, resulting in different flowering and fruiting times for plant species from year to year. Thus, the recorded dates may have a limited accuracy when compared to natural climatic events and seasonal changes and may not always correlate as strongly to temperature changes as the wild prairie plants examined in Nina's research (Bradley, Leopold, Ross, and Huffaker 1999).

Observations also vary based on the available technology and management within the Bradley Study Center. For example, the minimum/maximum thermometer was not installed until 1977; therefore 1976 contains qualitative observations about weather patterns but no specific quantitative data measurements. Therefore, the charts do not graphically display 1976, but instead focus on 1981, 1986, 1991, 1996, 2001 and 2006. Selected plant and temperature graphics include only species that were recorded in all of the previous years mentioned.

Journal Notes and Graphics

The maximum and minimum temperatures for 1981, 1986, 1991, 1996, 2001 and 2006 have been recorded and graphed in Figure 2.8. The white dashed lines on the graphs indicate the average maximum and minimum temperatures among all six years. The first and last frost dates are shown relating to the average frost dates from the six years previously mentioned. Frost dates were determined from recorded temperatures and/or journal notes. For example, in 1981, the journals recorded the temperate at 2°C, which is above the freezing point. However, the journal notes state, "Although the porch thermometer did not register frost, two tomato plants whose covers blew off were completely frosted," (Bradley and Leopold Bradley 1976–2009). The average last frost date prior to the growing season is May 1st and first frost date after the growing season is October 3rd (Bradley and Leopold Bradley 1976–2009).

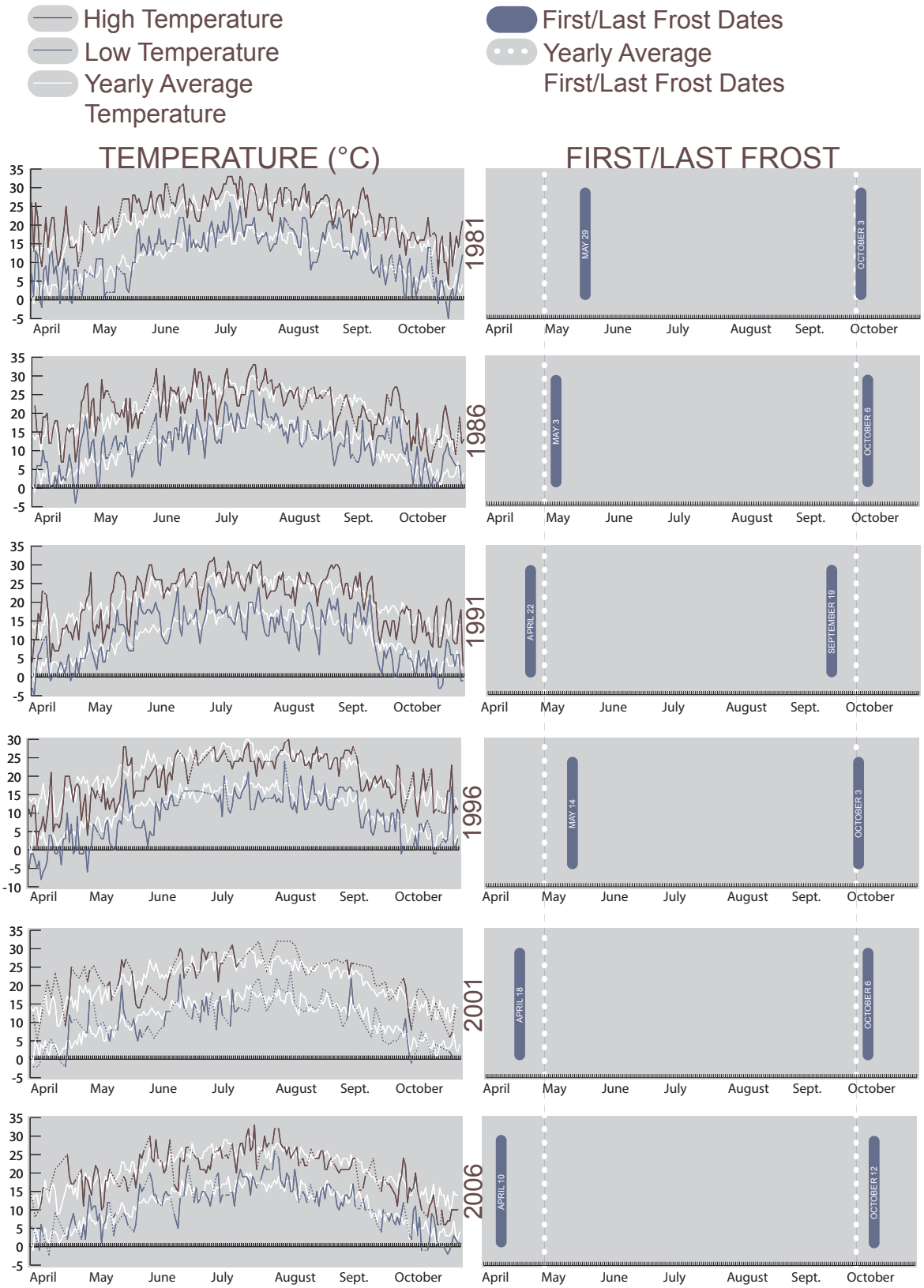


Figure 2.8: First and last frost dates from 1981-2006. Graphic by author.

General garden activities have been recorded for 1981, 1986, 1991, 1996, 2001 and 2006 from Nina's journals (Figure 2.9). The years show similar activity trends, including the dominant activities of pruning the caneberry and grape species in early April, planting annual species from April through June, mulching potatoes from May to June, harvesting from June through October, processing from late July through September, and cleaning the garden at the end of the growing season in October (Bradley and Leopold Bradley 1976–2009). Species specific visualizations (Appendix D) reveal patterns of garden species that are more dominant during a specific time of year. Asparagus represents one of the earliest crops to be harvested, while potatoes are the last crop and harvested after the last frost based on Nina's journals (Bradley and Leopold Bradley 1976–2009).

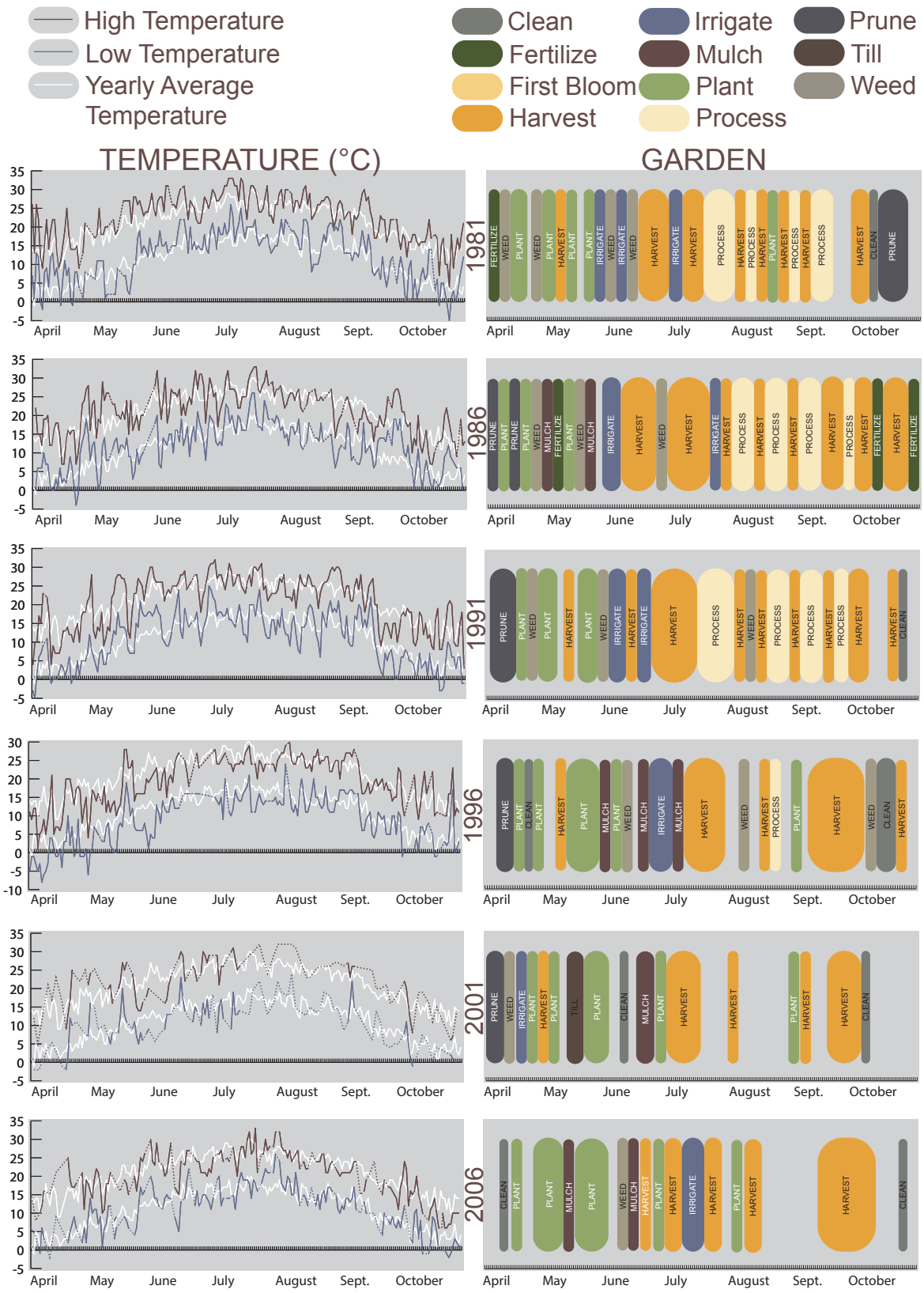


Figure 2.9: General garden activities visualization. Graphic by author.

While the visualizations show certain annual trends, they also reveal changes in observation and record-keeping over a longer time-frame. For example, processing is a dominant part of the garden activities in 1981, 1986, and 1991. However, by 1996, only one record of processing is present and is no longer recorded after 1996. This correlates to Charlie Bradley as the primary note-taker in the earlier journals, who focuses on processing activities including making kraut, pickles, and hot sauces (Bradley and Leopold Bradley 1976–2009). The 1992 journal begins, "Changing of the Guard - NLB takes over from C.C.B." referring to Nina as the primary note-taker after 1992 with additional observations from visitors, interns, and family members (Bradley and Leopold Bradley 1976–2009). In the later journals, Nina focuses more on the planting, weeding and harvesting activities (Bradley and Leopold Bradley 1976–2009).

This chapter documented the occurrence of species and associated management activities by the Leopold family at the Shack from 1935 to 1948 and by Nina Leopold Bradley and Charlie Bradley at the Bradley Study Center from 1976 through 2009. The species from Nina's garden have been presented graphically compared to seasonal temperatures to show garden management activities for specific species and the garden in general. The records will help guide the creation of an edible landscape plan presented in Chapter 3. The next chapter will recognize the need for sustainable landscape development. Goals, strategies, and objective for the edible landscape will be adapted from *SITES v2 Reference Guide* (SITES™ 2014), the *Sustainable Sites Handbook* (Calkins 2012) and *Designing the Sustainable Site* (Venhaus 2012).

CHAPTER 3

USING THE PAST TO GUIDE THE FUTURE

When designing an edible landscape for the Aldo Leopold Foundation (ALF) interns, it is necessary to consider the Leopoldian philosophy of sustainability. According to Aldo Leopold, "we abuse the land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect," (A. Leopold [1949] 1968). Nina's philosophy of sustainable landscapes reflects an understanding of the connection between people and nature where the land provides a habitat for multi-generational use, versus the disconnect of people and place like the sterile environment of the supermarket. Environmental historian William Cronon (1996) follows Aldo Leopold and Nina Leopold Bradley's environmental philosophy to describe the disconnect of removing humans from nature. Cronon (1996) writes about "urban folk for whom food comes from a supermarket or a restaurant instead of a field, and for whom the wooden houses in which they live and work apparently have no meaningful connection to the forests in which trees grow and die." Written almost 50 years apart, both Cronon and Leopold convey similar thoughts about the dangers of disconnecting from the land.

Aldo Leopold's *A Sand County Almanac*, now considered a "classic in environmental literature," according to Leopold historian Curt Meine, was "at the cutting edge of conservation activity and environmental thought," (Meine and Berry 2010). Leopold's environmental philosophy and land management practices extended

beyond the Shack. Aldo Leopold was a pioneer of environmental conservation, which established concepts that evolved into the idea of sustainability. Leopold valued the idea of preservation for future generations and supported land conservation as a strategy to connect people and nature. Working in the Southwest, he was a pioneer in establishing the first designated Wilderness Area surrounding the headwaters of the Gila River in New Mexico (Meine and Berry 2010). Leopold's idea of a wilderness area benefited both nature and people through "some logical reconciliation between getting back to nature and preserving a little nature to get back to," (Leopold 1921). After returning to Wisconsin, Leopold established the Department of Wildlife Management at the University of Wisconsin to educate students about conservation and land management practices (Meine and Berry 2010). Educating the next generation to increase environmental awareness was essential to Leopold, which he did through writing, teaching, and in practice, which laid the foundations for a modern environmental movement in the 1960s and led to the definition of sustainability in the 1980s.

Recognizing sustainable development as a framework to meet human needs without compromising the environment is a key element to design, construction and maintenance of landscapes. Sustainable development was first defined by the United Nations (United Nations 1987) in the Brundtland Report to "meet the needs of the present without compromising the ability of future generations to meet their own needs." Before this, the modern environmental movement in the United States was brought into the public realm in 1962 with the publication of Rachel Carson's *Silent Spring*, which addressed the relationship of people and nature and the growing threats of unregulated

environmental damage (Kline 2007). As the modern environmental movement became mainstream, new government legislation followed (Table 3.1 adapted from Kline 2007).

Other significant events included the publication of Ian McHarg's *Design with Nature* in 1967, which introduced the concept of creating composite suitability maps to plan for the place of humans in nature. Through the evaluation and analysis of the suitability overlays, McHarg developed the ideas that "development is inevitable and must be accommodated" by mapping and working with "physiographic principles for conservation and development" based on "optimum land use," (McHarg 1969). In 1970, the First Earth Day, championed by Senator Gaylord Nelson of Wisconsin, "demonstrated the popularity of environmental issues among the general public," (Kline 2007).

Table 3.1: Major environmental federal legislation from 1960 - 1980. Descriptions of federal acts during the modern environmental movement. Adapted from Kline (2007).

Federal Legislation (1960s-1980s)	Date	Description
Clean Air Act	1963	Appropriated funds for a federal attack on air pollution
Wilderness Act	1964	Established the National Wilderness Preservation System to designate sections of forests as protected wilderness areas
National Environmental Policy Act	1970	Required environmental-impact statements for federally funded construction projects and established the Environmental Protection Agency (EPA) to enforce new statues
Clean Water Act	1972	Regulated the release of pollutants into waterways, storm sewers, and reservoirs while mandating steps to restore polluted waters for recreational use
Endangered Species Act	1973	Allowed species to be listed as threatened or endangered without considering the economic consequences of those decisions… and develop and carry out plans for their recovery
Resource Conservation and Recovery Act	1976	Regulated the disposal and treatment of solid and hazardous waste from "cradle to grave"

Since the publication of the Brundtland Report, many of the leaders in environmental conservation, preservation, and sustainable development, have been influenced by Aldo Leopold and used his knowledge as a platform on which to build current research. Nina and Charlie encouraged the communication and interactions of many leading scientists, researchers, and designers through seminars at the Shack. Landscape architect and professor Darrell Morrison gave a lecture in 1981 describing the rehabilitation of the land through the evolution of the profession to include a native plant palette (Bradley and Leopold Bradley 1976–2009). Although revolutionary at the time for landscape architects, Aldo Leopold had promoted and tests the ideas of native plant for land rehabilitation in the 1930s. Yet, professionals like Morrison need to help promote Leopold's land ethic to increase environmental awareness and sustainability.

The ideas of sustainability have continued to evolve in professions outside conservation, ecology, and landscape architecture to include fitting buildings into the natural environment. Green building and alternative design solutions have been enacted through voluntary building assessment rating systems, such as LEED (Leadership in Energy and Environmental Design) in 2000. In 2002, William McDonough and Michael Braungart introduced the concept of "cradle-to-cradle" where "waste equals food" versus the "cradle-to-grave" model in which "modern industries still operate according to paradigms that developed when humans had a very different sense of the world. Neither the health of natural systems, nor an awareness of their delicacy, complexity, and interconnectedness, have been part of the industrial design agenda... it is focused on making a product and getting it to a customer quickly and cheaply without considering much else," (McDonough and Braungart 2002). Tracking the nutrient flows of a system

is important for a healthy, functioning landscape, especially connecting the systems at a local level. Local sustainability "opens the doors to profitable local enterprise. It also avoids the problem of bioinvasion, when transfer of materials from one region to another inadvertently introduces invasive nonnative species to fragile ecosystems," (McDonough and Braungart 2002).

Currently, one of the leading landscape design rating systems is the Sustainable Sites Initiative (SITES™) initially developed as a pilot project in 2006 and introduced as the SITES v2 Rating System in 2014 (SITES™ 2014). Based on the definition of sustainable development from the Brundtland Report, sustainable design is "design, construction, operations and maintenance practices that meet the needs of the present without compromising the ability of future generations to meet their own needs," (Calkins 2012). According to the *SITES v2 Reference Guide*, "a systematic comprehensive set of guidelines and a rating system is needed to define sustainable sites, measure their performance, and ultimately elevate the value of landscapes," (SITES™ 2014). Using the *SITES v2 Reference Guide*, along with the *Sustainable Sites Handbook* (Calkins 2012) and *Designing the Sustainable Site* (Venhaus 2012), the goals, objectives (performance targets), and strategies (means to achieve objectives) for the edible landscape will be examined.

Sustainable Site Design Goals

One of the goals of the edible landscape is to promote sustainability on-site while acknowledging the need for plasticity and resilience. The landscape faces changes on many levels: climate change has been documented through Nina's studies at the Bradley Center showing a relationship of phenology with warming temperatures

(Bradley, Leopold, Ross, and Huffaker 1999). The ecosystems are composed of dynamic, interconnected parts of the natural environment. Plants grow based on the availability of nutrients, water, and sunlight. The Leopold Reserve (the Reserve) has challenges with invasive species including garlic mustard, which has origins as a garden escapee. Plant selection must be rigid when dealing with aggressive and invasive species to prevent further management problems outside the garden. At a more ephemeral level, the turnover of interns results in a wide array of knowledge levels, experience in garden maintenance and personal preferences for edible species. Combined these changes results in a design that needs to accommodate the various cycles and plan for resiliency. To create a sustainable landscape, goals, adapted from Venhaus (2012), have been established for the creation of a sustainable and resilient edible landscape site. Following Table 3.2, each guideline has been adapted into goals, objectives, and strategies to promote the Leopold legacy in the edible landscape in both the short- and long-term future (Tables 3.3-3.11).

Table 3.2: Sustainable site goals. Adapted from Venhaus (2012).

Characteristics	Sustainable Site
Philosophy	Values nature and the ecosystem services it provides. Accepts the responsibility of sustainability and providing a meaningful quality of life to future generations. Strives to reverse the degradation of the earth's natural resources by creating regenerative and resilient systems.
Aesthetics	Design solutions grow from the place and are representative of the local soils, vegetation, materials, and culture.
Energy	The landscape creates favorable microclimates that reduce the energy consumption of buildings and increase the comfort of site users.
Soils	The disturbance of healthy soils is minimized. Degraded soils are restored prior to replanting. Soil biota and organic matter from on-site vegetation promote healthy plant growth.
Vegetation	Maximizes the integration of all existing native and ecologically appropriate vegetation into the site design. Plant selection considers a broad range of factors, including growing conditions, beauty, resiliency, ecological function, native range and habitat, invasiveness, and maintenance requirements.
Water	Landscape primarily relies upon precipitation or wastewater resources such as air-conditioner condensation, greywater, or reclaimed water.
Materials	Site structures and features can be adapted and reused in place or easily deconstructed and reclaimed or recycled.
Maintenance	The individuals responsible for maintenance understand and support the goals of the project. Education and training is provided to ensure that maintenance optimizes the site's ecological and cultural performance. Post-occupancy evaluations and monitoring guide land-care practices. The site evolves and adapts in a way that continually improves its ecological function and the visitor's experience.
Continued Learning	Monitoring is built into the design and information gathered is used to improve future projects and the success of the sustainable design industry.

Table 3.3: Philosophy: goals, strategies and objectives.

Philosophy	
GOALS	Value nature through Aldo Leopold's Land Ethic to care for the land without compromising the soils, waters, plants, and animals.
	Accept responsibility of sustainability for future interns, Foundation employees, scholars-in-residence, and site users.
	Strive to restore the landscape by creating regenerative and resilient systems, following Nina's legacy and garden design.
OBJECTIVES	Ensure on-site sustainability in the face of climate change.
	Decrease reliance on grocery store produce through on site food production.
	Connect to nature through land stewardship and understand the maintenance and growing requirements of food.
STRATEGIES	Require interns to monitor and document success of edible landscape in owner's manual and pre- and post-occupancy surveys.
	Transition to at least 50% reliance on edible landscape and garden as primary source of produce within first year of establishment. Work to achieve 100% reliance.

Table 3.4: Aesthetics: goals, strategies and objectives.

Aesthetics	
GOALS	Evoke the history of the place through design solutions, including historic plant communities of oak-savanna and riparian areas to fit with the sandy soil profiles, use of local materials, and follow in the steps of Aldo Leopold and Nina Leopold Bradley.
OBJECTIVES	Evoke a sense of place based on records from the Shack journals and the Bradley Study Center journals.
	Remain consistent with the aesthetic at the Leopold Center and surrounding landscape to fit in with the sense of place.
STRATEGIES	Photograph site conditions before and after construction and implementation of edible landscape to determine if site keeps with character of the place.
	Use the Shack journals, Bradley Study Center journals, and historic photos and plant community assemblages of species as a reference point for garden aesthetic.

Table 3.5: Energy: goals, strategies and objectives.

Energy	
GOALS	Create favorable microclimates that reduce the energy consumption of the intern facility and increase the comfort of site users.
	Reduce excessive energy use for transportation and on-site maintenance.
OBJECTIVES	Decrease reliance on air conditioning or fans through passive cooling using shade trees near the building.
	Provide optimal solar energy to greenhouse area by using vegetation with shorter growth habits.
	Decrease reliance on gasoline-powered mowing by incorporating the usage of a reel mower (push mower) for vegetated trails.
	Decrease “food miles,” or distance food products must travel from farm to table by growing local produce.
STRATEGIES	Monitor energy consumption in facility as landscaping matures to function as designed.
	Track equipement usage that relies on fuel and substitute with environmentally friendly alternatives, when possible.
	Document quantities of produce harvested from garden.

Table 3.6: Soils: goals, strategies and objectives.

Soils	
GOALS	Minimize the disturbance of healthy soils from facility construction.
	Remediate nutrient-poor sandy soils.
	Promote soil biota and organic matter from on-site vegetation and healthy plant growth.
	Maintain or increase water-storage and infiltration of soils.
OBJECTIVES	Create a soil management plan to salvage and repurpose healthy topsoil on site disturbed from housing facility construction.
	Protect the native microbial community by reducing soil additions from foreign sources (limit imported topsoils).
	Establish soil from Nina's garden as a reference and annually test soil fertility for nitrogen, carbon, and additional nutrients as needed.
	Prevent nutrient degradation.
	Increase soil nitrogen-fixation and promote carbon sequestration on site.
	Recycle 100% of vegetation trimmings and compostable food waste.
STRATEGIES	Harvest 0-4 inches (A horizon) of loamy sand disturbed on facility construction on plainfield loamy sand (PfDT) and redistribute to garden area.
	Evaluate existing infiltration rates and water-holding capacity of soils and restore compacted topsoil by tilling and adding appropriate compost.
	Restore areas of disturbed soils at least 12 inches using compost amendments, topsoil, and mulch.
	Measure maturity of compost pile (completeness of aerobic processes) through carbon dioxide and ammonia release.
	Implement crop rotation for annual species to prevent nutrient degradation within the annual cultivation zone and amend soils where needed.
	Increase soil nitrogen-fixation through legume plantings.
	Establish a compost pile with at least two separate sections (active vs. mature) that can be turned into organic matter with kitchen and garden waste, in addition to leaves, grass clippings, etc.

Table 3.7: Vegetation: goals, strategies and objectives.

Vegetation	
GOALS	Maximize the integration of all existing native and ecologically appropriate vegetation into the site design based on the Shack journals and the Bradley Study Center journals.
	Select plants based on native range and habitat growing conditions for regional context in Sauk County, Wisconsin and site specific conditions.
	Select plants to ensure on-site sustainability in the face of climate change with species that promote resiliency and ecological functions, including pollination.
	Limit aggressive species and eradicate invasive species.
OBJECTIVES	Enhance biodiversity through a native planting palette attractive to wildlife and targeted for humans, native birds, pollinator species, and any rare or endangered species.
	Preserve existing pine trees surrounding site and high quality prairie near proposed building.
	Use only plant species that are not currently listed as invasive on any federal, state, or regional lists.
	Select historically significant cultivars listed in Nina's journals and the Shack journals.
	Design garden zones based on the microclimates onsite - planting plan includes all new vegetation to be installed.
STRATEGIES	Remove invasive species before or during construction phase of the project and include a plan for active, multi-year invasive species control and management of any invasive species, along with long-term monitoring.
	Consult local experts to determine appropriate protection measures for existing vegetation and protect root zones of trees by buffering one foot radius per inch of tree's DBH.
	Determine existing site biomass density index (map quality of plant material in zones of existing vegetation) and use as a baseline for proposed plantings.
	Select turf grasses that are regionally appropriate and minimize requirements for irrigation, pesticides, fertilizers, and maintenance.
	Collect and sow native seed to preserve plant genetics on site.
	Plant diversity provides resistance to disease and pests and select species that contribute to the plant diversity of the community and region as a whole.

Table 3.8: Water: goals, strategies and objectives.

Water	
GOALS	Rely on harvested rainwater to reduce excessive potable water consumption and create a net-zero water balance landscape.
	Protect and replicate processes of natural water systems, including infiltration, evaporation, transpiration, and runoff.
OBJECTIVES	Reduce landscape water requirements.
	Reduce usage of potable water to meet landscape water requirements, relying on non-potable sources.
	Increase awareness and educate interns and site users about net-zero water balance and rainwater harvesting.
STRATEGIES	Install and monitor a rainwater collection system (cistern) to capture roof runoff and reuse for irrigation.
	Install high efficiency equipment (drip irrigation systems) for annuals and other species with greater water requirements (berries, fruit trees, etc).
	Use the EPA WaterSense Budget Tool to calculate the baseline case and water savings.
	Record daily storm event data (precipitation) in owner's manual.
	Install water meters to track monthly water volumes collected and used (frequency and duration) on site to monitor the water balance.
	Use simple signage to convey information specific to cistern, including total volume, gallons collected from intern facility during storm events, and informational graphics about drip irrigation.
	Install irrigation in hydrozones (watering can be discontinued as plants become established).

Table 3.9: Materials: goals, strategies and objectives.

Materials	
GOALS	Site structures, such as raised bed beams and Leopold benches, can be harvested from local, renewable materials.
	Increase lifecycle of materials by adapting and reusing in place or easily deconstructing and reclaiming or recycling.
OBJECTIVES	Prioritize using local materials and if unavailable, seek salvaged, reused or recycled materials.
	Use regional materials to decrease energy demand for transportation.
	Design construction details to facilitate disassembly without damage to the material.
STRATEGIES	Use Nina's journals as a reference for sources of local materials, such as oak beams for garden beds.
	Soils, compost, and mulch: extraction, harvest, or recovery must occur onsite (within the Leopold Reserve).
	Boudlers, rocks, and aggregate: extraction, harvest, or recovery must occur within 50 miles.
	Plants: all growing facilities and suppliers must be located within Wisconsin, with a preference for those in Sauk County.
	All other materials: extraction, harvest, or recovery must occur within 250 miles, with a life-cycle assessment that ensures environmental practices.

Table 3.10: Maintenance: goals, strategies and objectives.

Maintenance	
GOALS	Inspire interns to understand and support the goals of the edible landscape and the Aldo Leopold Foundation.
	Provide education and training in the owner's manual to ensure that maintenance optimizes the site's ecological and cultural performance.
	Guide land-care practices through pre- and post-occupancy evaluations.
	Evolve and adapt in a way that continually improves the edible landscape's ecological function and the intern's experience.
OBJECTIVES	Implement an adaptive management plan, including short-term and long-term goals.
STRATEGIES	Pre- and post-occupancy evaluations allow the Aldo Leopold Foundation to monitor the attitudes and beliefs of interns before and after using the edible landscape.
	Water: Proper maintenance activities (including anticipated maintenance and watering schedule) used to ensure effectiveness of cistern and drip irrigation; monitor water usage and rainfall.
	Soil Stewardship: Conduct soil tests and apply amendments for nutrient deficiencies and alleviate soil compaction detrimental to plant health.
	Vegetation (Plant Stewardship): Maintain vegetation through monitoring according to long-term plans for the site, including food producing gardens and edible landscapes, and health, growth, and harvest.
	Vegetation (Invasive Species Management): List of invasive plant species identified in the area according to regional/state/federal laws and include an invasive management plan for control and monitoring; promote plant diversity.
	Materials: List of preferred characteristics for replacement materials (local sources, recycled content, etc) to repair and maintain site amenities.
	Material Waste: Recycle or reuse materials on-site, including composting kitchen and garden waste to prevent them from entering the municipal solid-waste stream.
	Landscape Maintenance Equipment: Manual (reel) mowers to be used on site.
	Adaptive Management: Update site maintenance plan to reevaluate on an annual basis and revise as needed to adapt to future conditions and unforeseen changes.

Table 3.11: Continued learning: goals, strategies and objectives.

Continued Learning	
GOALS	Provide interns with easily accessible educational materials on the garden and the Leopold legacy.
	Create the owner's manual to adaptively manage the landscape.
OBJECTIVES	Create educational tools, such as garden signage and a seasonal management poster, to help interns develop plant identification and management skills.
	Create an owner's manual to continue phenological observations and monitor garden sustainability.
STRATEGIES	Develop pre- and post-occupancy surveys can help both the interns and ALF monitor the success of the garden and also provide adaptive management recommendations.
	Use owner's manual to record observations of daily garden activities, temperature (minimum/maximum), and phenology (first bloom, arrival of migrating birds, etc) to continue tracking Nina's research of changes on the Leopold Reserve.

Methodology to Determine Suitable Native Edible Species

Edible native plants have been organized into a plant matrix to supplement the planting design and ensure all plants within the design will have a degree of edibility. Edibility (criteria defined below) refers to the part of the plant that can be eaten, along with the type of processing needed to be consumable. Wild edible plants have been selected based on criteria as shown in Appendix E (*PlantSearchOnline.com* 2011, LBJ Wildflower Center 2012, PFAF 2012, Johnson's Nursery, Inc. 2014 , Ecoscapes Sustainable Landscaping 2015, Edible Landscaping 2015, Enz and Blue 2015, IPAW 2015, USDA, NRCS 2015, Xerces Society 2015). The list has been adapted from *Wild Berries and Fruits Field Guide* by Teresa Marrone (2009), *The Peterson Field Guides for Edible Wild Plants: Eastern/Central North America* by Lee Allen Peterson (1977), *The Forager's Harvest: A Guide to Identifying, Harvesting, and Preparing Edible Wild Plants*

by Samuel Thayer (2006) and "Native Plants for Edible Landscaping" by Good Oak Ecological Services (2012). The prerequisites for inclusion on the chart are (1.) Native to Wisconsin and (2.) Native to Sauk County based on the United States Department of Agriculture (USDA, NRCS 2015) plant profile maps. Emergent and submergent aquatics have been removed due to an absence of a water body on the study site. Mushrooms and fungi require advanced identification skills, as they often have toxic look-a-likes, and have been removed. The matrix identifies the requirements for design consideration based on the following categories: suitable habitat, ecological impacts, identification knowledge level required, level of edibility and cultivation techniques. The following terms have been defined to construct a selection criteria matrix to help determine the suitability of an edible wild plant for inclusion in the edible landscaping portion of the design.

Suitable Habitat: Divided into two subcategories of plant community types and tolerance of well-drained sandy soil, this determines plants that are suitable within the site-specific context. Plants must be tolerant of well-drained sandy soils for the site. Suitable plant communities are documented from *The Vegetation of Wisconsin* by John T. Curtis (1959), (Table 3.12). Excluded communities include: emergent aquatic, submergence aquatic, alder thicket, lake beach, bracken-grassland, open bog, cedar glade, exposed cliff, shaded cliff, lake dune, fen, northern sage meadow and shrub carr. All other communities have varying degrees of suitability for the site based on microclimates.

Ecological Impacts: This term has two subcategories - impact to pollinators and wildlife, and aggression or allelopathic levels of the plant. Ecosystem services, which benefit the site beyond a food source for humans, will increase with plants that also offer habitat, nectar, and food sources for wildlife including pollinators. Plants that are overly

Table 3.12: Plant community abbreviations. Adapted from Curtis (1959).

Abbreviation	Description	Abbreviation	Description
AQE	Emergent Aquatic	**NWM**	Northern Wet-Mesic Forest
AQS	Submergent Aquatic	**OB**	Oak Barrens
AT	Alder Thicket	**OO**	Oak Openings
BEA	Lake Beach	**PB**	Pine Barrens
BF	Boreal Forest	**PD**	Dry Prairie
BG	Bracken-Grassland	**PDM**	Dry-Mesic Prairie
BOG	Open Bog	**PM**	Mesic Prairie
CG	Cedar Glade	**PWM**	Wet-Mesic Prairie
CLE	Exposed Cliff	**SB**	Sand Barrens
CLS	Shaded Cliff	**SC**	Shrub Carr
DUN	Lake Dune	**SD**	Southern Dry Forest
FN	Fen	**SDM**	Southern Dry-Mesic Forest
ND	Northern Dry Forest	**SM**	Southern Mesic Forest
NDM	Northern Dry-Mesic Forest	**SS**	Southern Sedge Meadow
NM	Northern Mesic Forest	**SW**	Southern Wet Forest
NS	Northern Sage Meadow	**SWM**	Southern Wet-Mesic Forest
NW	Northern Wet Meadow		

aggressive or allelopathic will decrease biodiversity on site and could potentially spread beyond the site boundary thereby causing ecological problems elsewhere in the Reserve.

Identification Knowledge Level: The criteria for this category covers two subsets including toxic look-a-likes and skill level. If a plant has a toxic look-a-like, it could cause problems, especially since one of the goals of the planting design is edibility. Toxic look-a-likes often require specialized knowledge, and if wild toxic plants grow within the site, it may cause confusion for anyone unfamiliar with the plants. Therefore, plants will be selected with care to avoid potential harm. The skill level for identifying plants is also essential. Many wild plants with domestic counterparts are easily identifiable, such as raspberries, strawberries and grapes. Certain longer-lived species, such as shrubs

and trees could include educational information (plaques or signage) to help with plant identification. The seasonal management plan will include photographs and/or drawings along with a key to help identify plants.

Level of Edibility: Plants defined as edible are not always readily edible in a raw food state. Many edible plants require a form of processing prior to ingesting the product. For example, ground nut (*Apios americana*) has edible tubers that contain protease inhibitors only destroyed by cooking (Thayer 2006). The tubers can be boiled, roasted, or baked, similar to a potato. However, ingesting raw tubers causes the protease inhibitors to interfere with protein metabolism and will cause an upset stomach (Thayer 2006). Certain plants are listed in the literature as being eaten raw, while other research points to a need for processing. In these cases, they will be categorized as requiring processing to provide a greater level of safety. Caution is advised when consuming unfamiliar plants. Always process and eat in small amounts first to determine if there are any negative side effects.

Cultivation: This term covers a wide range of subcategories: (1.) ease of cultivation, (2.) rejuvenation after harvest, (3.) timespan to reach maturity, (4.) edible part of plant, and (5.) mention in the historic record. (1.) The ease of cultivation refers to methods of defense the plants have developed to resist being harvested. For example, young stinging nettles (*Urtica dioica*) can be eaten, however, the stinging hairs on the plant produce unpleasant effects, hence the common name (Thayer 2006). Wearing gloves during harvesting can reduce the risk of unpleasantness and cooking the nettles removes the stinging properties. Yet the chance of accidentally touching them in the landscape may deter a person from the desire to harvest the nettles and decrease the suitability of having the plant in the landscape. In fact, nettles are sometimes used as a barrier species

to prevent access or are removed to prevent accidental contact. (2.) Rejuvenation after harvest describes whether the plant will grow again after being harvested or if that action will eliminate the plant from the garden. Depending on the edible portion, some plants, such as ramps, will not rejuvenate because the entire plant is harvested. Other plants need to be selectively harvested to leave a portion of the plant or colony to regrow. Ground nuts are an example where a percentage of the tubers need to be left for the plants to continue to grow. Ostrich ferns (*Matteucia struthiopteris*) are harvested as the fronds emerge at an early "fiddlehead" stage when the tops are still coiled in spring. This action kills the frond, but the rosette will continue to grow if only a few fiddleheads are harvested (Thayer 2006). (3.) The timespan to reach maturity, or the stage when the plant can be eaten, can vary based on the growth habit. Trees, such as sugar maples (*Acer saccharum*), are frequently noted in the Shack journals and the Bradley Study Center journals, however, the trees cannot be tapped until they reach maturity when the trunk diameter is at least 10 inches, or ~40 years of age (Cornell Sugar Maple Research & Extension Program 2015). Therefore, the plants with a longer maturity timespan will not be readily available to cultivate. (4.) The edible part of the plant refers to the fruit, leaf, nut, pome, tuber, etc. that can be eaten. Most edible plants are not entirely digestible and can contain toxic portions. (5.) The mention in the historic record refers to a note in either the Shack journals or the Bradley Study Center journals and provides a cultural and historical significance for the plant, especially when referenced several times in both journals. These plants, considered culturally significant, will have a higher weighted value in the matrix.

Based on the criteria for edibility, a planting list will be suggested for the project. The habitat suitability will be examined first to determine if the species is correct for the project location. The other factors will be weighted to determine if they meet the criteria to be considered suitable for the edible landscape and garden. Factors such as aggression will take on a heavier weight since it may decrease the biodiversity in the long-term on site, especially without routine maintenance to keep the plants in check. The culturally historic plants will also receive a heavier weight since they help tie the gardens to the Leopold family.

Limitations and Delimitations

Native garden zones includes plants found in pre-settlement time as mentioned in *The Vegetation of Wisconsin* by John T. Curtis (1959). Naturalized plants, such as plantains (*Plantago* spp.), dandelions (*Taraxacum officinale*) and wild carrot (*Daucus carrota*), to name a few, will not be included on the criteria for edibility because they have been documented as being introduced within the last 250 years through European settlement in Wisconsin. Many naturalized plants contain an element of aggression and will not be suitable for increasing biodiversity and sustainability on site because they may pose a risk to extirpating native plant species. Non-native exotic and ornamental plants will not be considered in the native garden zones for reasons mentioned above, and also due to the unpredictable nature of the reproductive potential of the plants that may increase the current problem of invasive species within the Reserve. This study does not focus on novel ecosystems.

The criteria for edibility of plants is meant to be used as a guideline for potential edible plants; however, it is not an exhaustive list of all edible native plants within Sauk

County. Determining the suitability of plants will be examined in the criteria selection matrix, however, the final selection implemented in the planting plan may not always cater to the needs of the current and future interns. Due to personal taste preferences, future interns may choose not to grow or harvest certain species within the design, and in that case the guidelines may offer an alternative plant of interest as a replacement. The chart also includes criteria for being considered edible based on the level of processing needed. This refers to the preparation of the edible portion as either raw (available directly from the plant) or cooked, boiled, pickled, etc., in a certain manner. Caution should always be used when harvesting and processing the edible portion of the plant to avoid harmful side-effects from consumption. Undercooking plants may result in illness or upset and should not be consumed. A starting point for more information about cooking and processing edible wild plants can be found in *The Forager's Harvest: A Guide to Identifying, Harvesting, and Preparing Edible Wild Plants* by Samuel Thayer (2006), along with the Plants for a Future online database (PFAF 2012).

Although the plant matrix is not an all-inclusive list of edible plant species in Sauk County, it provides recommendations and suggestions for a planting list in the garden based on records of what was grown locally. The categories for assessment can be used when adding additional species to the list, and will help guide decisions of future plants to add within the garden. Due to personal preferences of interns both for plant taste and management, along with temporal changes in the garden, the original plant list may be updated and expanded as necessary.

The Edible Landscape Plan

The edible landscape is designed based on the existing site vegetation, topography, aspect, views and proposed building site (Figure 3.1). During the site survey, Huffaker indicated vegetation to preserve, including the row of mature pine trees, mature oak trees, and high quality prairie (Huffaker 2014). The proposed intern facility will be built into the hill slope to minimize grading on site. Therefore, the planting plan is designed to fit into the natural topography. The annual garden will require the most sunlight and has been placed on the southern side of the facility. Native plantings surrounding the facility can be sourced from on site or local seed to keep the plant genetics native to the area.

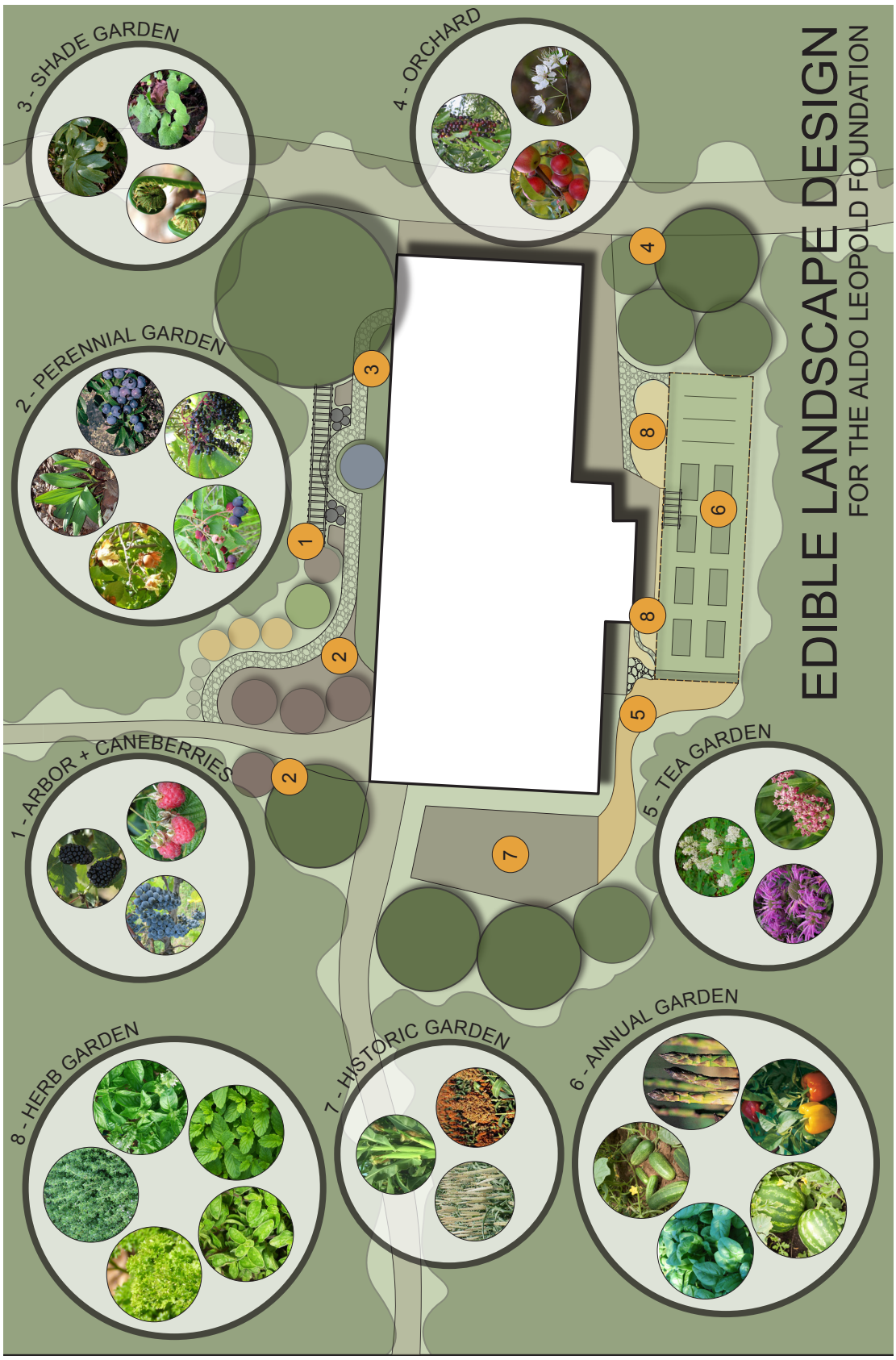


Figure 3.1: Edible landscape design for ALF. Graphic by author.

The edible landscape zones have been characterized based on the microclimates assessed on site based on the soil types, landscape forms, existing vegetation, and building design. The zones are divided into the following: herb, tea/pollination, shade, arbor/caneberry, native perennials, orchard, historic, and annual gardens.

The herb garden is located near the house along the pavement walkway to encourage daily usage, while preventing accidental garden escapees (Figure 3.2). Care will be taken to prevent herb invasions similar to garlic mustard. In the event of including a more aggressive herb, such as mint, the planting area can be lined with stones or planted in a submerged plastic pot to prevent aggression, or simply planted in a pot. Herbs in pots also allow for multi-seasonal usage since they can be transported into the greenhouse during cooler weather and winter. Certain species should not be allowed to produce florescence.

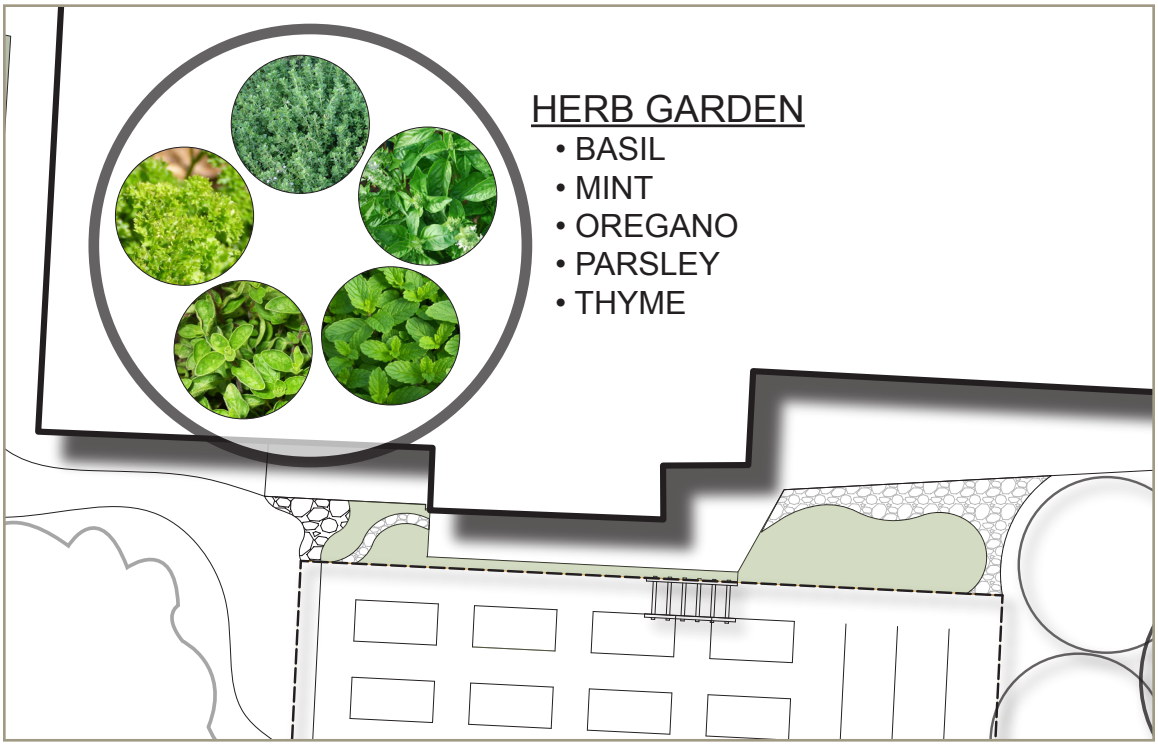


Figure 3.2: Herb garden. Graphic by author.

The tea garden area features native plants, such as pale purple coneflower (*Echinacea pallida*), New Jersey Tea (*Ceanothus americanus*) and wild bergamot (*Monarda fistulosa*) that have been historically used for tea. Several of these species currently exist within the reserve and the seeds could be collected from the high quality prairie area adjacent to the tea garden (Figure 3.3). Using on site seed sources helps maintain the local genetic composition of the plant community. It also reduces the risk of accidentally planting a non-native cultivar that may invade and endanger the local genetic plant population, which has been recorded in Wisconsin with purple coneflower crossbreeding with pale purple coneflower. The flowers of the tea plants are also highly attractive to pollinators and provide an increased ecosystem service that will also encourage pollinators into the landscape. By placing the flowers near the annual garden, the fruiting species will benefit from increased pollination and produce a larger harvest.

Figure 3.3: Tea garden. Graphic by author.

The shade garden is located north of the building where the ground layer will be in partial to full shade (Figure 3.4). The amount of solar radiation reaching the ground layer is impacted by both the amount of overhead vegetation, or tree canopy, along with the shading created by the building. The microclimate allows for a different variety of plants to flourish in the cooler, higher moisture environments. This area will be idea for more sensitive plants that require higher soil moisture conditions such as fiddlehead ferns and wild ginger. It would also be the most suitable place for a larger tree, such as a sugar maple, that favors shade and mesic forest conditions. Although the sandy soils infiltrate water more quickly than rich, mesic soils, sugar maple trees have a history of intentional planting on the Reserve. The journals describe how Nina and Charlie harvested sap from trees planted by the Leopold family in the 1930s. Not only would the maple tree connect the interns to this unique history, but it also provides vibrant fall color.

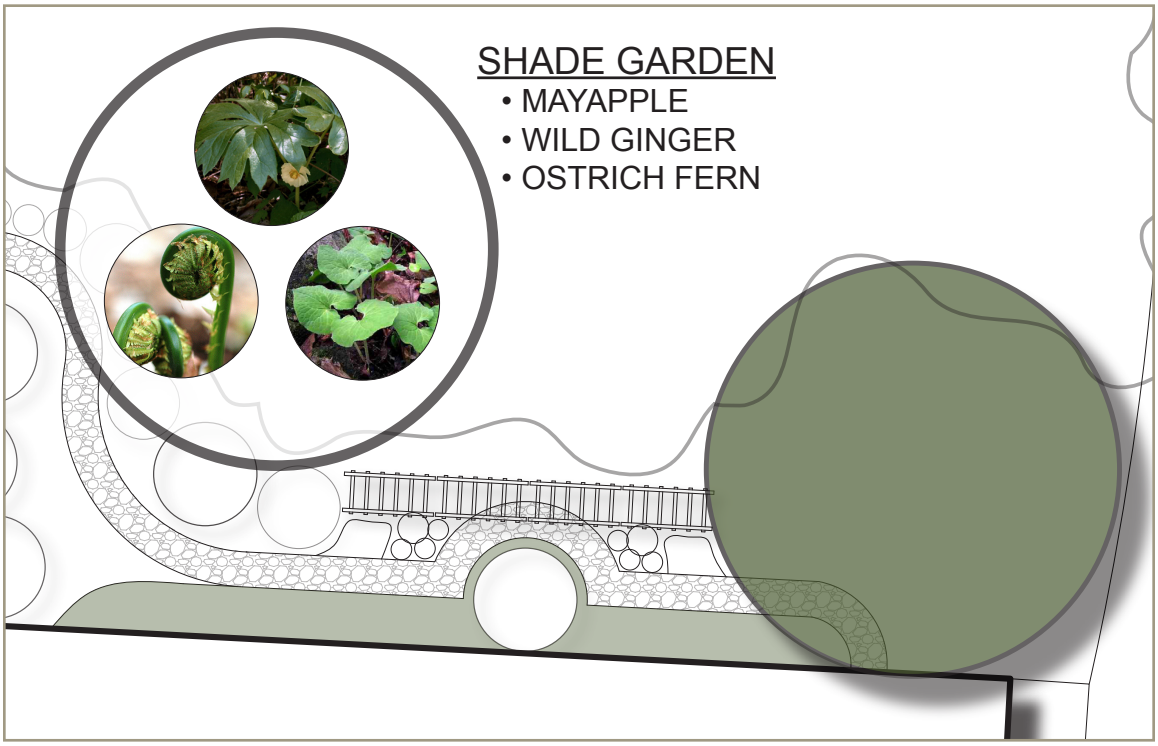


Figure 3.4: Shade garden. Graphic by author.

The arbor and caneberry garden zone features a grape arbor similar to Nina's arbor (Figure 3.5). The Bradley Study Center arbor also served as a ramp from the deck to the yard, while providing a support structure for the concord grapes. The grapes and caneberries, or raspberries and blackberries, are longer living woody species that require supporting structures and irrigation to be successful. Both species also require pruning at the start and end of the planting seasons. This zone, once established, will need little replanting. While grapes are long-lived, cane species have a two-year cycle but will continue to grow from suckering clones. Based on the topography of the site, the arbors can be terraced to fit into the hill slope.

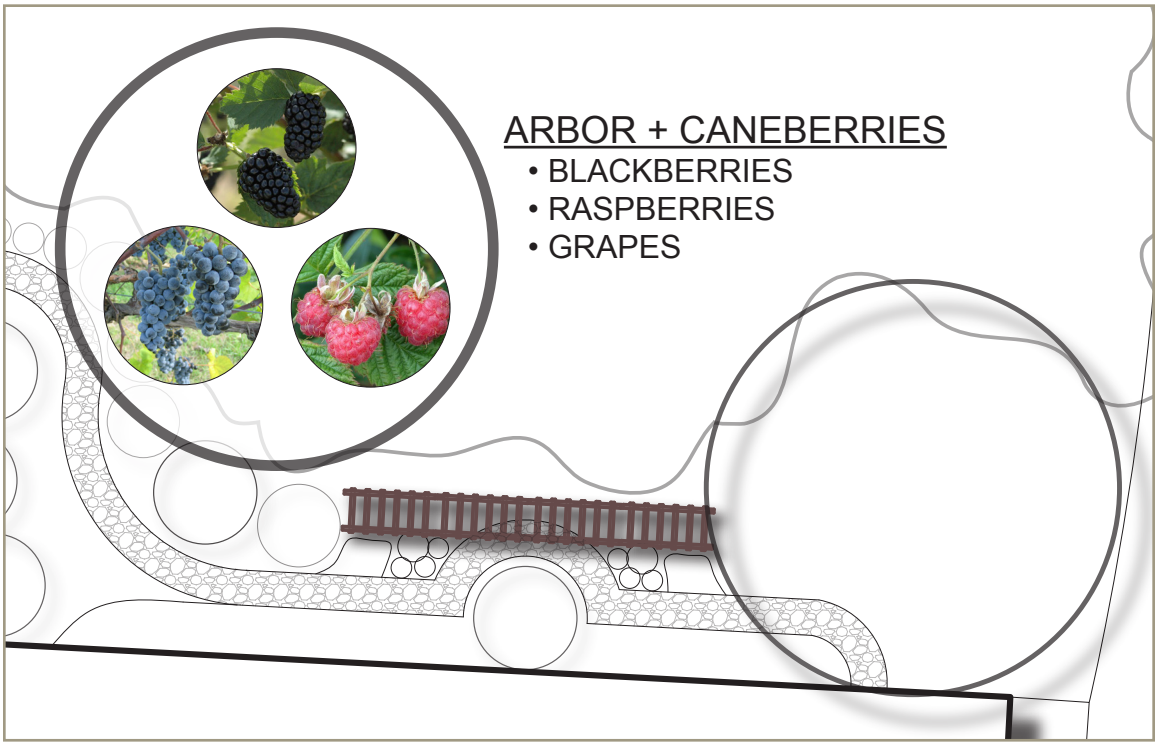


Figure 3.5: Arbor and caneberry garden. Graphic by author.

Native perennial zone includes primarily shrubs and trees that produce fruits and nuts (Figure 3.6). Many species have been documented in the Shack journals and Nina's journals both as planted on site and native to the area. Nina's journals made note of the phenology involved with many blooming and fruiting species, such as *Amelanchier* spp., or serviceberry. This edible native produces berries for both people and wildlife, while being one of the earlier blooming small trees. Therefore, it could become an educational tool for interns to track the phenology of spring blooms on site with educational signage to provide tree identification. An extensive list of native species, along with each plant's culinary uses can be found in Appendix E.

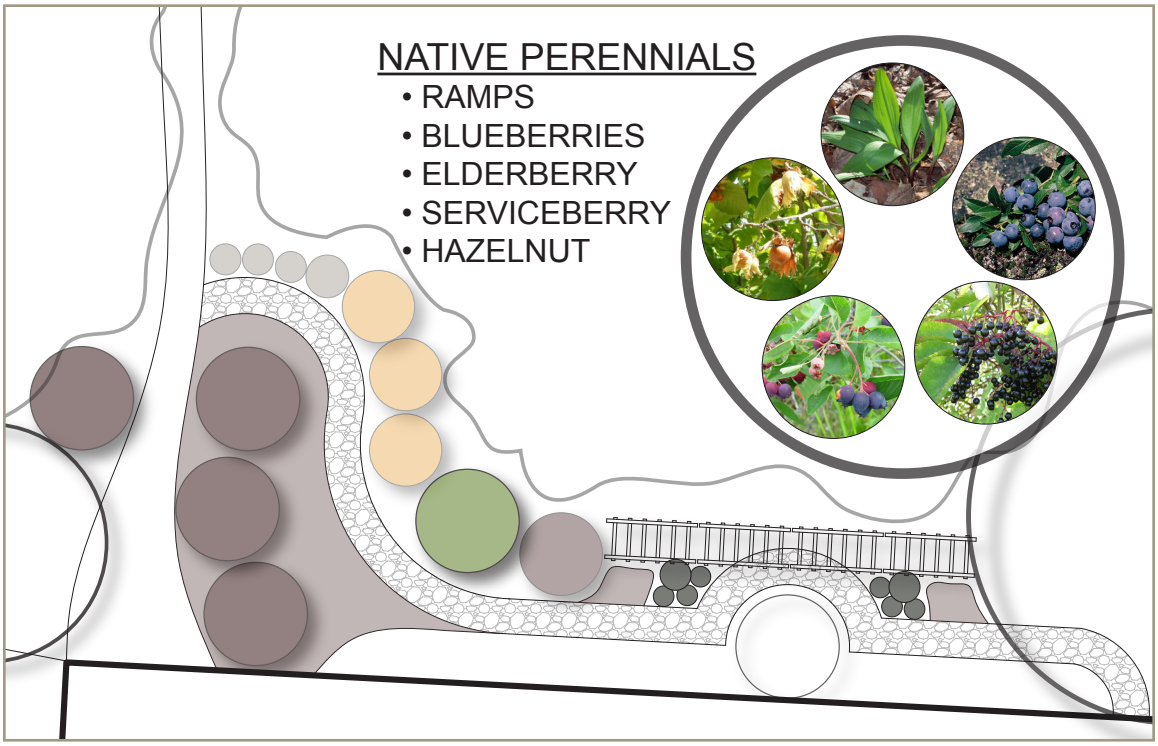


Figure 3.6: Native perennial garden. Graphic by author.

The orchard garden contains domestic cultivars of species planted by the previous farmer in addition to the Leopolds (Figure 3.7). The Shack site had established apple trees in the orchard, which Nina and Charlie worked to replant in the 1970s (Figure 3.8). The Shack journals also describe planting plum trees and Nina recorded pear tree blooms in her phenology. Orchard trees will require both pruning and irrigation, especially during the first five years of establishment. Due to a record of pests on the trees, the orchard will be limited to a few tree specimens that have been cultivated for pest resistance. Harvesting times for the fruit trees will vary based on species. Nina's journals refer to picking apples and processing for applesauce from late September through October (Bradley and Leopold Bradley 1976–2009).

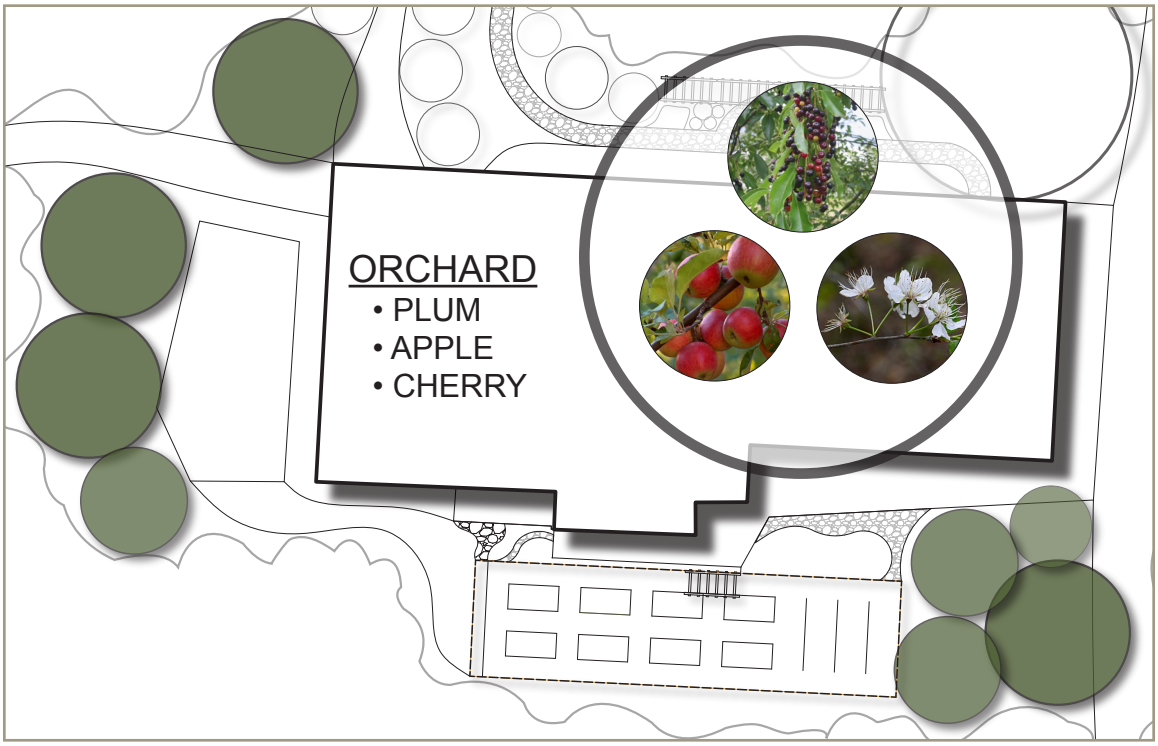


Figure 3.7: Orchard garden. Graphic by author.

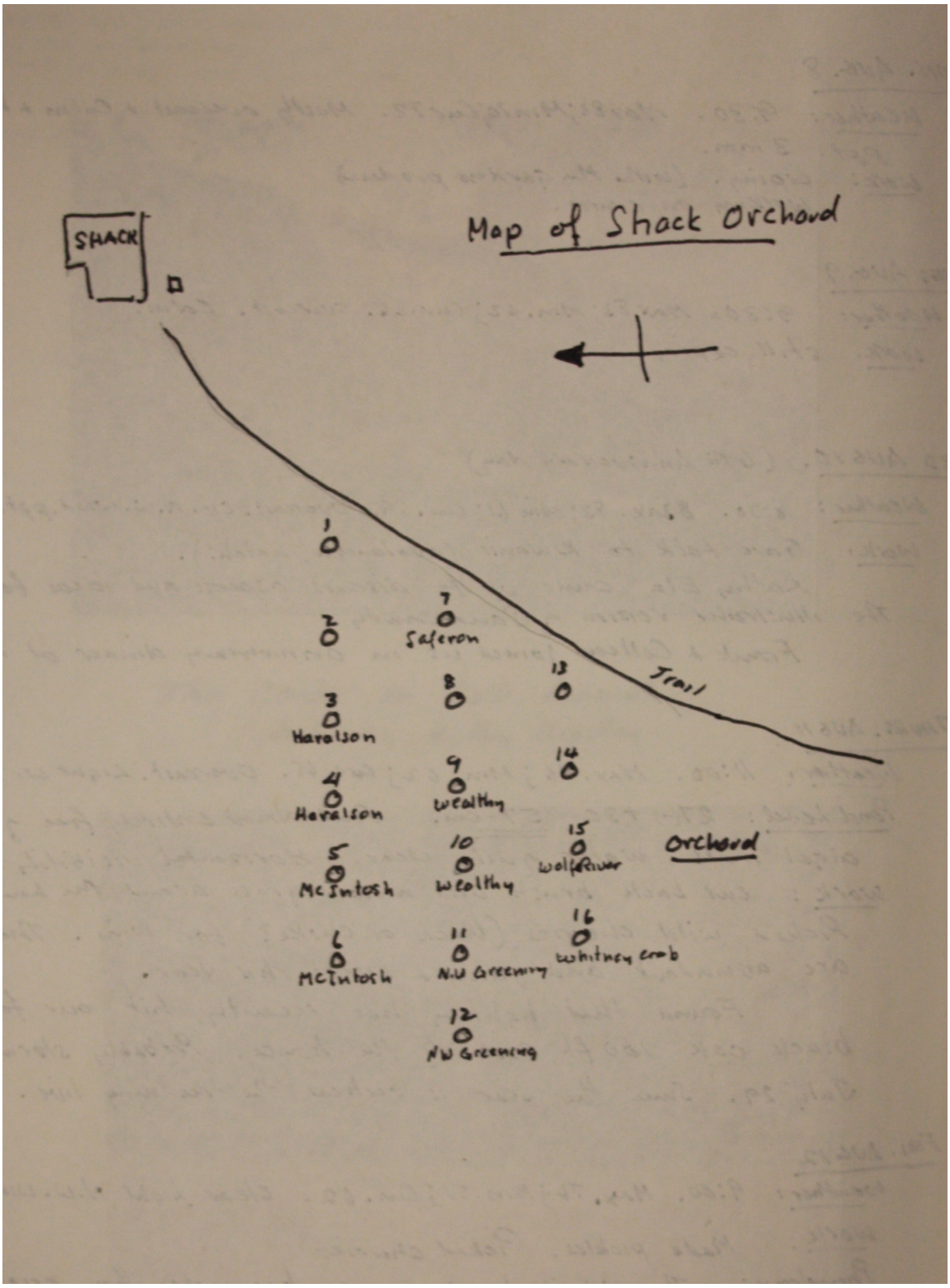


Figure 3.8: Hand-drawn map of the Shack orchard. Nina and Charlie planted additional trees to the old farm orchard adjacent to the Shack. From the Bradley Study Center journals, August 1977.

The historic garden zones features plants that were significant to the food patch, but may no longer be commonly cultivated today. An example is sorghum, which was documented in both the Shack journals and historic photographs, but was never planted in Nina's gardens. This species provides a unique opportunity for interns to research older recipes using sorghum syrup and molasses, and understand how the garden landscape of the Shack would have looked for the Leopold family. The shape of the historic garden zone is a smaller scale version of Nina's garden, drawn from one of the journal maps (Bradley and Leopold Bradley 1976–2009).

Figure 3.9: Historic garden. Graphic by author.

The annual gardens feature raised beds similar to Nina's gardens (Figures 3.10, 3.11). These zones will require the greatest amount of maintenance for planting, weeding, watering, harvesting, and cleaning, but will be heavy producers of vegetables. Following Nina's example, the gardens will be drip irrigated using water from a cistern, a structure that stores rainwater for subsequent reuse on-site. The annual gardens will be open to interpretation by the interns, based on personal preference for each season. For example, the design may designate an area for early greens with a listing of suitable species, such as spinach, kale or lettuce, but will leave the exact planting up to the interns. This area will also need to be rotated each season since various plants have different nutrient requirements. As a disease control practice, plants within the same family, such as potatoes and tomatoes, should not be planted within the same area in

Figure 3.10: Nina's garden with raised beds. From the Bradley Study Center journals, 1989.

a consecutive season. Rotating plants with higher nutrient requirements with nitrogen fixing plants, such as legumes, will help amend the soils. Fertilizer, such as compost or chicken manure, will also be essential to build up the soil nutrients similar to Nina's garden. Soil fertility analyses should be performed every few years to test for soil pH and whether major nutrients are adequate or deficient. Certain species, such as blueberries, prefer a more acidic soil. The garden will require a gate system and circulation trails wide enough for a wheelbarrow or other equipment to enter and exit to collect garden waste for compost, harvest vegetables or prepare seedbeds for planting.

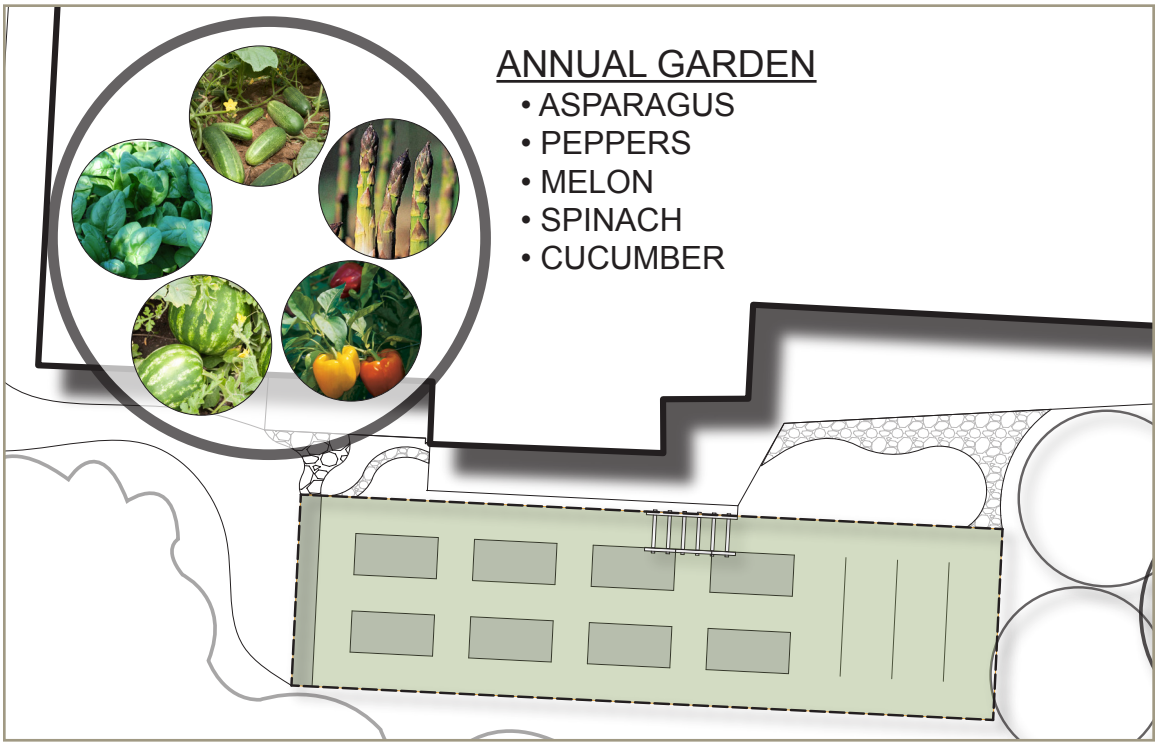


Figure 3.11: Annual garden. Graphic by author.

Garden Phases: Edible Landscapes and Production Gardens

As part of the design for the edible landscape, plantings will be phased based on the maintenance and cost requirements. Phase one will focus on edible native species, including the tea/pollination, shade, arbor/caneberry, native perennials, orchard, and historic gardens. Phase two is the development of the annual and herb gardens, which includes the development of a deer-proof fenced garden space with raised beds and permanent drip irrigation. Phase one allows interns to interact with the edible landscape without having a large demand for garden maintenance, including planting, weeding, harvesting and cleaning garden beds. Although phase one does include the arbor with grapes and caneberries, the area will only need to be planted once and all species follow similar maintenance requirements. Phase two features a small-scale version of Nina's garden for the interns to grow on-site produce. The annual garden area with raised beds will require significantly more maintenance; however, it will also provide the greatest supply of on site produce for interns to harvest. Therefore, it will be an essential part of the design to replace the need for grocery stores and help connect to the land through food production.

Future design phases may include livestock, such as chickens and/or bees. Chickens provide a source of protein with egg-laying. They also act as a source of fertilizer and contribute to pest control. However, chickens will not discriminate between weeds and cultivated species within a garden and should be managed accordingly. A bee hive would not only provide a source of honey, but also help contribute to pollination of the gardens. With many bee species declining with pesticide usage, the edible landscape provides a pesticide free reserve for pollinator species to thrive.

Garden Foundations and Amenities

The foundational features of the garden include trails, pathways, and landscape borders. Trail types suitable for the area may include the following: stones or gravel, stepping stones, permeable pavers, or turf. Each type will be evaluated based on the suitability to the area for sandy soils, rainfall events, and maintenance requirements. *Stones or gravel:* A type of local crushed aggregate, such as limestone or Baraboo quartzite, allows for stormwater infiltration, with no mowing maintenance. However, this source is subject to displacement during larger storm events based on surface water movement through the site. A type of landscape edging, such as landscape stone or wooden beams may help hold the gravel in place, but may still require seasonal maintenance to rake or compact the stone. A filter fabric or deeper aggregate base of stone will be needed to keep out weedy species. Larger stone slabs provide a walkway and can be separated either by organic plant materials, such as a low growing moss, sedum or turf, or a crushed stone aggregate. This type of material would be suitable for the pathway between the shade garden and perennial plantings near the arbor. It could also be used in the smaller pathway from the sidewalk through the herb garden. *Permeable pavers:* The designed interlocking paver systems allow water to percolate through a void space between the pavers. The pavers are held in place by a type of plastic paver edging or concrete curb. This alternative will be more expensive and will unlikely be made of vernacular materials. However, for hardscape areas on the architect's plan, instead of using concrete with a highly impervious surface, permeable pavers offer a better solution to limit stormwater runoff.

Amenities within the garden include seating and dining areas, views both within the garden and to the garden from the house, bird feeders and compost locations (Figure 3.12). Nina's house included two decks for outdoor eating and socialization. Nina's kitchen was designed with an eating space that had a view to the deck with bird feeders. This allowed her to document the seasonal migration of birds visiting the landscape, along with seasonal color changes of non-migratory birds. Providing the interns with a similar experience would encourage interns to develop an appreciation for birding and the importance of taking notes. Designing an area for interns to have an outdoor seating space creates a place for people to gather and enjoy meals together. The outdoor seating space incorporates designs modeled after Leopold's bench to withstand the winter season. Finally, the garden will need a zone for composting garden and kitchen waste. Nina had a large area for composting wastes which were frequently turned and added to the garden.

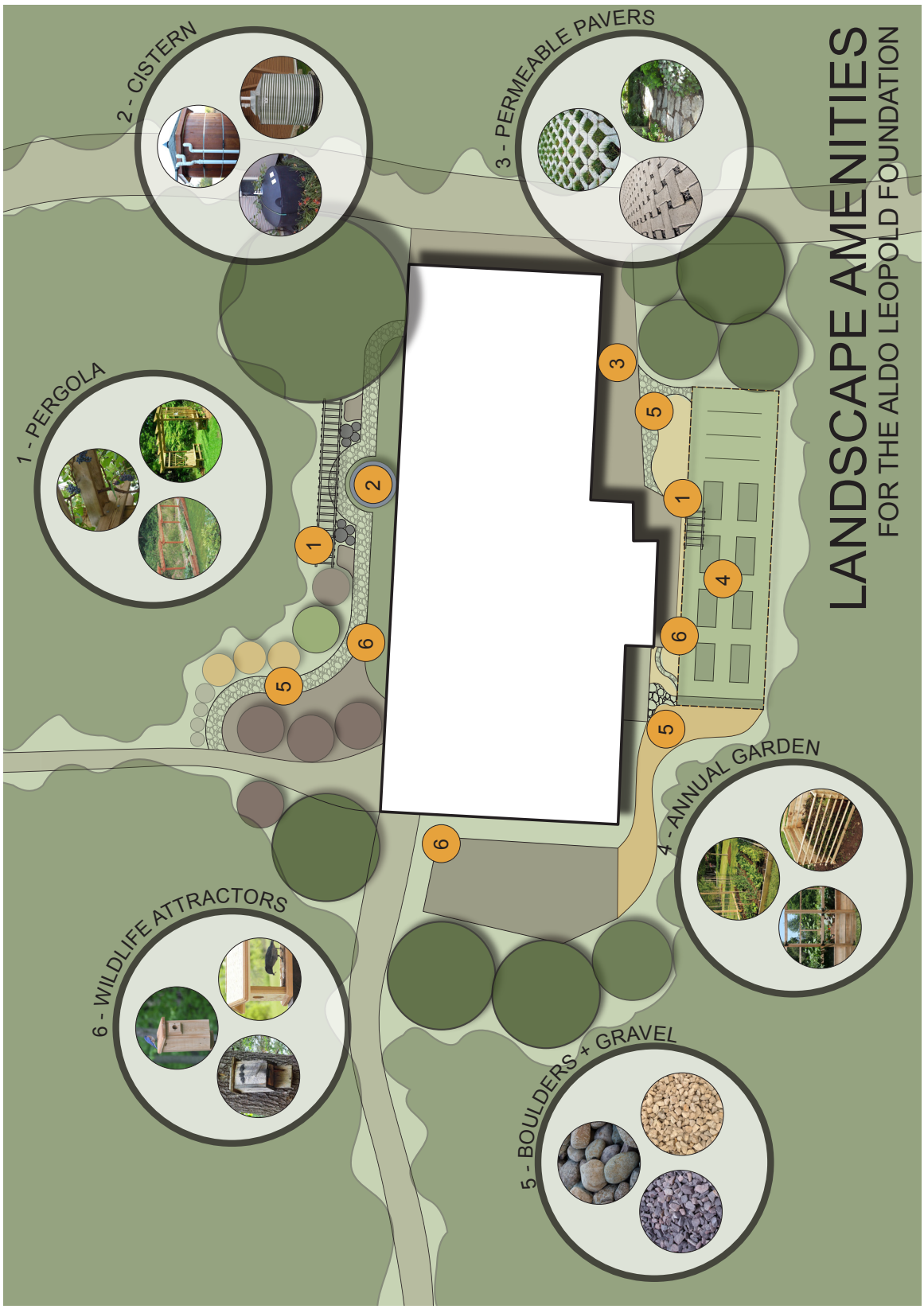


Figure 3.12: Amenities for the edible landscape. Graphic by author.

Creating a Living, Dynamic Campus

In this chapter, the goals, strategies, and objective of the edible landscape were introduced to develop the design plan. Each zone within the plan was explained, along with suggested species that would suit the microclimate and design intention of each area. In Chapter 4, the goals, strategies, and objectives will be evaluate using a scoresheet to determine if they are met through the design or management plan. The edible landscape acts as an education tool for interns to learn about sustainable food production, observations and documentation, as well as the history of agriculture within the Reserve. Creating interpretative signage with plant identification and historic facts can help interns interact with the garden and edible landscape. A unique opportunity for interns to connect the food to history includes a cookbook for interns that contains recipes used by the Leopold family. Nina's journals note many "domestic activities," such as making hot sauce, eggplant parmesan and pickles, among others, which would provide an opportunity to pass down information about using the produce. As the interns learn from the garden, they could use the handbook or owner's manual to add in their own observations, recipes and phenology to create a journal similar to Nina's, while gaining an understanding of the environment, ecological processes and seasonality. Not only do the interns become land stewards through tending and managing the landscape, but they also help create a document that carries on the Leopold legacy. The owner's manual and signage will be explore in the following chapter.

CHAPTER 4

ADAPTING FOR THE FUTURE: MONITORING AND MANAGEMENT

Adaptive Management

The Leopold family recorded daily activities, events and climate data, and through this record-keeping, Nina Leopold Bradley produced research that corroborated earlier bloom dates with climate change. Using the 40+ year record Nina kept at the Bradley Study Center as a guide, an adaptive management plan has been created to help interns monitor and document the short- and long-term sustainability of the edible landscape. The adaptive management plan, or owner's manual, is set up to follow the phenology of the area. Using a seasonal calendar with associated events and activities provides the framework to follow Aldo Leopold's *A Sand County Almanac with Sketches Here and There* ([1949] 1968). The activities are primarily based on Nina's records to help interns learn about the seasonal activities relating to the garden and phenology. Figure 4.1 shows the various seasons for planting, weeding and harvesting garden species based on average times recorded in the journals from 1976-2011. However, this calendar acts as a set of guidelines and may need to be adapted based on local events, such as drought, and seasonal variation.

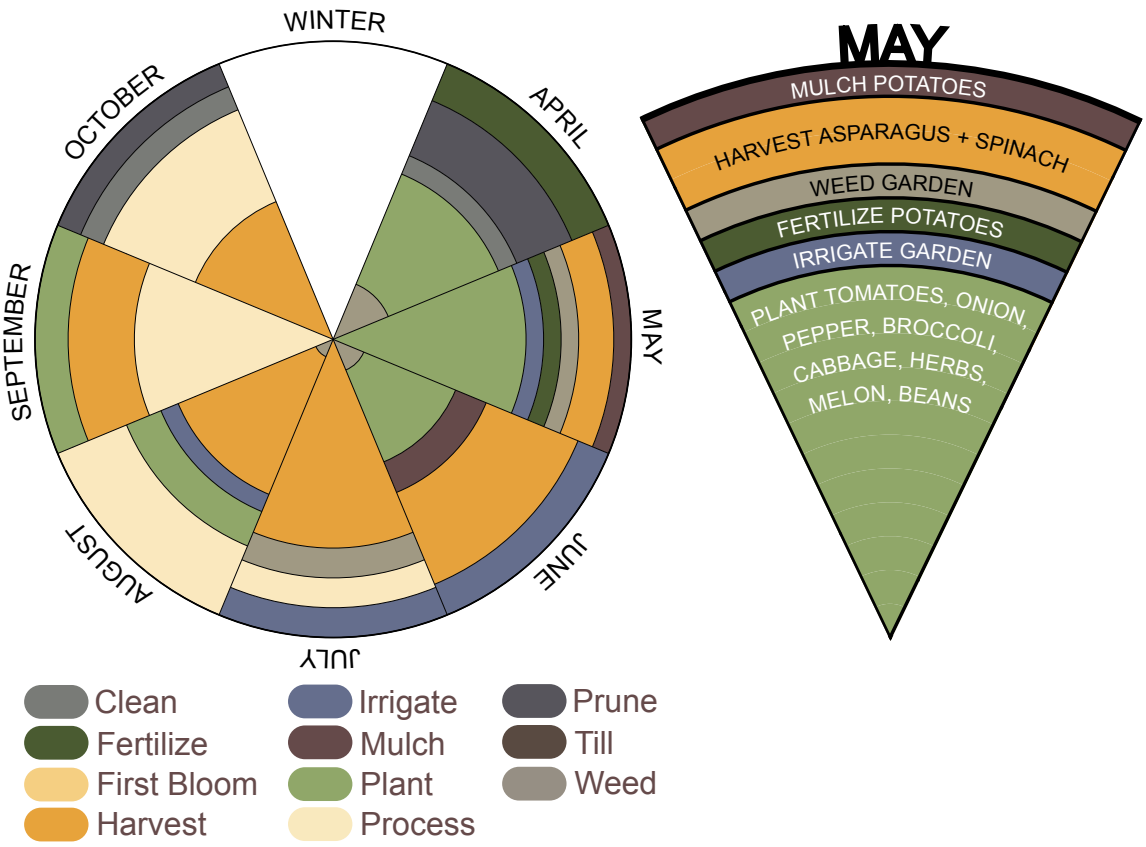


Figure 4.1: Garden calendar. The growing season and monthly activities are color coded. Sample month of May taken from calendar. Graphic by author.

The creation of an owner's manual helps interns using the site, while promoting the system's functions, and allows the interns to become land stewards (Figure 4.2). The monitoring/maintenance plan in the owner's manual includes the following: garden calendar based on Nina's records listing the growing season based on frost-free days, photos of common invasive species/weeds and removal sources, a guide to composting, a log of water usage and schedule for inspections of the cistern filter and irrigation system for leaks or other malfunctions, and a daily journal for events and minimum/ maximum temperatures, garden blooms and maintenance activities. The data collected in the owner's manual will be compiled for new interns to use. The owner's manual

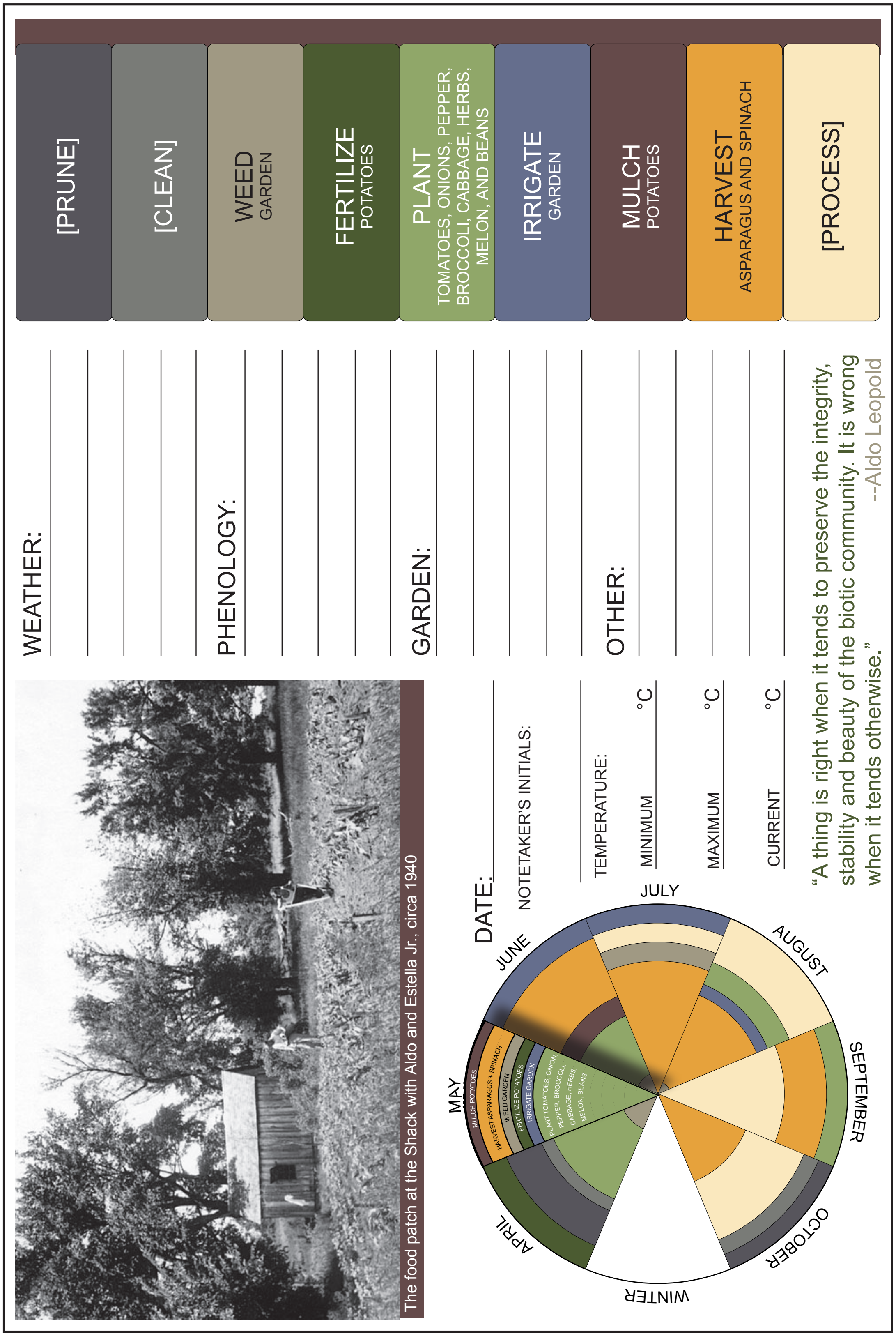
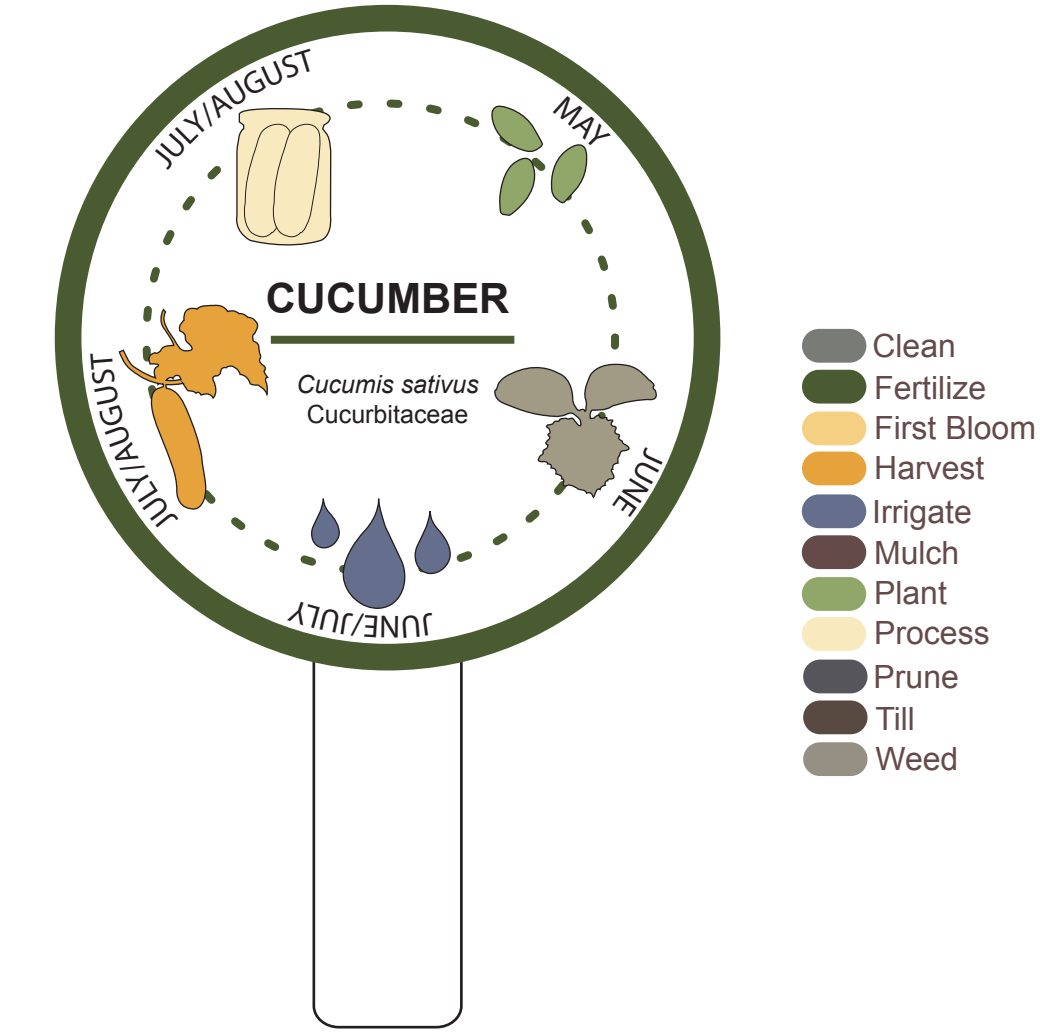


Figure 4.2: Owner's manual. Template for owner's manual page. Record-keeping includes date, temperature, weather, phenology and garden activities. Graphic by author.

details the goals of the garden design, with references to the garden zones and general maintenance for each zone. It also includes a copy of the plant matrix to educate interns on the edibility of plants, stressing the importance of plant identification and processing techniques. The seasonal garden activities, including planting, maintaining, and harvesting produce are clearly stated and conveyed to interns tending the garden for a successful design. The educational calendar helps the interns understand the seasonal processes and management activities. The garden calendar is based on Nina's garden records with a range of suitable dates for various garden activities. Other educational opportunities include creating signage for each type of species with images of each important stage in the plant's lifecycle to help inform how to care for and manage the plant. Early stages of the plant could be confused as weedy species and so providing an image of each phase can reduce confusion and help convey specific plant maintenance (Figure 4.3). The owner's manual will continue to grow and expand as the interns keep a journal similar to Nina's to record the daily activities, along with suggestions for continuous management improvements.

Another important aspect to measure sustainability on-site is the development of a survey for interns to take pre- and post-occupancy. The pre-occupancy survey instrument includes a Likert scale questionnaire for interns to fill out to assess their incoming knowledge of Leopold's land ethic, gardening, native plants, sustainable management practices and dependency on grocery stores. The post-occupancy survey includes the same questions to allow for comparative change in knowledge. A well-crafted survey instrument also allows a means to decipher whether interns found the gardens to be a sustainable source of food and a valuable educational experience. The survey will



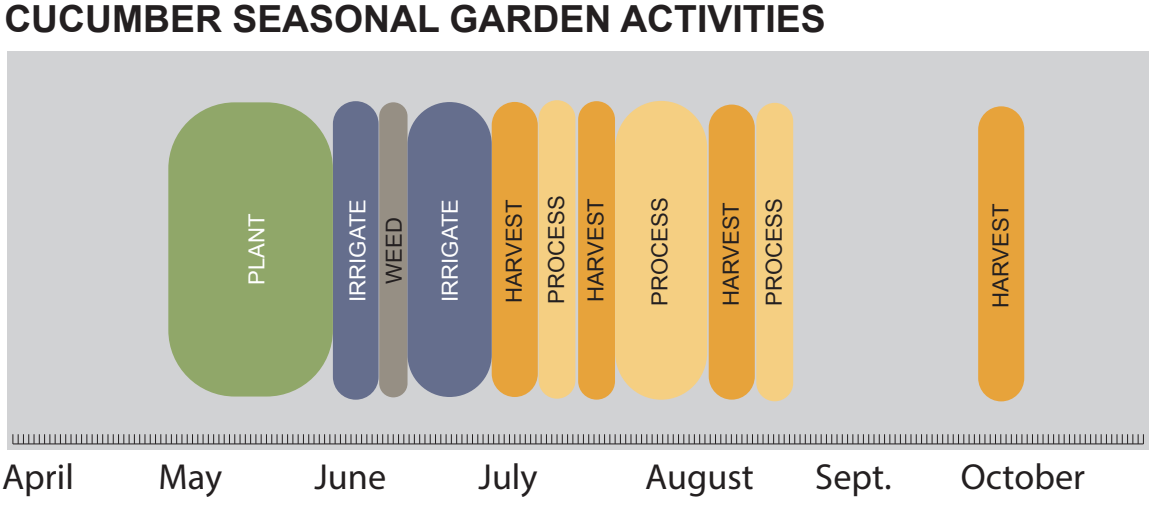


Figure 4.3: Template for simple signage. Plant lifecycle requirements and management activities are color coded correspond to the calendar. Graphic by author.

gather suggestions for improvements of the owner's manual, signage and monitoring/ management guidelines. Using the survey results, the design can be altered to better fit with each intern's experience and expectations of a sustainable site, and help create improved guidelines for interns to use and implement while on site.

These changing dynamics create a living campus and can be managed adaptively based on the current needs of each change in the system. Maintenance and adaptive management are essential to creating a sustainable site because "landscapes are comprised of living systems that evolve and change over time," (Venhaus 2012). Each plant will grow and change over time, impacting the area around it. For example, a young tree sapling will have little impact on the canopy until it begins to mature and the tree crown expands. This results in different shade patterns as trees grow, which causes understory plants to adapt to thrive in modified conditions. As other trees reach the end of their life cycles, they create gaps in the canopy that releases the ground floor for competition among species dependent on the increased availability of light. Nina described how the maple tree currently in front of the Shack tolerated the shade created by larger, mature trees, yet remained smaller possibly due to the competition for resources in the sandy nutrient poor soils. Yet when a larger tree fell and opened up the canopy for the maple to grow, it became one of the defining trees that frame the view of the Shack and is documented in photographs and shown in many artistic renderings.

Not only will the landscape dynamics change over time, but Nina's research showed a correlation of warmer spring temperatures causing earlier first bloom dates for several plant species. Therefore, the long-term monitoring allow for adaptation to the complexity of the environment in response to climate change. Climate change, as

noted in Nina's phenologic records and corroborated by USDA changes in the hardiness zone map, has practical implications for the edible landscape. For example, records from 2006 indicated a longer growing season. Vegetables can be planted and harvested earlier and certain species could have a secondary late season planting, creating an opportunity for multiple cropping sequences with crops such as beets, carrots, lettuce. The longer growing season in Wisconsin could result in gardening management techniques closer to tho what it used to be in the middle of Illinois. Native species to Illinois, such as sassafras or pecans, could become tolerant of changing conditions in Wisconsin.

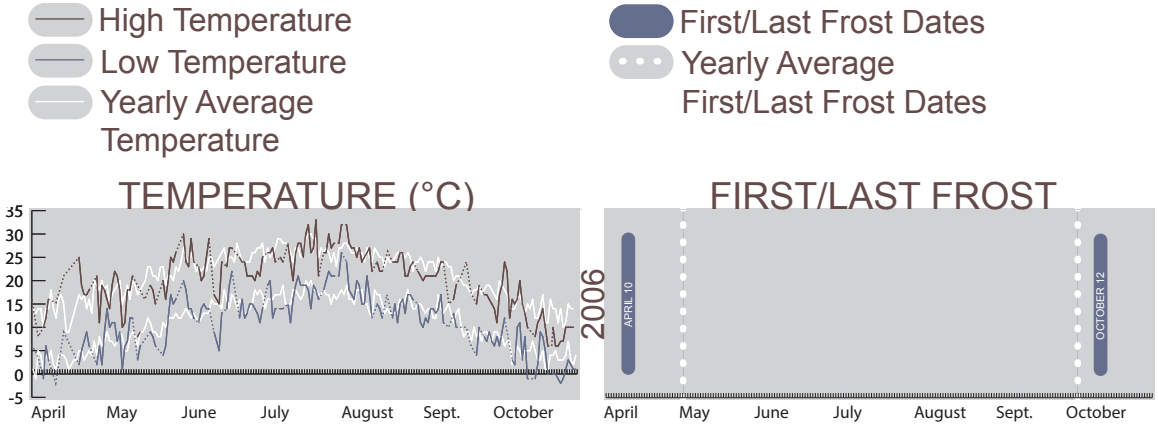


Figure 4.4: Longer growing season in 2006. Graphic by author.

Edible Landscape Design Scoresheet

A scoresheet (Appendix F) has been developed to evaluate how the design and management plans meet the goals, objectives and strategies of the edible landscape. Each goal, objective or strategy is met either through design, management or other, or has not been met. An explanation for categories designated as "other" has been provided.

Philosophy Strategy: "Transition to at least 50% reliance on edible landscape and garden as primary source of produce within first year of establishment. Work to achieve 100% reliance." This strategy acts as a guideline. Ideally, 100% reliance on the edible landscape would help better achieve sustainability goals; however, unforeseen events may prohibit 100% reliance based on year-to-year seasonal events (i.e. drought). To establish a 50% reliance on the edible landscape, it will be necessary to calculate a baseline of calorie intake of fruits and vegetables per week or dollars spent on fruits and vegetables at the grocery store per month. Using either the number of calories or dollars spent, within the first year, the number of calories from on-site food production should account for at least 50%, or the amount of money spent at the grocery store should be half of the original amount. This method would exclude calories/dollars spent on items other than fruits or vegetables (for example meats or dairy) because the edible landscape do not produce these types of products and would be unlikely to allow for 100% reliance on the edible landscape based on nutritional needs of each individual living and working with ALF.

Aesthetics Strategy: "Photograph site conditions before and after construction and implementation of edible landscape to determine if site keeps with character of the place." A suggestion for the Foundation to document the construction process. Ideally, a timelapse photograph sequence would help show construction activities of the facility and garden implementation to make sure all activities are protecting and preserving soils and existing vegetation.

Energy Goal: "Reduce excessive energy use for transportation and on-site maintenance." This goal may be hard to achieve with today's maintenance equipment. Many tools, including implements such as weed-wackers and lawn mowers rely on fossil fuels.

However, as more green energy technology solutions become widely available, older equipment should be phased out in favor of newer, greener technologies.

Energy Objective: "Decrease reliance on air conditioning or fans through passive cooling using shade trees near the building." Although the plan designates tree plants near the building, some species may take several years to become established and provide their full function on site.

Energy Objective: "Decrease 'food miles,' or distance food products must travel from farm to table by growing local produce." While the edible landscape provides a source of on site vegetable production, it does not provide 100% of food options. To supplement the edible landscape produce, interns should support local food options, such as farmers markets, community-supported agriculture (CSA), and look for local options at the grocery store.

Soils Goal, Objective and Strategy: "Minimize the disturbance of healthy soils from facility construction," (Goal) and "Create a soil management plan to salvage and repurpose healthy topsoil on site disturbed from housing facility construction," (Objective) and "Harvest 0-4 inches (A horizon) of loamy sand disturbed on facility construction on plainfield loamy sand (PfDT) and redistribute to garden area," (Strategy). The goal, objective and strategy for soils will need to be shared with the architects, designers, and contractors during the facility design and construction phases.

Vegetation Strategies: "Consult local experts to determine appropriate protection measures for existing vegetation and protect root zones of trees by buffering one foot radius per inch of tree's DBH," and "Determine existing site biomass density index (map quality of plant material in zones of existing vegetation) and use as a baseline for

proposed plantings." Both strategies need to be implemented prior to construction and the results should be shared with the architects, designers, and contractors to help protect mature, high quality vegetation from construction activities.

Materials Strategies: "Boulders, rocks, and aggregate: extraction, harvest, or recovery must occur within 50 miles," and "Plants: all growing facilities and suppliers must be located within Wisconsin, with a preference for those in Sauk County," and "All other materials: extraction, harvest, or recovery must occur within 250 miles, with a life-cycle assessment that ensures environmental practices," act as guidelines for material sources. Exceptions may be made for materials, but should only be considered under exceptional circumstances, such as importing a rare plant from a neighboring Mid-western state to further enhance biodiversity.

Chapter 4 explored adaptive management and monitoring through the creation of an owner's manual. Interns can document and record the activities within the edible landscape and adapt Nina's journal for the new facility. The scoresheet evaluated the design and management plans to determine how the edible landscape meets each goal, strategy and objective. Recommendations were presented for goals, strategies, and objectives that were not fully met through design or management. The concluding chapter will suggest future research, including using the monitoring and record-keeping from the edible landscape to carry on Nina's legacy of on site research.

CHAPTER 5

CONCLUSION

A Model for Record-Keeping and Management

The owner's manual can act as a model to be implemented on other sites suited to an edible landscape and garden. Aldo Leopold and Nina Leopold Bradley demonstrated the importance of record-keeping for research evidence of short-term and long-term seasonal changes. Documentation included both daily activities and seasonal events, such as Aldo recording bird calls responding to light intensity over the course of a morning, or Nina recording phenologic events based on plant responses to weather patterns. The record-keeping created a long-term study of native plant and animal responses to climate changes. As the interns begin the process of documentation, they will add to the body of knowledge and help decipher environmental patterns and adapt accordingly. Although Nina's records are unique to the site, following her process of observation and documentation is essential to create a seasonal management plan for a business, school institutional campus, or work site. Educational tools, such as the garden calendar, signage, and owner's manual will help the user understand the seasonal management, while beginning to record their own experiences of reconnecting with nature.

Future Research

The broader impacts of the Leopoldian philosophy could be researched to determine if the edible landscape has a increasing impact of sustainability for attitudes and behavior. While working in Nina's garden, I was able to directly communicate with

Nina and learn from her encouragement and passion for environmental conservation. Nina, a direct link to Aldo Leopold, helped convey the conservation efforts at the Shack and on the Reserve to me. Without Nina as a mentor, future interns lose the direct link with a Leopold family member who spent more than 40 years living on the land. By studying behavior and attitude of interns, it may be possible to measure a correlation of the edible landscape and land management practices with an increasing awareness of environmental conservation and the Leopold philosophy.

This thesis has examined the Bradley Study Center journals stratified into 5-year intervals. Expanding the study into a yearly review would help reveal potential trends of cultivated species reacting to climate change and build on Nina's research. Sharing the research from the journals with a wider range of academic scholars and nature enthusiasts would continue to carry on Nina's legacy. Scanning and creating digital copies of the journals could help not only this research project, but any additional projects that could use a 40+ year study of the phenology and daily management activities at the Bradley Study Center.

Interviews with Nina's family and those who have helped in the garden would clarify the daily garden activities that may have been overlooked in the journals. Nina rarely worked alone in the garden - interns, family members, and friends frequently visited and would partake in the gardening activities. Since Nina was never interviewed specifically on the garden, interviews with those who interacted with her garden would be essential to preserve the garden knowledge.

An evaluation of the implemented design could inform an adaptive management plan. Monitoring the water usage would help determine if the cistern had been sized

correctly for the rainfall events and required water usage for the gardens. Rain events may change frequency and duration with climate change, and could impact the amount of water needed for the garden. For example, if there was an increase of droughts, the cistern would be essential to capture and store water for reuse during periods of water scarcity. Monitoring the water demand helps convey the importance of rainwater harvesting.

The plant list could be evaluated based on the temporal changes to see how the layers interact and change. Certain plants may need to be pruned, separated, or removed based on the performance on site. If any plant species show aggression or unwanted self-seeding, that species may need to be removed to prevent any further invasions on the Leopold Reserve. Also, the plants will need to be monitored with climate change. It is possible that plants requiring cooler winters may begin to be out-competed with increasing winter temperatures, and may need to be replaced with plants that prefer warmer climates. In adding these plants to the design, they should be evaluated following a similar plant matrix to determine if they benefit the ecosystem.

A survey of biodiversity of wildlife, specifically birds, would be helpful to see if the garden did have a positively influenced biodiversity. Certain bird species prefer different habitats, as noted in Nina's journals and the design may predetermine bird species attracted to the site. Keeping a log of the bird species related to the planting design, phenology, and weather could show a correlation of increased native plant diversity and native bird populations.

Nina's records and research showed certain native species have reacted to the changing temperature associated with climate change. However, the research did not include garden cultivars. Therefore, the interns could document cultivated species within

the garden that react to the changing temperatures and create a management plan for gardens to adapt to climate change. This project will carry on Nina's legacy of a local sustainable garden that acts as an educational tool. Sharing the knowledge of the garden studies can allow the public to interact with the garden, while keeping the physical space private for the interns. However, if ALF should choose to allow the space to be open to the public, the garden could become a center for learning that could target school-age children to help them understand the importance of sustainable food production in the face of climate change.

Conclusion

As Charlie Bradley said in his Bradley Study Center dedication speech in 1976, "If, in the end, we too -- those today and those who may follow -- are able to add something to the store of wisdom about the relationship of man to land, the Study Center will have helped make the Reserve an even more worthy memorial to Aldo Leopold." The Study Center not only carries on the traditions of Aldo Leopold but also Nina Leopold Bradley. The edible landscape has been researched to carry on Nina's legacy to encourage local food production and sustainability, while connecting with nature. Through the journals, Nina documented more than 40 years of management and change on the site. Her journals, along with the Shack journals, are a unique research tool and historical record of land conservation that help reinforce and promote the Land Ethic. After tending the garden, the interns may gain a better understanding of the history of their food, along with a connection to the Leopold family.

Nina's voice will carry on through her journals. "Charlie and I walked the trail through Charlie's woods, home by the Turner Trail - sheer delight. On return we sat on

the bench by the house and watched the clouds of geese, moving from the River to the corn fields. Only in old age can one sit, quietly, unencumbered by responsibilities - just a' sittin! Call it enjoying a 'sense of place' - no desire to be elsewhere."

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APPENDIX A

THE LEOPOLD RESERVE AERIAL MAPS 1937-2015

The 1937 aerial map of the Leopold Reserve shows the Reserve area approximately two years after Aldo Leopold purchased the property. The dominant landuse is primarily agriculture surrounding the Shack property. The following maps (1940, 1949, 1955, 1962, 1968, 1978, 1986, 1993-1994, 2000, and 2015) show the results of the Leopold family's restoration activities as the pines mature. The Wisconsin River changes the shapes of the islands and shore edge. However, the Shack is located on higher ground on a morraine deposit and is not impacted by the changes in the river.

The 1937 aerial map is approximately two years after the Leopolds purchased the property and began restoration efforts at the Shack. The images from 1937-1955 are prior to the development of Highway 94 (south of the Reserve). Aldo Leopold writes how he chose his piece of land for the "lack of a highway," ([1949] 1968).

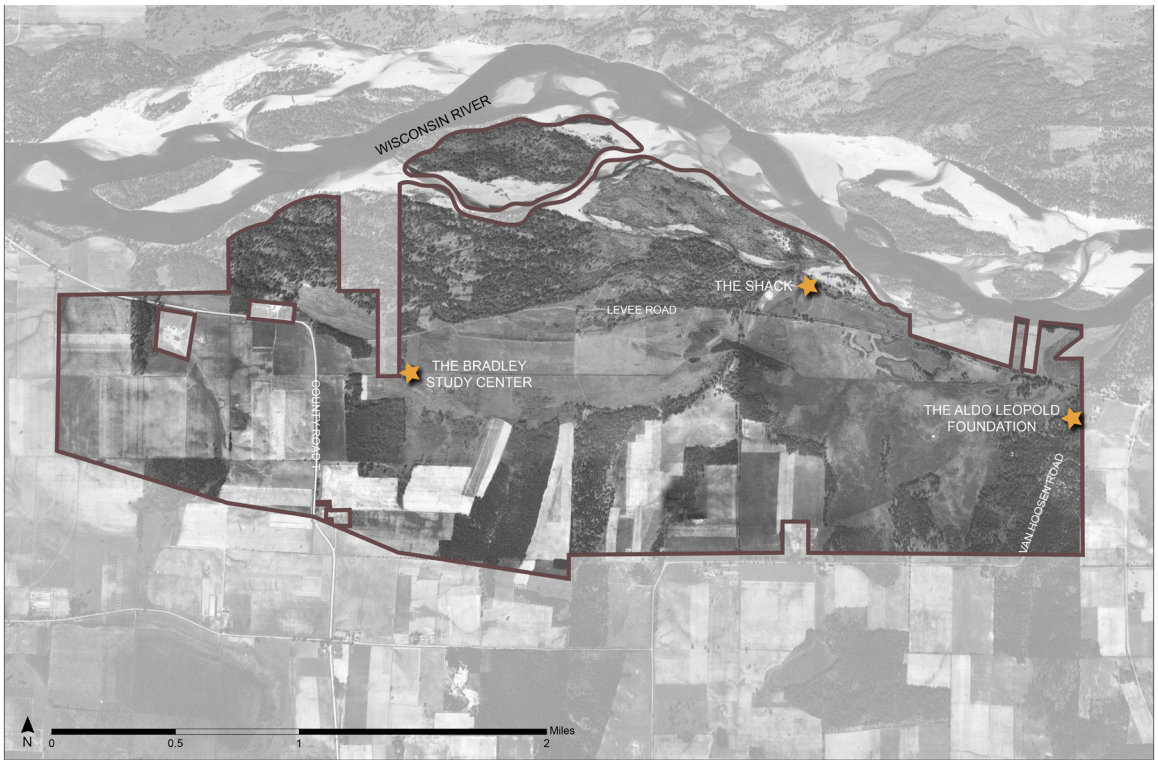
Throughout the maps, the vegetation changes based on the Leopold's restoration activities including planting pines and prairies. The Shack journals refer to a "sand blow" southwest of the Shack, or an open area of sand. According to Leopold, the area was never able to host vegetation or crops until the family began restoration activities ([1949] 1968). This area appears on images from 1937 to 1962 but gradually gets covered in vegetation as the health of the land is restored.

By 1968, several artificial ponds have been excavated within the marshland areas of the Reserve. Nina describes how digging the ponds created ideal habitats for invasive

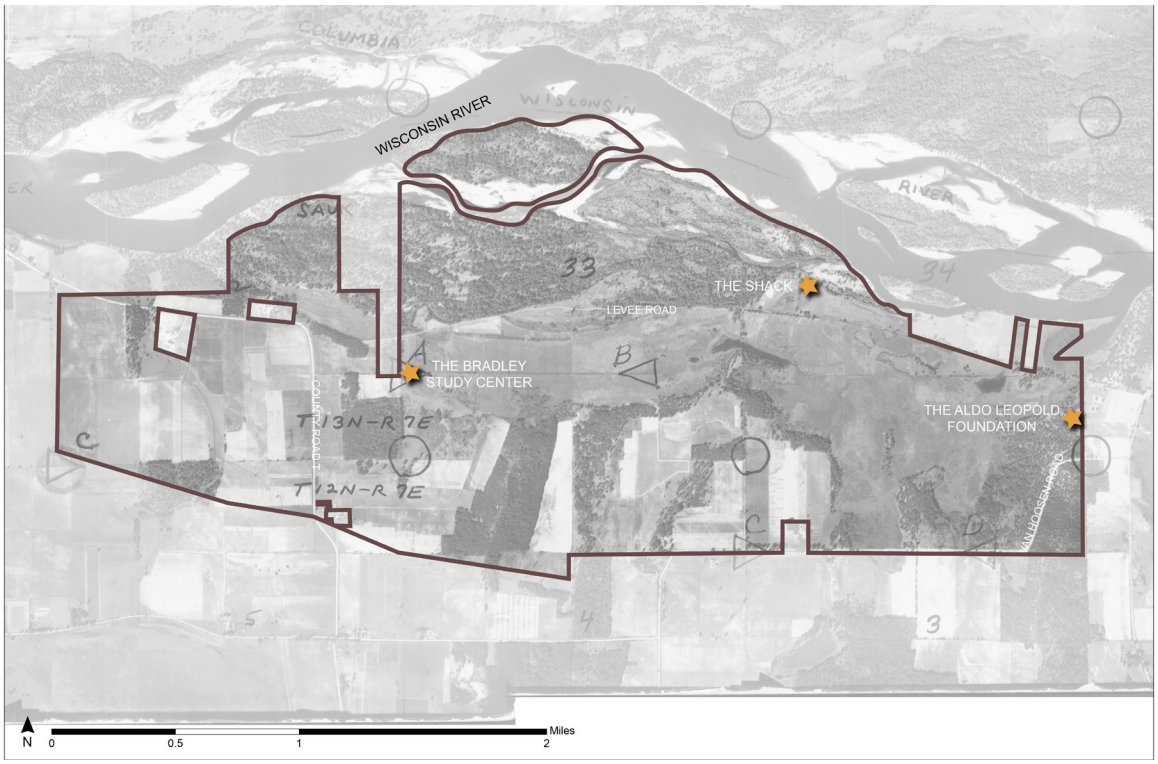
exotic species to out-compete native species within the Reserve (Leopold Bradley 2000). According to Nina, since the 1980s, invasive species have been one of the largest threats to the Reserve (Leopold Bradley 2009). However, interns with ALF focus management activities on invasive species control within the Reserve.

The Bradley Study Center and pond are established on the 1978 aerial. Nina and Charlie harvested mature pine trees planted in the 1930s to construct the Bradley Study Center. Using the displaced soil from constructing the Bradley Study Center, Nina and Charlie created the raised beds in the garden.

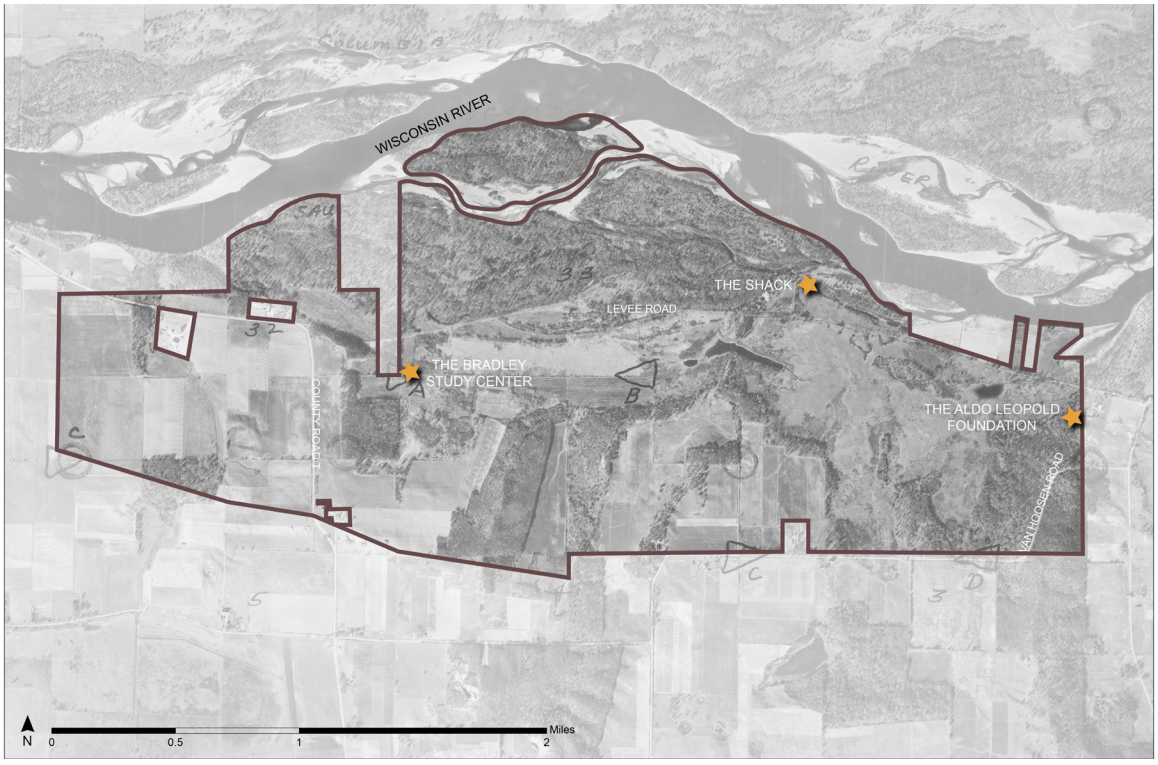
The Leopold Legacy Center, built in 2007, is on the current 2015 aerial image. The site was previously an ecologically degraded area and has been restored with native landscaping, water harvesting methods, and a Platinum LEED Certified facility.



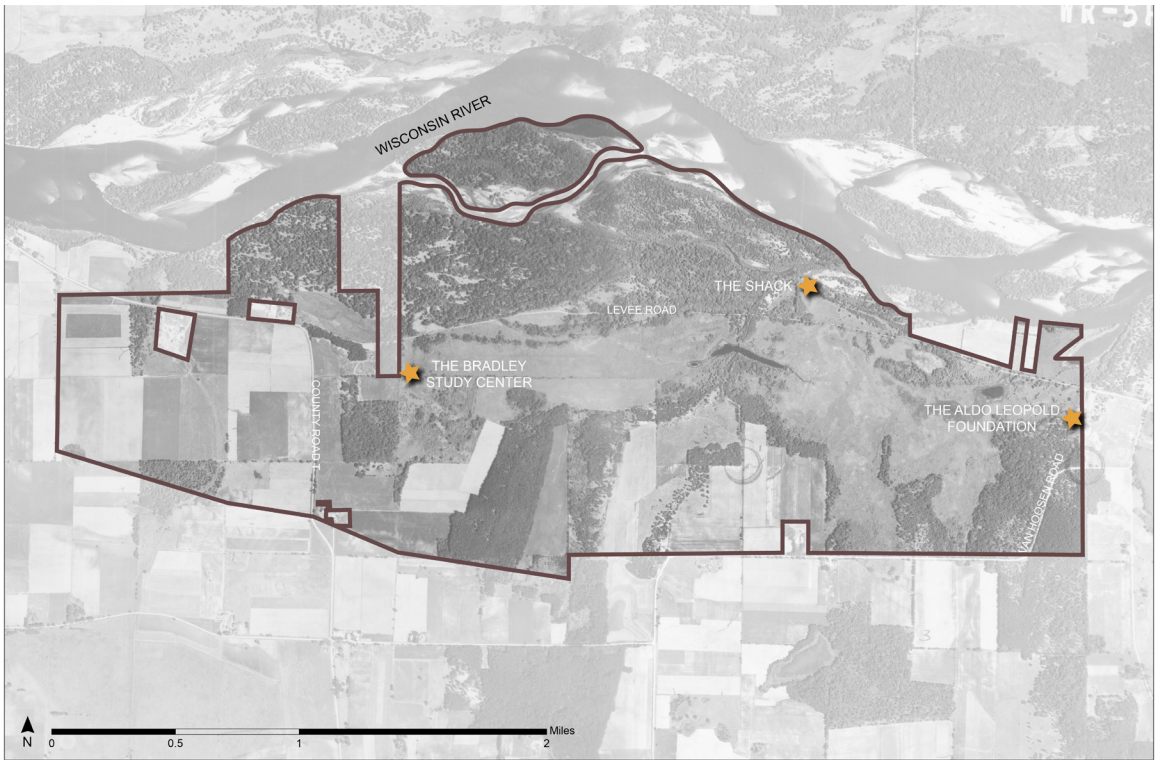
1937 aerial map courtesy of the Wisconsin Historic Aerial Imagery Finder (WHAI) http://www.sco.wisc.edu/whaifinder/whaifinder.html. Map by author 9 March, 2015.



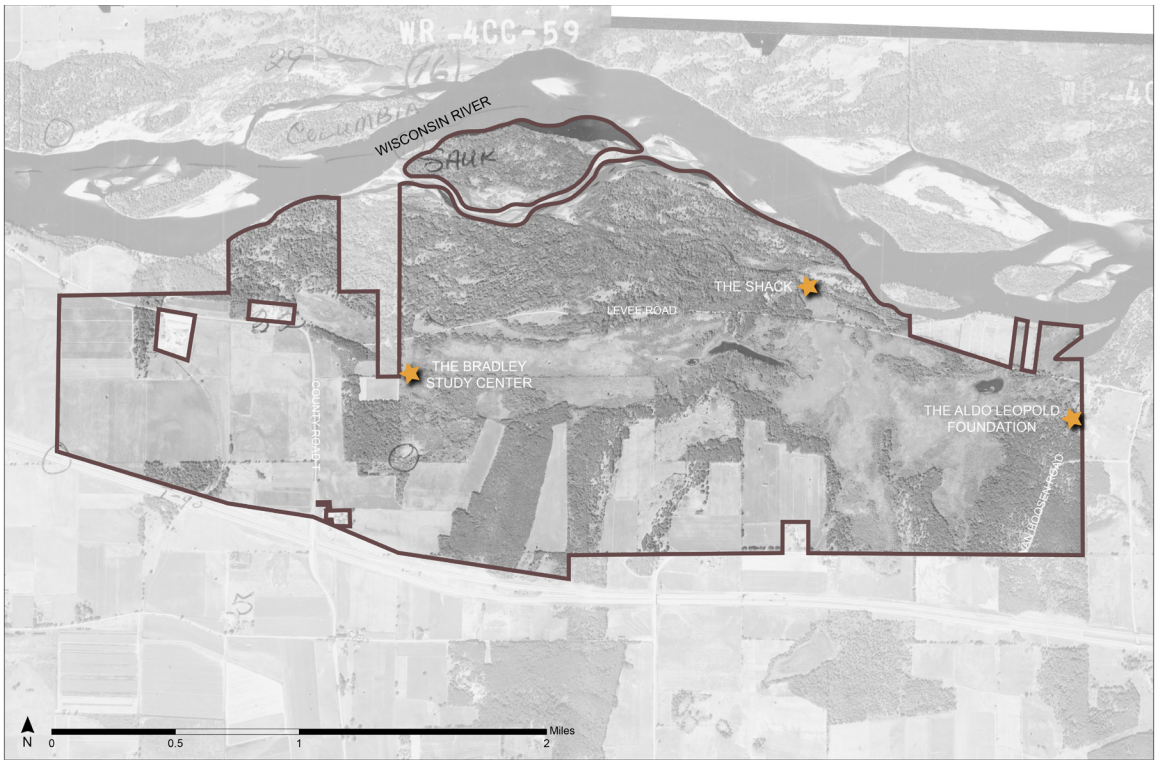
1940 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Agriculture, Agricultural Adjustment Administration. Map by author 9 March, 2015.



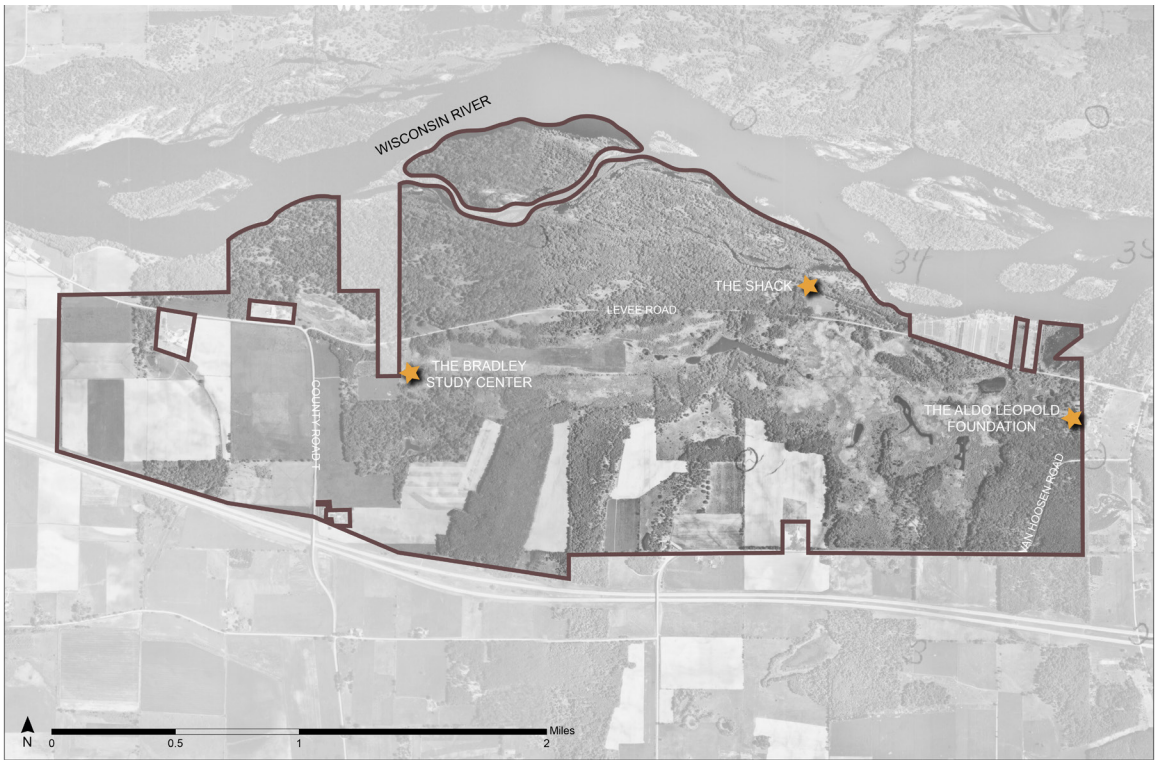
1949 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Agriculture, Production and Marketing Administration. Map by author 9 March, 2015.



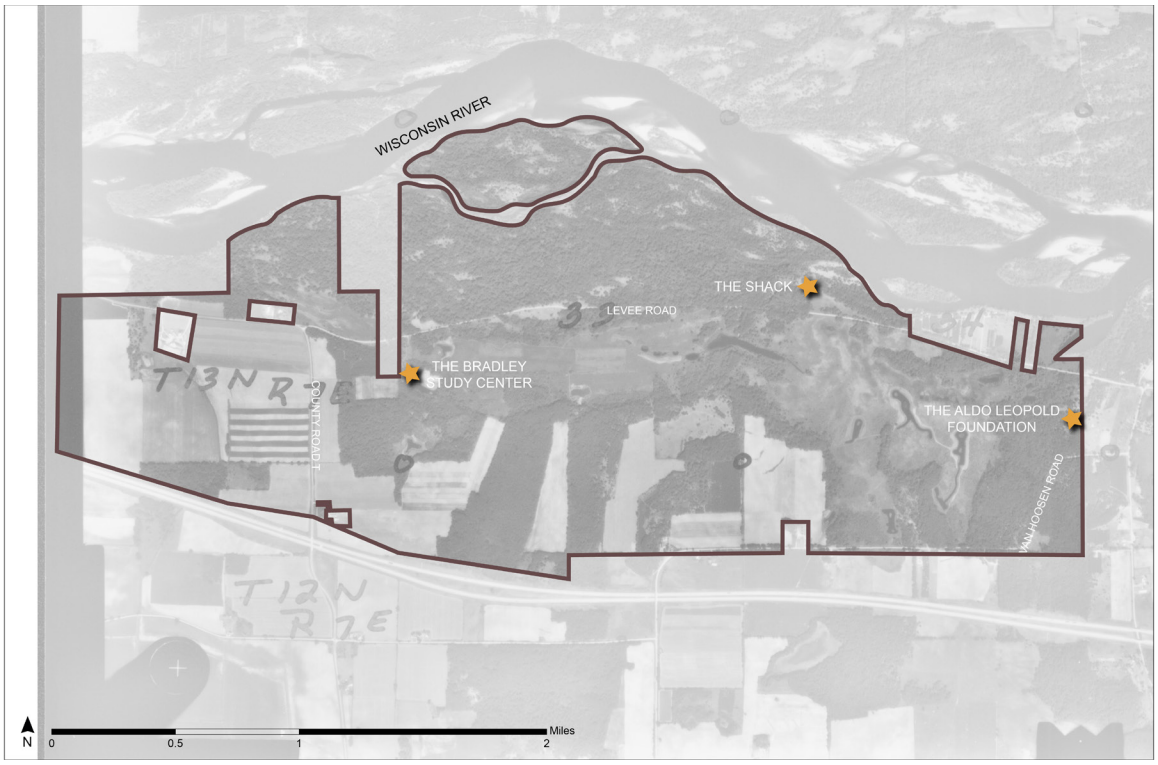
1955 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Agriculture, Commodity Stabilization Service. Map by author 9 March, 2015.



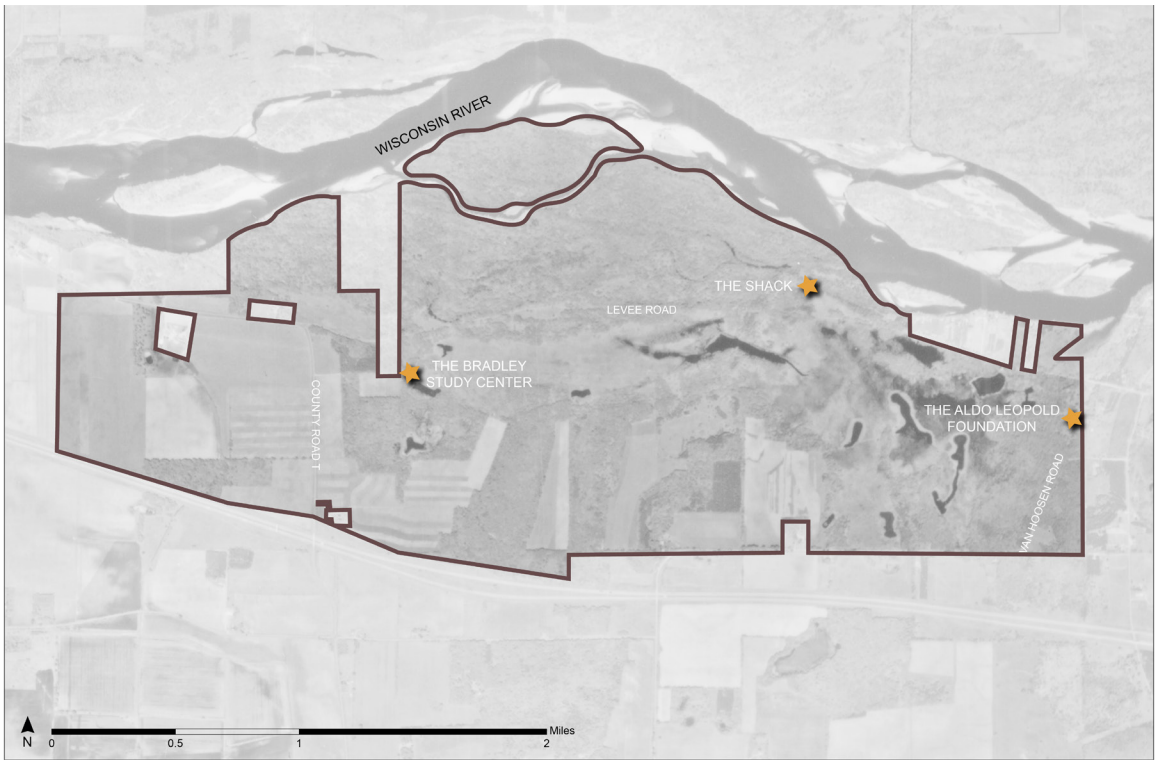
1962 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Map by author 3/9/15.



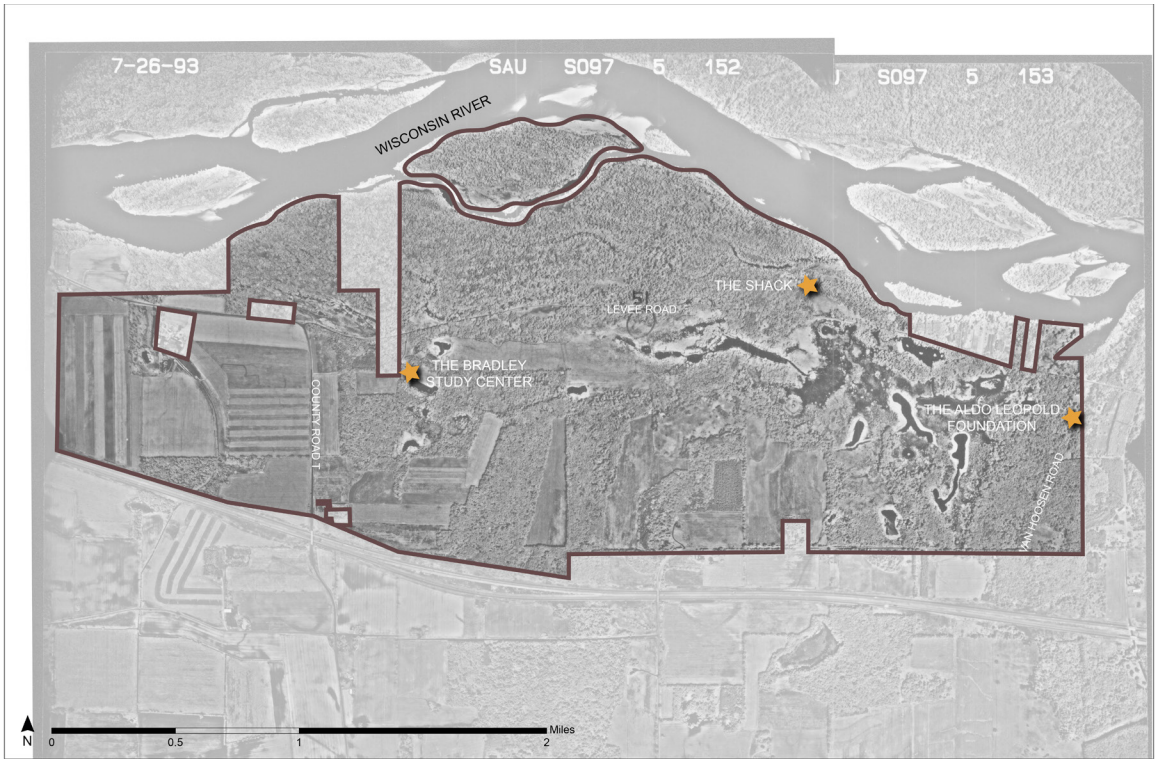
1968 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Map by author 3/9/15.



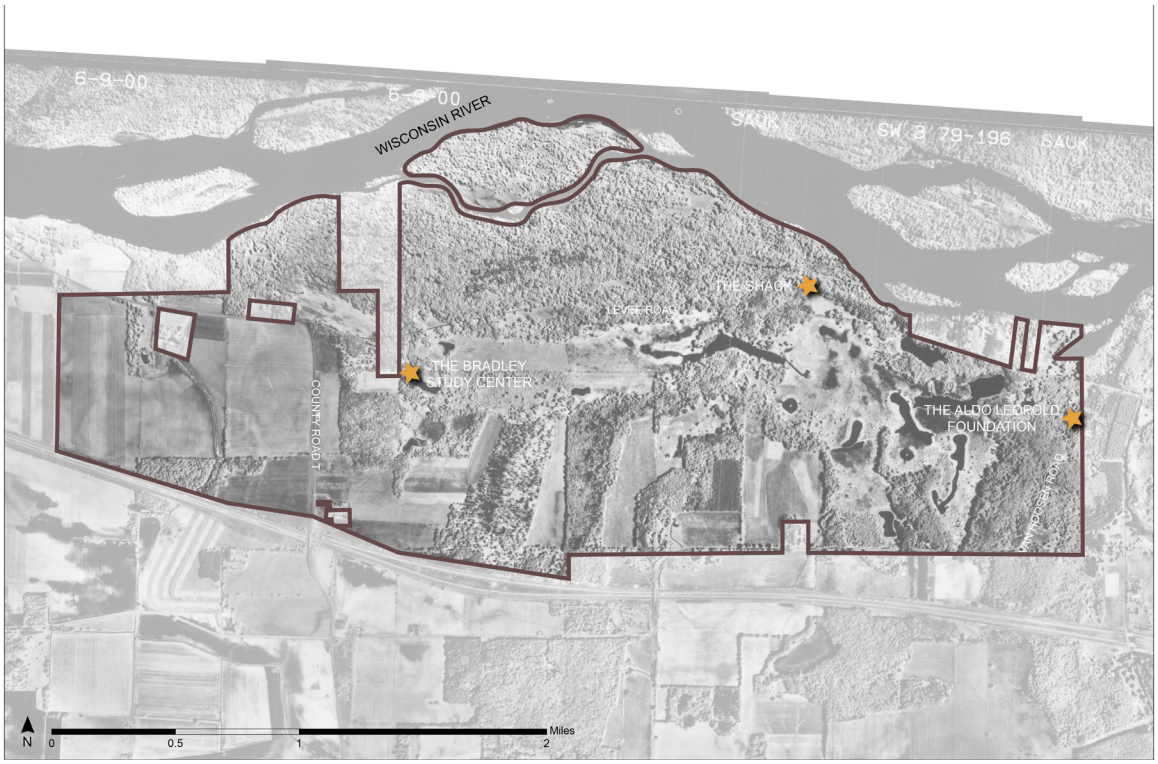
1978 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Transportation, Division of Highways. Map by author 9 March, 2015.



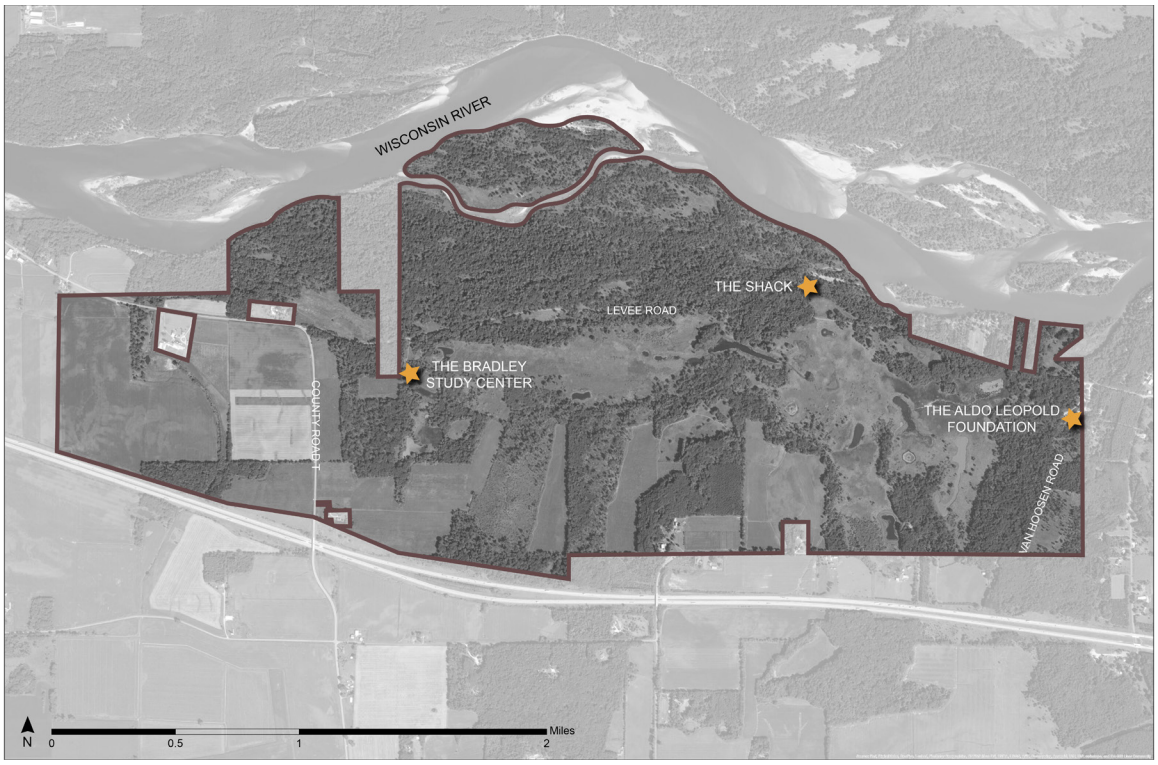
1986 aerial map of the Leopold Reserve, courtesy of National High Altitude Photography (NHAP). Map by author 9 March, 2015.



1993-1994 aerial map of the Leopold Reserve, courtesy of the U.S. Department of Transportation. Map by author 9 March, 2015.



2000 aerial map of the Leopold Reserve, courtesy of the Wisconsin D.N.R. Map by author 9 March, 2015.



2015 aerial map of the Leopold Reserve, courtesy of Esri, USGS. Map by author 9 March, 2015.

APPENDIX B

SOIL CLASSIFICATION TABLE (NRCS 2013)

Leopold Reserve, Sauk County, Wisconsin		
Map Unit Symbol	**Map Unit Name**	**Drainage Class**
Ad	Adrian muck	Very poorly drained
BlB	Billett sandy loam, 1 to 6 percent slopes	Well drained
BrA	Brems loamy sand, 0 to 3 percent slopes	Moderately well drained
BtB	Briggsville silt loam, 2 to 6 percent slopes	Well drained
Fu	Fluvaquents	Somewhat poorly drained
Fw	Fluvaquents, wet	Poorly drained
GoB	Gotham loamy sand, 1 to 6 percent slopes	Well drained
GoC	Gotham loamy sand, 6 to 12 percent slopes	Well drained
GoD	Gotham loamy sand, 12 to 25 percent slopes	Well drained
Gr	Granby loamy sand	Very poorly drained
Ho	Houghton muck	Very poorly drained
Mc	Marshan loam	Very poorly drained
MdB	McHenry silt loam, 2 to 6 percent slopes	Well drained
Pd	Pits, gravel	N/A
PfBT	Plainfield loamy sand, till plain, 2 to 6 percent slopes	Excessively drained
PfCT	Plainfield loamy sand, till plain, 6 to 12 percent slopes	Excessively drained
PfDT	Plainfield loamy sand, till plain, 12 to 30 percent slopes	Excessively drained
RmA	Rimer loamy sand, 0 to 3 percent slopes	Somewhat poorly drained
RnB	Ringwood silt loam, 2 to 6 percent slopes	Well drained
ShA	Shiffer variant sandy loam, 0 to 3 percent slopes	Somewhat poorly drained

Leopold Reserve, Sauk County, Wisconsin		
Map Unit Symbol	**Map Unit Name**	**Drainage Class**
W	Water	N/A
WxB	Wyocena sandy loam, 2 to 6 percent slopes	Well drained
WxC2	Wyocena sandy loam, 6 to 12 percent slopes, eroded	Well drained
WxD2	Wyocena sandy loam, 12 to 20 percent slopes, eroded	Well drained

APPENDIX C

THE BRADLEY STUDY CENTER JOURNAL NOTES

Due to the establishment of the Bradley Study Center in 1976, the garden notes are recorded starting July 6th. Temperatures are not recorded becasuse the minimum/ maximum thermometer was installed the following year in 1977. The following notes have been condesnsed for 1976. All other years (1981, 1986, 1991, 1996, 2001, 2006) contain the entire growing season from April 1st to October 31st.

1976			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 6			Decided to create pond 100 m. SE of [housing] site, use spoil around house, peat and muck for garden plot. Spent afternoon clearing around building site
July 7			
July 8			Pond site: Soil auger showed water table 75 cm. deep at NW end. 50 cm deep SE end. 100 cm deep at garden site. Water table sits on top of clay, gravel, top layer is well sorted sand.
July 9			
July 10			
July 11			
July 12			
July 13			This is a very dry summer, bad for crops but great for digging ponds.
July 14			
July 15			Good rain. May save some crops.

1976			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 19			More rain… Garden area clear 100’ x 75’ covered with peat.

1976			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 13			Manure on garden. Cistern in place. Heavy rain storm.
August 14			Rain wash caused further gullying and probably carried some manure into pond.

1976			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 25			Garden water line started.
October 26			
October 27			Water line to garden buried with back inclination for autumn drainage. It is about 1’ deep at garden.
October 28			
October 29			Grape arbor constructed.
October 30			
October 31			

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1	26	7	
April 2	13	1	
April 3	26	13	Bloodroot first bloom
April 4	22	12	
April 5	12	0	Fertilized raspberries, Phenology: Skunk cabbage 1st bloom
April 6	9	-2	Activity: N. weeding strawberry bed.
April 7	15	8	
April 8	22	9	
April 9	14	4	
April 10	19	12	
April 11	22	13	N. working in garden.
April 12	22	7	
April 13	14	9	Nina in garden. Repaired rototiller. Working in garden putting oak slab edging on raised beds.
April 14	9	5	N in garden.
April 15	11	-1	In garden
April 16	15	6	
April 17	19	11	
April 18	25	7	
April 19	18	9	
April 20	14	0	
April 21	14	-1	Planted 8 walnut (black) trees on the west edge of North Prairie.
April 22	14	8	Pear tree blossoming, Amelancier full bloom on Reserve.

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 23	15	8	
April 24	9	4	
April 25			
April 26	13	1	Activity: Weeded raspberries + grapes.
April 27	21	8	
April 28			
April 29	13	7	Work: Planted fruit trees in the Shack orchard. Felled the four places where trees had died; weeded and fertilized all trees.
April 30			Planted a cherry (Northland) and an apple along driveway
May 1			Cleared sod from concord grapes along ramp, mulched with compost; planted 2 concord grape in vineyard
May 2	17	6	Garden: Planted seeding to peat pots, tomatoes, gr. peppers. lettuce
May 3	18	11	
May 4	25	11	Garden: Planted onion “plants”
May 5	18	11	
May 6	18	11	Picked 117 lbs. of asparagus at Tricie’s
May 7	20	1	Many areas had frost, Apple trees are in full bloom and may have suffered. Garden: Planted potatoes
May 8	20	2	
May 9			
May 10			

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 11	22	2	
May 12	18	2	
May 13	19	9	
May 14			
May 15			
May 16	27	7	Chokecherry first bloom
May 17	27	7	
May 18	27	3	
May 19	27	2	Although the porch thermometer did not register frost, two tomato plants whose covers blew off were completely frosted.
May 20	21	6	Activity: planted tomatoes
May 21	28	10	Activity: Garden, compost. Started the new compost pile.
May 22	28	10	Activity: Garden - planted cantaloup, squash, cucumbers, beans. Almost through planting. Started heavy watering. Soil is powder dry.
May 23	26	17	Worked in garden
May 24	27	19	Activity: Watered Garden. Mowed Lawn.
May 25	25	13	Activity: Weeded garden
May 26	23	15	Activity: Mowed garden trails and around outside.
May 27	24	14	Activity: finished weeding raspberries. Watered garden in evening.
May 28	24	12	Activity: garden
May 29	26	17	

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 30	29	14	Worked in garden
May 31	25	12	Activity, Watered garden. Phenology: first bloom rose
June 1	23	15	Activity: watered garden.
June 2	27	15	
June 3	28	19	
June 4	28	15	Activity: I sprayed grapes
June 5	24	15	
June 6	31	16	Activity: Watered and Weeded garden
June 7	31	13	Activity: Worked around yard, garden
June 8			
June 9	26	15	
June 10	26	15	Garden weeding
June 11	25	15	First bloom pale purple coneflower
June 12	28	19	
June 13	30	22	Activity: Picked a big basket of huge, juicy strawberries. N. worked in garden
June 14			
June 15	31	22	N. worked in garden
June 16	26	18	
June 17	22	13	Activity: Garden, We are gathering about 2 gallons of strawberries/day - large and delicious! Mowed around the garden.
June 18	27	20	Activity: Picked strawberries. Hoed garden and fixed bedding supports.

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 19	26	14	Activity I mended collapsed garden bed support. Picked 2 gals. of strawberries.
June 20	25	16	Activity: Sprayed the garden. Sudden disastrous blight hitting cabbage, peas, beans, eggplant. We picked 2 gal strawberries.
June 21	22	14	
June 22	21	15	Activity: Picked 2 gal strawberries.
June 23	21	14	
June 24	24	14	We picked 2 gal. strawberries.
June 25	28	18	
June 26	27	14	Activity: Picked 1 gal. strawberries.
June 27	25	13	
June 28	27	19	Activity: Garden, picked 2 gal. strawberries.
June 29	30	21	
June 30	29	18	
July 1	27	14	
July 2	27	20	Activity: watered garden.
July 3	28	18	
July 4	29	18	
July 5	31	21	
July 6	31	18	
July 7	33	19	Activity: Got up 5:30a to water garden and weeded. Picked 1 gal raspberries.

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 8	33	26	Activity: Got up 5:30 watering and weeding garden.
July 9	33	23	Activity: N. picked a gal of raspberries and worked in garden.
July 10	31	16	
July 11	31	19	Picked 1 gal raspberries.
July 12	27	21	Activity: Worked in garden.
July 13	33	25	Activity: Picked raspberries.
July 14	32	20	
July 15	26	17	Picked raspberries.
July 16	22	20	Activity: N. in garden.
July 17	28	20	
July 18	31	20	
July 19	31	20	
July 20	30	22	
July 21	28	17	Activity: N + I in garden. I made 1st kraut this season.
July 22	24	15	N gardened and mowed.
July 23	24	16	I made pickles, N. in garden.
July 24	25	17	
July 25	28	17	Activity: Garden, pickles, kraut. N. planted strawberries.
July 26	31	18	Activity, Nina in garden. We pulled off netting from raspberries. I reorganized compost. More pickles.
July 27	23	15	
July 28	23	13	Activity, Nina worked in the garden

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 29	21	14	Activity: canned 6 qt. of pickles
July 30	26	15	
July 31	26	15	Activity: I canned 2 gal. pickles and 3 qts. sauerkraut. N. worked in garden.
August 1	29	18	Activity: Nina freezing beans hand over fist
August 2	30	22	
August 3	25	18	Activity, cannned 7 qt. of cucumber pickles. N froze several qt. of beans.
August 4	30	22	Activity, pickles. We opened 1st bottle of sparkling strawberry wine. O.K.
August 5	30	21	Activity: Garden. N digging onions (shallots).
August 6			
August 7	29	19	Activity: 4 qt. pickles, 4 qts frozen beans
August 8	24	19	Activity: mowed lawn and made 5 qt. of kraut.
August 9	27	18	
August 10	27	17	Activity, I propped up raspberries and N mowed garden trails.
August 11	25	14	
August 12	27	14	Big production of beans, squash, tomatoes.
August 13	30	22	
August 14	31	22	Activity: Huge harvest of tomatoes and beans. I pickled beans and cucumbers.

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 15	26	21	Activity: Heavy harvest.
August 16	29	15	Activity: Mowed lawn and harvested
August 17	22	8	Activity: Harvest
August 18	23	10	Made 6 qt. sauerkraut
August 19	24	10	N worked in garden.
August 20	26	10	
August 21	26	12	Activity, garden
August 22	27	15	Activity, garden
August 23	27	18	Canned 21 qt. tomato juice (5 Roma - 16 regular)
August 24	28	16	
August 25	28	20	
August 26	27	21	
August 27	23	21	
August 28	20	19	
August 29	22	20	N in garden harvesting tomatoes, squash, beans, and eggplant
August 30	26	19	Made hot sauce
August 31	27	22	Harvested Roma's
September 1	26	20	Activity, canned tomatoes and hot sauce
September 2	22	13	
September 3	23	13	
September 4	24	13	
September 5	24	13	Activity, Harvested tomatoes + melons
September 6	18	11	Sumac starting to turn color
September 7	23	13	

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 8	22	13	Activity: Picked corn
September 9	23	12	Activity froze beans
September 10	26	15	Activity: N canned tomatoes (16 qts)
September 11	29	19	
September 12	30	16	Activity, made 3 qt. tomato juice and 6 pints hot sauce
September 13	27	13	
September 14	28	18	
September 15	24	15	
September 16	22	8	Activity Canned 16 qt. tomato juice and 14 pints puree
September 17	17	7	
September 18	17	8	
September 19	19	9	Activity N Harvesting
September 20	23	6	
September 21	22	12	
September 22	22	7	
September 23	16	4	
September 24	18	7	
September 25	22	11	
September 26	22	12	
September 27			
September 28	22	5	
September 29	17	9	Activity: N made big harvest of pepper, zucchini, cucumber, tomatoes
September 30	14	12	
October 1	18	9	

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 2	17	2	Activity: Harvested winter squash
October 3	12	0	Activity: concord wine making, worked on compost. Cleaned out pepper and bean plants. dug 1/2 row potatoes (1 wheelbarrow load mostly good size and fine condition).
October 4	16	9	Activity: Nina cleaned garden.
October 5	16	11	I dug more potatoes (1/2 wheelbarrow)
October 6	18	1	Cut aspen to give garden afternoon sun. N harvesting potatoes
October 7	18	6	
October 8	16	1	Started weeding and cleaning up raspberries and grape arbor.
October 9	15	3	
October 10	16	7	
October 11	16	9	
October 12	16	6	N in garden, Pruned raspberries. N cleaned garden shed.
October 13	18	7	
October 14	22	14	
October 15	17	14	Activity, worked in garden
October 16			
October 17	18	3	
October 18	17	6	
October 19	7	-1	
October 20	15	5	Activity: Pruned raspberries

1981			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 21	17	5	
October 22	10	2	
October 23	10	-1	Turned compost
October 24	4	-5	
October 25	18	1	
October 26	9	3	Pruned Raspberries
October 27	13	0	Put leaves on compost
October 28	17	2	
October 29	14	6	
October 30	18	9	
October 31	21	12	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1			
April 2	22	0	Activity, finished pruning grapes. N still working on raspberries
April 3	15	6	
April 4	15	6	Nina planted lettuce seedlings in cold frame and garden, Also started more seedlings.
April 5	12	6	Nina planted peas in AM
April 6	19	10	Nina in garden
April 7	19	7	
April 8	20	7	Nina in garden planting peas and potatoes
April 9	12	2	N finished pruning raspberries. Mole has still not passed my trap.
April 10	12	0	
April 11	16	0	Domestic plum breaking bud. Chokecherry leafing. Raspberries leafing.
April 12	18	3	
April 13	18	1	Dentaria 1st bloom, N working with crew clearing, burning, and turning garden beds and compost (turned only 1/2 compost because center still frozen).
April 14	14	6	
April 15	7	2	Amelanchier leafing. Pruned grape arbor
April 16	7	3	Amelanchier in bud, Nina weeded strawberries.
April 17	13	2	Chokecherry leafing
April 18	16	5	Black Cherry leafing

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 19	15	9	N weeded and planted potatoes
April 20	16	6	Fern fiddleheads up, Yellow violet 1st bloom, domestic gooseberry in bud
April 21	16	1	
April 22	7	-4	N in garden planting lettuce and preparing beds
April 23	10	-1	Amelanchier 1st bloom, N transplanted tomatoes, hot peppers, parsley.
April 24	15	10	Domestic plums first bloom, N weeded strawberry patch
April 25	23	13	Purple violets first bloom, domestic cherry first bloom, N weeded garden.
April 26	24	15	1st bloom wild strawberry, N planted strawberries in garden, planted kiwi between shed and kitchen garden
April 27	27	19	
April 28	28	15	Domestic Strawberry 1st bloom
April 29	16	8	Got load of sawdust for strawberry mulch. N did the mulching
April 30	23	12	
May 1	24	13	Garden: dug old strawberries on E. garden periphery and replanted with variety Sparkle. Potatoes are up. Peas 3” high.
May 2	14	6	
May 3	19	0	Mowed lawn, hilled 2 potato beds, re-worked kitchen garden, Hauled load of chicken manure

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 4	18	2	Oxalis first bloom, Garden: watered peas and strawberries. Picked spinach (froze a batch), planted sage and leeks, cleaned more peripheral beds
May 5	29	12	Widened paths in the garden, spread compost on S. periphery for the asparagus. Picked spinach - delicious!
May 6	24	14	Garden: continued digging beds and adding chicken manure. Planted Italian parsley, sweet basil, potted broccoli and cabbage. Worked in garden.
May 7	26	8	Placed new oak beams on outer periphery. Watered new pear trees and old plums. Planted geraniums. Watered peas and strawberries.
May 8	26	8	Activity: Moved last of compost (Bin #1) to garden.
May 9			N worked in garden
May 10	23	11	Worked in garden. Put up tomato ladders and plants. More weeding and mowing, esp. garden trails.
May 11	23	13	1st bloom blueberries. Worked in garden.
May 12	20	14	Nina planted cabbage, broccoli, and brussel sporuts.
May 13	20	10	1st bloom high bush cranberry, Activity - N and I planted onions, 3 kinds of cucumbers, carrots, radishes, kentucky wonder beans, few hot peppers.
May 14	19	12	N planted.

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 15	21	12	N planted peppers.
May 16	19	11	Weeded raspberries (added to compost).
May 17	24	14	
May 18	15	9	
May 19	24	9	Moved brush piles from S. side of garden to edge of pond. N in garden mowing trails and outer edge of garden.
May 20	16	3	1st bloom dewberry + Blackberry
May 21	18	5	
May 22	20	11	Got truck load of chick manure, cut brush around apple trees.
May 23	16	7	Cleared around apple trees. Hauled hay from Frank to garden (potato mulch).
May 24	20	9	
May 25	20	10	
May 26			
May 27			
May 28			
May 29			
May 30			
May 31	28	18	Obs. Our pond has developed big algal mat for the 1st time. I suspect the abundant surface draining from Turner Pond + its agricultural recharge.
June 1	32	20	N planted lima beans, egg plant, replanted melons.

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 2	25	7	1st strawberries (both wild and domestic), N watered garden
June 3	19	6	N watered, I weeded grapes
June 4	24	14	N watered garden.
June 5	30	13	
June 6	18	12	Good picking of strawberries (big + tasty). Cut nettles around log garage + composted them
June 7	21	15	
June 8	27	15	Berry picking
June 9	26	10	
June 10	26	16	
June 11	25	16	N picked strawberries.
June 12	27	13	1st bloom pale purple coneflower, picked strawberries, Weeded garden w/Nina.
June 13	20	19	I worked on grapes
June 14	23	12	Picked 1 gal+ strawberries
June 15	20	14	Picked strawberries, hoed.
June 16	23	17	Hoeing garden.
June 17	25	9	1st bloom St. Johnswort. N in garden.
June 18	23	14	N picked peas and strawberries. Planted lettuce. weeded peas.
June 19	28	17	I picked strawberries. 1st bloom elderberry.
June 20	32	13	N worked in garden.
June 21	27	21	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 22	31	18	Harvested Peas, Strawberries, Radishes
June 23	31	16	Wild Rasp in fruit, weeded garden.
June 24	28	13	Domestic Raspberry 1st fruit.
June 25	18	8	N put up grosbeak repellant net over peas.
June 26	25	15	I hoed melon bed. N planted shallots. N and I moved “kiwi” to north garden fence outside.
June 27	30	20	Worked in garden.
June 28	28	19	Scythed oregano + mint patches over grown + composted that. N worked in garden.
June 29	25	18	
June 30	26	13	
July 1	17	12	N rejuvenating strawberry beds.
July 2	21	13	
July 3	23	12	Picked raspberries, dug up strawberries
July 4	25	17	
July 5	30	23	Picked 1 gal. raspberries.
July 6	32	22	Activity: Picked raspberries. N. watered
July 7	27	18	1st bloom Monarda

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 8	27	20	Activity: N + I picked 1 1/2 gal. raspberries. We watered garden, picked zucchini, burpless cucumbers . I picked pickling cucumbers and made 3 qt. dill pickles using vinegar I made from Chaz cider
July 9	27	17	
July 10	26	15	
July 11	22	20	
July 12	22	19	Activities: picked 1 gal raspberries.
July 13	25	16	Activity: N + I mowed lawn. N + I picked 1 gal. raspberries
July 14	25	16	Activity: I built frames for netting over blue berries. Then we covered frame. (The catbirds had hard words to say.)
July 15	25	16	N. in garden. Catbirds + robins are foiling the netting on the blueberries so we added some more and tried to reduce loop holes.
July 16	29	20	N. in garden. N. planted new strawberry plants with blueberry bushes
July 17	31	24	N. in garden
July 18	32	26	
July 19	33	26	Activity: N + I picked 1 qt. raspberries. I made 8 qts. pickles

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 20	33	20	Activity: Weeded tomatoes, tried to fix netting on blueberries. Not a very good job. A whole family of flickers were inside. When we approached they got excited and battled berries right + left.
July 21	27	17	3 catbirds in blueberries. We decided to pick and got 1 qt. - most yet. Garden watering. Melons and cucumbers seem to have blight - looks bad.
July 22	26	17	Watered garden, put compost on beans. 1st blueberries for breakfast.
July 23	28	16	
July 24	29	24	No birds in the blueberries!!
July 25	32	22	
July 26	28	19	Melons and Cucumbers in trouble. 2 Threshers in blueberries. Improved blueberry net. Picked cucumbers, made 5 qts. pickles. N picked raspberries (about the last).
July 27			
July 28	29	19	N in garden. Found big grubs had destroyed the main stalks of the zucchini + beetles have passed disease to cucumbers and melons.
July 29	25	18	N harvested blue berries, kohlrabi, cucumbers, and lettuce. I harvested Roma tomatoes, cucumbers, and made 2 qts pickles.
July 30	27	20	
July 31	27	19	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 1	28	16	
August 2	25	17	
August 3	22	14	
August 4	23	15	
August 5	25	12	
August 6	26	17	
August 7	26	17	
August 8	24	15	
August 9	26	16	N worked in garden. I cut and tramped 3 gal of kraut (in crock) topped by a layer of future “kaubi” (kohlrabi sliced)
August 10	27	19	
August 11	22	12	
August 12	21	11	
August 13			
August 14	23	13	Mowed garden trails, started the 2-gal crock with saurkraut
August 15	26	18	
August 16			
August 17			
August 18	27	14	Nina made tomato juice, weeded peas, watered.
August 19	24	14	Big crop of eggplant + peppers. Blueberries about over. Cucumbers + squash finished (Blighted)
August 20	24	13	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 21	25	18	Started small crock of Kimchi. Made 7 pts. hot sauce (blend of several sweet + hot peppers) oregano, garlic, onion, + minimal amount of Roma tomatoes
August 22	24	13	
August 23			N in garden. Made more kraut. N made big kettle of tomato juice and pickled ripe melons. N also made a big batch musaca for freezing.
August 24	26	11	N made tomato juice + musaca.
August 25			Worked in garden, Sumac turning color
August 26	27	15	Nina was host to the Baraboo Area Gardners Club giving special attention to the veg. garden and to EBL Prairie.
August 27	22	10	Grapes are ripening. Turned garden bed and N planted it to buckwheat. N also making more tomato juice.
August 28	14	6	N making musaca. I made hot sauce.
August 29	17	8	I canned 5 pts. hot sauce. Mowed garden and pushed brush near pond for winter burning.
August 30	19	11	
August 31	20	12	
September 1			Helped N can tomatoes. Melons ripening. Flavor getting better.
September 2	24	11	Tomato, eggplant harvest.

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 3	25	18	
September 4	23	16	
September 5	21	8	
September 6	19	9	Canned tomato juice, freezing eggplant parmesan
September 7			
September 8	15	7	
September 9	19	7	
September 10	19	9	
September 11	22	18	Amelanchier and Black Cherry starting to turn
September 12	21	10	First bloom helianthus, Activity: tomato juice and puree.
September 13	19	11	Finished off 11 qts. of tomato juice. Harvested broccoli, lima beans.
September 14	18	12	Went to apple cider pressing party
September 15	18	10	
September 16	13	6	N harvested beans.
September 17	17	7	
September 18	17	13	
September 19	20	14	
September 20	18	14	Picked apples, picked tomatoes
September 21	17	14	Harvested tomatoes, melons, eggplant
September 22	20	13	Picked apples all day.
September 23	25	16	Grapes getting a fungus - otherwise good. Harvested more tomatoes

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 24			Nina harvested and I mowed.
September 25	22	12	N shucking beans. Started concord wine. Finished mowing garden trails.
September 26	26	19	Nina harvested lima beans, I pressed and strained wine. N used debris for grape jelly. Both worked in garden. Harvested and froze hot peppers
September 27	27	19	Harvested grapes. Also harvested peppers. N made Spanish sauce for omelette. + made applesauce.
September 28	27	16	Dug up one row potatoes (small wheelbarrow load).
September 29	25	19	N made Spanish sauce and tomato juice
September 30	21	14	
October 1	21	10	Deer have browsed beans and raspberries
October 2	18	9	N dug 2 rows of potatoes
October 3	17	12	
October 4	18	7	
October 5	10	6	Harvested (racing frost) peppers, tomatoes, eggplant, lima beans. Transplanted lettuce in cold frame + shut it. Brought geraniums + other plants inside. Picked apples all morning.
October 6	14	1	1st Frost - killed peppers and tomatoes. Finished harvesting peppers and eggplant. Picked 30 bu. apples.
October 7	12	6	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 8	20	11	Finished transplanting lettuce. Composted remaining frosted produce. Mowed garden trails. Harvested last of potatoes + double dug the bed. Weeded 2nd bed of strawberries.
October 9	12	5	
October 10	10	0	
October 11	13	5	Emptied old compost bin and put it on garden. Set mole trap. N froze lima beans and made eggplant parmesan + tomato juice.
October 12	16	8	
October 13	10	5	
October 14	7	2	
October 15	7	0	
October 16	10	3	
October 17			
October 18	13	1	
October 19	13	2	Harvested some left over concord grapes.
October 20	14	4	
October 21	20	9	
October 22	22	10	Worked in garden.
October 23	19	12	In garden.
October 24	16	9	Big grouse hit garden fence. Was filled with dogwood berries. N harvested beets, broccoli, carrots, celery, celeryac.
October 25	13	8	
October 26	13	7	

1986			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 27	9	6	Chopped leaves for compost
October 28			Chopped more leaves for compost, in garden
October 29	19	6	Collected load of apples, N made applesauce, raked and composted leaves
October 30	12	0	Started turning compost
October 31	13	6	Hauled compost to garden

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1	4	-3	
April 2	10	-5	
April 3	10	2	
April 4	17	6	
April 5	15	7	Pruned vineyard
April 6	23	9	
April 7			Black cherry leafing, N pruned orchard
April 8	22	11	Nina pruned fruit trees. Raking
April 9	17	3	
April 10	4	-1	Worked in garden. Mowed trails. N pruned raspberries.
April 11	9	0	
April 12	7	0	Blizzard
April 13	7	0	Nina pruned raspberries
April 14	7	2	
April 15	9	4	1st bloom spring beauty, N pruned raspberries.
April 16	13	3	Garden work
April 17	13	1	Nina planted 2 kinds of peas and radishes.
April 18	14	3	
April 19	12	6	
April 20	12	-1	Nina weeded strawberries
April 21	10	1	
April 22	13	0	N + Teresa weeded strawberries.
April 23	15	5	1st bloom early yellow violet.
April 24	10	1	Mowed lawn and garden.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 25	17	5	1st bloom Amelanchier
April 26	18	5	
April 27	18	5	
April 28	21	7	First bloom dentaria, Nina planted potatoes, Weeded garden and turned soil.
April 29	22	12	Nina in garden
April 30	28	8	1st bloom wild strawberry, Nina made jam from last year's berries
May 1	13	6	
May 2	11	4	Nina planted onions
May 3	14	2	Transplanted dentaria + spring beauty
May 4	13	7	Nina in garden
May 5	18	8	
May 6	9	4	
May 7	11	4	
May 8	14	7	
May 9	13	7	
May 10	22	10	
May 11	23	13	
May 12	27	12	
May 13	28	18	Teresa weeded and trimmed garden. N worked in garden. Picked asparagus and one morel mushroom.
May 14	28	14	1st bloom Black cherry.
May 15	27	14	

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 16	27	14	N + I in garden, planted green arrow peas. 2 kinds of greens. Kentucky wonder pole beans. Cherry bell radishes, and pickling cucumbers. N harvested remainder of old spinach and froze (4 pts.)
May 17	25	13	
May 18	13	8	Black cherry dropping petals like snowstorm
May 19	11	7	N froze spinach
May 20	18	7	
May 21	23	7	N in garden
May 22	23	15	Put up tomato fencing + planted tomatoes
May 23	27	14	Put up cucumber + tomato fences inside garden. N planted cucumbers.
May 24	26	21	Nina in garden
May 25	25	18	
May 26	21	17	Planted Roma + San Marzano tomatoes.
May 27	25	17	Mowed garden, N planted Italian tomatoes and beets. Hoed onions.
May 28	28	18	1st blooms Rose
May 29	30	18	Teresa prepared garden bed + weeded onions
May 30	30	17	N + I in garden. Planted eggplant, kohlrabi, melon, cabbage, sweet peppers, tomatoes. Hoed rest of onions.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 31	27	18	Picked up pepper plants from Blackearth. Picked first strawberries.
June 1	26	20	Planted in garden melons, hot peppers, giant garlic, basil. Ate 1st strawberries.
June 2	26	18	Watered plants (2 1/2 hours)
June 3	26	17	Moved greenhouse plants out. Cleaned root cellar, weeded, planted basil, covered strawberries w/ netting, watered plants (4 hours).
June 4	26	11	Watered plants (1 hr) covered more strawberries
June 5	21	10	Watered plants and garden, weeded garden
June 6	23	9	Watered plants, mowed (1 1/2 hours)
June 7	24	9	Watered, weeded mowed
June 8	23	11	Lots of strawberries - picked 2 qt. strawberries
June 9	25	14	Picked 2 1/2 gal strawberries, tied up blueberry bushes
June 10	25	17	
June 11	25	20	Mulched tomatoes, N weeded garden beds. I scythed weeds and grass around tomatoes and elsewhere.
June 12	26	24	Picked 6 qt. strawberries.
June 13	28	13	Picked strawberries
June 14	28	11	

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 15	29	19	Cleaned garden beds, planted bush beans, curly cress scallion by seed. Transplanted eggplant and broccoli.
June 16	24	16	N weeded garden. Picked strawberries (3 qts).
June 17	25	14	N in garden. Weeded south side and onions.
June 18	26	15	
June 19			N watered and weeded garden
June 20	28	16	I hoed onions and watered garden
June 21	28	18	Wild raspberry in fruit (also domestic raspberry), N weeded and watered, I harvested raspberries (1 pt). Brought in one load chicken manure and one load cow manure.
June 22	23	13	I weeded and composted
June 23	18	9	Scythed mint bed and piled it on chicken manure (didn't help much). N weeded cabbage
June 24	22	13	N worked in garden and picked 1 pt raspberries
June 25	24	15	N weeded and watered. Garden is very dry
June 26	27	17	1st bloom purple cone flower, N watered garden. I made 8 pts. of hot sauce from last years tomatoes and peppers
June 27	30	25	Picked gal. Raspberries. N watered.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 28	31	24	N watered garden. I picked 2 qt. raspberries.
June 29	31	22	N + I picked gal of raspberries, N watered garden
June 30	32	21	N picked 1 1/2 gal raspberries. Mowed garden and pruned grapes
July 1	27	17	Picked raspberries.
July 2	28	18	Monarda blooming, N harvested lettuce, peas, weeded and tended garden. Picked raspberries.
July 3	28	18	N + Teresa weeded strawberry patch. N harvested raspberries and I started turning compost pile.
July 4	26	17	Picked raspberries, watered garden
July 5	24	17	Picked 2 qts raspberries
July 6	27	19	Picked 2 qt. raspberries
July 7	31	16	N tended garden, Picked and canned 1st jar of pickling cucumbers
July 8	29	16	Picked 2 qts. raspberries and hand full of pickling cucumbers.
July 9	25	15	1 qt. pickles. N picked qt of raspberries
July 10	26	14	Another jar of pickles. Picked 1 1/2 qt raspberries.
July 11	28	17	I picked pickling cucumbers + 2 burpless (1st this year).
July 12	28	20	Picked pt. raspberries.
July 13	25	17	Wild blackberries in fruit, 2 qt. pickling cucumbers

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 14	24	12	N + I picked apples at Shack and N made applesauce
July 15	23	12	1 qt pickles.
July 16	26	10	
July 17	28	20	I did 1 qt pickles. Picked beans and peas.
July 18	25	20	3 qt. cucumber pickles.
July 19	30	20	3 qt. cucumber pickles (we now have 12 qts).
July 20	30	17	1 qt pickle cucumber. N picked beans, froze them, and weeded.
July 21	29	21	2 qt. pickles.
July 22	30	24	I made 2 qt. cucumber pickles.
July 23	31	18	2 qt. of pickles. Trimmed melon bed before mowing. Mowed inside garden. N mowed outside. Mowed trail around pond and apple trees.
July 24	24	15	1 qt pickles. N + Teresa weeded strawberries.
July 25	25	12	
July 26	21	11	2 qt. pickles, weeded + pruned grapes. N planted in green house - cabbage, lettuce, cauliflower, broccoli
July 27	22	11	N + Teresa prepared 2 big garden beds for autumn (cabbage, cauliflower, kohlrabi, broccoli, lettuce)
July 28	23	16	3 qt. pickles. N picked beans and froze them
July 29	23	16	

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 30	23	12	1 qt pickles.
July 31	24	16	I picked cucumbers (I have enough for 26 qt.). N weeded + I composted.
August 1	27	14	N harvested beans (bush beans are starting to produce). I worked on compost.
August 2	26	19	
August 3	28	14	
August 4	22	12	
August 5	22	12	
August 6	22	9	
August 7	21	15	
August 8	24	17	
August 9	19	12	
August 10	24	8	N planted cauliflower and lettuce
August 11	28	7	
August 12	26	14	Worked on compost, N picked and froze beans and is processing sweet pickles. Tomatoes are getting good. Few melon. Taste a bit watery. N thinks its my pruning back the vines to keep them off the walkways. I think it's the heavy recent rains.
August 13	25	14	Activity: Harvest
August 14	25	15	Wild raspberries still in fruit, N picked tomatoes and beans.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 15	28	19	N + I picked melons, tomatoes, cucumbers. (Melons are soft and watery. Recent heavy rain?)
August 16	27	20	Sumac in color, N + Teresa got tomatoes + onions ready + I made 3 qt. bean pickles, 4 qt. tomato juice, 5 pts. hot sauce.
August 17	25	19	
August 18	25	16	Mowed inside and outside garden.
August 19	24	12	
August 20	19	10	I started crock of kraut
August 21	23	6	
August 22	25	18	
August 23	26	16	5 pts. hot sauce, 4 qt. tomato juice. Teresa also weeded garden.
August 24	26	14	N jarred 9 pts. sweet pickles. Processed + froze egg plant and made 2 batches of eggplant parmesan.
August 25	27	19	N got big harvest of tomatoes
August 26	29	21	
August 27	30	18	Activity: Tomato Day: 10 qts. juice, 8 pts. hot sauce. N also worked in garden.
August 28	29	19	N made 8 qt. tomato juice. I jarred 5 qts. sauerkraut.
August 29	30	18	I harvested 2 Bu. large tomatoes. 1/2 Bu. Ital. tomatoes. 1 qt. raspberries (fall crop).

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 30	30	21	N + I made 6 qts. tomato juice
August 31	29	16	Teresa working in garden.
September 1	25	12	
September 2	22	11	Helianthus 1st bloom
September 3	25	17	
September 4	25	10	
September 5	21	9	
September 6	21	9	Worked in garden
September 7	25	17	
September 8	27	16	Weeded strawberries. Picked raspberries.
September 9	24	20	Weeded garden, picked potatoes
September 10	28	19	Grapes are ripe and sweet (big crop), N + I picked 1 gal + raspberries. N picked 1/2 Bu. tomatoes (Ital). I also picked cantaloup. Peppers.
September 11	22	14	N picked 1 1/2 Bu. tomatoes, I picked a few last peppers.
September 12	18	16	Made 5 qt. tomato juice and 6 pts. hot sauce.
September 13	21	14	Pond weed rafts much diminished. Emptied jars of last yrs kraut (too mushy). N + Teresa started lettuce and cabbage in cold frame + weeded north border of strawberry bed. N picked 2 qt. raspberries.
September 14	25	18	
September 15	26	22	
September 16	27	16	

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 17	20	10	
September 18	20	7	Teresa and I picked 1 gal raspberries. I harvested 1 Bu. tomatoes and 2 melons.
September 19	12	4	Harvested 1/2 Bu. lima beans. I covered peppers and peas against frost. Brought in house plants.
September 20	9	2	N froze raspberries, eggplant, beets. Teresa boiled and skinned beets. 1 harvested 2 qts raspberries.
September 21	12	1	
September 22	15	7	Picked 3 qt. raspberries, harvested spinach, froze lima beans, harvested grapes.
September 23	15	5	
September 24	13	7	
September 25	11	8	
September 26	15	5	
September 27	15	0	I made 4 qt. tomato juice. Harvested all ripe hot peppers, 3 1/2 qt. raspberries
September 28	10	0	Harvested wild onion (Jed's Island). I harvested remaining unripe hot peppers.
September 29	13	2	
September 30	17	6	Red maple full color, Teresa clean up garden + harvested potatoes w/N.
October 1	18	6	I harvested 1 qt raspberries
October 2	17	8	Strung hot peppers to dry, froze some, pickled some.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 3	19	7	I started a new crock of kraut.
October 4	18	5	Finished chopping cabbage. 2 gal of kraut.
October 5	18	5	
October 6	10	4	
October 7	9	1	
October 8	11	1	
October 9	18	7	
October 10	17	3	
October 11	12	4	
October 12	15	5	
October 13	11	1	
October 14	12	7	
October 15	9	3	
October 16	8	0	
October 17	16	0	
October 18	19	4	Shredded leaves for compost
October 19	8	-3	
October 20	8	-3	
October 21	11	-2	N dug 1 bu. potatoes
October 22	15	5	Shredded leaves for compost, N cleaned garden.
October 23	20	10	
October 24	21	9	
October 25	20	6	
October 26	10	6	
October 27	9	3	
October 28	9	6	Raked leaves for compost.

1991			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 29	15	6	
October 30	18	-1	Moved leaves to compost
October 31	3	-1	

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1	11	-5	
April 2	9	-1	
April 3	12	-1	
April 4	12	-3	
April 5	1	-5	
April 6	5	-3	
April 7	6	-8	
April 8	9	-6	
April 9	5	-5	
April 10	9	-3	
April 11	14	4	Garden: Pruned raspberries + grapes
April 12	21	4	
April 13	5	1	
April 14	7	-1	Garden: Finished pruning raspberries and grapes. Pruned apple trees.
April 15	7	-1	
April 16	6	1	Garden: Transplanted spinach seedlings into garden!
April 17	8	-4	
April 18	13	3	
April 19	20	3	
April 20	20	10	
April 21	20	2	Garden: Planted lettuce, peas, spinach, radishes
April 22	17	7	Garden: worked on outer periphery asparagus beds
April 23	13	-1	Garden: finished cleaning asparagus

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 24	17	0	Garden: Planted more potatoes, peas, spinach, + lettuce
April 25	18	9	
April 26	17	-1	
April 27	8	-1	Garden: Peas germinating, Asparagus showing
April 28	12	-1	Garden: dug one more raised bed
April 29	15	1	
April 30	4	-6	
May 1	9	0	
May 2	17	1	
May 3	16	7	
May 4	14	6	
May 5	16	5	
May 6			
May 7	13	3	First bloom Viola, Spring Beauty
May 8	18	3	
May 9	11	7	Garden: Picked 4 asparagus!
May 10	14	8	Garden: Planted onions and leeks
May 11	11	2	Garden: Planted more onions, dug one more bed.
May 12	13	1	Garden: Planted peas, cucumbers, radish, lettuce, spinach.
May 13	14	0	
May 14	10	0	1st bloom Amelanchier
May 15	12	7	

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 16	13	8	
May 17	18	7	
May 18	28	13	Wild strawberry 1st bloom
May 19	28	19	
May 20	23	15	Sand Cherry in bloom at Shack
May 21	23	10	Garlic mustard is in bloom! Horrors!
May 22	25	12	Garden: Planted 42 tomato plants
May 23	14	7	Garden: Planted shallots, cress, pickling cucumbers, kohlrabi
May 24	16	6	Garden, planted celery, mulched tomatoes.
May 25	16	6	Garden: dug another bed, cold + wet
May 26	16	6	Garden: planted peppers
May 27	16	6	Garden: planted sweet peppers, kohlrabi, beets, lettuce; dug more beds
May 28	16	8	
May 29	20	5	
May 30	19	1	Repaired and connected irrigation system
May 31	20	5	
June 1	21	4	
June 2	22	4	Garden: Hilled potatoes, put bat guano on tomatoes
June 3	23	13	Garden: Planted eggplant and beans
June 4	17	11	Garden: planted Brussel sprouts + flowers

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 5	17	8	
June 6	21	14	Garden: Planted seedlings of: cabbage, broccoli, cauliflower. Put new labels on pepper plants
June 7	23	12	
June 8	15	11	Garden: Planted melon and lettuce
June 9	20	11	Garden, mowed and weeded
June 10	21	14	
June 11	19	15	
June 12	24	12	Garden: weeded onions + garlic
June 13	26	12	
June 14	27	12	
June 15			
June 16			Peas 1st bloom
June 17	25	16	
June 18	22	16	Garden: Harvested asparagus + radishes
June 19	18	16	Mowed garden
June 20			Garden: Picked a bushel of spinach
June 21	26	15	Garden: mulched potatoes, first ripe strawberry
June 22			
June 23	27	16	
June 24	23	16	Garden: picked a few strawberries, mulched melons
June 25			Garden: Hoed peppers, Teresa mowed

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 26			
June 27			Garden: picked strawberries, irrigated twice for 2 hours each. Pruned tomato plants - removing lower leaves.
June 28			
June 29			
June 30			Phen: pale purple coneflower 1st bloom
July 1			Garden: finished mulching melons
July 2	28	15	
July 3	24	14	
July 4	24	13	
July 5	25	15	
July 6	26	9	St. Johnswort - 1st bloom
July 7	27	20	
July 8			
July 9	24	11	Garden: pea harvest
July 10	24	10	
July 11	22	12	
July 12	24	17	
July 13	24	15	Garden: harvested peas
July 14	24	14	
July 15	25	14	Monarda 1st bloom. Garden: picked raspberries
July 16	24	16	
July 17	27	17	
July 18	28	18	
July 19	29	21	

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 20	24	11	
July 21			
July 22	24	11	
July 23	20	14	Charlie picked raspberries + peas
July 24	25	16	
July 25	24	14	
July 26	22	13	
July 27	24	14	Pulled up pea plants, picked 1st two cucumbers, weeded melons.
July 28			
July 29			
July 30			
July 31	24	14	
August 1	22	15	
August 2	25	13	
August 3	26	14	
August 4	27	13	Garden: weeded periphery, one tomato turning color. Planted lettuce and spinach.
August 5	27	13	
August 6	29	24	
August 7			
August 8	30	17	
August 9	25	12	
August 10	24	11	
August 11	24	13	Thinned lettuce seedlings
August 12	26	10	
August 13	26	17	

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 14	27	20	
August 15	26	16	
August 16	23	11	
August 17	23	11	
August 18	24	13	Garden: Harvested onions, planted spinach
August 19	22	16	
August 20	26	20	
August 21	26	15	
August 22	28	15	
August 23	24	13	
August 24	25	12	
August 25	25	13	Domestic affairs: sweet pickles, hot sauce, kraut, beans.
August 26	26	18	Made cherry jam
August 27	26	12	
August 28	22	11	
August 29	22	11	
August 30	24	11	
August 31	25	14	
September 1	25	14	
September 2	20	17	Garden: Planted garlic
September 3	25	17	Garden: Planted spinach seedlings
September 4	25	17	
September 5	27	16	
September 6	27	16	
September 7	27	17	

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 8	26	17	
September 9	28	16	
September 10			
September 11	25	16	Garden: 1st heritage raspberries, picked tomatoes + beans
September 12	21	10	
September 13	16	6	
September 14	16	6	
September 15	17	9	
September 16	19	10	
September 17	16	11	
September 18	17	5	
September 19	19	4	
September 20	20	6	
September 21	18	11	
September 22	19	10	Garden: Picked raspberries, beans, lettuce, tomato
September 23	20	9	
September 24	17	10	
September 25	19	5	
September 26	17	5	
September 27	17	5	
September 28	14	10	Turned the compost
September 29	15	10	
September 30	15	5	
October 1	23	11	
October 2	22	10	Prepared for frost - picked bushels of peppers, tomatoes, etc.

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 3	13	-1	Picked raspberries
October 4	10	1	
October 5			
October 6			
October 7	22	1	
October 8			
October 9	21	1	
October 10	13	4	
October 11	9	0	
October 12	13	7	Garden: Weeded and mulched asparagus; harvesting lettuce and spinach
October 13	18	7	Garden: cleaned asparagus
October 14	22	5	
October 15	16	7	
October 16	18	8	
October 17			
October 18	22	5	
October 19	10	-1	Cleaned up in garden
October 20	11	-1	Picked potatoes
October 21			
October 22			
October 23			
October 24	10	3	
October 25	10	2	
October 26	16	3	Garden: dug beets
October 27	16	11	Garden: harvested celery (the best ever!), cleaned melon beds

1996			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 28	23	17	
October 29	10	0	
October 30	12	1	
October 31	11	3	

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1			Spinach about 2” and green. Garlic up 2”; Garden: Started pruning raspberries
April 2	12	-2	
April 3			C + N finished pruning the second row of raspberries
April 4	5	-2	
April 5			
April 6			
April 7			Garden: Pruned raspberries along west fence
April 8			
April 9	21	4	
April 10			
April 11	17	5	
April 12			Pruned the grapes
April 13	23	3	
April 14			We finished digging up the 3rd row of raspberries
April 15			
April 16	16	-1	
April 17			Garden: Started cleaning asparagus, pruning grapes
April 18	9	-2	
April 19	13	2	
April 20	17	12	
April 21	25	10	Pruned grapes and hooked up water
April 22			1st bloom dentaria
April 23	23	11	Garden: Planted onions and asparagus (20 plants)

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 24			
April 25	22	2	
April 26			First bloom yellow violet, spring beauty
April 27	25	8	
April 28			First bloom Amelanchier
April 29	21	7	First bloom wild ginger
April 30	24	16	First bloom wild strawberry, Garden: Planted spinach, Cleaned two beds, harvested asparagus
May 1			Planted more peas
May 2	25	15	Garden: Cleaned two raised beds, planted broccoli
May 3			
May 4	23	9	
May 5			
May 6			Planted 3 new blueberry bushes
May 7	20	10	Garden: Planted flowers at ends of beds
May 8			
May 9	20	7	
May 10	21	5	
May 11	16	8	
May 12			
May 13			
May 14	20	8	
May 15	22	13	
May 16	27	20	Roto-tilled the potato beds

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 17	25	13	
May 18	27	11	
May 19			Planted peppers. Planted tomatoes, cucumbers, and pole beans.
May 20			
May 21	24	9	
May 22	20	11	
May 23	15	7	
May 24	14	5	
May 25	14	8	
May 26	16	6	Garden: Planted tomatoes + carrots - weeded lettuce + onions
May 27			
May 28	18	8	Garden Work: planted peppers, weeded, planted tomatoes
May 29	20	9	
May 30			Garden: Planted kohlrabi, rose 1st bloom
May 31			
June 1	18	6	
June 2			
June 3			
June 4	17	8	
June 5			
June 6	16	9	
June 7	17	13	Cleaned two garden beds
June 8	21	13	

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 9	23	13	Garden: Planted zucchini, cleaned beds
June 10			George Archibald brought us a basket of his own strawberries! They are the first of the season!
June 11	26	15	
June 12			
June 13	28	16	
June 14	30	23	
June 15	29	17	
June 16	22	14	
June 17			First bloom purple coneflower
June 18	26	12	
June 19			Garden: planted more cucumbers; hilled potatoes
June 20	26	11	
June 21	25	15	Worked in the garden
June 22	22	14	
June 23			
June 24	24	10	
June 25	30	16	
June 26	29	13	
June 27	27	17	
June 28	29	12	
June 29			Garden: Picked the first raspberries
June 30	29	18	Planted cantaloupe seedlings in bed south of the solar panels.

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 1			Garden: Picked broccoli for freezing
July 2	29	8	Garden: Planted lettuce, kohlrabi, bunching onion
July 3	21	15	
July 4	26	17	Garden: very dry. Raspberries ripe
July 5	26	12	
July 6			
July 7			
July 8			
July 9	30	9	
July 10	31	19	Blueberries beginning to ripen. Picked raspberries.
July 11	28	13	
July 12	25	13	
July 13	26	14	
July 14			
July 15			
July 16			
July 17			
July 18	29	13	
July 19			Corn and soybeans have revived with the rain
July 20	30	20	First bloom Nodding wild onion
July 21			Worked in pepper beds
July 22			
July 23	32	22	
July 24			

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 25			
July 26			
July 27	24	13	
July 28			
July 29			
July 30	29	16	
July 31			
August 1	32	22	
August 2			
August 3	32	19	Picked first ripe tomato
August 4			
August 5			
August 6	32	18	
August 7			
August 8	32	24	
August 9			
August 10	31	15	
August 11			
August 12			
August 13			Turned the compost pile
August 14			
August 15	23	13	
August 16			
August 17	23	15	
August 18			
August 19			
August 20	25	14	

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 21			
August 22	26	14	
August 23			
August 24	26	19	
August 25			
August 26			
August 27	26	18	
August 28			
August 29	27	14	
August 30			
August 31	27	15	
September 1			Helianthus first bloom
September 2			
September 3	26	9	Garden: Planted garlic
September 4			
September 5	27	11	
September 6	23	16	Garden: great picking of green beans. The best ever.
September 7	26	22	Garden: large picking of beans
September 8	26	15	
September 9			
September 10			
September 11			
September 12			
September 13			
September 14			
September 15			

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 16			
September 17	25	6	
September 18			
September 19	20	14	
September 20			
September 21	20	11	
September 22			Nina + Carl picked grapes from the arbor on the west deck; dug potatoes
September 23			
September 24	21	5	
September 25			Garden: picked green beans and broccoli
September 26	16	4	
September 27			
September 28	17	5	
September 29			Garden: Planted spinach
September 30			
October 1	20	5	Garden: Dug potatoes
October 2			
October 3	22	8	
October 4	20	11	
October 5	15	5	
October 6	11	1	Frost in the garden - first of the season; Garden: Picked peppers, beans, broccoli, cucumbers, lettuce!
October 7	8	-1	
October 8			Cleaned some of the garden beds

2001			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 9			
October 10	19	3	
October 11			
October 12	19	7	
October 13			
October 14			
October 15	16	5	
October 16			
October 17	11	0	
October 18			
October 19	15	4	
October 20			
October 21			
October 22			
October 23			
October 24			
October 25			
October 26	6	2	
October 27	7	1	
October 28			
October 29	14	0	
October 30			
October 31			

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 1	16	6	
April 2			
April 3	8	4	
April 4			
April 5	10	-1	
April 6	12	6	
April 7	16	3	
April 8			
April 9			Cleaned garden beds, Planted Green Arrow Peas, and Super Sugar Snap Peas and radishes.
April 10	15	-2	Planted more Green Arrow Peas and lettuce seedlings from the greenhouse.
April 11			Planted spinach on the north border of the garden.
April 12			
April 13	21	9	1st bloom spring beauty
April 14			
April 15			Radishes have germinated.
April 16			
April 17			Garden: planted yukon gold potatoes which Trish gave us. Weeded garden.
April 18			Planted cucumber
April 19	25	2	First bloom Dentaria
April 20	19	5	
April 21	17	7	
April 22	17	9	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
April 23	18	6	First bloom wild gooseberry, garlic mustard, serviceberry (Juneberry)
April 24			
April 25			
April 26	21	2	Teresa planted beets and carrots
April 27	11	6	
April 28	19	2	First bloom wild strawberry
April 29	18	9	
April 30	16	14	
May 1	14	10	1st bloom Wild Ginger, Began replacing beams in the garden beds
May 2	19	11	
May 3	22	11	Pear blooming, Garden: planted “Straight Eight” Cucumbers.
May 4	21	7	
May 5	18	9	
May 6	10	1	
May 7	11	6	Planted: onions, beets, carrots.
May 8	18	7	Garden: Teresa planted Dahlias, snaps, cosmos, Gerber daisies, etc!!
May 9	18	12	
May 10	21	12	Garden: Planted Dahlia bulbs, yukon Gold potatoes; mulched the new asparagus.
May 11			The interns replaced rotten beams in the raised beds - great!

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
May 12	8	3	
May 13	9	6	
May 14			
May 15	16	6	
May 16			
May 17	19	9	
May 18	18	8	
May 19	15	6	
May 20			
May 21			
May 22	20	4	Garden: Planted tomatoes and a few flowers
May 23	16	6	Garden: planted cabbage, salad mix, cucumbers, + eggplant
May 24	20	12	First bloom Blackberry, Garden: Planted 15 Better Boy tomatoes; 2 kinds of cucumbers, 12 broccoli; many flowers
May 25	25	17	
May 26	24	15	
May 27	26	16	
May 28			Planted sweet potatoes in the bed on the south side of the house.
May 29			Garden: Planted beans, First bloom wild grape
May 30	30	20	
May 31	24	18	Wild Rose first bloom, Finished planting beans
June 1	23	14	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 2	29	14	
June 3	24	12	
June 4			
June 5	23	11	
June 6	20	14	
June 7	21	15	Garden: mulched tomatoes; weeded garlic + cucumbers
June 8	25	14	
June 9	29	14	Planted peppers
June 10			
June 11	17	9	
June 12	16	7	Garden: Mulched tomatoes and put up wire cages.
June 13	15	5	
June 14	24	13	
June 15			Garden: Weeded the beans - I weeded melons.
June 16	23	14	Mulched the beans, Put aluminum sulfate on the blueberries.
June 17	27	19	
June 18	27	22	First bloom St. Johnswort
June 19			First bloom Sumac, New Jersey Tea
June 20			
June 21	25	12	Garden: Picked the first peas, planted Buttercrunch lettuce, First bloom Elderberry
June 22	24	16	Planted beans
June 23	24	12	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
June 24	21	13	
June 25	21	15	
June 26	21	15	Cleaned the blueberry beds and put down plastic mulch. Planted winter lettuce.
June 27	20	14	
June 28	22	13	
June 29	21	11	
June 30	25	14	Re-planted peppers
July 1			
July 2	26	19	First bloom Monarda
July 3	26	20	Garden: The peak of the raspberry season. Teresa pulled most of the peas.
July 4	27	12	
July 5	24	14	
July 6			
July 7	25	14	
July 8	24	14	
July 9			
July 10	28	15	Fixed the irrigation system in the garden
July 11	24	11	
July 12	20	16	
July 13	26	19	Catbirds trying to get to the blue berries - good netting
July 14	28	21	
July 15	28	19	
July 16	25	19	Just overnight the field corn in the local fields has begun to tassel! Very hot!

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
July 17	30	19	
July 18	32	18	Garden: Drip irrigation is finally repaired - I ran it all night!
July 19	26	14	Garden: picked blueberries (about 2 quarts) and a pint of raspberries
July 20	27	19	
July 21	33	18	
July 22	21	16	
July 23			
July 24	26	18	Garden: Harvested cucumbers and beans
July 25	26	20	
July 26	30	22	
July 27	27	21	
July 28	28	21	
July 29			
July 30	28	21	
July 31	32	26	
August 1			
August 2	32	24	17 blooms on nodding wild onion
August 3	28	18	
August 4	27	17	
August 5	27	16	
August 6	25	20	
August 7	27	19	Planted buttercrunch + winter lettuce in garden
August 8	24	15	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
August 9	25	15	Dug garlic in garden
August 10	26	21	
August 11	27	17	
August 12	22	12	
August 13			
August 14	24	15	Planted spinach
August 15	22	14	
August 16	22	12	
August 17			
August 18	26	17	
August 19			
August 20	24	12	
August 21	24	15	
August 22	24	11	
August 23	26	15	
August 24	26	16	
August 25	21	13	
August 26	21	17	
August 27	23	17	
August 28	24	16	
August 29			
August 30	22	15	
August 31	21	11	
September 1	20	10	
September 2	21	12	
September 3	21	11	
September 4	21	14	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
September 5	21	14	
September 6	21	13	First bloom Helianthus
September 7	22	14	
September 8	24	17	Sumac turning color
September 9	24	11	
September 10			
September 11	15	10	
September 12			
September 13	16	13	Garden: Picked almost a bushel of green beans - and a quart of raspberries! Replanted spinach
September 14	19	10	
September 15			
September 16	21	10	
September 17			
September 18	24	10	
September 19			
September 20	17	6	
September 21			
September 22	15	4	
September 23	19	10	
September 24			
September 25	17	8	
September 26	17	7	
September 27	16	9	
September 28	15	7	
September 29	14	6	
September 30	11	8	

2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 1	17	6	
October 2	19	9	
October 3	24	12	
October 4	22		
October 5	12		
October 6	16	3	
October 7	15	2	Dug potatoes
October 8	16	10	
October 9	20	11	
October 10	15	3	
October 11	13	8	Garden: Picked probably the last raspberries - about 2/3 qt.; We watched a goldfinch land on the back of a grey squirrel - the squirrel did not respond, he kept on eating.
October 12	10	-1	
October 13			
October 14			
October 15	8	-1	
October 16	11	2	
October 17	12	9	
October 18	14	8	
October 19	10	5	
October 20	6	0	
October 21			
October 22	10	0	
October 23	6	0	
October 24	6	-1	
October 25	7	-2	

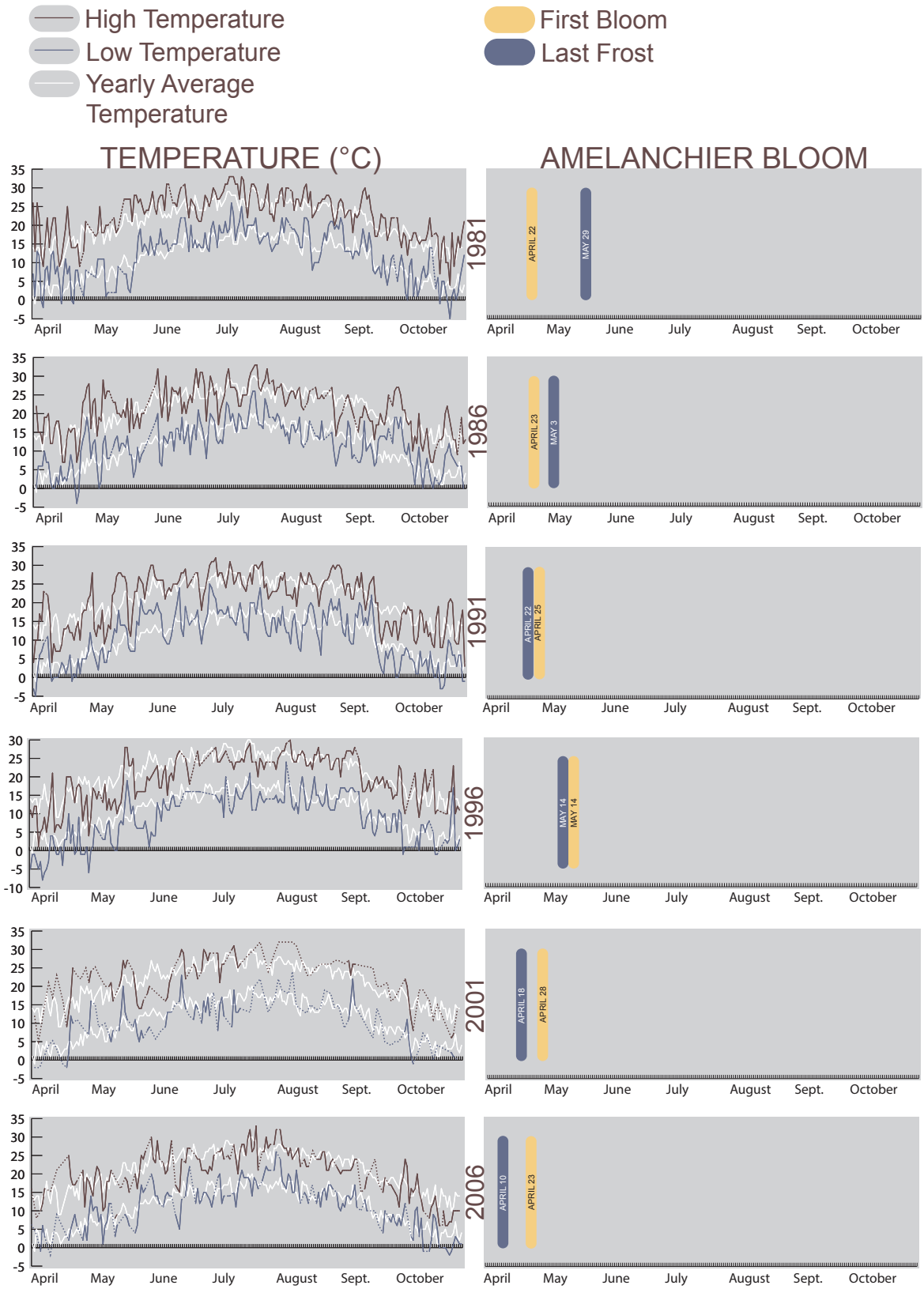
2006			
DAY	**High Temperature**	**Low Temperature**	**Notes**
October 26	7	-1	Cleaned up the garden
October 27	10	1	
October 28	10	3	
October 29	10	2	
October 30	10	1	
October 31		1	

APPENDIX D

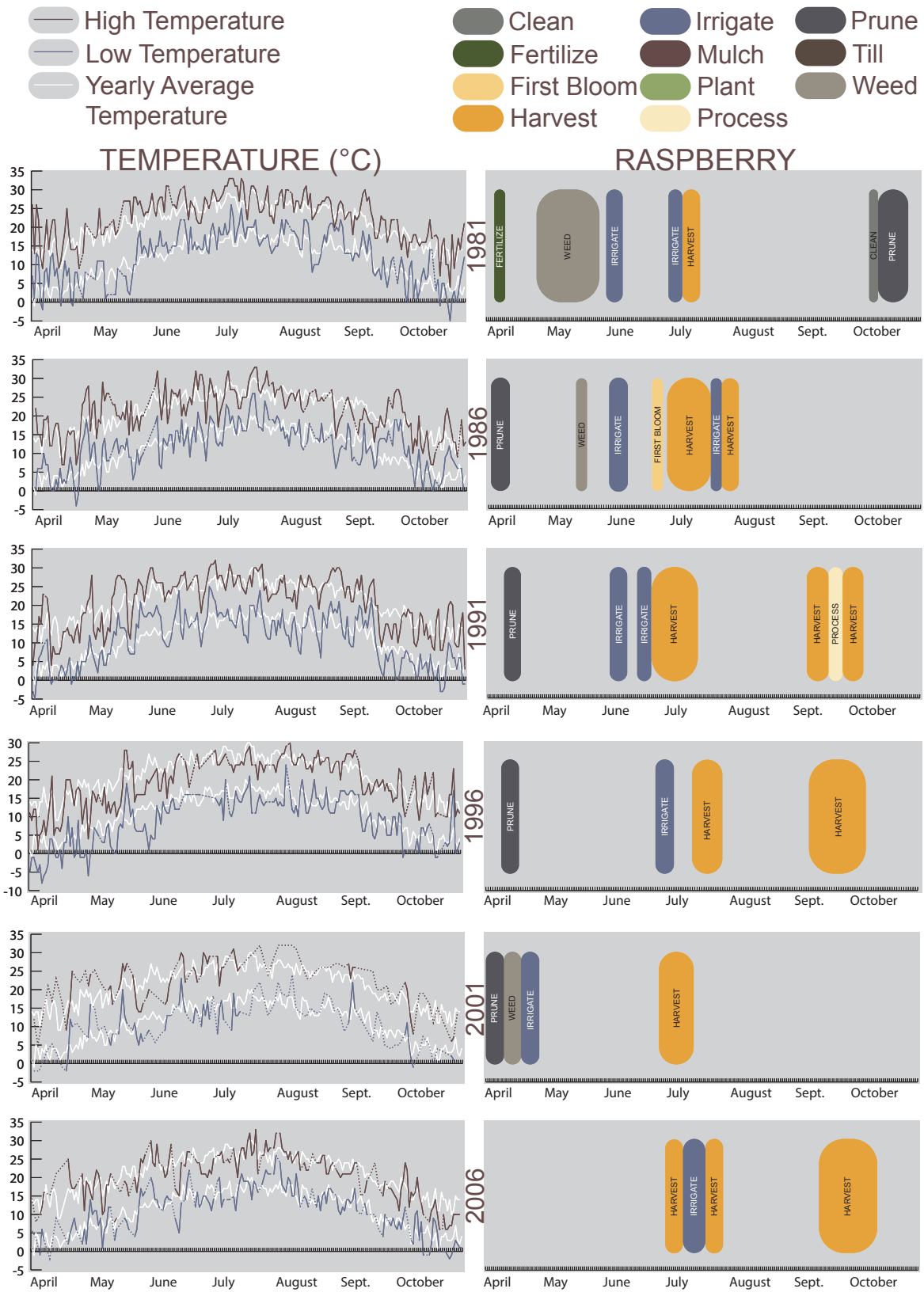
JOURNAL NOTES AND GRAPHICS

Native and cultivated species management activities relating to temperature records from the Bradley Study Center journals. The first graphic shows a native species (*Amelanchier laevis*) first bloom date based on Nina's phenology records. The four cultivated species selected (raspberry, cucumber, potato, and asparagus) were mentioned in each of the six years, 1981, 1986, 1991, 1996, 2001 and 2006.

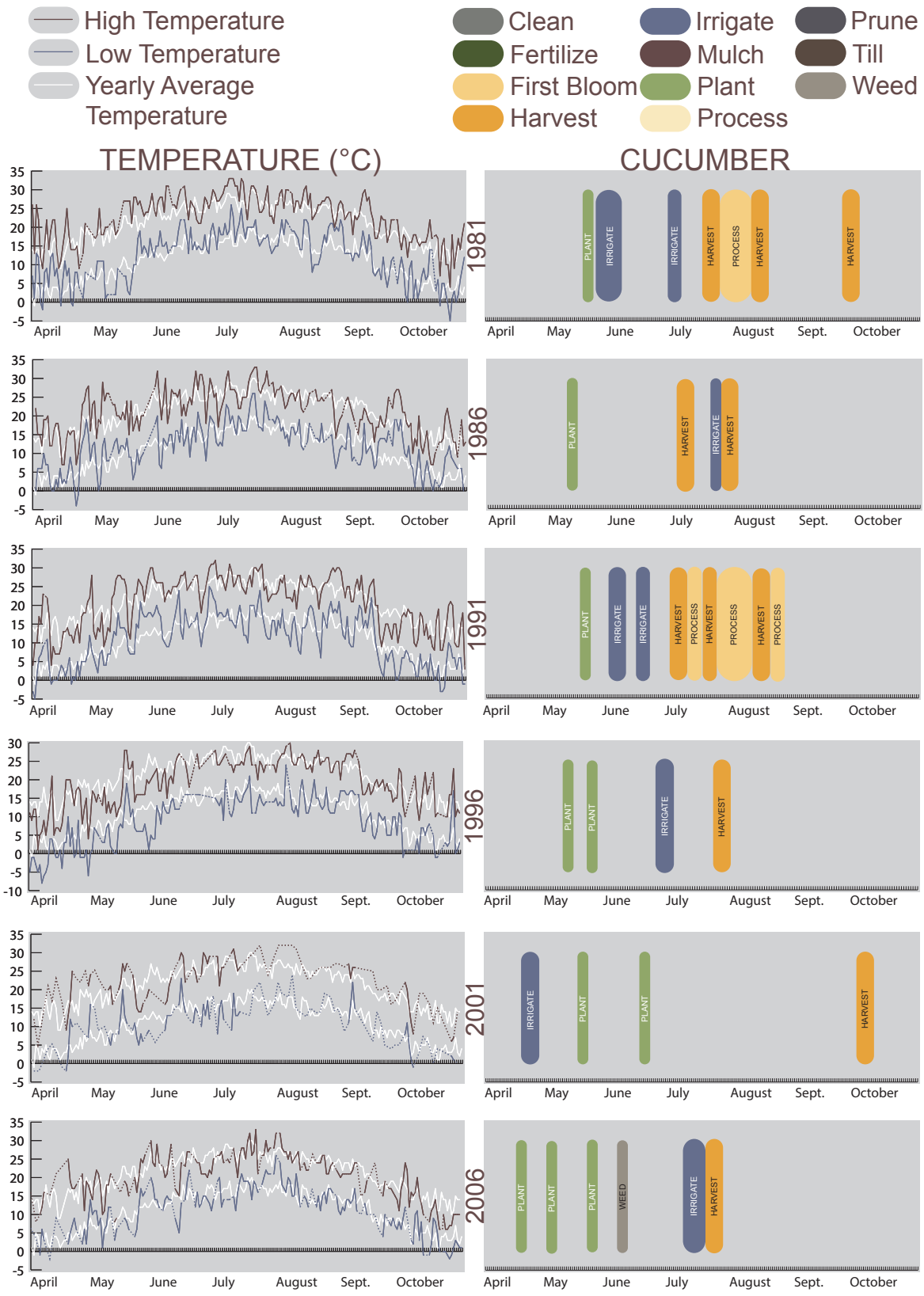
Similar to Nina's research, this graphic looks at the spring phenophase (defined by Nina as seasonal biological events) for *Amelanchier laevis*. Nina found the average first bloom date for *Amelanchier laevis* to be April 30th. Documented 25 times from 1976-1998, the species a regression rate that did not have significant increases in earliness. This translates to the bloom time being more responsive to factors other than last frost dates and warmer spring temperatures, such as day length. Being categorized as a species that will not significantly increase in first bloom dates can be beneficial to wildlife and associated ecological processes. Planting native species in the edible landscape that bloom at a consistent date is important for certain native pollinator species that will not adapt as quickly to earlier warmer spring temperatures. Therefore, the *Amelanchier* spp. will provide habitat and food for native wildlife and pollinators who rely on readily available resources during a specific period.


High Temperature
Low Temperature
Yearly Average Temperature
First Bloom
Last Frost
TEMPERATURE (°C)
AMELANCHIER BLOOM
1981
APRIL 22
MAY 29
1986
APRIL 23
MAY 3
1991
APRIL 22
APRIL 25
1996
MAY 14
MAY 14
2001
APRIL 18
APRIL 28
2006
APRIL 10
APRIL 23
April
May
June
July
August
Sept.
October

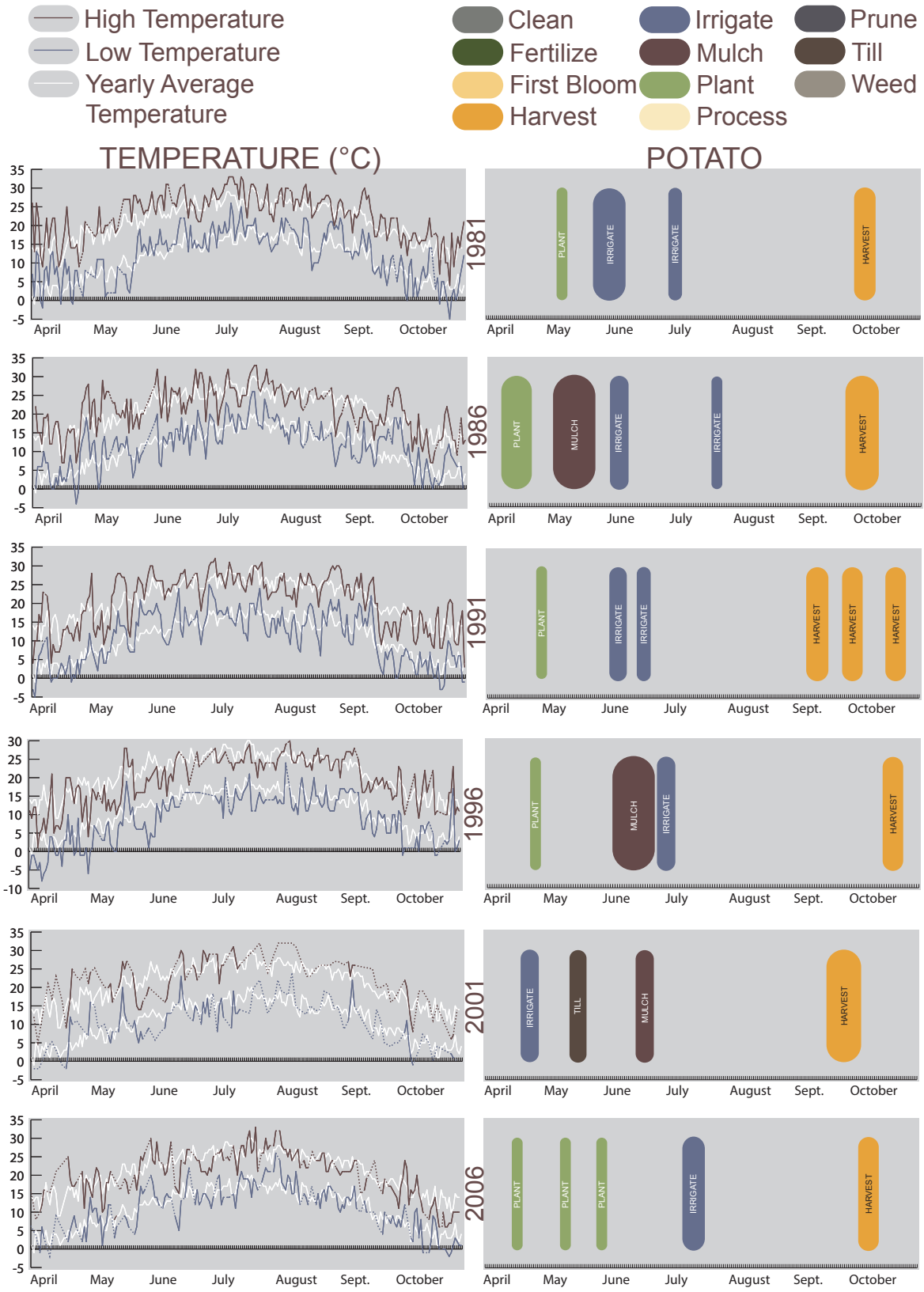
Raspberries (*Rubus* spp.) are a biannual species that establish upright canes during one growing season and produce fruit on the cane the following year. The canes require heavy pruning, typically at the start of the growing season in April or the end of the garden season in October (Bradley and Leopold Bradley 1976–2009). The plants propagate through suckers, which can become aggressive if they aren't contained and managed. Early weeding around canes and heavy irrigation from May through July result in the plants setting large amounts of fruit. At least 1-2 inches of water a week are necessary, especially while fruit is maturing (Creasy 2010). Fruit can be produced in summer and fall and Nina's journals typically record harvesting in July and September. Harvesting can occur daily, especially during peak berry producing weeks. Predators include birds, insects (especially wasps and ants), and even canine companions. During my internship with Nina, we often saw her chocolate lab enjoying berries on canes that had grown through the fence and into Nina's yard. Raspberries are one of the most frequently recorded cultivated species in Nina's journals.


High Temperature
Low Temperature
Yearly Average Temperature
Clean
Fertilize
First Bloom
Harvest
Irrigate
Mulch
Plant
Process
Prune
Till
Weed
TEMPERATURE (°C)
RASPBERRY
1981
FERTILIZE
WEED
IRRIGATE
IRRIGATE
HARVEST
CLEAN
PRUNE
1986
PRUNE
WEED
IRRIGATE
FIRST BLOOM
HARVEST
IRRIGATE
HARVEST
1991
PRUNE
IRRIGATE
IRRIGATE
HARVEST
HARVEST
PROCESS
HARVEST
1996
PRUNE
IRRIGATE
HARVEST
HARVEST
2001
PRUNE
WEED
IRRIGATE
HARVEST
2006
HARVEST
IRRIGATE
HARVEST
HARVEST
April
May
June
July
August
Sept.
October

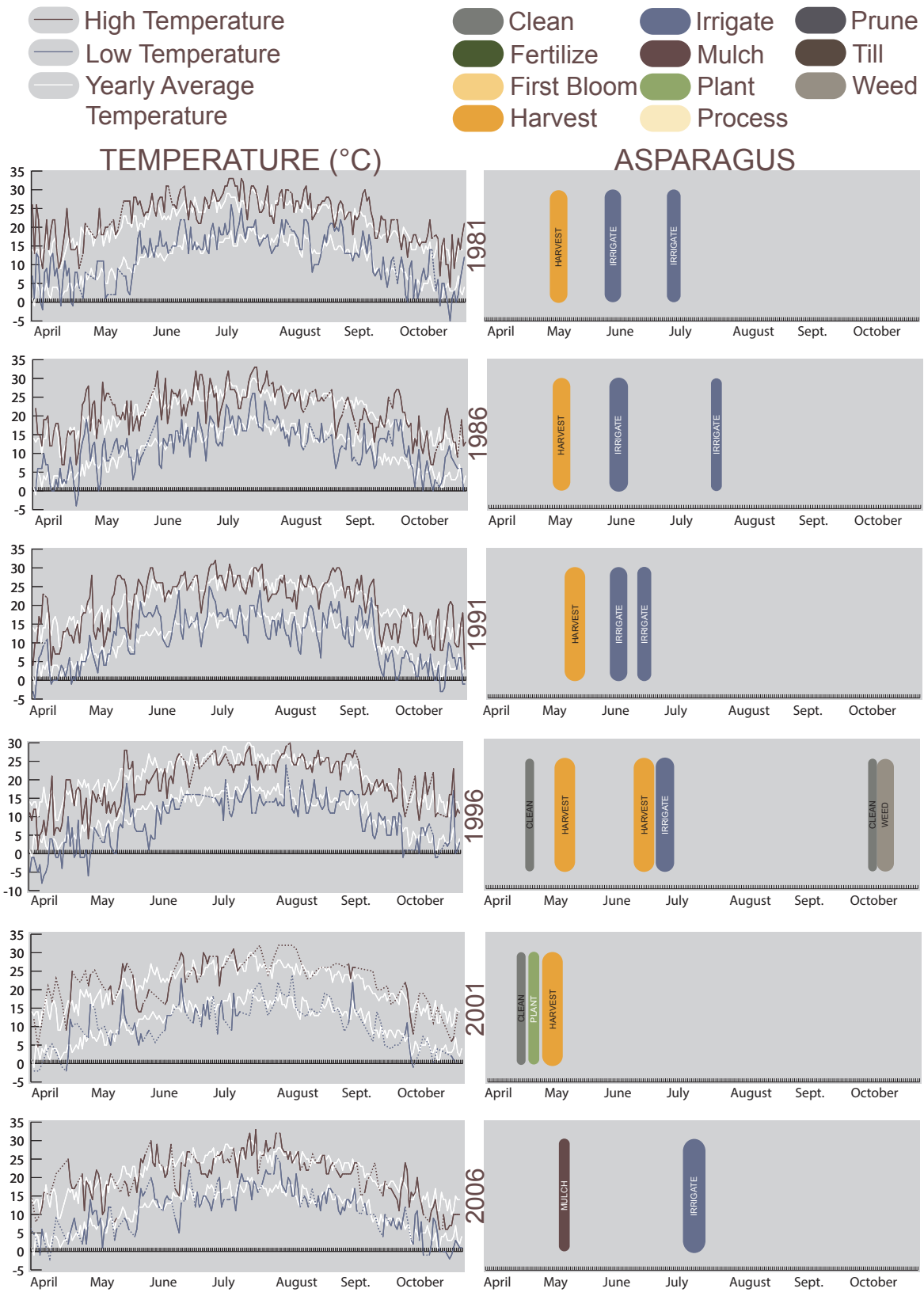
Cucumbers (*Cucumis sativus*) are frequently documented by Charlie Bradley in the journals, which included processing activities to make pickles (Bradley and Leopold Bradley 1976–2009). The annual species is grown from seed and produces vines during the growing season. The vines have large yellow flowers, which become cucumber fruits if pollinated (Creasy 2010). Nina's garden had a metal wire frame for the vines to climb, which made for an easy harvest, and prevents the cucumbers from rotting if the fruit grows on garden soil. According to Nina's journals, Charlie Bradley harvested and processed enough cucumbers to make 26 quarts of pickles from July 7th through July 31st in 1996 (Bradley and Leopold Bradley 1976–2009).


High Temperature
Low Temperature
Yearly Average Temperature
Clean
Fertilize
First Bloom
Harvest
Irrigate
Mulch
Plant
Process
Prune
Till
Weed
TEMPERATURE (°C)
CUCUMBER
1981
1986
1991
1996
2001
2006
April
May
June
July
August
Sept.
October
PLANT
IRRIGATE
HARVEST
PROCESS
WEED

Potatoes (*Solanum tuberosum*) are an annual species grown from "seed" potatoes, or pieces of an actual potato that are propagated vegetatively. Seed potatoes can be cut into smaller pieces and each piece must have an "eye" or areas where a bud will sprout. After cutting the potatoes, they must be allowed to callous or the potato piece will rot in the ground after planting (approximately one week). Nina's journals had a range of planting dates for potatoes, from April to early June (Bradley and Leopold Bradley 1976–2009). After planting the potatoes, the beds require mulching, or hilling, to prevent the new potatoes from turning green due to sunlight exposure. Mulching typically takes place approximately one month after planting the potatoes as recorded in Nina's journals (Bradley and Leopold Bradley 1976–2009). During the growing season, potato plants will produce flowers and fruits similar to tomatoes; however, these are not edible. When the potato leaves begin to die back at the end of the growing season, the potatoes will be ready to harvest. Nina and Charlie typically did not harvest the potatoes until after the first frost in October (Bradley and Leopold Bradley 1976–2009).


High Temperature
Low Temperature
Yearly Average Temperature
Clean
Fertilize
First Bloom
Harvest
Irrigate
Mulch
Plant
Process
Prune
Till
Weed
TEMPERATURE (°C)
POTATO
1981
1986
1991
1996
2001
2006
April
May
June
July
August
Sept.
October
PLANT
IRRIGATE
MULCH
HARVEST
TILL

Asparagus (*Asparagus officinalis*) is an herbaceous perennial requiring three years to become established before harvesting can occur (Creasy 2010). To establish asparagus, it is necessary to plant the crowns in well-prepared soil beds, which include natural fertilizers, such as chicken manure or mature compost (Creasy 2010). Nina's journals included cleaning the beds in early April, mulching in May, and harvesting in late May to early June (Bradley and Leopold Bradley 1976–2009).


High Temperature
Low Temperature
Yearly Average Temperature
Clean
Fertilize
First Bloom
Harvest
Irrigate
Mulch
Plant
Process
Prune
Till
Weed
TEMPERATURE (°C)
ASPARAGUS
1981
1986
1991
1996
2001
2006
HARVEST
IRRIGATE
CLEAN
WEED
PLANT
MULCH
April
May
June
July
August
Sept.
October

APPENDIX E

PLANT SUITABILITY MATRICES

Species		Suitable Habitat		
Scientific Name	**Common Name**	**Plant Community****	**Presence in Oak Opening or Southern Dry Forest**	**Mention in Historic Record**
Acer saccharum	**Sugar Maple**	SM	No	Yes
Allium canadense	**Wild Onion**	PWM	No	Yes
Allium tricoccum	**Ramp**	SM	No	No
Amelanchier canadensis	**Serviceberry**	SM	No	Yes
Amorpha canescens	**Leadplant**	PD	Yes	Yes
Amphicarpaea bracteata	**Hog Peanut**	SDM	Yes	No
Apios americana	**Ground Nut**	SW	No	No
Asarum canadense	**Wild Ginger**	CLS	No	No
Asclepias syriaca	**Common Milkweed**	PWM	Yes	Yes
Carya ovata	**Shagback Hickory**	OO	Yes	No
Ceanothus americanus	**New Jersey Tea**	PM	Yes	No
Claytonia virginica	**Spring Beauty**	SM	No	Yes
Corylus americana	**Hazelnut**	SD	Yes	Yes
Crataegus spp.	**Hawthorn**	PD	No	No
Erythronium albidum	**White Trout Lily**	SM	No	No

Species		Suitable Habitat		
Scientific Name	**Common Name**	**Plant Community****	**Presence in Oak Opening or Southern Dry Forest**	**Mention in Historic Record**
Fragaria virginiana	**Wild Strawberry**	ND	No	Yes
Helianthus tuberosus	**Jerusalem-artichoke**	SC	Yes	No
Juglans nigra	**Black Walnut**	SDM	No	Yes
Malus ioensis	**Prairie Crabapple**	PM	No	Yes
Matteuccia struthiopteris	**Ostrich Fern**	NS	No	Yes
Monarda fistulosa	**Wild Bergamot**	CG	Yes	Yes
Morus rubra	**Red Mulberry**	SM	No	No
Podophyllum peltatum	**Mayapple**	SM	No	No
Prunus americana	**American Plum**	SM	No	Yes
Quercus spp.	**Oak Species**	SD/OO/OB	Yes	Yes
Rhus glabra	**Smooth Sumac**	PDM	Yes	Yes
Rhus typhina	**Staghorn Sumac**	OB	Yes	Yes
Ribes spp.	**Black Currant/ Gooseberry**	AT	No	Yes
Rosa arkansana	**Prairie Rose**	PM	Yes	Yes
Rosa carolina	**Pasture Rose**	PM	Yes	Yes
Rubus allegheniensis	**Blackberry**	SD	No	Yes
Rubus idaeus	**Red Raspberry**	BF	No	Yes
Rubus occidentalis	**Black Raspberry**	SDM	No	Yes
Sambucus canadensis	**Elderberry**	SD	No	Yes
Urtica dioica	**Stinging Nettle**	SWM	No	No
Vaccinium angustifolium	**Low-bush Blueberry**	ND	No	Yes
Vitis riparia	**Wild Grape**	SW	Yes	Yes

Species		Ecological Impacts			
Scientific Name	**Common Name**	**Bird or Butterfly Attractant**	**Deer Resistant**	**Nitrogen-Fixing Capabilities**	**Aggressive or Allelopathic**
Acer saccharum	**Sugar Maple**	No	Yes (once established)	None	None
Allium canadense	**Wild Onion**	Yes	Yes	None	Aggressive (but not problematic)
Allium tricoccum	**Ramp**	Yes	Yes	None	None
Amelanchier canadensis	**Serviceberry**	Yes	Moderate	None	None
Amorpha canescens	**Leadplant**	Yes	Yes	Yes	None
Amphicarpaea bracteata	**Hog Peanut**	Yes	No	Yes	None
Apios americana	**Ground Nut**	No	N/A	Yes	Aggressive
Asarum canadense	**Wild Ginger**	No	No	None	Aggressive
Asclepias syriaca	**Common Milkweed**	Yes	Yes	None	Aggressive
Carya ovata	**Shagback Hickory**	No	Yes (once established)	None	None
Ceanothus americanus	**New Jersey Tea**	Yes	Yes	None	None
Claytonia virginica	**Spring Beauty**	No	No	None	Aggressive (but not problematic)
Corylus americana	**Hazelnut**	No	Yes	None	None
Crataegus spp.	**Hawthorn**	Yes	Yes	None	None
Erythronium albidum	**White Trout Lily**	No	No	None	Aggressive (but not problematic)
Fragaria virginiana	**Wild Strawberry**	Yes	No	None	Aggressive

Species		Ecological Impacts			
Scientific Name	**Common Name**	**Bird or Butterfly Attractant**	**Deer Resistant**	**Nitrogen-Fixing Capabilities**	**Aggressive or Allelopathic**
Helianthus tuberosus	**Jerusalem-artichoke**	Yes	Yes	None	Aggressive
Juglans nigra	**Black Walnut**	No	Yes	None	Allelopathic
Malus ioensis	**Prairie Crabapple**	Yes	No	None	None
Matteuccia struthiopteris	**Ostrich Fern**	No	Yes	None	None
Monarda fistulosa	**Wild Bergamot**	Yes	Yes	None	Aggressive
Morus rubra	**Red Mulberry**	Yes	Yes	None	None
Podophyllum peltatum	**Mayapple**	No	No	None	None
Prunus americana	**American Plum**	Yes	No	None	None
Quercus spp.	**Oak Species**	No	Yes (once established)	None	None
Rhus glabra	**Smooth Sumac**	Yes	Moderate	None	Aggressive
Rhus typhina	**Staghorn Sumac**	Yes	Moderate	None	Aggressive
Ribes spp.	**Black Currant/ Gooseberry**	Yes	Yes	None	None
Rosa arkansana	**Prairie Rose**	Yes	Yes	None	Aggressive
Rosa carolina	**Pasture Rose**	Yes	Yes	None	Aggressive
Rubus allegheniensis	**Blackberry**	Yes	No	None	Aggressive
Rubus idaeus	**Red Raspberry**	Yes	No	None	Aggressive
Rubus occidentalis	**Black Raspberry**	Yes	No	None	Aggressive
Sambucus canadensis	**Elderberry**	Yes	Yes	None	Aggressive

Species		Ecological Impacts			
Scientific Name	**Common Name**	**Bird or Butterfly Attractant**	**Deer Resistant**	**Nitrogen-Fixing Capabilities**	**Aggressive or Allelopathic**
Urtica dioica	**Stinging Nettle**	No	No	None	Aggressive
Vaccinium angustifolium	**Low-bush Blueberry**	Yes	No	None	Aggressive
Vitis riparia	**Wild Grape**	Yes	Yes	None	Aggressive

Species		Identification Knowledge Level Required	
Scientific Name	**Common Name**	**Plant Toxicity or Toxic Look-A-Likes**	**Skill Level (Beginner, Intermediate, Advanced)**
Acer saccharum	**Sugar Maple**	None	Advanced* (sap collection occurs prior to leaf out)
Allium canadense	**Wild Onion**	None	Beginner
Allium tricoccum	**Ramp**	None	Intermediate
Amelanchier canadensis	**Serviceberry**	None	Intermediate
Amorpha canescens	**Leadplant**	None	Beginner
Amphicarpaea bracteata	**Hog Peanut**	None	Intermediate
Apios americana	**Ground Nut**	None	Intermediate
Asarum canadense	**Wild Ginger**	Leaves Toxic	Intermediate
Asclepias syriaca	**Common Milkweed**	Contains toxic compounds	Advanced (Young shoots confused with Dogbane)
Carya ovata	**Shagback Hickory**	None	Intermediate
Ceanothus americanus	**New Jersey Tea**	None	Intermediate
Claytonia virginica	**Spring Beauty**	None	Intermediate
Corylus americana	**Hazelnut**	None	Intermediate
Crataegus spp.	**Hawthorn**	None	Beginner
Erythronium albidum	**White Trout Lily**	None	Beginner
Fragaria virginiana	**Wild Strawberry**	None	Beginner
Helianthus tuberosus	**Jerusalem-artichoke**	None	Intermediate
Juglans nigra	**Black Walnut**	None	Beginner

Species		Identification Knowledge Level Required	
Scientific Name	**Common Name**	**Plant Toxicity or Toxic Look-A-Likes**	**Skill Level (Beginner, Intermediate, Advanced)**
Malus ioensis	**Prairie Crabapple**	Apple seeds contain small amounts of cyanide	Intermediate
Matteuccia struthiopteris	**Ostrich Fern**	None	Intermediate
Monarda fistulosa	**Wild Bergamot**	None	Beginner
Morus rubra	**Red Mulberry**	Milky sap and unripe fruit contain hallucinogens	Beginner
Podophyllum peltatum	**Mayapple**	Roots and leaves poisonous, unripe fruit strongly laxative	Advanced
Prunus americana	**American Plum**	Contains small amounts of cyanide	Intermediate
Quercus spp.	**Oak Species**	None	Height
Rhus glabra	**Smooth Sumac**	Poison Sumac (Rhus vernix)	Beginner
Rhus typhina	**Staghorn Sumac**	Poison Sumac (Rhus vernix)	Beginner
Ribes spp.	**Black Currant/ Gooseberry**	None	Beginner
Rosa arkansana	**Prairie Rose**	None	Beginner
Rosa carolina	**Pasture Rose**	None	Beginner
Rubus allegheniensis	**Blackberry**	None	Beginner
Rubus idaeus	**Red Raspberry**	None	Beginner
Rubus occidentalis	**Black Raspberry**	None	Beginner
Sambucus canadensis	**Elderberry**	Roots, stems, leaves, and unripe fruits toxic	Intermediate
Urtica dioica	**Stinging Nettle**	Leaves have stinging hairs; Older plants contain cystoliths	Advanced
Vaccinium angustifolium	**Low-bush Blueberry**	None	Intermediate
Vitis riparia	**Wild Grape**	None	Beginner

Species		Cultivation		
Scientific Name	**Common Name**	**Hazards (thorns, allergies, etc.)**	**Rejuvenate after Harvest**	**Timespan to Reach Maturity**
Acer saccharum	**Sugar Maple**	None	Yes	40+ Years
Allium canadense	**Wild Onion**	Must be consumed in moderation	No* (if bulb is harvested)	Season
Allium tricoccum	**Ramp**	Must be consumed in moderation	No	Season
Amelanchier canadensis	**Serviceberry**	None	Yes	5+ Years
Amorpha canescens	**Leadplant**	None	Yes	Season
Amphicarpaea bracteata	**Hog Peanut**	None	No	Season
Apios americana	**Ground Nut**	Potential allergy for some people	Harvest <50%	2+ Years
Asarum canadense	**Wild Ginger**	Leaves cause dermatitis for some people	Yes	Season
Asclepias syriaca	**Common Milkweed**	Must be consumed in moderation	Yes	Season
Carya ovata	**Shagback Hickory**	None	Yes	20+ Years
Ceanothus americanus	**New Jersey Tea**	None	Yes	Season
Claytonia virginica	**Spring Beauty**	None	Harvest <50%	Season
Corylus americana	**Hazelnut**	None	Yes	2+ Years
Crataegus spp.	**Hawthorn**	Thorns	Yes	5+ Years
Erythronium albidum	**White Trout Lily**	May be mildly emetic	No	Season
Fragaria virginiana	**Wild Strawberry**	None	Yes	Season

Species		Cultivation		
Scientific Name	**Common Name**	**Hazards (thorns, allergies, etc.)**	**Rejuvenate after Harvest**	**Timespan to Reach Maturity**
Helianthus tuberosus	**Jerusalem-artichoke**	None	No	Season
Juglans nigra	**Black Walnut**	Thick Husk	Yes	20+ Years
Malus ioensis	**Prairie Crabapple**	Must be consumed in moderation	Yes	5+ Years
Matteuccia struthiopteris	**Ostrich Fern**	Must be consumed in moderation	Harvest <50%	Season
Monarda fistulosa	**Wild Bergamot**	None	Yes	Season
Morus rubra	**Red Mulberry**	Milky sap in leaves causes dermititus	Yes	5+ Years
Podophyllum peltatum	**Mayapple**	Must be consumed in moderation	Yes	Season
Prunus americana	**American Plum**	Must be consumed in moderation	Yes	5+ Years
Quercus spp.	**Oak Species**	None	Yes	40+ Years
Rhus glabra	**Smooth Sumac**	Sap may cause skin rash	Yes	3-4 Years
Rhus typhina	**Staghorn Sumac**	Sap may cause skin rash	Yes	3-4 Years
Ribes spp.	**Black Currant/ Gooseberry**	Some species have thorns	Yes	2+ Years
Rosa arkansana	**Prairie Rose**	Layer of hairs surround seeds and may cause irritation	Yes	2+ Years
Rosa carolina	**Pasture Rose**	Layer of hairs surround seeds and may cause irritation	Yes	2+ Years
Rubus allegheniensis	**Blackberry**	Thorns	Yes	2+ Years
Rubus idaeus	**Red Raspberry**	Thorns	Yes	2+ Years
Rubus occidentalis	**Black Raspberry**	Thorns	Yes	2+ Years

Species		Cultivation		
Scientific Name	**Common Name**	**Hazards (thorns, allergies, etc.)**	**Rejuvenate after Harvest**	**Timespan to Reach Maturity**
Sambucus canadensis	**Elderberry**	None	Yes	5+ Years
Urtica dioica	**Stinging Nettle**	Stinging leaves cause irritation	Yes	Season
Vaccinium angustifolium	**Low-bush Blueberry**	None	Yes	2+ Years
Vitis riparia	**Wild Grape**	None	Yes	2+ Years

Species		Level of Edibility			
Scientific Name	**Common Name**	**Raw or Processed**	**Edible vs. Delicious**	**Edible Part of Plant**	**Edible Uses**
Acer saccharum	**Sugar Maple**	Processed	Delicious	Sap	Sweetener
Allium canadense	**Wild Onion**	Raw	Delicious	Leaves, Flowers, Root	Seasoning, Garnish
Allium tricoccum	**Ramp**	Raw	Delicious	Leaves, Flowers, Bulb	Seasoning, Garnish
Amelanchier canadensis	**Serviceberry**	Raw	Delicious	Fruit	Fruit, Jelly, Pie
Amorpha canescens	**Leadplant**	Processed	Edible	Leaves	Tea
Amphicarpaea bracteata	**Hog Peanut**	Processed	Delicious	Seed, Root	Cooked Vegetable
Apios americana	**Ground Nut**	Processed	Delicious	Root, Seed, Seedpod	Similar to Potato
Asarum canadense	**Wild Ginger**	Processed	Edible	Rhizomes	Spice (Ginger substitute)
Asclepias syriaca	**Common Milkweed**	Processed	Edible	Young shoots and young leaves; Flower clusters	Similar to Asparagus; boiled to make sweetener
Carya ovata	**Shagback Hickory**	Raw	Edible	Nut	Similar to Walnuts
Ceanothus americanus	**New Jersey Tea**	Processed	Edible	Leaves	Tea
Claytonia virginica	**Spring Beauty**	Processed	Edible	Root	Similar to Potato
Corylus americana	**Hazelnut**	Processed	Edible	Nut	Nuts, Flour, Candy
Crataegus spp.	**Hawthorn**	Processed	Delicious	Pome	Jam, Tea
Erythronium albidum	**White Trout Lily**	Processed	Edible	Corms, Leaves	Cooked Vegetable
Fragaria virginiana	**Wild Strawberry**	Raw	Delicious	Fruit	Fruit, Jam

Species		Level of Edibility			
Scientific Name	**Common Name**	**Raw or Processed**	**Edible vs. Delicious**	**Edible Part of Plant**	**Edible Uses**
Helianthus tuberosus	**Jerusalem-artichoke**	Processed	Delicious	Tuber	Similar to Potato
Juglans nigra	**Black Walnut**	Raw	Delicious	Nut	Nuts, Flour, Candy
Malus ioensis	**Prairie Crabapple**	Processed	Edible	Fruit	Jelly and Cider
Matteuccia struthiopteris	**Ostrich Fern**	Processed	Edible	Fiddleheads	Similar to Asparagus
Monarda fistulosa	**Wild Bergamot**	Processed	Edible	Leaves, Flower	Tea, Garnish
Morus rubra	**Red Mulberry**	Raw	Edible	Fruit	Fruit, Jam
Podophyllum peltatum	**Mayapple**	Processed, Remove rind	Edible	Fruit	Jam, Preserves
Prunus americana	**American Plum**	Processed	Edible	Fruit	Jam, Preserves
Quercus spp.	**Oak Species**	Processed	Edible	Acorn	Nuts, Flour, Candy
Rhus glabra	**Smooth Sumac**	Processed	Edible	Fruit	Lemonade-like drink
Rhus typhina	**Staghorn Sumac**	Processed	Edible	Fruit	Lemonade-like drink
Ribes spp.	**Black Currant/ Gooseberry**	Processed	Edible	Fruit	Jam, Preserves
Rosa arkansana	**Prairie Rose**	Processed	Edible	Fruit	Jam or Tea
Rosa carolina	**Pasture Rose**	Processed	Edible	Fruit	Jam
Rubus allegheniensis	**Blackberry**	Raw	Delicious	Fruit	Fruit, Jam
Rubus idaeus	**Red Raspberry**	Raw	Delicious	Fruit	Fruit, Jam
Rubus occidentalis	**Black Raspberry**	Raw	Delicious	Fruit	Fruit, Jam

Species		Level of Edibility			
Scientific Name	**Common Name**	**Raw or Processed**	**Edible vs. Delicious**	**Edible Part of Plant**	**Edible Uses**
Sambucus canadensis	**Elderberry**	Processed	Delicious	Fruit	Jelly, Cold Drink
Urtica dioica	**Stinging Nettle**	Processed	Delicious	Leaves	Greens, Tea
Vaccinium angustifolium	**Low-bush Blueberry**	Raw	Delicious	Fruit	Fruit, Jelly, Pie
Vitis riparia	**Wild Grape**	Raw, (Leaves Processed)	Edible	Fruit, Leaves	Fruit, Jam

APPENDIX F

SCORESHEET FOR THE EDIBLE LANDSCAPE

The scoresheet categorizes each goal, strategy, or objective into design, management, or other. If design is selected, the edible landscape meets the requirement through the design plan. If management is selected, the edible landscape meets the requirement through the owner's manual. If other is selected, the category did not meet the goals, strategies, or objectives through design or management.

		DESIGN	MANAGEMENT	OTHER
Philosophy				
GOALS	Value nature through Aldo Leopold's Land Ethic to care for the land without compromising the soils, waters, plants, and animals.	X		
	Accept responsibility of sustainability for future interns, Foundation employees, scholars-in-residence, and site users.		X	
	Strive to restore the landscape by creating regenerative and resilient systems, following Nina's legacy and garden design.	X		
OBJECTIVES	Ensure on-site sustainability in the face of climate change.		X	
	Decrease reliance on grocery store produce through on site food production.	X		
	Connect to nature through land stewardship and understand the maintenance and growing requirements of food.		X	
STRATEGIES	Require interns to monitor and document success of edible landscape in owner's manual and pre- and post-occupancy surveys.		X	
	Transition to at least 50% reliance on edible landscape and garden as primary source of produce within first year of establishment. Work to achieve 100% reliance.			X
Aesthetics				
GOALS	Evoke the history of the place through design solutions, including historic plant communities of oak-savanna and riparian areas to fit with the sandy soil profiles, use of local materials, and follow in the steps of Aldo Leopold and Nina Leopold Bradley.	X		
OBJECTIVES	Evoke a sense of place based on records from the Shack journals and the Bradley Study Center journals.	X		
	Remain consistent with the aesthetic at the Leopold Center and surrounding landscape to fit in with the sense of place.	X		
STRATEGIES	Photograph site conditions before and after construction and implementation of edible landscape to determine if site keeps with character of the place.			X
	Use the Shack journals, Bradley Study Center journals, and historic photos and plant community assemblages of species as a reference point for garden aesthetic.	X		

Energy				
GOALS	Create favorable microclimates that reduce the energy consumption of the intern facility and increase the comfort of site users.	X		
	Reduce excessive energy use for transportation and on-site maintenance.			X
OBJECTIVES	Decrease reliance on air conditioning or fans through passive cooling using shade trees near the building.			X
	Provide optimal solar energy to greenhouse area by using vegetation with shorter growth habits.	X		
	Decrease reliance on gasoline-powered mowing by incorporating the usage of a reel mower (push mower) for vegetated trails.		X	
	Decrease “food miles,” or distance food products must travel from farm to table by growing local produce.			X
STRATEGIES	Monitor energy consumption in facility as landscaping matures to function as designed.		X	
	Track equipement usage that relies on fuel and substitute with environmentally friendly alternatives, when possible.		X	
	Document quantities of produce harvested from garden.		X	
Soils				
GOALS	Minimize the disturbance of healthy soils from facility construction.			X
	Remediate nutrient-poor sandy soils.		X	
	Promote soil biota and organic matter from on-site vegetation and healthy plant growth.		X	
	Maintain or increase water-storage and infiltration of soils.		X	
OBJECTIVES	Create a soil management plan to salvage and repurpose healthy topsoil on site disturbed from housing facility construction.			X
	Protect the native microbial community by reducing soil additions from foreign sources (limit imported topsoils).		X	
	Establish soil from Nina’s garden as a reference and annually test soil fertility for nitrogen, carbon, and additional nutrients as needed.		X	
	Prevent nutrient degradation.		X	
	Increase soil nitrogen-fixation and promote carbon sequestration on site.	X		

Soils (Continued)				
OBJECTIVES	Recycle 100% of vegetation trimmings and compostable food waste.		X	
STRATEGIES	Harvest 0-4 inches (A horizon) of loamy sand disturbed on facility construction on plainfield loamy sand (PfDT) and redistribute to garden area.			X
	Evaluate existing infiltration rates and water-holding capacity of soils and restore compacted topsoil by tilling and adding appropriate compost.		X	
	Restore areas of disturbed soils at least 12 inches using compost amendments, topsoil, and mulch.		X	
	Measure maturity of compost pile (completeness of aerobic processes) through carbon dioxide and ammonia release.		X	
	Implement crop rotation for annual species to prevent nutrient degradation within the annual cultivation zone and amend soils where needed.		X	
	Increase soil nitrogen-fixation through legume plantings.	X		
	Establish a compost pile with at least two separate sections (active vs. mature) that can be turned into organic matter with kitchen and garden waste, in addition to leaves, grass clippings, etc.	X		
Vegetation				
GOALS	Maximize the integration of all existing native and ecologically appropriate vegetation into the site design based on the Shack journals and the Bradley Study Center journals.	X		
	Select plants based on native range and habitat growing conditions for regional context in Sauk County, Wisconsin and site specific conditions.	X		
	Select plants to ensure on-site sustainability in the face of climate change with species that promote resiliency and ecological functions, including pollination.	X		
	Limit aggressive species and eradicate invasive species.		X	
OBJECTIVES	Enhance biodiversity through a native planting palette attractive to wildlife and targeted for humans, native birds, pollinator species, and any rare or endangered species.	X		
	Preserve existing pine trees surrounding site and high quality prairie near proposed building.	X		
	Use only plant species that are not currently listed as invasive on any federal, state, or regional lists.	X		

Vegetation (Continued)				
OBJECTIVES	Select historically significant cultivars listed in Nina's journals and the Shack journals.	X		
	Design garden zones based on the microclimates onsite - planting plan includes all new vegetation to be installed.	X		
STRATEGIES	Remove invasive species before or during construction phase of the project and include a plan for active, multi-year invasive species control and management of any invasive species, along with long-term monitoring.		X	
	Consult local experts to determine appropriate protection measures for existing vegetation and protect root zones of trees by buffering one foot radius per inch of tree's DBH.			X
	Determine existing site biomass density index (map quality of plant material in zones of existing vegetation) and use as a baseline for proposed plantings.			X
	Select turf grasses that are regionally appropriate and minimize requirements for irrigation, pesticides, fertilizers, and maintenance.		X	
	Collect and sow native seed to preserve plant genetics on site.		X	
	Plant diversity provides resistance to disease and pests and select species that contribute to the plant diversity of the community and region as a whole.	X		
Materials				
GOALS	Site structures, such as raised bed beams and Leopold benches, can be harvested from local, renewable materials.	X		
	Increase lifecycle of materials by adapting and reusing in place or easily deconstructing and reclaiming or recycling.		X	
OBJECTIVES	Prioritize using local materials and if unavailable, seek salvaged, reused or recycled materials.	X		
	Use regional materials to decrease energy demand for transportation.	X		
	Design construction details to facilitate disassembly without damage to the material.		X	
STRATEGIES	Use Nina's journals as a reference for sources of local materials, such as oak beams for garden beds.	X		
	Soils, compost, and mulch: extraction, harvest, or recovery must occur onsite (within the Leopold Reserve).		X	

Materials (Continued)				
STRATEGIES	Boulders, rocks, and aggregate: extraction, harvest, or recovery must occur within 50 miles.			X
	Plants: all growing facilities and suppliers must be located within Wisconsin, with a preference for those in Sauk County.			X
	All other materials: extraction, harvest, or recovery must occur within 250 miles, with a life-cycle assessment that ensures environmental practices.			X
Maintenance				
GOALS	Inspire interns to understand and support the goals of the edible landscape and the Aldo Leopold Foundation.		X	
	Provide education and training in the owner's manual to ensure that maintenance optimizes the site's ecological and cultural performance.		X	
	Guide land-care practices through pre- and post-occupancy evaluations.		X	
	Evolve and adapt in a way that continually improves the edible landscape's ecological function and the intern's experience.		X	
OBJECTIVES	Implement an adaptive management plan, including short-term and long-term goals.		X	
STRATEGIES	Pre- and post-occupancy evaluations allow the Aldo Leopold Foundation to monitor the attitudes and beliefs of interns before and after using the edible landscape.		X	
	Water: Proper maintenance activities (including anticipated maintenance and watering schedule) used to ensure effectiveness of cistern and drip irrigation; monitor water usage and rainfall.		X	
	Soil Stewardship: Conduct soil tests and apply amendments for nutrient deficiencies and alleviate soil compaction detrimental to plant health.		X	
	Vegetation (Plant Stewardship): Maintain vegetation through monitoring according to long-term plans for the site, including food producing gardens and edible landscapes, and health, growth, and harvest.		X	
	Vegetation (Invasive Species Management): List of invasive plant species identified in the area according to regional/state/federal laws and include an invasive management plan for control and monitoring; promote plant diversity.		X	

Maintenance (Continued)				
STRATEGIES	Materials: List of preferred characteristics for replacement materials (local sources, recycled content, etc) to repair and maintain site amenities.		X	
	Material Waste: Recycle or reuse materials on-site, including composting kitchen and garden waste to prevent them from entering the municipal solid-waste stream.		X	
	Landscape Maintenance Equipment: Manual (reel) mowers to be used on site.		X	
	Adaptive Management: Update site maintenance plan to reevaluate on an annual basis and revise as needed to adapt to future conditions and unforeseen changes.		X	
Continued Learning				
GOALS	Provide interns with easily accessible educational materials on the garden and the Leopold legacy.		X	
	Create the owner's manual to adaptively manage the landscape.	X		
OBJECTIVES	Create educational tools, such as garden signage and a seasonal management poster, to help interns develop plant identification and management skills.	X		
	Create an owner's manual to continue phenological observations and monitor garden sustainability.	X		
STRATEGIES	Develop pre- and post-occupancy surveys can help both the interns and ALF monitor the success of the garden and also provide adaptive management recommendations.		X	
	Use owner's manual to record observations of daily garden activities, temperature (minimum/maximum), and phenology (first bloom, arrival of migrating birds, etc) to continue tracking Nina's research of changes on the Leopold Reserve.		X	