

Suburban Permaculture:

How can permaculture design be applied to be within county regulations at a suburban middle class home to produce food and enhance shared family maintenance time?

Anna Fletcher



Figure 1. A yield of the site's produce last summer (Fletcher, 2023)



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HORT 4092: Horticulture Senior Project

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Student Identification & Previous Experience



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“To the world we dream about, and the one we live in now” (Mitchell, 2019).

Figure 2. Headshot of Designer (Kasnik, 2021).

2023-2024

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Professor Brian Grubb

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Fall 2023, Urban Land I: Forestry, HORT 3040

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Projects include: Tiken Farm Project

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Fall 2023, Horticultural Entomology, HORT 3020

Professor Gene Kritsky PhD

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Spring 2023, Sustainable Landscape Design II, HORT 2041

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Spring 2023, Herbaceous Ornamentals I, HORT 2032

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Projects include: CCM Garden Redesign

2022-2023

Spring 2023, Horticultural Science II, HORT 1011

Professor James Hansel

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Spring 2023, Soil Science and Plant Nutrition, HORT 3010

Professors Tania Burgos-Hernandez PhD & Dan Peterson PhD

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Spring 2023, Woody Ornamentals II, HORT 2031

Professor Steve Foltz

Projects include: School Tree Identification Map

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Fall 2022, Native Plants I, HORT 1030

Professors Donna McCollum & David Gressley

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Fall 2022, Sustainable Landscape Design I, HORT 2040

Professor Katherine Kady

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2022-2023

Fall 2022, Landscape History to 1900, HORT 3050

Professor Frederick Lutt

Projects include: Ancient Roman Green Roofs

2022-2023

Fall 2022, Horticultural Technology, HORT 1010L

Professor James Hansel

2022-2023

Fall 2022, Woody Ornamentals I, HORT 2030

Professor Steve Foltz

2022-2023

Fall 2022, Permaculture I, DAAP 5061

Professor Chris Smyth

2021-2022

Spring 2022, Urban Landscape IV: Roofs and Facades, HORT 3044

Professor Virginia Russell

Projects include: Campus Green Green Roof

2021-2022

Spring 2022, Agriculture Ecology, HORT 2012

Professor Tania Burgos-Hernandez PhD

Projects include: Olive Growth Report

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Spring 2022, Plants and People, BIOL 1003

Professor Denis Conover

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Spring 2022, Horticultural Science I, HORT 1010

Professor Brian Grubb

Abstract

“Permaculture is: design protocols for critical thinking, decision making, and problem solving all based on the patterns of nature” as defined by Larry Santofo, the founder of The Permaculture Academy (Definitions of Permaculture, 2017). However, these design principles are often used on large scale properties such as farms, ranches, or even homesteads that have multiple acres of land to be managed. Therefore, this design is asking how can permaculture design be applied to be within county regulations at a suburban middle class home to produce food and enhance shared family maintenance time. In order to answer this question this research explores a design which follows the principles of permaculture and implements them through elements of the landscape. The design is based on a half an acre lot in a suburban neighborhood located in Medina, Ohio. This design addresses how permaculture design principles could be effectively used to feed a family and have a maintenance schedule that is in tune with family life all while following county regulations set for residential zones.

Keywords

Permaculture, Suburban, Landscape Design, Land Management, Horticulture, Home Vegetable Gardening, Suburban Lawn, Forest Edge, Native Plants, City Regulations, Food Production, Family Life, Cleveland, OH

Understanding of the Project

Problem Statement

How can permaculture design be applied to be within county regulations at a suburban middle class home to produce food and enhance shared family maintenance time?

Project Justification

The project explores how a five person middle class suburban home in Cleveland, OH could implement permaculture design principles that follow county regulations to produce food and enhance the time that the family spends together on maintenance. This research is worthwhile as it can help create a model of how to create a food productive lawn in suburban areas. Following the findings of *Urban Horticulture, from Local Initiatives to Global Success Stories*, productive lawns are beneficial to individuals, communities, and the environment as it allows individuals cost savings by growing their own food and creating healthy and diverse diets with improved food safety. The implemented design principles benefit the environment by being a more efficient use of resources and mitigating emissions from greenhouse gases (Ebel et al. 2020). There are a variety of other goals that are approached through a permaculture lens. These goals include growing fresher food, improving soil health, restoring native plants to their habitats, creating animal habitats, having an efficient and effective maintenance plan, and efficiently using energy. Of these goals, this design will work to address growing fresh food for five people with an efficient and effective maintenance plan that all works with the county zoning regulations. The family can strive to reach these goals through Mollison's Principles of Permaculture Design (Mollison & Slay, 2016):

1. Least change for the greatest effect

2. Relative location
3. Multiple functions for each element
4. Redundancy
5. Energy efficient planning
6. Interaction
7. Appropriate technology
8. Use biological resources
9. Observe and replicate natural patterns
10. Stability is the number of beneficial links in the system

This final project is an appropriate demonstration of the knowledge and skills that require knowledge of plants, ecological systems, understanding climates, landscape design, permaculture design principles, replicating natural systems, how to work with land and not against it, and working with clients.



Figure 3. Current vegetable garden on site during the summer (Fletcher, 2023).

The Proposal

User/Client Description

The client for this design is for the home owners. This design is specifically modeled to fit the needs of both the homeowners and site in order to best support its success and longevity. It is also notable that this design is intended for a house in a middle class suburban neighborhood that does not have a homeowners association. The goal for this family in implementing the design is producing food for their family in a way that follows county zoning regulations and efficiently uses their maintenance time with a busy family life.

There are five family members who live in the house. Two are the mother and father who are in their early fifties who work outside of the house and enjoy working on projects outside. Additionally there is a daughter in her 20s in college, a son who is in high school, and a son who is in middle school. The family has an active lifestyle and enjoys spending time together doing outdoor activities. The mother follows a vegan lifestyle and the daughter is vegetarian. The family inhabits the home year round, but the outdoor areas are used the most during the spring and summer months and somewhat in the fall. Four members of the household can drive so there must be space to accommodate three cars parked. Additionally, the family values spending time with their extended family and would like including a gathering space as well having areas that are more easily accessible to older family members. The family already has a vegetable garden on the property, but would like to utilize more of the space for food production.

Major Project Elements

The design incorporates multiple major project elements in order to fulfill the family's goals and needs. The home has a comfortable gathering space where the family and extended family can access and enjoy spending time together. In regards to garden spaces, the front lawn features edible landscapes and herbs while the backyard has more intensive food production with an alley cropped orchard. To support these gardens, there is a maintained compost pile and a storage shed. The backyard has another element that will cater to both the need for function and gathering. This is a small cottage-like structure that is connected to a greenhouse with a nearby campfire space. The greenhouse helps facilitate further food and plant production while the cottage and firepit acts as a gathering place and further draws interest to the greenhouse. Finally, the fence has been expanded to encompass the entire property where ginseng and mushroom logs are nestled among the hickory trees.

Site Information

The site of the design is located in Medina, Ohio located about 40 minutes south of Cleveland, Ohio. The site has been residential since 1998 and was previously farmland. The total lot is 0.48 acres with a largely flat front yard and backyard that gently slopes down from the house to the edge of a mid successional forest that inhabits the back of the property. It is notable how the soil in the forest and forest edge at the bottom of the slope is far richer than the soil near the house at the top of the hill. The property is nestled on the edge of a suburban neighborhood with a north facing house. Through all four seasons the property provides evoking views of the forest. Since the site backs up to a forest it works cohesively with the permaculture design

concept of designing in zones of high to low usage. Most of the following land can be redesigned to be highly productive of food to support the family living there.



Figure 4. Front of house during summer (Fletcher, 2019).

Site Inventory and Analysis Quantitative

When planning a landscape design there are statistics that are important, including how soil, topography, climate, vegetation coverage, and zoning all work together on a site. The USDA Web Soil Survey lists the soil that is on site as “100% Ritman Silt Loam”, which would result in soil that is well draining and holds nutrients and organic matter well, which is important to know in order to choose plants appropriate to the site (Web Soil Survey - Home). The site is located on a slight hill with the house being at the highest point and the backyard having a 2-6% slope (Web Soil Survey - Home). The site topography is vital to know in order to plan the implementation of design aspects correctly. It can also be used to note how water will run down the slope and gather at the bottom creating an area with richer soil. Finally, topography

is important as it also determines site build ability and the slope in addition with the forest and neighboring houses would deter the use of any heavy construction equipment.



Figure 5. Topographic Map of area around site (MC-GIS, 2020).

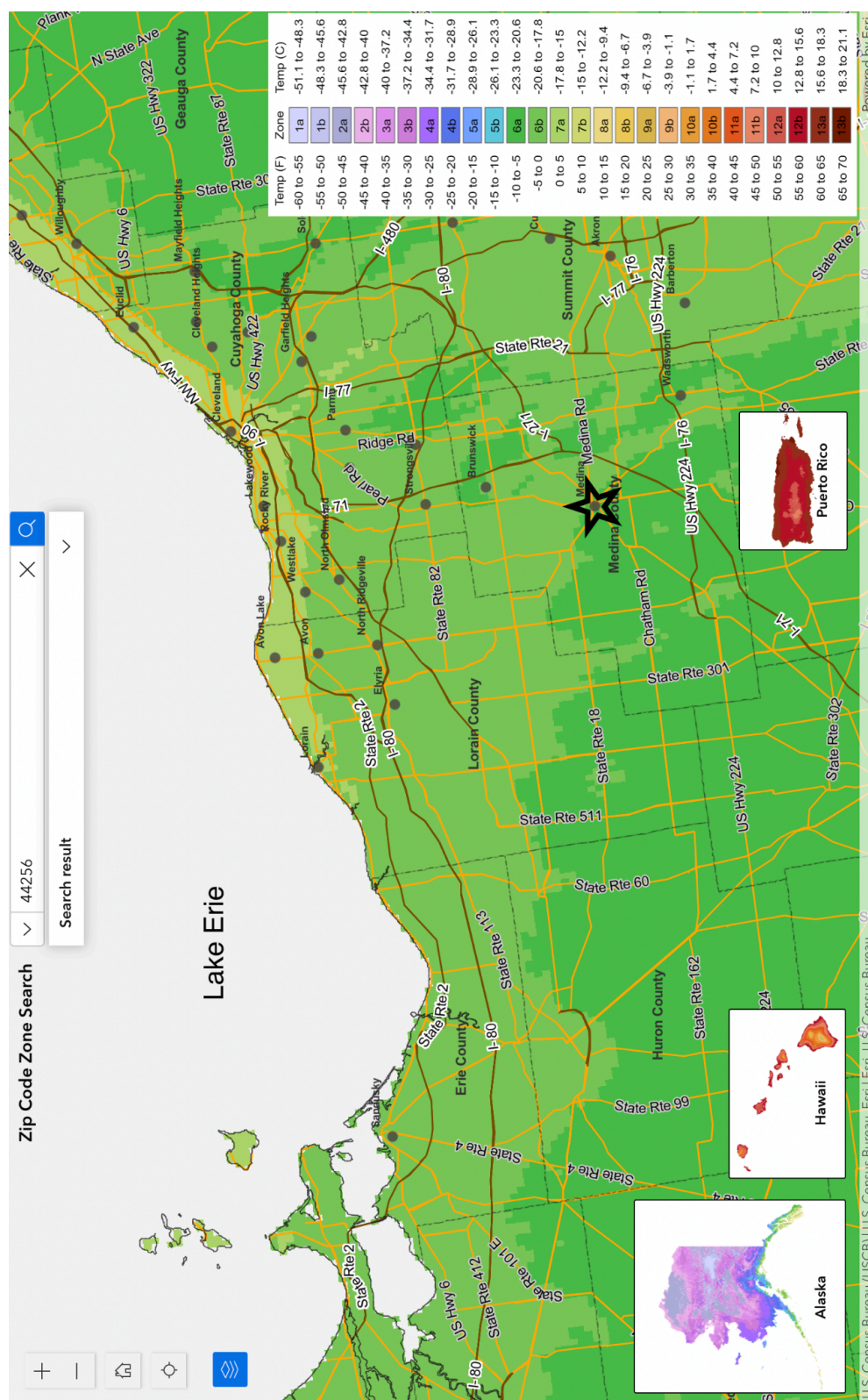


Figure 6. Plant Hardiness Zone Map of Medina, OH marked with a star (2023 USDA Plant Hardiness Zone Map, 2023).

The map above depicts the USDA hardiness zone of Medina, OH which is rated as zone 6a (2023 USDA Plant Hardiness Zone Map, 2023). A site's plant hardiness zone is vital to know in order to select plants that will survive the climate of the site and handle the secondary snow belt that is a result of the lake effect from Lake Erie. The city of Medina is also currently facing the sustainability issue of white tailed deer overpopulation where, "Wildlife Services concludes that this count yields a range estimate of 504-593 deer within the City of Medina at the time this count was conducted" (The City of Medina Deer Management Process, 2023). This current issue is needed in order to pick plants or systems that deter deer browsing especially in unfenced front yards.

Another city wide consideration is that the site is zoned by the City of Medina Official Zoning Map as low density residential (Zoning map, 2023). This zoning constrains what can and cannot be done on site in order to work within the city limits. Finally it is important to understand what land makes up the site itself. The total property lot is 20,909 square feet or 0.48 acres with the lot spanning 81ft x 233 ft (Halifax LN Property Records, 2021). In addition to this 0.143 of the acres are in the front yard and 0.345 acres are in the backyard. Of the backyard 0.264 acres are fenced in and 0.81 acres are unfenced. This results in a total of 0.169 acres of the lot being covered by the forest (MC-GIS, 2020). These numbers are for understanding how the land is divided and plan how much shade and existing vegetation is located on certain areas of the property. By having a deep understanding of the property a fuller design can be made.

Site Inventory and Analysis Qualitative

There are other notable aspects of the site that need to be considered in the planning process. On the site there is currently a large selection of existing vegetation that ranges from the

local native plant provenance to highly bred and imported plants. In the front yard there are garden beds surrounding the utility box, the mailbox, a walkway to the front door, on the east and west sides of the front door, and wrapping around both side yards of the house.



Figure 7. Site Overview (MC-GIS, 2020).



Figure 8. Flower bed next to the path to the front door in winter (Fletcher, 2024).



Figure 9. Garden around mailbox in winter (Fletcher, 2024).



Figure 10. Garden around utility box in winter (Fletcher, 2024).



Figure 11. East side yard in winter (Fletcher, 2024).



Figure 12. West side yard in winter (Fletcher, 2024).

The backyard features garden beds that wrap down both sides of the fence that transition from full sun to partial shade. A garden bed wraps around the patio, garden pond, and deck leading to the raised vegetable garden on the west side of the yard. This vegetable garden is parallel to the rose garden that runs along a portion of the fence. Finally at the south end of the site there is a shade garden that transitions into being among the forest trees and finally dwindles off to just being the forest trees and native groundcovers and spring ephemerals.



Figure 13. Woodland Path construction (Fletcher, 2020).



Figure 14. Completed Woodland Path (Fletcher, 2020).



Figure 15. Plantings in Woodland Path (Fletcher, 2020).

It is important to know what vegetation already exists on the site in order to have any idea of what material should be kept or discarded. It is also useful knowing what native species exist on the site in order to plan minimal disruption of them, as permaculture seeks to work in sync with the natural ecosystem. This forest provides a beautiful view off of the site that adds seasonal interest.



Figure 16. Backyard in autumn (Fletcher, 2022).

The forest also contributes to an array of animal habitats on site. The whole site sees a variety of birds, chipmunks, black and gray squirrels, rabbits, and pollinating insects. The front yard in particular has also attracted chipmunks and garden snakes under the front porch steps and deer that like to browse the plant foliage. The backyard attracts many animals to the garden pond such as toad, bull frogs, gray tree frogs, and garter snakes.



Figure 17. Garden pond after installation (Fletcher, 2023).

The presence of the forest additionally attracts occasional racoons, foxes, moles, wild turkeys, salamanders, ground bees, and a variety of other insects throughout the year. It is important to know what animals currently inhabit the site so that their habitats can be minimally disturbed and plants are picked that receive minimal pressure from the over-populated deer. The minimal habitat disturbance is important in this area now as there has been recent neighborhood development on the other edge of the forest which destroyed part of the animal's habitat. However, the remainder of the forest immediately behind the property owners of Halifax Lane is

now part of the Medina County Park System due to the McCabe Creek, which feeds into the Rocky River and eventually Lake Erie. By better understanding how development is impacting the surrounding area one can be better informed on how these will impact our site.

Site Summary

After evaluating the site there are valuable takeaways that have greater implications in achieving the site goals. By knowing what vegetation is existing on the site the vegetation can be evaluated for whether it should remain, be transplanted, or removed from the site. The basic layout of the existing flower beds will give inspiration on how to form any new flower beds as the designer can improve upon what works and does not work with the current layout. In creating an effective landscape design with appropriate plants the site will be able to better achieve the goal of being able to produce food to support the family. Knowing the existing conditions on site is vital as it can somewhat provide an idea of what immediate progress can be made. Knowing these is beneficial in creating a plan that will work well with the site and result in more success over time.

This also includes knowing the zoning of the site which helps guide the permaculture design in fitting within the Medina City regulations for residential areas. Finally, it is essential in landscape design projects to know the size of the lot in order to create a cohesive design that is appropriate for the site. In knowing the site size and having the design for it the designer will be able to have an approximation of time that will be spent on upkeep maintenance. This is vital in achieving the project's last goal of having a regular maintenance schedule that is in line with the amount of maintenance time and effort that the family is willing to do. In fully considering all of these quantitative and qualitative points the goals of a site can be better achieved.

Case Studies and Literature Review

1. Bending Oak Permaculture Farm - Youngstown, Ohio

Bending Oak Permaculture Farm is a twenty five acre farm located in Youngstown, Ohio. The farm is a woman run educational farm that has been focused on teaching sustainability for the past several years. Following the principles of permaculture the farm produces produce such as hazelnuts, chestnuts, walnuts, grapes, apples, pears, raspberries, black berries, elderberries, blueberries, gouda, aronia, honeyberry, honey, and maple syrup. The land was previously a forest that was timbered and degraded full of oil and gas wells, but is now being ecologically restored through the work of the farm. In some areas the farm has been able to create five new inches of topsoil on site over the past ten years (Bending Oak Permaculture Farm). Some design notable design elements include:

- Ecological pond
- Shipping container barn
- Rainwater harvesting cistern
- Solar power, gravity fed irrigation system
- Deer fence grape arbor with chicken run
- Orchard garden with fruit and nut trees
- Fruit tree plant guildes
- Composting toilet
- Photovoltaic electricity
- Wetland filtration habitat



Figure 18. Before and After of Bending Oak Permaculture Farm (Bending Oak Permaculture Farm, n.d).

The case study overlooks how permaculture can be implemented on a smaller scale farm of 25 acres. Additionally, the basic function of one site as an educational farm and the other has a suburban home is quite notable. This case study is valuable as it explores how to produce food in a similar USDA hardiness zone and building soil on an area that was previously a forest.



Figure 19. View from under shelter (Bending Oak Permaculture Farm, n.d).

2. Village Homes - Davis, California

Village Homes is a seventy acre development in Davis, California. The subdivision was built in 1975 and focuses on community, energy conservation, and natural resource conservation. The total development is made up of two hundred and twenty five homes and twenty apartment units with a community center and pool. The buildings take advantage of the California sun by having mostly passive solar, some active solar, and very few non solar. Finally, twenty three of the seventy acres are communal edible landscapes that residents can harvest from to feed their families (Village Homes Davis). Some design notable design elements include:

- House oriented north and south
- Streets are twenty five foot wide without sidewalks
- Extensive bike and walking paths
- Natural drainage through creek beds and swales
- Communal edible landscapes
- Forty percent of the total land is communal spaces



Figure 20. Concept Plan for Davis Village Homes (Francis, 2007).

While the case study does overlook how permaculture principles can be implemented in the individual lots, the study focuses on designing at a larger scale. It is interesting to see how these same principles can be implemented on a community scale and how edible landscapes can be interwoven as edible landscapes.



Figure 21. Community Viewbook (Smart Feature, n.d).



Figure 22. Community center with amphitheater that acts as winter river (Local Wiki, n.d).

3. Tropical Permaculture Homestead - San Isidro, Peñas Blanco, Costa Rica

The Tropical Permaculture Homestead was designed by Porvenir Design in 2019 and is located in San Isidro de Peñas Blancas, Alajuela, Costa Rica. The site is eight hundred square meters and was abandoned for ten years before being redesigned. The goal of the site is to create a permaculture centered homestead in a small space with minimal inputs. The design explores how a small space minimizes labor, costs, and allows intensive food production (Concept Plan, 2019). Some design notable design elements include:

- Stormwater management with water collection
- Greywater system
- Tilapia pond

- Using waste materials for projects on site
- Culinary garden
- Edible trees and shrubs
- Outdoor shower



Figure 23. Concept Plan of Tropical Permaculture Homestead (Concept Plan, 2019).

The Tropical Permaculture Homestead design is important as it shows how permaculture design can be implemented on a smaller scale at an existing home to produce food. The design also shows how the designers were able to work with the preexisting landscape and how they saved or tweaked aspects of it.



Figure 24. Aerial view of Site (Porvenir Design, n.d).



Figure 25. Shade structure on property (Porvenir Design, n.d).

Historical Context of the Final Project

The concept of permaculture design came into being in the 1970s by Bill Mollison. As told in Bill Mollison's *Introduction to Permaculture*, growing up in the village of Stanley, Tasmania he grew to become very aware of ecological issues that the local environment was facing. After working with the CSIRO Wildlife Survey Section and Tasmanian Inland Fisheries Department he eventually became a professor at the University of Tasmania. When he met David Holmgren the two worked together and published *Permaculture One* in 1978. The word permaculture comes from the contraction of both permanent agriculture and permanent culture (Mollison & Slay, 2016). This reflects on the idea of creating a permanent agriculture system that focuses on the relationship between the individual elements in order to create the whole system. By 1979 Mollison resigned from his tenured position and dedicated his life to educating others on permaculture systems. Today, "it is growing exponentially and influencing

all levels of humanity from the third world village level to up-market, high end developments. Courses are taught in most countries and languages, teachers are growing in numbers as well as in land restoration” (Mollison & Slay, 2016). In the context of the final design project the permaculture design principles are being implemented in a specific social and physical area. The design is occurring in a suburban area with residential zoning which typically does not support individuals in food production endeavors. These codes also typically reinforce the idea of non productive grass lawns in the physical landscapes. There simply are also greater restrictions on the final design site as it is a half an acre plot with minimal access for equipment.

Case Study Summary

Overall the case studies presented have been informative in how to move forward with the capstone design. Bending Oak Permaculture Farm was interesting as it was able to provide an example of permaculture designed landscapes that produce food in a similar climate. The farm is able to offer inspiration for what crops will thrive in the Northeast Ohio climate. The Village Homes in Davis, Davis Californian acts as template of how permaculture design and practices can be implemented in a whole community. It is interesting to take aspects of this design, such as the edible landscapes, and implement them at a smaller rather than larger suburban scale. Finally the Tropical Permaculture Homestead showcases how permaculture designs that produce food can be effective on a smaller scale in a residential area. Overall, by learning from these studies an understanding of what elements such as vegetation and water collection work well in the final project climate will be valuable. The cases have also suggested what design and layout plan can be effective on a smaller scaled property.

Project Goals

After reviewing the previous research and case studies, it is pertinent to establish goals that help in specifying the focus of the design. The three goals set for the design are growing food for the household, growing the food in a maintenance effective manner, and following all zoning regulations. To greater specificity, the crops should comprise half of the required food for the household during the garden's peak season of summer. The required upkeep of the landscape can be largely done by the family. Finally, the zoning regulations for Medina County are followed, allowing for the design to be more easily replicated in the area while still following the core principles of Permaculture Design. By striving towards these goals for the final project, a clearer focus is created.

Programmatic Requirements

For the programming of the site it is important to establish the predicted state and needs of the site. The property will remain 0.48 acres, although more of the land will be easily accessible to the family as the fence will be moved to the back of the property. The site is remaining residential and will be used essentially everyday, with more intensity during the summer months. In terms of technical information, the design will need to keep in mind the cold winter climate and wet areas that form in the spring. The further technical aspects of where garden beds, plants, or other objects will be placed, is based on where the land needs it, rather than forcing it to do something unnatural. Finally, in terms of spatial relations it is important to keep open space for gatherings to allow gathering and family connection as well as a visual break.

Final Project Design Elements

In the process of finding the solution, the design went through the design stages. After speaking with the clients, their wants of a water feature, an arbor, a cutting garden, a larger vegetable garden, fruit trees, and a green house with a potting shed were noted. A quick site inventory and analysis was then sketched outlining some of the main aspects of the areas of the site. Rather than trying to force a specific design on the site, permaculture design takes a larger scale look at the natural cycles of the site and how those can be harnessed. In addition to the first sketch, a site zone map was created to emphasize which areas were more often and heavily utilized than others.

Process Documentation

As seen in the figure below, zone 1 is red and represents areas that are used most often-being every day. Zone 2 is pink and represents areas that are used around three times a week, zone 3 is yellow and represents areas that are frequented once a week, zone 4 is blue and is frequented or maintained once a month, and finally zone 5 is blue and maintained once a year. By recognizing these established zones, items are planned for locations depending on how often they are utilized or maintained. This practice allows us to recognize our own patterns and how to best use them to our advantage.

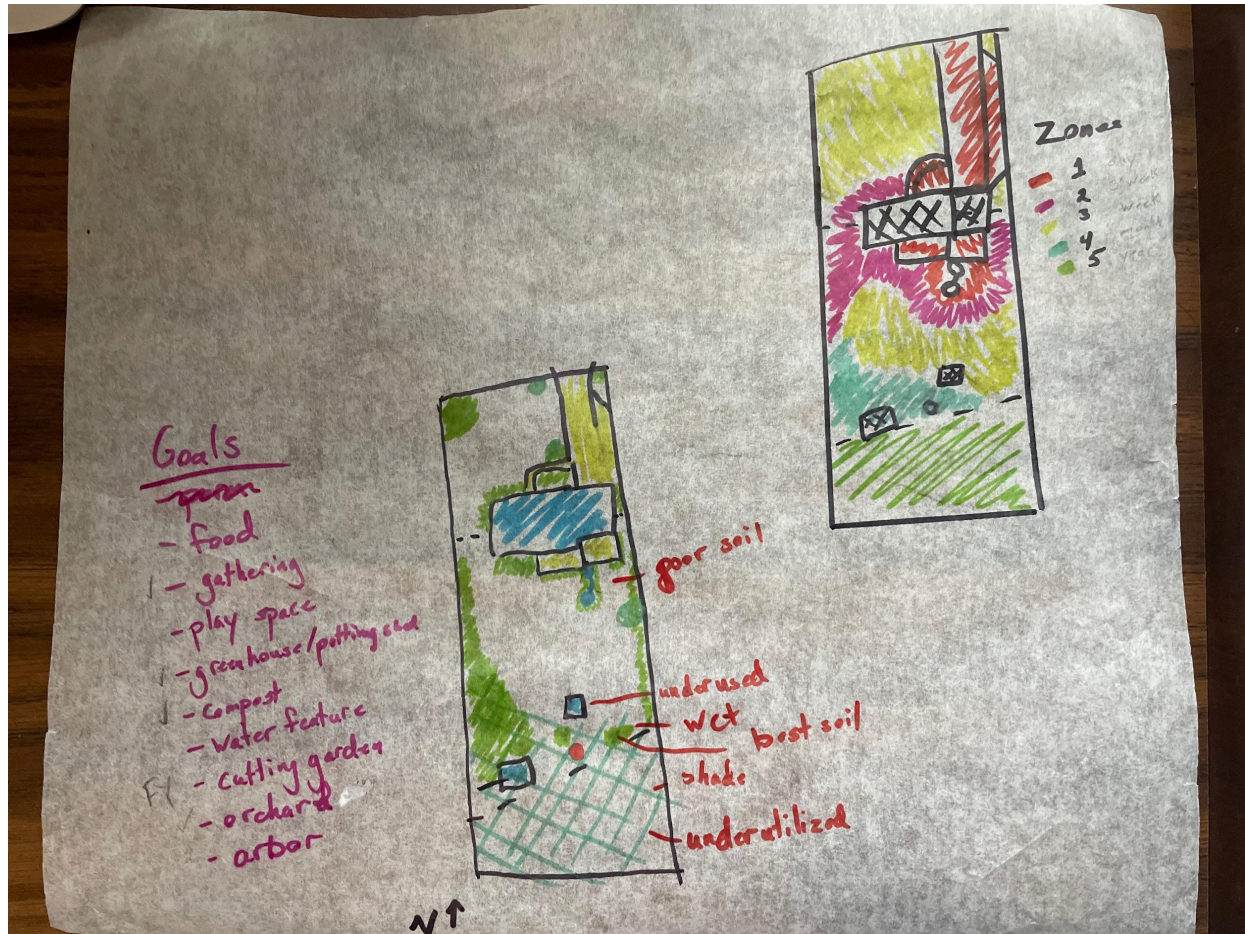


Figure 26. Site Inventory and Analysis Sketch with Site Zones.

Moving forward with these three concepts in mind, a bubble diagram of the site was created. This plan explored how the different elements supported and interacted with each other on the site. It was also satisfying to see the plan start to take form in accomplishing the family's goals and wants. However, after assessing the diagram it felt rigid and was in need of some more natural curves.



Figure 27. Bubble Diagram of Suburban Permaculture Site.

Moving from the Bubble Diagram to a Concept Design was satisfying in showing how some of the finer details of the design fit together. The drawing also catered to a less rigid design that allowed the curves and organic shapes to fit in nicely.

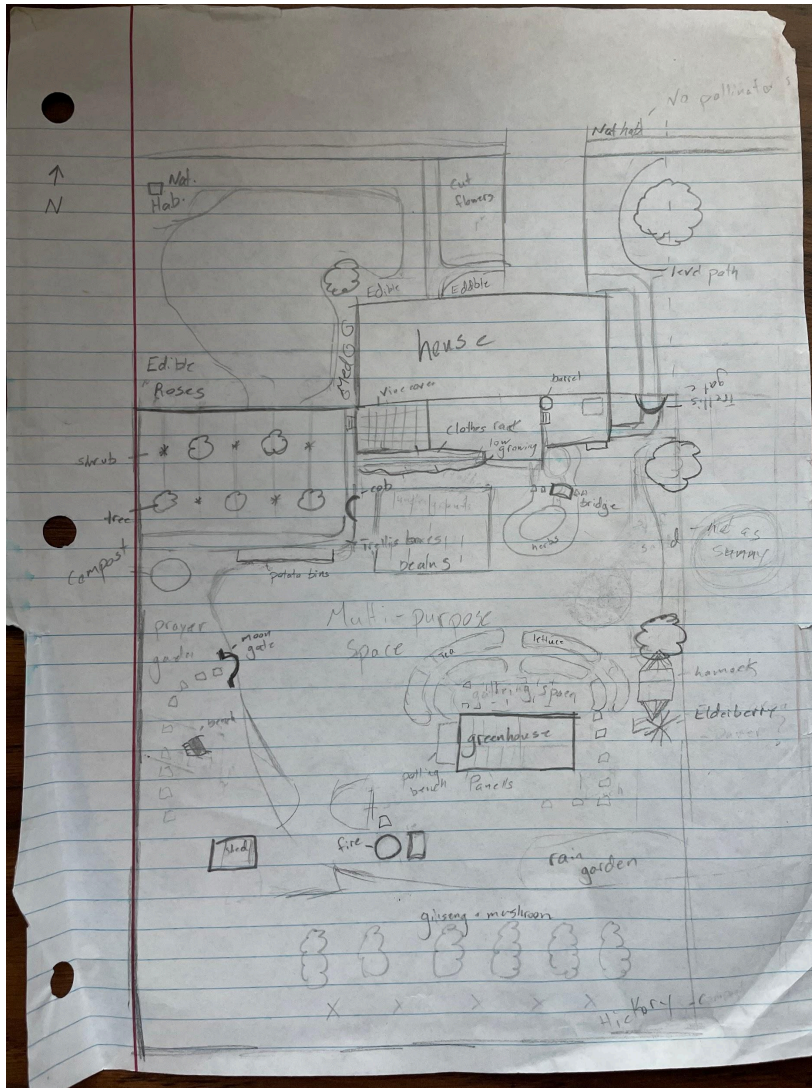


Figure 28. Concept Design of Suburban Permaculture Site.

Project Solution

A solution to, "how can permaculture design be applied to be within county regulations at a suburban middle class home to produce food and enhance shared family maintenance time?" is explored in the final design.

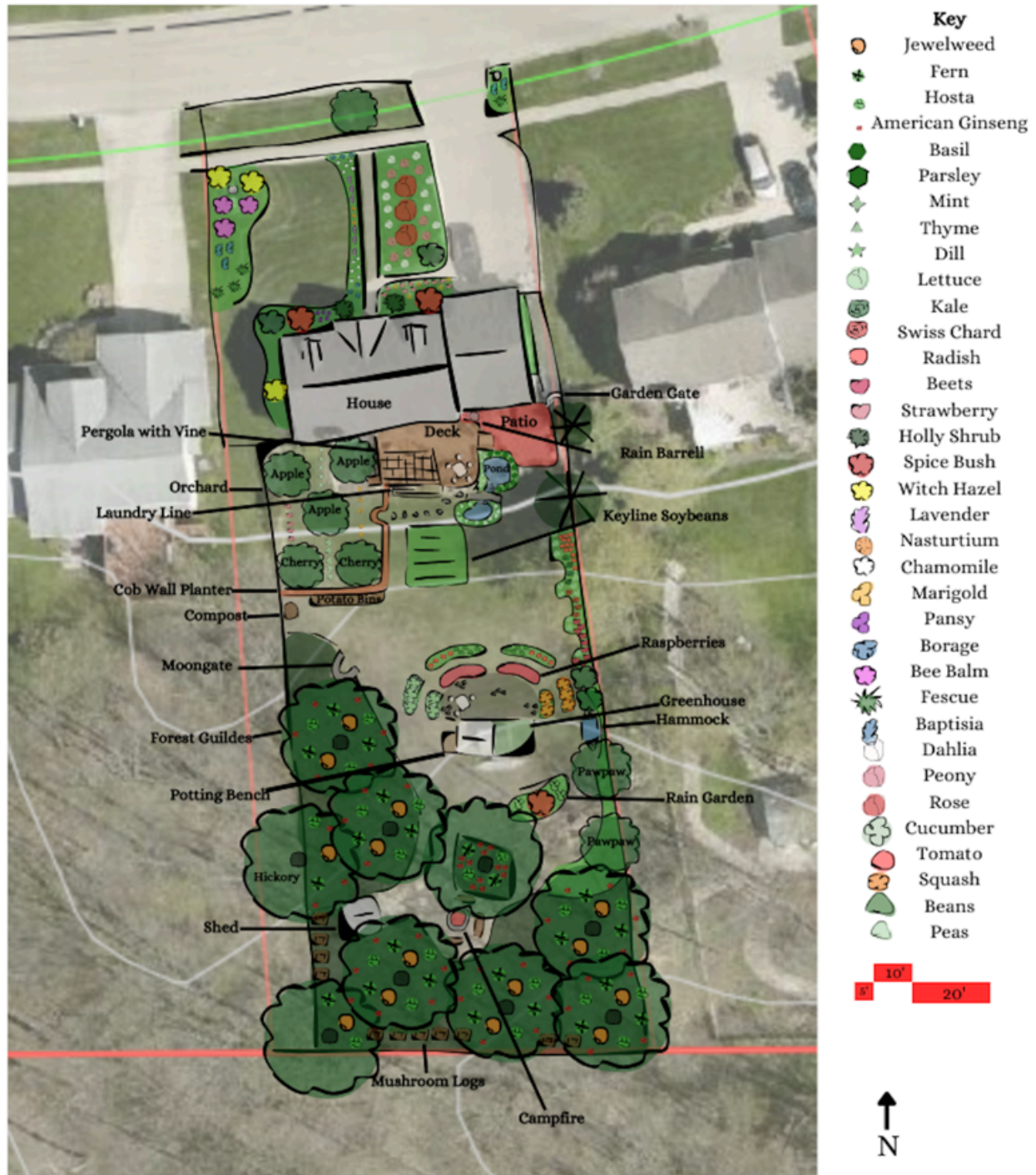


Figure 29. Final Design for Suburban Permaculture Home in Medina, OH.

This design features several gardens on the site such as pollinator garden, edible flowers garden, cutting flower garden, orchard, pond herb garden, salad garden keyholes, soybeans on a keyline, a rain garden, and groupings of plants called guilds in the forest. These different sections work

together to take advantage of the site's various qualities in order to provide a wide amount of food for the family. These gardens allow for the family to produce around 2,035.59 pounds of fresh produce through the year. The various required maintenance and upkeep will also largely be able to be handled by the family which will provide them with opportunities for education and bonding experiences. Finally, the design is following the Medina County regulations and allowed for the opportunity to learn about what is achievable. By fulfilling these three requirements the design is able to act as a solution and inspiration for how permaculture can move forward.

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Appendix

Suburban Permaculture:

How can permaculture design be applied to be within county regulations at a suburban middle class home to produce food and enhance shared family maintenance time?

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Existing Site



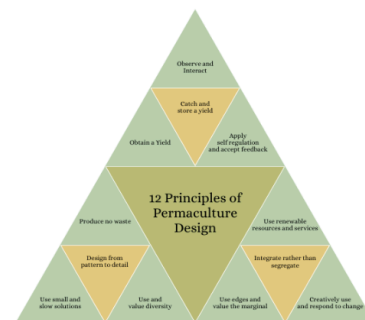
Aerial topographic map of site (MFC GIS, 2018)

Site Conditions:

- Located in Medina, Ohio
- USDA Plant Hardiness Zone 6a (2013 USDA Plant Hardiness Zone Map, 2013)
- No Home Owners Association in Neighborhood
- The lot is 0.48 acres
- 100% Ritman Silt Loam (Web Soil Survey - Home)
- 2-6% Slope (Web Soil Survey - Home)
- Mid-Succession Oak-Hickory Forest at the back of the property

The Client

The family who occupies the home is an active five person family with two members following plant-based diets. The family wants to utilize more of the landscape to produce food while following permaculture design principles



Site Zones



Figure 30. Capstone Board 1.



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Figure 32. Capstone Board 2.

Plant Analysis

	Scientific Name	Common Name	Location	Total Quantity of Plants	Total Yield per Season
	<i>Lactuca sativa L.</i>	Romaine Lettuce	Salad Garden	11	15.13 lbs
	<i>Brassica oleracea Acephala</i>	Kale	Salad Garden	4	4 lbs
	<i>Beta vulgaris L.</i>	Swiss Chard	Salad Garden	4	4 lbs
	<i>Raphanus sativus</i>	Radish	Salad Garden	13	1 lb
	<i>Beta vulgaris</i>	Beets	Salad Garden	9	2.7 lbs
	<i>Fragaria virginiana</i>	Strawberry	Front Lawn, Orchard	15	18.75 lbs
	<i>Cucumis sativus</i>	Cucumber	Lower Garden	5	15 lbs
	<i>Solanum lycopersicum L.</i>	Tomato	Lower Garden	8	120 lbs
	<i>Rubus idaeus</i>	Raspberry	Lower Garden	8	12 lbs
	<i>Cucurbita pepo var.</i>	Spaghetti Squash	Lower Garden	5	125 lbs
	<i>Phaseolus vulgaris</i>	Pole Beans	Lower Garden	10	10 lbs
	<i>Pisum sativum L.</i>	Snow Peas	Orchard	5	3 lbs
	<i>Glycine max</i>	Soybeans	Keyline	50	5 lbs
	<i>Malus domestica 'Golden Delicious'</i>	Dwarf Golden Delicious Apple	Orchard	3	120 lbs
	<i>Prunus avium 'Bing'</i>	Dward Bing Cherry	Orchard	2	50 lbs
	<i>Solanum tuberosum</i>	Potato	Outer Orchard	16	80 lbs
	<i>Sambucus nigra ssp. canadensis</i>	Elderberry	Lower Garden	2	24 lbs
	<i>Asimina triloba</i>	Pawpaw	Forest Edge	2	60 lbs
	<i>Panax quinquefolius</i>	American Ginseng	Forest Guild	52	0.21 lbs
	<i>Lentinula edodes</i>	Shiitake Mushroom	Forest Guild	11	16.5 lbs
	<i>Carya ovata</i>	Shagbark Hickory	Forest Guild	9	1,350 lbs
	Total: 2,035.59 lbs				

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Figure 32. Capstone Board 3.

Solution

How can permaculture design be applied to be within county regulations at a suburban middle-class home to produce food and enhance shared family maintenance time?

Overall, this is explored by selecting to cultivate crops that work with the given environment, site requirements, and client needs. Enhanced family time is achieved by the regular maintenance that

is required being largely manageable by the family and allowing opportunities for education and bonding. Finally, county regulations have been followed by researching what these regulations are and being informed on what can be reasonably achieved.



A yield of the site's produce last summer (Fletcher, 2022)

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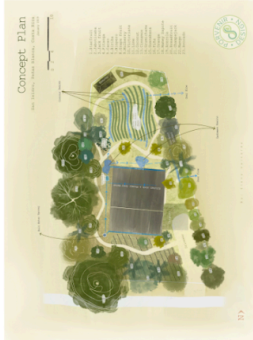
Case Studies

Village Homes - Davis, California



Concept Plan for Davis Village Homes (Francis, 2007).
This design explores how permaculture design can be implemented at a community scale.

Tropical Permaculture Homestead - San Isidro, Peñas Blanco, Costa Rica



Concept Plan of Tropical Permaculture Homestead (Concept Plan, 2019).
This design is important as it shows how permaculture design can be implemented on a smaller scale at an existing home to produce food.

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Figure 34. Capstone Boards 4 and 5 . .