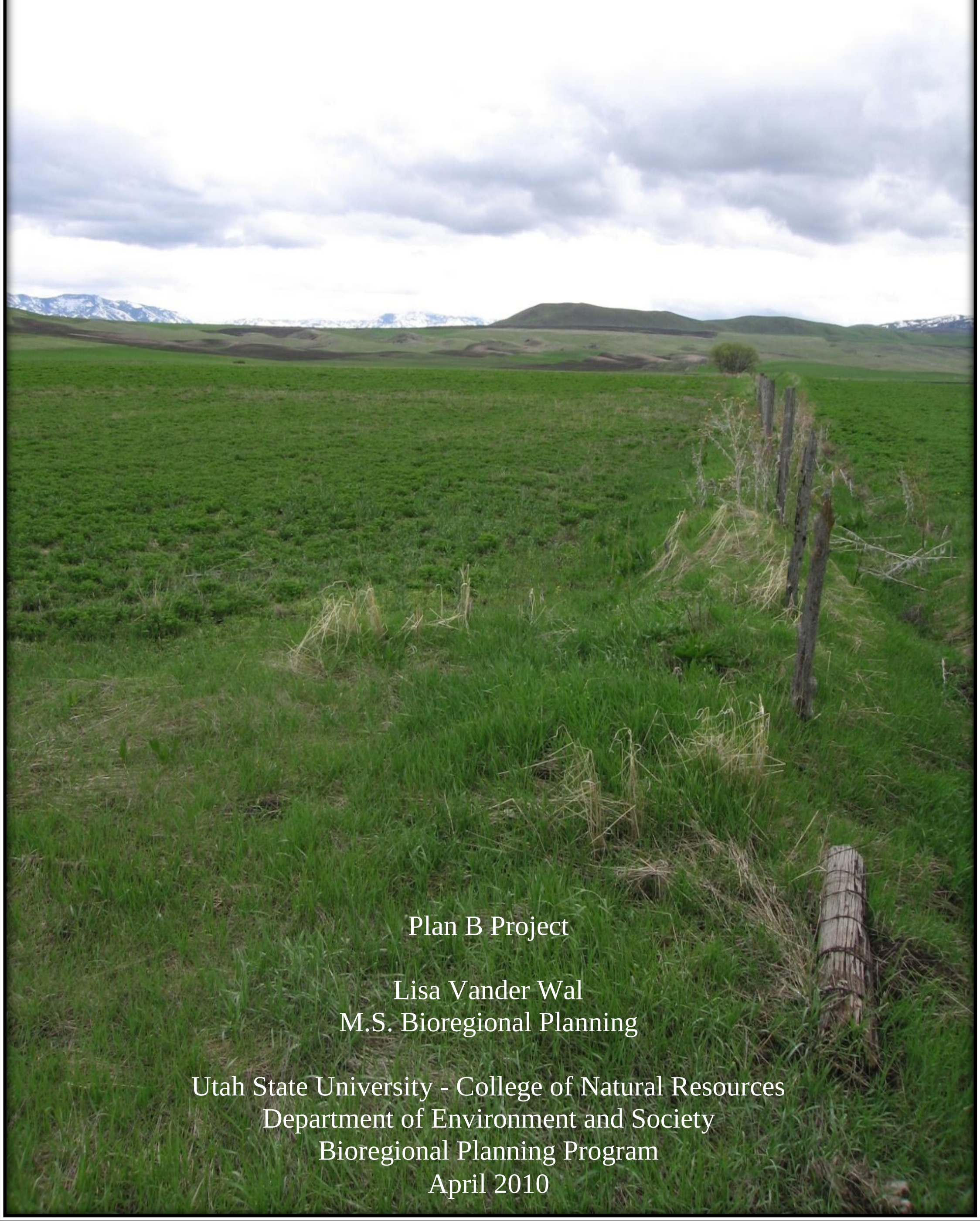
South Cache Ecovillage:

Addressing the Past, Present and Future



Plan B Project

Lisa Vander Wal
M.S. Bioregional Planning

Utah State University - College of Natural Resources
Department of Environment and Society
Bioregional Planning Program
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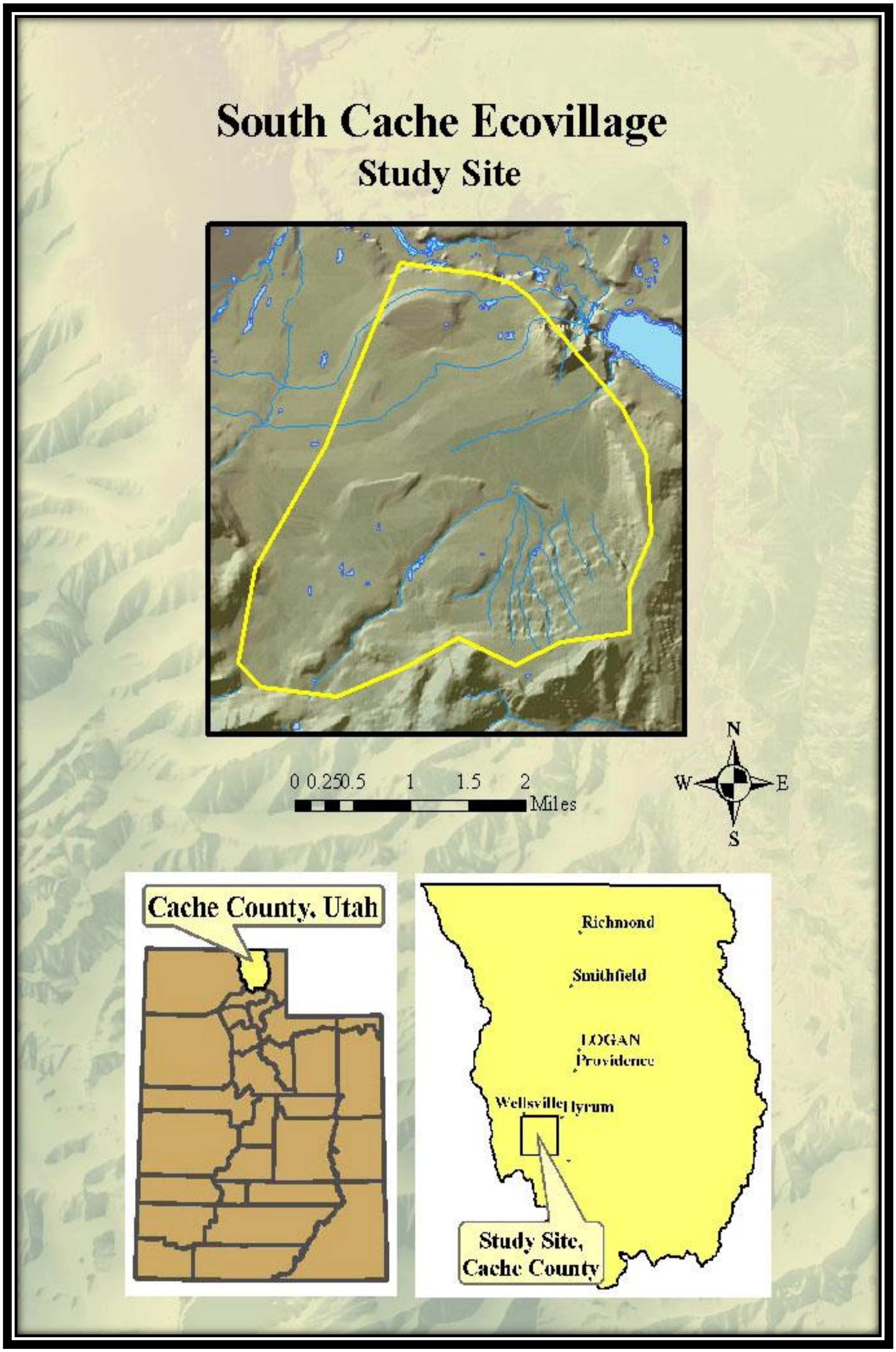
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South Cache Ecovillage:
Addressing the Past, Present, and Future

By: Lisa Vander Wal

A Plan B project submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Bioregional Planning

Committee Chair: Michael Dietz

Committee Members: Richard E. Toth, David T. Anderson, and Charles W. Nuckolls

Department of Environment and Society
College of Natural Resources
Utah State University

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Abstract

Population growth, climate change, peak water, and peak oil greatly stress the land and its people. In the past, various green communities were introduced to alleviate and combat these issues, but none took hold in the planning field. Communities continue to grow in destructive ways. However, ecovillages, a relatively new community type, are forming all across the world, offering an alternative community. Benefits include ecological, social, and economical sustainability. No one template exists for individual ecovillages; rather, the people and the land shape each unique community. The goal for this research was to plan an ecovillage that would offer a sustainable solution to the expanding population in Cache Valley. An extensive literature review provided an initial understanding of ecovillages. Additionally, visits to seven communities offered hands-on experiences and learning opportunities. Four interviews allowed one-on-one communication with current ecovillage residents at various communities; these interviews presented variations among individual ecovillages in terms of purpose and function. This project identified and analyzed potential ecovillage features for the South Cache Ecovillage. The site identified as a suitable area for a "New Town" in a previous study, *Cache Valley 2030—The Future Explored* (Toth et al., 2006), serves as the location for the potential South Cache Ecovillage. This study used Geographic Information Systems (GIS) to spatially identify a suitable layout for an ecovillage in south Cache Valley. Agricultural lands, conservation lands, and potential building sites were identified using GIS data. Two potential ecovillage layouts provide different options for this proposed rural community. Both layout options are comprised of five individual ecovillages that make up the South Cache Ecovillage. The first potential layout has all

five ecovillages together, and the second potential layout has the individual ecovillages throughout the landscape.

Project Formulation

Introduction

As the world's population continues to increase, new housing developments continue destroying historic farmlands and wildlands. The demand for more and more resources continues to grow. Cities and towns rely on other cities and towns for various services, such as jobs and food, straining the people and the land. Oftentimes, goods are shipped from all over the globe. In addition, people feel detached from their community, causing an even greater loss in respect for the land that sustains us.

The land planning field provides the means to combat development's destructive ways; however, little action has been taken. In the past a few green community concepts, such as Ebenezer Howard's *Garden City*, Le Corbusier's *The Radiant City*, and Frank Lloyd Wright's *Broadacre City*, became well-known but failed to take hold in the planning world (Berke, 2008). Berke (2008) found that green community planning is not well incorporated into future visions despite the growing markets for greener communities. This study examines ecovillages as a green community option that localizes community by bringing people, jobs, food, and nature back together. "Ecovillage" is a rather new term coined in the early 1990s (Christian, 2002). Gilman (1991) describes an ecovillage as a "human-scale, full-featured settlement." These communities act as sustainable pockets throughout the landscape. They address issues that affect the health of the land, resources, people, and community. Ecovillages can provide healthier living options while compromising little and should not be looked at as sacrifices, but choices. These choices can produce less negative impacts on the environment while producing positive impacts on the social, cultural, and economic wellbeing of the people.

For this study, I propose an ecovillage in southern Cache County, Utah while addressing the issues of population growth, habitat loss, and agriculture loss. The site was designated as suitable for a *New Town* based on findings from a previous study titled *Cache Valley 2030—The Future Explored* (Toth et al., 2006). This previous study, conducted for Cache Valley, used Geographic Information Systems (GIS) analysis to designate this rural site as a new town in response to population growth. By making the new town an ecovillage, the environment and its people experience less stress. The process I use will demonstrate how to turn a given piece of land into an ecovillage, offering a more sustainable alternative to current land planning.

Issues

Climate change, peak oil, peak water, and species extinction represent a few controversial topics (Brown, 2008). Couple these issues with population growth, and the pressure results in greater stress to the land and its people. Scientific proof confirms these issues. The earth's warming, oil shortages, water shortages, and species loss are all real. Little progress has been made in fighting these problems, and people continue to live as they did in years past. This section discusses the primary issues including local population growth, loss of agricultural lands, and habitat loss.

Utah's high population growth exacerbates these problems. The U.S. Census Bureau estimates that from April 1, 2000 to July 1, 2008, the population grew 22.5 percent in Utah while the national average was 8.0 percent (U.S. Census Bureau, 2009). Cache County, Utah, is no exception; population growth has been similar to or slightly higher than the state's rate (Patrick, 2009a).

***Figure 1*. Cache Valley on a clear air day.**

Population growth can be both good and bad. Sales tax, housing sales, and local businesses all benefit from growth. However, the effects of population growth on local resources can be substantial. New housing developments consume wildlands and agriculture fields, more people stress the current infrastructure, and air quality can worsen. The air quality in Cache Valley during winter inversions has been so bad that people are advised not to go outside, and the air has been ranked worst in the nation on several occasions (Wheeler, 2009) (see Figures 1 and 2).

High rates of population growth, coupled with poor planning, can result in negative impacts to the local environment. Building and road expansions destroy prime habitat. Cities and towns base their layout around automobiles. Urban sprawl increases commute time to work and retail, causing an increase in pollution. In the past, the greatest amounts of CO_2 came from inner cities; now the cities' urban fringe produces the greatest amounts of CO_2 (Stutz, 2009). People feel detached from their community, causing a decrease in respect for the land that sustains us. The "stereotypical scene" on the outskirts of major cities includes

***Figure 2.* Cache Valley inversion.**

subdivisions with “large lots and big houses, landscaped to the curb with turf” (Western Resource Advocates, 2009, p. 1). Food, fiber, water, and energy are extracted, transferred, and delivered from large sources worldwide to individual communities (Berke, 2008).

Loss of agricultural lands is happening at an extraordinary rate. New developments in the United States consume 45.6-acres of farmland every hour of the day (James & Lahti, 2004). This affects more than farmers; agriculture loss also hurts the workers, the community, and the people who are now responsible for growing food for the world. The family farm is becoming a thing of the past (Murphy, 2008). Yet in 1978, China replaced its system of agricultural collectives with family farms, resulting in its successful economic reform (Brown, 2008). Worse yet, agriculture has become “regionalized.” For example, corn dominates the Midwest and vegetables dominate California, causing food to travel further (Murphy, 2008).

Habitat loss is also occurring at an accelerated pace. When habitat is destroyed, the plants and animals that lived there are also destroyed. Habitat loss also includes recreational losses and service losses such as lumber, windbreaks, flood control, and nitrogen fixers (Brown, 2008). Therefore, economic gain and social opportunities diminish when habitat is destroyed.

Background: Cache Valley 2030

Cache Valley 2030-The Future Explored (*CV 2030*) was completed in 2006 by Utah State University’s Bioregional Planning Studio Class. The studio team included Ellie Leydsman-McGinty, Kent Braddy, Jordy Guth, Lynne Slade, Jay Price, and

Brandon Taro, all under the direction of Professor Richard E. Toth (Bioregional Planning Program, n.d.).

CV 2030 explores Cache Valley's future "with respect to planning, growth, and the welfare of Cache Valley's residents in Utah and Idaho" (Toth et al., 2006). Objectives include updating the GIS database for Cache Valley and continuing analysis of public surveys for the region. Assessment models were created to analyze physical characteristics within various categories ranging from wildlife habitat to public, health, welfare, and safety. These assessment models provide valuable information to the alternative futures. (See Appendix A for a full definition of *alternative futures*.) The alternative futures, based on the 25-year growth projections, offer a series of plans for Cache Valley. One alternative future, the "New Town" future, serves as the basis for this research project (Toth et al., 2006).

The New Town future offers a site suitable for a new community at the southern end of Cache Valley. The site contains 5,400 acres of mostly-undeveloped land, and it could accommodate 34,000 new people at a density of 6.4 people per acre. Reasons for this location include:

- Favorable soils
- Favorable slope
- Out of floodplain regions
- Low impact to the visual quality of the area
- Beautiful mountain views
- Easy access to Highway 89/90 for those who commute to Salt Lake City

Drawbacks for this location include:

- Crowding of nearby towns
- Possible increase in air pollution
- Considerable infrastructure costs
- Lengthy process in land acquisition and governmental buy-in
- Difficulty in obtaining financial support

As population continues to grow, development will need to occur somewhere within the valley. Development of the New Town offers a solution to help ease the negative impacts of population growth within Cache Valley.

Research Questions and Objectives

The goal for this research is to plan an ecovillage that would offer a sustainable solution to the expanding population in Cache Valley. However, instead of a development that could accommodate 34,000 new people who rely on goods and services from outside communities, the goal is to provide a sustainable development for 3,000 people. The questions asked are: How can a sustainable development in the location identified by *CV 2030* be created to last for multiple generations without having a large impact on the land and the surrounding ecosystem? What are suitable ecovillage features for this site?

The objective of this study is to identify the different ecovillage features that make a community sustainable in its ecological, social, and economical elements for its people and the land over time. Previous studies, current technology, site-specific location, and GIS analysis assist in selecting various ecovillage features. Further research identifies suitable features that make this ecovillage sustainable by presenting alternatives for energy, housing materials, water supply, sewage treatment, and food sources. These features include alternative options for: (a) transportation, (b) building materials, (c) water collection and wastewater treatment, (d) alternative energy, (e) open space, and (f) garbage disposal. Furthermore, this study identifies those ecovillage features that are suitable for the identified ecovillage site.

Another objective of this study is to spatially identify a suitable layout for an ecovillage in south Cache Valley. GIS, a computerized map-making tool, provides the means to see what currently exists at the study site. The GIS data provide the basis for the different zones—agriculture, conservation lands, and building sites. The final layouts show where the South Cache Ecovillage can be located. Overall, this research project constructs an example of an ecovillage layout based on sound planning practices. The goal is to balance community needs with environmental impacts.

Methodology

The methodology is a crucial component to planning, providing a theoretical framework for the entire project. In land planning, the process is cyclic (Toth, 1974). Constant re-evaluation followed by an action produces a well thought-out plan. As times change, project issues and needs change.

This study uses a framework developed by Richard Toth as a guideline throughout the research (Toth, 1974). The methodological categories include:

(1) Pre-analysis sector

(2) Data inventory and file

(3) Full-scale analysis sector

(4) Criteria-evaluation development

(5) Concept development

(6) Concept evaluation and selection

(7) Site planning

(8) Site design

(9) Implementation

However, due to the nature of this project, step 9—Implementation—will be excluded. Based on Toth's methodology, a similar framework was developed for this project as shown in Figure *3*. As each step progressed, the project goals and objects remained the central focus; they guided the research through every action.

The Project Formulation phase identifies the site, the issues, and the objectives. In this case, *CV 2030* identified the site for this project. The main issues were population growth and land preservation, and the goal was to provide a place for people to live while preserving the farmlands and conservation lands that give Cache Valley its identity. This research project asks the question: How can a sustainable development in the location identified by *CV 2030* be created to last for generation after generation without having a large impact on the land and the surrounding ecosystem? Since this analysis is a continuation of the previous bioregional report, this study zooms into the ecovillage site at the community level.

In the Pre-analysis phase, an extensive literature review helped shed light on ideas and information concerning ecovillages and green development. This study examines ecovillages and other communities (i.e., cohousing and intentional communities) that strive for sustainability. A site visit provided a visual assessment of the New Town site. Visits to seven different ecovillages and intentional communities also proved very

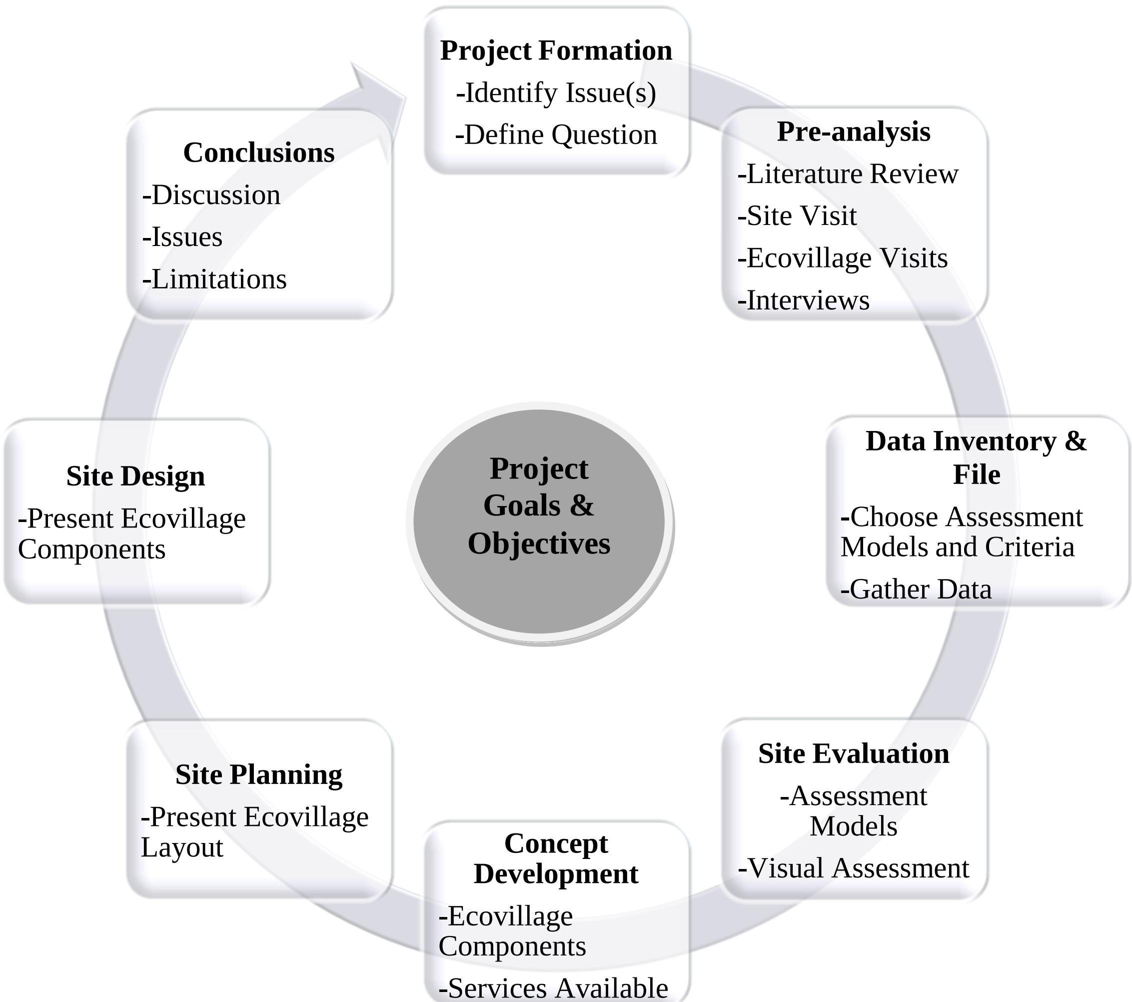

***Figure 3*. Project methodology developed in a circular fashion with the project goals and objectives as the central focus.**

valuable in understanding and defining these communities. Four interviews with residents of various communities were conducted while attending a conference at an ecovillage. Interviews shed light on existing ecovillages, explaining topics such as what makes their community an ecovillage, troubles that arise, and reasons for an ecovillage—socially, economically, and ecologically. A criterion for evaluation, including the identification of data needs, was established.

In the Data Inventory and File phase, assessment models were chosen based on project needs. Previous ecovillage research and previous Bioregional Planning studies provide a basis for the assessment model criteria. Then data needs were examined. Following, data were acquired mainly through The Utah GIS Portal and the Soil Survey Geographic (SSURGO) database by the Natural Resource Conservation Service.

In the Site Evaluation Phase, the assessment models are developed and run using GIS software (see Appendix B). The purpose of the assessment models for this project is to provide a potential layout for the Ecovillage based on existing data, dividing the site into areas for agriculture, conservation lands, and development. A similar study used GIS to locate sites suitable for an ecovillage near Stockholm, Sweden (Aranon, Sinha, & Wall, n.d.). Following the GIS analysis, a site visit was conducted to see if current land use trends matched with the results from the assessment models. The idea was to find matching land uses between what currently exists and what the assessment models presented to be suitable land uses. For the purpose of this research, a suitable land use refers to using the land in a way that embraces the existing physical characteristics of the site; for example, agriculture fields located where soil designated as prime agriculture exists and houses found in areas identified as having suitable soils for potential building sites.

The Concept Development phase identified ecovillage components. The components include:

- Transportation
- Building materials
- Water collection and wastewater treatment
- Alternative energy sources
- Open space (i.e., farms, gardens, parks, etcetera.)

- Garbage disposal

Many different options exist for each component. Ecovillages vary greatly depending on factors such as location and preferences of the people involved in planning and designing the development. The goal is to find the most suitable option for each individual ecovillage.

The Site Planning and the Site Design phases are relatively similar. In the Site Planning phase, the assessment models served as the basis for the ecovillage layout. This layout breaks the site into different zones: Conservation Lands, Agriculture, and Building Sites. The primary focus is to accommodate the proposed 3,000 future occupants. The Site Design phase offers a more specific ecovillage layout. The individual ecovillage features are identified for this specific site. Following, the Conclusion presents findings, along with a discussion of issues and limitations.

Literature Review

Ecovillage Defined

"Ecovillage" is a vague term and can be interpreted in various ways. Many definitions exist. Some key sources refer to Robert Gilman's definition: "A human-scale, full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite future" (Gilman, 1991, p. 10). The Global Ecovillage Network (GEN) essentially follows his definition (Bang, 2005). The components are: (a) human scale, (b) full-featured settlement, (c) in which human activities are harmlessly integrated into the natural world, (d) in a way that is supportive of healthy human development, and (e) that can be successfully continued into the indefinite future (Gilman, 1991).

First, *human scale* refers to an ecovillage size. This size is the amount of people at which social interactions are enhanced; each member feels that they can influence the communitie's direction (Gilman, 1991). Gilman (1991) estimates the size of an ecovillage based on evidence from modern industrial societies and other cultures. He states that the upper limit is approximately 500 people. He continues by stating that ecovillages can have as high as 1,000 people, while some have less than 100. Auroville, India, is a 34-year-old community with approximately 2,000 people that is comprised of ecovillages clustered together (Jackson & Svensson, 2002). Regardless, the size of an ecovillage is important as it is important for residents to know one another and feel important no matter the number of people.

Next, *a full-featured settlement* refers to the functions within an ecovillage. Essential functions include residence, food provision, manufacture, leisure, social life, and commerce; all need to be “present and in balanced proportions.” Regardless, the definition does not mean that ecovillages are completely self-sufficient or isolated from neighboring communities (Gilman, 1991). Not every ecovillage can or should contain a hospital and/or airport. Typically, ecovillages may contain a school and/or training center, daycare, community center, café, mercantile, and/or shops; others may include a bed and breakfast, elderly care center, nursery and garden center, art gallery, welcome center, bakery, and/or business center.

The phrase *in which human activities are harmlessly integrated into the natural world* brings the “eco” into the word ecovillage. Resources are used in a cyclic fashion, not linear, so as not to waste them (Gilman, 1991). For example, compost, comprised of organic waste, returns to the soil to nourish gardens and agriculture fields. Today in western society, the “thrown-away lifestyle,” or the linear approach, has become the norm (Bang, 2005).

The definition continues with *in a way that is supportive of healthy human development*. These human communities need a balanced and integrated approach to human needs—physical, emotional, mental, and spiritual. This is true for the community as a whole as well as the individuals (Gilman, 1991). Human development influences the economic, governance, and social issues of the community (Irrgang, 2005)

Lastly, *and that can be successfully continued into the indefinite future* focuses on the sustainability aspect. Focusing on the long-term is a great challenge, but it provides a future that is fair and just for the next generation. For example, soil maintained through sustainable agriculture practices can produce food for current consumption and continue to do so for future generations.

Ecovillages can be located in both urban and rural settings and in industrialized and non-industrialized countries (Rosenthal, n.d.). Gilman (1991) calls ecovillages, "a comprehensible microcosm of the whole of society." Ecovillages attempt to be sustainable, but what does being "sustainable" really mean? Ecovillages attempt to be sustainable by balancing the ecological, sociocultural, and economical dimensions (Lietaert, 2008). In contrast, the Global Ecovillage (n.d.) presents the three dimensions as ecological, socioeconomical, and spiritual. However, for this project the focus will be on the ecological, social, and economic dimensions, the three dimensions most commonly associated with sustainability. The "three legged stool" often refers to these dimensions (Bang, 2005; Lietaert, 2008). All the legs need to be strong and balanced for community sustainability to exist (Global Ecovillage Network, n.d.). The following is a discussion of the different dimensions in more detail, supplying further information on how ecovillages operate.

The ecological dimension, also referred to as ecological sustainability, signifies a connection to the natural world. Ecological sustainability has the following characteristics:

- Organic food production and distribution comes from local and bioregional sources.
- Wildlife and botanical habitat are preserved.
- Human lifestyles do not negatively impact the environment.

- Transportation systems and methods practice that conservation land and resources.
- Consumption and waste generation is minimized.
- Renewable water resources are conserved and protected.
- Human waste and wastewater are recycled back into the environment in a beneficial way.
- Renewable, non-toxic energy sources are used to heat and power the community.
- Bioconstruction is used. Bioconstruction is the use of local, natural building materials to blend with and complement the natural environment with lower levels of environmental impact.
- An enhanced sense of place for residents (Bissolotti, Santiago, & Oliveira, 2006; Global Ecovillage Network, n.d.).

Incorporation of all of these characteristics can be challenging; therefore, different communities may focus more on certain characteristics. For example, EcoVillage at Ithaca first concentrated on energy reduction measures such as super-insulated homes (Walker, 2005). Regardless of techniques used, the goal is "to ensure the harmless integration of ecovillage activities into the natural world" (Irrgang, 2005).

Next, the social dimension or social sustainability in an ecovillage creates an environment where people thrive as individuals and as part of a group without feeling threatened (Svensson, 2002). Everyone is regarded with respect and as equals. Concerning the social dimension, Svensson (2002) includes these characteristics:

- People are able to recognize and relate to others.
- Members learn to make good decisions and solve conflicts.

- The community accepts all people including the children, elderly, and marginal groups.
- Education is continuous.

Most ecovillage members view their community as their extended family. This very reason draws many people to these communities (V. Montagne, personal communication, 2009). Nevertheless, social sustainability can be difficult to maintain. Personal and community-wide conflicts arise within ecovillages (Walker, 2005). However, the rewards are exceptional by providing a place to raise kids, spend more time with family, and spend less time at a stressful job (Svensson, 2002). It also provides a home to those who find it difficult to fit into current society, such as the mentally handicapped and elderly. Recently, ecovillages and other intentional communities have become increasingly popular among the elderly and disabled (Beck, 2009). Overall, social sustainability creates unity and understanding while providing an environment for all people to live and prosper. The point of an ecovillage is to “foster an inclusive community” (Beck, 2009).

Included in the social dimension is the cultural dimension (sometimes called the spiritual dimension). Cultural sustainability provides meaning and direction to community members. The Global Ecovillage Network in its *Community Sustainability Assessment* describes communities to be culturally balanced when characterized by:

- Activities and celebrations that help sustain area cultures.
- Leisure time is not only suggested but valued.
- Members’ backgrounds, cultural and spiritual, are respected.
- Members are aware of their place in relation to the whole picture.

- The community willfully chooses and contributes to the creation of a sustainable world.

This dimension represents the personal level. Community members respect other community members for who they are and where they come from while educating the community on their background.

The economic dimension or economic sustainability is a fundamental part. Yearly expenses need to be met; they include property taxes, liability insurance, and repair and maintenance costs for roads, buildings, and power and water systems (Christian, 2002). Depending on property ownership, mortgage payments may also need to be paid by the residents. One way to meet residents' financial needs includes selecting the community site near a good job market: 30-minutes from a low-wage job market and 45-60+ minutes from a high-wage job market (Christian, 2002). Ecovillages also encourage entrepreneurship, but building profitable businesses takes time and money (Stevenson, 2002). The Farm in Tennessee is a great example of a community striving to meet financial needs through various community businesses, from The Mail Order Catalog to The Law Offices of Alan Graf (The Farm Ecovillage, n.d.). However, it took many years for individual businesses to establish themselves at The Farm.

Economically, some people may argue that ecovillages cost more, and this can be true. Initially, the start-up costs can be devastating; however, what might be more expensive today might be cheaper for society at large tomorrow (Lietaert, 2008). For example, a house built using green building practices costs about 20 percent more than a conventionally built house. Within a few years, that money will be recovered through energy savings (Carruba, 2008). As a result, tomorrow's demand for energy resources decreases. Conversely, Mohamed (2006) found that green developments are less expensive to build. Developments that are more compact also save on infrastructure cost (Western Resource Advocates, 2009). Additionally, green developments carry a premium and sell more quickly than conventional developments (Mohamed, 2006).

The three dimensions—ecological, sociocultural, and economic—contribute to a strong and sustainable ecovillage. In order to address the “sustainability” aspect, the resources, jobs, and services within this community need to be localized. Ecovillage residents must remember their part in belonging to and serving the larger picture (Dawson, 2006a). The key is education as communities constantly strive to maintain or strengthen themselves. Ecovillages may more heavily weight a particular dimension depending on their overall community focus. These variations among individual ecovillages make each place unique.

Ecovillage Features

Transportation

Kevin Lynch (1960) refers to transportation routes as *paths*—“the channels along which the observer customarily, occasionally, or potentially moves” (p. 47). This includes streets, walkways, transit lines, canals, and railroads. While Lynch was interviewing individuals, the majority of people viewed paths as the predominant elements in their city (Lynch, 1960). Ecovillages strongly support the use of alternative transportation methods along environmentally friendly and user friendly paths. The transportation layout determines how people will move around and where the desirable buildings are located based on decisions in building roads, bike paths, and rail lines (O'Meara, 1999). Access to roads, bike paths, and rail lines is key (Lynch, 1981).

Post-World War II era planning encouraged cities and towns that were designed for cars, not people (Register, 2002). Car-centered systems promote social inequality since the young, the old, and the poor cannot drive (O'Meara, 1999). Sidewalks and bike lanes that can accommodate all people are lacking in many American communities (Brown, 2008). Cars cause harmful air pollution as well as water pollution via runoff (Register, 2002). Register (2002) found that car accidents kill about half a million people worldwide each year, along with millions of mammals, reptiles, amphibians, and birds. Cars, as well as bicycles and walkways, can co-exist in a well-planned community. This section examines the potential options for transportation—public transportation, automobiles, golf carts, bicycles, and pedestrian paths—and the potential surfaces of these paths.

First, public transportation is a viable transportation option (see Figure 4). Many ecovillages seek out locations based on nearby access to public transportation. Transit buses offer a much safer mode of transportation when compared to passenger automobiles, vans, SUVs, and pickup trucks. In a study by the National Safety Council, a fatal accident is 35 times more likely to occur when using passenger automobiles, vans, SUVs, or pickup trucks instead of transit busses (American Public Transportation Association, 2009). In addition, public transportation offers further benefits such as improvement in air quality,

Figure 4. **Cache Valley Transit Center, Logan, Utah.**

reduction in greenhouse gas emissions, facilitation of compact development by conserving land and decreasing travel demand, and energy savings by moving more people with fewer vehicles. For example, on average the number of passengers on a transit bus is 10 persons versus 1.6 for private vehicles (Federal Transit Administration, n.d.). Buses take more people off the road and provide a travel means for people of all ages and abilities.

Next, personal vehicles currently provide the majority of travel, offering freedom to travel whenever and wherever. People are attached to, and rely heavily upon, their vehicles. Generally, if a person is greater than a quarter-mile distance away from their destination, they will drive instead of walk. In 2001, households in the Mountain West region owned, on average, two cars. That number increased when households were in a rural landscape instead of an urban landscape (Energy Information Administration, 2005).

Certain measures within a community can be made to decrease the need or desire to own a personal vehicle while still providing vehicle ownership as an option. Traffic-calming actions taken to discourage and restrict automobile use can provide a space where residents feel safer and are encouraged to walk, play, and participate in outdoor activities more often. Examples of traffic-calming include roundabouts, speed bumps, and sidewalk extensions (Beatley, 2000). Another measure communities can make to decrease personal vehicles is to limit vehicles. Many ecovillages include parking limitations. Two of the five communities visited in Portland offer only on-street parking. Some view on-street parking as more pedestrian-friendly since it acts as a protective barrier and space between the sidewalk and moving traffic (Woodhull, 1992). Other communities, such as Wasatch Commons, only offer parking on the perimeter. Time restrictions can have a great effect on the number of vehicles as well (Beatley, 2000). Some communities ban automobiles altogether. Cerro Gordo Ecovillage in Oregon is planning to ban automobiles from the “townsite” while promoting the use of community transit, bicycles, pedestrian paths, and a community delivery service (Urban Ecology, 1990).

Though automobiles are deemed inefficient, there is an alternative to personal ownership of vehicles. Car shares provide a highly successful transportation option, giving users the same flexibility as owning a personal vehicle. Car-sharing networks have been popular in Europe since the 1980s and are now catching on in other places, including many ecovillages. They provide easy access to vehicles without the costs of owning or the hassle of renting (O'Meara, 1999). According to the Automobile Association of America, in 2006 the average cost for driving a car was $664 per month (Anderson, 2009). Dancing Rabbit, an ecovillage in Missouri, shares three cars among 50 people (Anderson, 2009; Pierceall, 2009). This is substantially lower than the one car per person for the average American (Pierceall, 2009). Car-sharing works best in places where residents have other practical options for their daily movement such as public transportation or a bicycle, while living within close proximity to their workplace, shopping, daycare and other basic services (Beatley, 2000).

In addition to automobiles, plug-in rechargeable golf carts provide a transportation option for travel within a community. Golf carts provide in-town travel for the elderly and disabled and can carry heavy loads from shopping trips. Other included benefits: (a) golf carts are roughly 10 times more energy efficient than automobiles per mile; (b) less room is required for parking and maneuvering golf carts; and (c) they operate at slower speeds, so they are less invasive socially and ecologically (Register, 2002). Many ecovillages make this an option while some offer golf chart shares, similar to car shares. Earthaven Ecovillage near Asheville, North Carolina, makes golf carts available to residents with an annual rate of $50 (Earthaven Ecovillage, 2010). At The Farm, residents charge golf carts using solar energy from another resident's solar panels (see Figure 5). Golf carts provide quick access over short distances and are less costly than owning automobiles.

Figure 5. **Solar panels provide power to a nearby building and to neighborhood golf carts at The Farm.**

Next, bicycles provide the most energy-efficient form of transportation. It takes roughly 350 calories to travel ten miles by bike and 18,000 calories by car for the same trip (Snyder, 1992). Compared to walking, bicycles are about eight times more energy-efficient (Register, 2002). Moreover, bicycles cost less, create zero emissions, are available to young and old, provide physical exercise, and take up very little space (Brown, 2008). Residents, both young and old, at the EcoVillage at Ithaca found bicycles to be a suitable mode of transportation to and from work or school, while increasing their physical fitness (Walker, 2005). This environmental friendly mode of transportation offers greater mobility over shorter distances than automobiles (Beatley, 2000).

Communities can promote bicycle use in numerous ways. Cities can install express lanes on main thoroughfares to promote bicycle travel over car travel (Brown,

Figure 6. **Bicycle parking at Columbia Ecovillage in Portland, Oregon.**

2008). Bicycle parking facilities should be placed throughout the community (Beatley, 2000) (see Figure 6). Most transit busses have a bicycle carrying rack on the front, providing access to those places buses do not go or to those who have a longer commute. For example, some residents at the EcoVillage at Ithaca bike to Ithaca, a few miles down the road, where they catch a bus to their workplace (Walker, 2005). Bicycle lockers provide a place for commuters to store their bike at their destination stop along a bus route (Snyder, 1992). A bicycle rental program would also promote this alternative mode of transportation. Successful in Paris, bikes are available at docking stations throughout the city (Brown, 2008). However, in order for bicycle use to succeed, priority needs to be given to the bicyclists over automobile users (Beatley, 2000; Brown, 2008).

Figure 7. **A bridge over a creek promotes walking between housing units at Cascadia Commons, Portland.**

The next alternative transportation mode is walking. Walking provides the simplest form of transportation over short distances while supporting one’s health. It is available to all who are able and comes with minimal costs. Car-free apartments and condominiums cost approximately $15,000 to $25,000 less per parking place eliminated (Register, 2002). Walking also lessens the impacts on vegetation and wildlife. Walkable communities reinforce this mode of transportation (see Figure 7).

There are numerous ways to promote walking. Individually, people should seek jobs near their home; landlords can rent preferentially to people who do not have cars or work close to home, and companies should use delivery services (Register, 2002). Communities might try to hire locally and encourage shopping locally. Mixed-use neighborhoods and buildings encourage people to walk, especially if the places and buildings are enjoyable. In hot climates, shade trees or cloths stretched over marketplaces create a better pedestrian environment (Register, 2002). Bus schedules and maps posted at stops help create walkable centers (Register, 2002). In a Utah community that supports walkabilty, 71 percent of elementary students were found to walk to or from school at least once a week, while the national average is less than 15 percent (Kennecott Land, 2007). Providing access is what makes these alternatives successful.

Other than the type of transportation, another factor in the ecovillage transportation component is how paths are constructed. Concrete and other types of pavement dominate communities across the United States. These impermeable surfaces cause less water to infiltrate the ground below. Runoff can contain concentrations of harmful chemicals left behind from vehicles. Register (2002) writes, "Water is polluted by runoff from oily, sooty, sometimes salty roads, which, according to the Environmental Protection Agency, rivals sewage in water resource damage" (p. 140). Runoff can also increase chances for flooding homes and businesses. Alternatives to concrete and pavement do exist.

Pervious concrete, also called permeable concrete, allows stormwater to seep through, recharging groundwater and reducing runoff. It consists of a water and “cementitious materials” paste that forms a thick coating around aggregate particles. When properly designed and installed, pervious concrete functions well, even in cold climates with freeze-thaw conditions (Dietz, 2007). This type of concrete filters water passing through, improving the water quality; after the water filters through the pervious concrete, it can be harvested for various uses such as agriculture (Huffman, 2005). Large parking lots, pedestrian plazas, low-volume streets, driveways, sidewalks, and golf cart paths can use pervious concrete while reducing construction costs (Huffman, 2005; National Ready Mix Concrete Association, 2010). Because of its light gray color, pervious concrete absorbs less solar heat and cools more rapidly than asphalt (Huffman, 2005).

Two other pervious surface types include crushed stone and green roads. A community in Tucson, Arizona uses a paving material composed of crushed stone with a non-toxic polymer. This non-petroleum-based product allows water to infiltrate, reducing runoff. Filling potholes is easy; all it takes is a few shovels full of the material (Milagro Cohousing Community, n.d.). “Green roads,” as described by Register (2002), are made of dense plants covering the land instead of pavement. Benefits from green roads include: (a) inexpensive when compared with highways; (b) excludes the use of automobiles; and (c) retains water rather than creating runoff during rainstorms (Register, 2002). Green roads also prevent heat buildup typically associated with asphalt paths.

The last surface materials discussed here are “Gravelpave” and “Grasspave.” They both consist of cylindrical plastic tubes connected on a flexible grid system. Fill material helps stabilize them. This system can withstand significant loads by

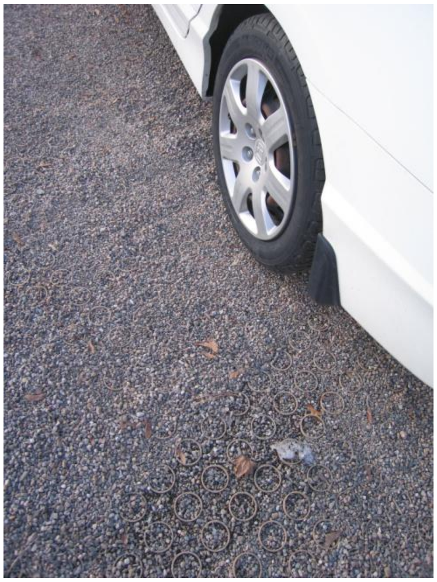

Figure 8. **Gravelpave provides parking at the USU Caine House.**

Figure 9. **Grasspave provides parking in an Oregon neighborhood.**

transferring the weight from the top of the rings to the base course. Although not suitable for high traffic areas, they work great for fire lanes, driveways, parking lots, pedestrian trails, and bicycle paths (see Figure 8 and Figure *9*). Past research proves that they also allow for wheelchair travel (Invisible Structures, Inc., 2006). Locally, the Caine House at Utah State University in Logan, Utah uses Gravelpave for its parking lot, as does the Utah House in Kaysville.

In summary, these alternative surfaces are better for the environment. Unfortunately, in many situations, asphalt is cheaper. However, if the stormwater benefits are included in the equation, they can be cheaper overall. Finding the surface type that fits the mode of transportation is key. Using various alternative transportation methods—bus, car shares, golf carts, bicycle, and pedestrian paths—decreases noise, pollution, congestion, and even frustration (Brown, 2008). These alternatives enhance communities' social, ecological, and economical well-being.

Building Materials

Typical construction in the United States is performed with little or no consideration of the climatic conditions (Olgyay, 1963). Olgyay (1963) blames technological advances in home heating and cooling. This partly helps explain why buildings are such large consumers of energy (James & Lahti, 2004):

1. In the U.S., the average single-family home creates between two and five tons of solid waste through its construction, while producing twice as much greenhouse gases per year as the average car.
2. One-quarter of all wood harvested is used to construct buildings.
3. Buildings consume one-third of all the energy and two-thirds of all electricity used in the United States.
4. Buildings use 40 percent of the world's materials and energy.
5. Almost one-third of newly built or rehabilitated buildings expose occupants to sick building syndrome (p. 60).

To make matters worse, James and Lahti (2004) found that the average size of new homes built in the United States grew from 983 square feet in 1950 to 2,265 square feet in 2000. Ecological housing reduces dependence upon fossil fuels, heavy metals, and minerals that accumulate in the environment, encroachment on the natural world, and wasteful dependence on chemicals and synthetic substances (James & Lahti, 2004). There are many different building materials available. Local climate, culture, and available materials need to be considered when selecting appropriate building materials (Elizabeth, 2002a). In ecovillages, homes and neighborhoods are designed to house more people per acre, with smaller units made out of various non-toxic materials (Lockyer, 2008). It is very important to work with officials while in the planning stage. Building departments may be skeptical about certain building materials, and building codes may interfere with plans (Elizabeth, 2002b). This section focuses on a few common ecovillage building materials—cob, adobe, straw bale, brick, wood, cordwood, and stone.

Cob is a very old building method using clay, sand, and straw (Green Home Building Team, n.d.; Hejgaard, 2002; Switzer, personal communication, 2009). This sculptural material allows for great variation and creativity (Green Home Building Team, n.d.b; Switzer, 2009) (see Figures 10, 11, 12, and 13). Advantages to cob use are that it is:

- Readily available
- Inexpensive
- Simple to use
- Often found on-site
- Able to withstand weather of all kinds
- Hygroscopic (keeps humidity levels more consistent)
- Virtually fireproof
- Long lasting

A cob house constructed at Dancing Rabbit Ecovillage cost roughly $3,000 in materials (Pierceall, 2009). However, cob building is very labor intensive, requiring many people. Although it is slightly better than adobe in terms of insulation qualities, it is still a poor insulator and would not be comfortable in climates with extreme temperatures (Green Home Building Team, n.d.). When deciding if cob fits as a green building technique for a certain location, one must examine the soil first to see if the ingredients exist (Snell & Callahan, 2009).

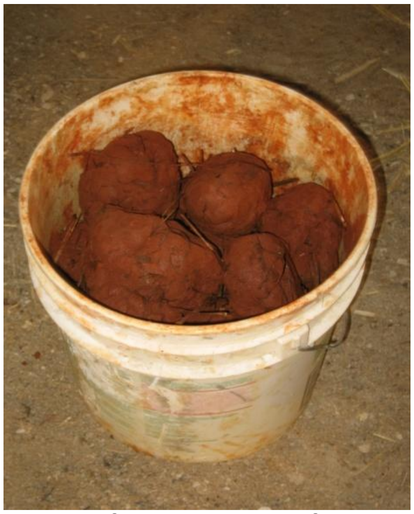

Figure 10. **Balls of cob material used for cob buildings.**

Figure 11. **Inside a cob building under construction.**

Figure 12. **A lion sculpted into a cob wall.**

Figure 13. **A window in a cob house showing cob's sculpt-ability.**

Next, adobe building techniques have been used for thousands of years all over the world (Snell & Callahan, 2009). Its composition varies from place to place depending on available soils. In general, adobe is comprised of "a soil mix blended with water containing a sand aggregate of differing sizes and enough clay to bind it" (Snell & Callahan, 2009, p. 285). A soil composed of 15 percent to 30 percent clay, with the rest being sand or larger aggregate, works best for adobe (Green Home Building Team, n.d.a). Similar to cob, the same materials are formed into individual blocks and then dried before installing (Snell & Callahan, 2009). Adobe does not insulate very well, so certain measures such as creating an air space in the wall or creating a double wall, help insulate adobe buildings. Hejgaard (2002) found the building method in all climatic areas.

Many parts of the world in many different climates use straw bale building methods (see Figures 14, 15, 16, and 17). This technique, developed in the late 1800s, is currently experiencing a revival, especially in the southwestern United States (Green Home Building Team, n.d.f; Snell & Callahan, 2009). Straw bale material is a food byproduct that works great in dry climates (Snell & Callahan, 2009). However, it is not suitable in humid, tropical climates due to problems with rot (Hejgaard, 2002). Straw bale properties include:

- Easy to work with
- Excellent insulator
- Lightweight
- More fire resistant than concrete when properly baled and plastered
- High earthquake and wind resistance
- High strength in relation to weight (Hejgaard, 2002).

There are two types of straw bale building: (1) infill, and (2) load-bearing. The most common type is the non-load bearing straw bale buildings. Here, the bales serve as infill with a post and beam framework supporting the basic structure, making it the only way many building authorities allow the use of straw bale (Green Home Building Team, n.d.f). A clay or lime plaster is applied to both the interior and exterior of straw bale buildings (Lietaert, 2008). Like cordwood and cob, straw bale walls are hygroscopic—a property of the material that takes on water and lets off water while keeping the humidity relatively constant. This can cause problems if the straw bales get too wet, causing mold,

***Figure 14.* Straw bale house in Teton Valley, Idaho. *Note.* Source of picture: Bingham, W. Retrieved April 14, 2010, from Wayne Bingham website http://www.wjbingham.com/**

***Figure 15.* Werner Heiber Co-housing duplex in Colorado, made with straw bales. *Note.* Source of picture: Bingham, W. Retrieved April 14, 2010, from Wayne Bingham website http://www.wjbingham.com/**

***Figure 16.* Inside a straw bale house located in Idaho. *Note.* Source of picture: Bingham, W. Retrieved April 14, 2010, from Wayne Bingham website http://www.wjbingham.com/**

Figure 17. Wasatch Community Gardens Greenhouse, under construction in Salt Lake City, Utah. *Note.* Source of picture: Bingham, W. Retrieved April 14, 2010, from Wayne Bingham website http://www.wjbingham.com/

mildew, and decay. With careful design, water problems can be avoided (Snell & Callahan, 2009).

Next, brick is a common building material that dates back more than 6,000 years (Snell & Callahan, 2009). Since it is so common today, building with this material would face little, if any, resistance from building authorities. Bricks are essentially kiln-baked clay (Hejgaard, 2002; Snell & Callahan, 2009). Several advantages of brick are that it absorbs less humidity, it is more impermeable to weather, has higher tensile strength, and it is lighter than unburnt clay. Bricks have been utilized in all climatic conditions (Hejgaard, 2002).

Another common building material is wood (see Figure 18). It is easy to work with, relatively light, renewable, and has high tensile strength but is flammable in itself. Wood offers no temperature regulation. It also causes problems due to rot (Hejgaard, 2002). Careful consideration must go into choosing wood based on availability, durability, estimated insulation value, and shrinkage factor (Snell & Callahan, 2009). Lumber that is Forest Stewardship Council (FSC) certified complies with high social and environmental standards while promoting responsible forest management worldwide (Forest Stewardship Council, A.C., n.d.). Using recycled wood decreases the demand for new forest products. The Utah House in Kaysville used recycled trestle wood timbers retrieved from the Great Salt Lake (Utah State University Extension, 2003).

Figure 18. **Wood house located in Hyrum, UT.**

Next, cordwood consists of short pieces of air-dried round or split wood that is laid in a double bed of mortar (Snell & Callahan, 2009) (see Figure 20). Instead of the commonly used mortar, Portland-cement based, cob material can also be used (Green Home Building Team, n.d.c; Snell & Callahan, 2009). Cordwood is available wherever firewood is found and can make use of wood that might not have much value otherwise. Other materials, such as glass bottle ends can be included, allowing light to enter the wall (Green Home Building Team, n.d.c). Other benefits include:

- Inexpensive
- Low impact

- Renewable
- Hygroscopic
- No plaster or other wall finish is needed
- Decent insulator
- Wood can be cut for the width of wall desired (Snell & Callahan, 2009).

To increase the insulation value, sawdust can be added to the mortar and, in severe climates, thicker walls or two walls can also help increase insulation values. The big disadvantage to cordwood is the difference in wood and mortar properties. The wood limits the mortar's lifespan. Wood dries and shrinks while mortar is rigid. Wood also absorbs water, causing mold, fungus, and even insects and small mammals to reside within it. However, these problems are all design challenges. Selecting certain woods based on durability and shrinkage properties, along with adding water-protection features (i.e. large overhangs), counteract these problems (Snell & Callahan, 2009). Many building authorities require a post and beam (or similar supporting structure) while using cordwood as infill, despite cordwood being very strong and capable of supporting a considerable load (Green Home Building Team, n.d.c) (see Figure 19). Overall with cordwood, it is very important to spend time designing a suitable housing plan dependant on the climate.

Finally, stone, rarely used as a building material today, dates back to the beginning of human history. This abundant material is especially suitable in locations where thermal mass (capacity to hold heat) is preferred (see Figure 21). During hot summer days, stone buildings maintain a comfortable temperature by absorbing heat

Figure 19. **A two-story house made out of cordwood located at The Farm.**

Figure 20. **Using cordwood building materials.**

Figure 21. **Stone house located in Cache County, Utah.**

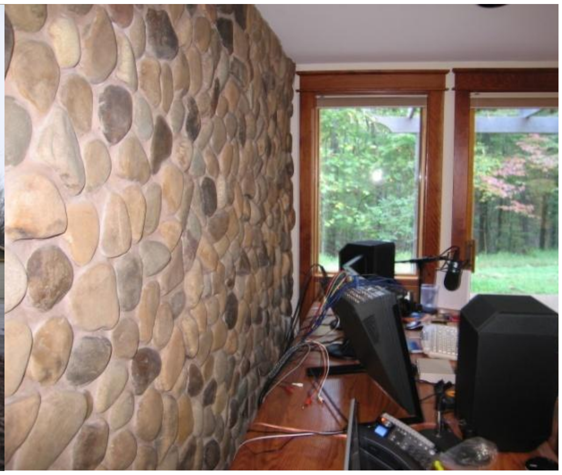

Figure 22. **Indoor stone walls capture solar gain in winter and keep buildings cooler in summer.**

during the day and re-radiating it at night (Olgyay, 1963). Stone holds its temperature well due to its good thermal mass quality. However, stone makes a poor insulator. When placed on the interior wall, stones struck by the sun can store heat or moderate temperature changes (see Figure 22). Placed on the exterior of the wall, insulation on the inside prevents stones from bleeding heat or cold in either direction (Green Home Building Team, n.d.e).

Green roofs, metal roofs, fly ash, and stucco siding can also add value to buildings. Green roofs add additional benefits including low construction impact, resource efficiency, long lasting, nontoxic, and beauty (Snell & Callahan, 2009). Metal roofs last more than 50 years and work great with rainwater collection systems, although they can be more costly than traditional roofing materials. When using concrete, recycled fly ash makes it harder. Stucco siding reduces the need for painting. The Utah House combined various features including a metal roof, concrete containing fly ash, and stucco siding (Utah State University Extension, 2003).

Overall, this is by no means a complete list of building materials; however, they are the most commonly used building techniques. Other natural building materials have been used succcessfully. For example, “Earthships” are constructed out of used tires stacked up like bricks and filled with earth. A plaster is then applied on the inside (Green Home Building Team, n.d.d). Rammed earth houses or houses that utilize the earth around them for building and/or wall construction are another popular building technique. They work great in locations where lumber is scarce (Wikipedia, 2010b). Other communities simply reuse unwanted buildings (see Figure 23). Some builders combine techniques. For example, at The Farm in Tennessee, straw bale techniques insulate the west side of the *Green Dragon Tavern* while cob techniques are used on the east side (Switzer, 2009) (see Figure 24 and 25).

Figure 23. **This old farm house was transformed to the common house at Columbia Ecovillage, Portland.**

Deciding what are considered "green building materials" boils down to "using appropriate, local materials" (Switzer, 2009). Buildings should "work with, not against, the forces of nature" (Olgyay, 1963, p. 10). However, not everyone wants to live in a house constructed of these materials. In these cases, new and existing structures can add certain features to reduce water and energy needs. Like Colorado, Utah has adopted a program called "Build Green Utah" that certifies homes based on energy and water saving techniques (Built Green Colorado, 2008). Another green building certification system, Leadership in Energy and Environmental Design (LEED), is recognized internationally for "energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts" (U.S. Green Building Council, 2010).

Water

Water quality and scarcity are worldwide issues. Out of the nearly 326 cubic miles of existing water, only 0.02 percent is available and accessible fresh water, making

Figure 24. **The Green Dragon Tavern is under construction. It is made out of cob and straw bale with a living roof, under construction at The Farm Ecovillage Training Center.**

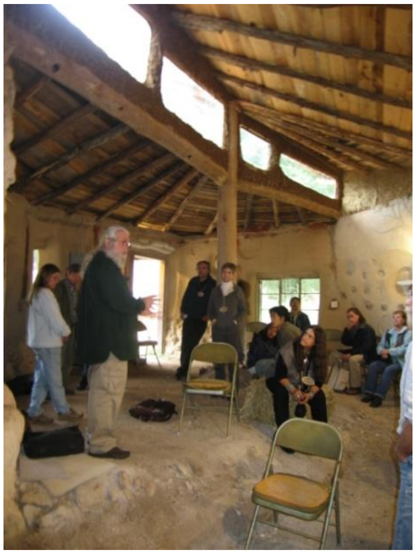

Figure 25. **Inside Green Dragon Tavern.**

pollution of this resource a cause for great concern (Bang, 2005). In fact, artificial substances that we release into nature make it around the world via the hydrologic cycle in roughly 80 months (Bang, 2005). Where toxic build-up occurs, chronic health problems, such as cancers, are common (Roley, 1992). Even in regions where water is plentiful, fresh, clean water can be scarce due to water-borne diseases and pollution (Weisman, 1998). Groundwater tables are dropping in many regions of the world (Jackson & Svensson, 2002). In parts of Mexico City, excessive groundwater withdrawal has caused the ground to sink more than 9 meters (O'Meara, 1999). Aquifer depletion will greatly impact agricultural production in regions that rely heavily on irrigation (Brown, 2008).

Utah is considered part of the Interior West region (Colorado, Utah, Arizona, Nevada, and New Mexico) in the United States. This region “is simultaneously the driest and fastest growing region of the United States” (Western Resource Advocates, 2009). Utah ranks as the second driest state (Western Resource Advocates, 2009). Locally, Cache County residents used 299 gallons of water per day, which was higher than the state of Utah average of 258 gallons per capita in 2005. Of the 4.7 billion gallons per year of potable water used by Cache County residents, 2.2 billion gallons went to watering lawns and gardens (Patrick, 2009b). In the past, damming rivers and building pipelines provided water supplies, to the detriment of the environment (Western Resource Advocates, 2009). Many water-saving techniques exist to meet demands while preserving the integrity of rivers and watersheds. These techniques can potentially reduce water use, infrastructure costs, and water loss (Western Resource Advocates, 2009). This section introduces a few simple water conservation techniques before covering (a) water collection, (b) greywater use, and (c) wastewater treatment options.

Water conservation begins with awareness (Roley, 1992). People are not aware of the issues at hand and, more importantly, do not know what they can do to conserve water. Many water conservation techniques are available for individual homes and buildings. Updating to energy efficient and water-saving appliances (i.e., high-efficiency toilets and WaterSense® faucets), along with planting a water-wise landscape, can have big impacts. For example, low-flow toilets can save over 20 gallons of water a day for each person; that equals a yearly saving of 7,300 gallons of water per person. Dual flush toilets provide additional water savings by allowing the user to flush specifically for urine or fecal matter. In addition, low-flow showerheads generally have a flow rate between 1.5 and 3 gallons per minute, while standard showerheads use 5 to 10 gallons per minute (Roley, 1992). For outdoor water use, xeriscaping, which means selecting plants appropriate for the landscape, can reduce water usage by over 50 percent (Roley, 1992). Limiting irrigable areas, restricting turf, or using a conservation water budget also reduces water needs (Western Resource Advocates, 2009). By installing low-flow showerheads and faucets, low-flush toilets, collecting rainwater for irrigation, and reusing water machines for toilet use, the Berea College Ecovillage experienced a 49 percent reduction in water use compared to other Berea residents (Briggs & Olson, 2005). Additionally, “green homes” increase housing values, providing an added bonus. Green homes in Civano, Arizona found selling prices 18-20 percent higher per square foot than equivalent homes in the same area (Western Resource Advocates, 2009).

Rainwater harvesting is one form of water collection (Western Resource Advocates, 2009), and many cultures have used this nearly 4,000-year-old technology (Roley, 1992). Barrels or underground cisterns collect rainwater from the impervious roofs of buildings, reducing irrigation requirements (Bang, 2005; Western Resource Advocates, 2009). By burying cisterns underground, the arrival of life forms (i.e., algae) is delayed (Snell & Callahan, 2009). The amount of water gained from rainwater collection is fairly predictable based on meteorological data (Bang, 2005). Rainwater collection systems can be set up for either drinking use (requiring an expensive filtering system) or non-drinking use, simplifying the system for uses such as garden watering (Snell & Callahan, 2009). For example, two urban ecovillages—Cascadia Commons and Columbia Ecovillage—use rainwater harvesting for irrigation purposes (Planchon & Huggett, 2009) (see Figures 26 and 27). Many other ecovillages also take advantage of this simple way to collect water.

Figure 26. **Rainwater collection at Columbia Ecovillage in Portland, OR.**

Figure 27. **Rainwater collection at Cascadia Commons in Portland, OR.**

In addition to rainwater barrels and cisterns, this section introduces various Low Impact Development (LID) techniques. LID techniques aid in water collection by directing runoff towards vegetation that needs irrigation (Western Resource Advocates, 2009). LID practices collect water for various reasons, including groundwater recharge, retention or detention of runoff, pollutant settling, aesthetic value, and multiple use (Prince George's County, 1999). This includes bioretention, dry wells, filter/buffer strips, swales, and infiltration trenches. (Prince George's County, 1999). These methods require alterations be made to landscapes. *Bioretention* manages and treats stormwater through a shallow depression that uses a conditioned planting soil bed and planting materials to filter and store runoff. *Dry wells* consisting of a small-excavated trench backfilled with aggregate such as pea gravel or stone, hold and slowly release rooftop runoff (see Figure 28). *Filter strips,* usually grass, are planted between the pollutant source (i.e., parking lot) and a receiving waterbody; they filter runoff, preventing pollutants from entering downstream waterbodies (Prince George's County, 1999). *Swales,* placed along contour lines, are drainage ditches meant to stop water; the slightly wetter conditions in the bottom of the swale allow perennials to grow (Bang, 2005). *Infiltration trenches* consist of an excavated trench backfilled with stone to form a subsurface basin. In these trenches, stormwater runoff is stored for several days until the water can infiltrate the soil (Prince

Figure 28. **A dry well helps control rainwater from roofs at Daybreak Cohousing.**

George's County, 1999). All these LID management practices reduce the impact development has on the land by reducing the speed of stormwater runoff, causing greater infiltration.

Generally, the term *greywater* refers to treated or untreated water from washing machines, bathtubs, showers, and sinks (Bang, 2005; Roley, 1992). Greywater use can have significant impacts on reducing water demand while providing some groundwater recharge (Roley, 1992). Greywater can be used for irrigating landscapes and agriculture; for example, four washing machine loads per week could maintain a small orchard (Roley, 1992). Certain greywater systems capture, filter, and disinfect sink or shower water to be used for toilet flushing which does not require highly treated drinking water (Western Resource Advocates, 2009). One serious concern in greywater use deals with health issues since the physical and chemical properties inhibit microorganism growth such as Escherichia coli (Roley, 1992). Limited data exists on greywater use and its risks (Roley, 1992). When using untreated greywater, it is a good idea to use it on non-food plantations (Bang, 2005). However, various methods exist to purify the greywater. At Dancing Rabbit Ecovillage in Missouri, constructed wetlands use gravel beds and certain aquatic plants to disinfect the greywater, and at Earthaven Ecovillage in North Carolina, a home runs sink water from the drain through a concrete box of woodchips and into the vegetable garden below. The woodchips contain microorganisms that feed on the effluent in the greywater (Steinman & Christian, 2006). Greywater can be used in a variety of ways; choosing a suitable system depends on individual situations.

Other than the traditional sewer or septic tank that commonly pollutes soils and water, many alternative wastewater treatment options exist. Generally, wastewater, also called blackwater, refers to water that is flushed down the toilet, and the toilet is responsible for the largest percentage of household wastewater (Roley, 1992). Several ecovillages attempt to process all their own wastewater, thus reducing the costs associated with connecting to a local sewer system. Various solutions not only treat wastewater but also allow the purified water to be recycled back into nature with decreased risk of contamination. In many ecovillages, wastewater is viewed as a useful commodity instead of a problem. The following wastewater treatment options will be discussed: (a) composting toilets, (b) Living Machines, (c) wetlands, including rootzones, and (d) Sequencing batch reactors. The benefits include treatment without chemicals, saving water, and creating local jobs while making use of a local resource (Jackson & Svensson, 2002).

Composting toilets allow residents to manage their own wastewater. Variations include toilets that compost on the spot, while others need to be emptied periodically (Bang, 2005). Some composting toilets are in individual households, while others are shared units. Common in ecovillages, shared composting toilets are set up like outhouses around the ecovillage (see Figure 29). Unlike the typical outhouse, compost toilets do not have an odor. Over the course of a year, one adult barely fills two five-gallon cans with decomposed compost of fecal matter and kitchen scraps (Roley, 1992).

***Figure 29.* Composting toilet at The Farm Ecovillage Training Center.**

The composted material should be used on non-food producing landscapes (Bang, 2005). To make compost toilets success, individual attention and occasional monitoring is required (Roley, 1992).

Next, Living Machines intensely process sewage and work great in areas with limited space. Powered by the sun, this system involves circulating wastewater through several steps (Jackson & Svensson, 2002). Guterson (1993) describes the Living Machine process as, “a series of distinct ecologies, each contained within a cylinder. The cylinders communicate through water flowing within connector tubes. Waste generated by the inhabitants of one cylinder flows through the tubes and becomes food for the inhabitants of another” (p. 37). Essentially, the organisms—including microbes, invertebrates, plankton, fish, flowers, mollusks, and shrubs—live off the pollutants (Bang, 2005). The end product is even fit for drinking by U.S. Environmental Protection Agency’s standards. (James & Lahti, 2004; Bang, 2005). A Living Machine’s size, shape, and casing vary according to function (Guterson, 1993). Individual houses or buildings can connect to a greenhouse that harbors a Living Machine, providing suitable growing conditions to plants and even crops (Jackson & Svensson, 2002). Living Machines need active attention and interest in the production process (Jackson & Svensson, 2002). Although very effective, this system can be expensive (Jackson & Svensson, 2002). Living Machines’ benefits include: growing foods, treating

***Figure 30.* Living Machine at Findhorn Ecovillage.**
***Note.* Picture by L. Schnadt, courtesy of Wikipedia.**

sewage, detoxifying harmful chemicals, regulating climates in buildings, transforming wastes, and generating fuels (Bang, 2005). This system works great in temperate and arctic areas (Jackson & Svensson, 2002). For example, Findhorn Ecovillage in Scotland has a Living Machine system that accommodates up to 500 people (Findhorn Ecovillage, n.d.) (see Figure 30).

Another practical example is provided by Guterson (1993), describing the use of a Living Machine in a school. The Boyne River School in Toronto, Canada adopted this system to break down waste biologically, providing an educational tool and a surprisingly attractive display:

> "When you walk into the central atrium of the school, you see this wonderful water sculpture. The tanks are 14 feet tall then spiral down to about 4 feet in a snail spiral. And then you see the water flowing off to a marsh and from there to a pond. The sculpture is the only sewage treatment plant for the school, and it's beautiful-it's a work of art" (Guterson, 1993, p. 37).

Students use conventional water-based toilets, but once waste is flushed down the toilet, it passes through four cells—two with oxygen and two without—where it rapidly digests. Then it is pumped to the highest tank, with 17 total tanks. Clear tanks allow students to observe the tanks, first filled with algae, then with aquatic plants, and finally with animals such as clams, snails, and fish. Despite the end water meeting legal drinking standards, no one drinks it due to the psychological reaction. Therefore, most of the water is reused for toilet use. This system at Boyne River School is designed to handle 500 or more students.

Other wastewater treatment systems use wetlands. Wetlands process nutrients and pollutants naturally and cyclically. The natural sedimentation process reduces suspended particles. The plants absorb and utilize the nutrients and sediments (James & Lahti, 2004). In Eskilstuna, Sweden, the 100-acre Ekeby wetland processes sewage and later became a stopover for migratory birds. Their wetland system came with a price tag that was one-third what a conventional treatment system would have cost. The Ekeby wetland removes 70 tons of nitrogen from the wastewater while filtering out phosphorus (James & Lahti, 2004). Another example, the Terre d'Enaille, an ecovillage in Belgium, uses wetlands for sewage treatment. This small community runs wastewater into a series of ponds and wetlands using gravity to move the water. The final product is water clean enough to support fish while providing irrigation water for vegetable gardens (Bang, 2005). One specific type, rootzones, is comprised of subsurface wetlands and sand filters (Jackson & Svensson, 2002). Acting as a biological filter, the rootzone bed (reedbed) treats water "in a volume of soil, which is penetrated by the roots of plants" (Jackson & Svensson, 2002, p. 60). Organic pollutants serve as food sources for a variety of microorganisms while other contaminants (i.e., heavy metals) are fixed in soil in which the plants are rooted (Rootzone Australia Pty. Ltd., n.d.). This compact design is simple and has very low operational costs (Jackson & Svensson, 2002). Other benefits include being environmentally safe and friendly, long lasting, having no byproducts including smell or noise, having a wide range of applications, and not needing technical expertise to operate (Rootzone Australia Pty. Ltd., n.d.). Mining, metal plating industries, schools, hospitals, oil exploration, private homes, and more use rootzones. Overall, wetland treatments prove successful, relying on natural processes to break down wastes.

Oshara Village in Santa Fe, New Mexico uses an onsite Sequencing Batch Reactor, or SBR. According to the U.S. Environmental Protection Agency (1999), the SBR process can be summarized as follows: "Wastewater is added to a single "batch" reactor, treated to remove undesirable components, and then discharged" (p.1). Based on the fill-and-draw principle, the five basic steps are: idle, fill, react, settle, and draw (U.S. Environmental Protection Agency, 1999). It consists of a concrete or steel tank buried underground and a small building that sits above ground (see Figure 31 andFigure *32*). The modular design allows the system to fit site-specific needs (Oshara Village, n.d.; U.S. Environmental Protection Agency, 1999). Used to treat both municipal and industrial wastewater, this system is useful in areas where available land is limited (U.S. Environmental Protection Agency, 1999). Some of the advantages and disadvantages listed by the U.S. Environmental Protection Agency (1999) include:

Advantages:

- Equalization, primary clarification, biological treatment, and secondary clarification achieved in a single reactor.
- Potential capital cost savings by eliminating clarifiers and other equipment.
- Operating flexibility and control
- Minimal footprint

Disadvantages:

- A higher level of sophistication is required (compared to conventional systems) of timing units and controls
- Higher level of maintenance (compared to conventional systems)

At Oshara Village, the SBR system was designed to turn wastewater into 30,000 gallons of water per day for various uses (Oshara Village, n.d.). This system provides all the irrigation water needed for residential use and open spaces, along with supplying toilet water in commercial buildings at Oshara (Western Resource Advocates, 2009). Due to

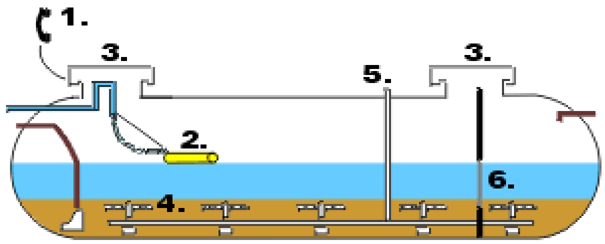

***Figure 31*. SBR System. 1. PLC control and modem. 2. Floating decant. 3. Gasketed covers control noise and odor. 4. Course bubble diffusers. 5. Positive displacement blowers. 6. Accessible screening chamber.**
Source: Walden Corporation (2001). http://www.waldeninc.com/SBR.htm

***Figure 32*. View of an SBR above ground.**
Source: SBR Wastewater Treatment (2007). http://www.sbr-wastewatertreatment.eu/

the limited availability of water in places such as Santa Fe, an SBR provides a means to reuse this precious resource (Oshara Village, n.d.).

Currently, at The Farm in Tennessee, water is the greatest yearly expense for the community (Stevenson, personal communication, 2009). There is no doubt that water is a limited resource, yet millions of gallons are wasted every year that could be used for agricultural and landscape reuse (Roley, 1992). Smaller lot sizes (increased density) decrease per capita water demands (Western Resource Advocates, 2009). Furthermore, education and awareness are very important. Daybreak community in Utah provides residents with information packets on water conservation quarterly. Other educational options include bill stuffers, marketing campaigns, and local eco-teams that visit individual homes (Western Resource Advocates, 2009). Wastewater and greywater can be recycled, while water collection can help meet local needs. Here in Utah, water collection and water reuse are very important since yearly precipitation is low. Water is a precious resource (Jackson & Svensson, 2002).

Alternative Energy

Threats of "peak oil" keep arising. Peak oil is "the point in time at which oil production reaches its maximum and then begins to decline" (Murphy, 2008, p. 4).

Currently, power generation is usually centralized around population centers with imported fuel (Murphy, 2008). In the United States, the average person in 2005 used about eight times the amount of oil than the average person in the developing world (Lockyer, 2008). Utah relies on coal for over 80 percent of its energy needs (Nicholas, 2009). Only 2.3 percent of electricity in Utah comes from renewable resources (Berry et al., 2009). Locally, Rocky Mountain Power is planning to upgrade the current transmission line to keep up with Cache Valley's demand (Patrick, 2010). Originally, this project planned to utilize GIS models to determine suitability of renewable energy for the study site. However, project level data was not available. Instead, this section discusses alternative energy options—wind, solar, geothermal, and biomass—and closes with simple, household design choices.

Wind

Throughout the world, wind energy accounts for the fastest growing renewable energy resource (see Figures 33 and 34). In the United States, wind energy development has "outpaced all other forms of energy" (Berry et al., 2009, p. 8). Within the state of Utah, wind power is taking hold through various large- and small-scale projects (State of Utah, 2007).

Benefits include:

- Low cost
- Wind abundance
- Wide distribution (Brown, 2008)
- Clean energy
- Farmers and ranchers can lease land for wind turbine placement

- Nearly 90 percent of wind turbine parts can be recycled and reused (James & Lahti, 2004)

Unfortunately, wind is considered an intermittent energy source due to its nature (Berry et al., 2009). Wind strength varies depending on the time of day, the season, direction, and topography (Bang, 2005). It is also difficult to store but can be stored under pressure in a tank as hydrogen (Jackson & Svensson, 2002) although this involves conversion of water into its elements and some energy is lost. An early concern for bird safety due to turbine blades has since been proven to have minimal risks (Brown, 2008). Before using wind energy, the site needs to be examined for suitability (Bang, 2005). Locally, the Utah State Energy Program (USEP) estimates Hyrum to be a Class 2 wind site, making it unsuitable for any large-scale wind energy production (Berry et al., 2009).

At Findhorn Ecovillage, four wind turbines owned by the community supply more than 100 percent of the community' s electricity needs with a total capacity of 750 kW (Findhorn Ecovillage, 2010). Their own private electricity grid provides a backup

Figure 33. **Wind turbines in Oregon.**

Figure 34. **Wind turbines along the Columbia River, Washington.**

electricity source when the wind is not blowing and allows the community to export any extra electricity. Overall, the ecovillage is a net exporter of electricity (Findhorn Ecovillage, 2010).

Solar

Various solar technologies (i.e., panels and shingles) can turn a building into a “nearly invisible power generator” (O'Meara, 1999). Solar energy offers clean energy and can take up very little space. Solar electric systems are not dependent on transmission availability and can be installed almost everywhere (Berry et al., 2009). This option is especially useful in rural properties or in remote locations that are not connected to the grid (Kalmer, 2009). Generally, solar energy comes with up-front installation costs (Mega, 2005). For Utah, quality solar resources are abundant (Berry et al., 2009). Locally, Logan, Utah was found to be desirable for solar energy (Burgess, 2009).

Two popular ways to harness solar energy are (1) solar hot water systems, and (2) photovoltaics (also called PVs). Solar thermal collectors heat domestic water and can also be used for space heating (Brown, 2008). Rooftop solar water systems provide cheap hot water and are becoming increasingly popular (Brown, 2008) (see Figure 36). Alternatively, PVs convert sunlight into electricity and currently are the world’s fastest growing energy source (Brown, 2008). PVs are highly reliable, long lasting, and have low maintenance costs (Mega, 2005). The different systems include stand-alone, hybrid, and grid-connected systems. Connecting to the grid provides various benefits. On cloudy days, households can purchase electricity, and on sunny days when electricity demands are high, the electric company can buy any excess energy from individual producers. This

Figure 35. **PV panels used to power a law office at The Farm in Tennessee.**

Figure 36. **PV rooftop panels provide power to the hostel at The Farm.**

is called “net metering” (O'Meara, 1999). Solar power systems with a battery backup allow electricity to flow on cloudy days and at night (Kalmer, 2009).

Many individuals and communities have successfully used solar energy. One community in Damanhur, Italy, installed twenty PV electric generators to meet the domestic energy needs for roughly 130 people (Dawson, 2006a). The Utah House in Kaysville uses PVs to generate one-quarter of its electricity (Utah State University Extension, 2003). Nearby, Campbell Scientific in Logan is experimenting with an array of 64 solar panels (Burgess, 2009). At The Farm, a lawyer found solar photovoltaic cells suitable for his law office (see Figure 35). A state grant for small businesses and a federal grant paid for seventy percent of the PV system (Graf, 2009). Currently, the lawyer pays ten cents a kilowatt-hour for power from the local company; however, the local company pays him fifteen cents a kilowatt-hour for every hour generated through the PV system (Graf, 2009). Monthly electricity bills went from $100-$120 a month down to $15-$20 a month after the PV system was installed (Graf, 2009). In addition to powering the law office, neighbors charge their golf carts via these panels.

Geothermal

Geothermal energy production consists of hot water or steam that is generated from a geothermal reservoir underground. The steam is then used to power a heat engine to generate electricity (Berry et al., 2009). Geothermal resources can also be used directly, using the hot water to provide heat for buildings, crop and lumber drying, industrial process heat needs, aquaculture, horticulture, and district heating systems (Berry et al., 2009). Benefits include:

- Energy reliability and security
- Local economic development
- Clean (Green & Nix, 2006)

It produces zero carbon emissions once constructed. Disadvantages to geothermal energy include high up-front cost and site development risk and, unlike solar or wind energy, geothermal does not have surface measurements to assess its potential (Berry et al., 2009). Overall, geothermal resources contribute 1.6 percent of global electricity production (Mega, 2005). Currently in the United States, all 50 states use geothermal energy (Green & Nix, 2006).

Another option most commonly associated with geothermal energy is ground source. Geothermal Heat Pumps (GHP) use subsurface temperatures to heat and/or cool buildings. It moves heat from the ground to the building in cold weather and from the building to the ground in warm weather (O'Meara, 1999). While temperatures above the ground experience extreme changes, the ground beneath holds a relatively constant temperature—between 45 and 75 degrees Fahrenheit, depending on latitude (U.S. Department of Energy, 2009). GHP benefits include:

- Quiet
- Long lasting
- Requires very little maintenance
- Not dependent on outside conditions
- Humidity control—roughly 50 percent indoor relative humidity
- Design flexibility
- Few moving parts

The high installation costs are returned within 5-10 years while the system lasts 25-50+ years (U.S. Department of Energy, 2009). Compared to a conventional heating or cooling system, a GHP uses 25-50 percent less energy (U.S. Department of Energy, 2009). A device in some GHPs, called a "desuperheater," can also be used to produce domestic hot water. In summer, the heat taken from the house heats the water for free; in winter, water heating costs are reduced by roughly half (U.S. Department of Energy, 2009).

There are four main types of ground loop systems: horizontal closed-loop, vertical closed-loop, pond/lake closed-loop, and open-loop (U.S. Department of Energy, 2009). Two geothermal heat pump systems would work for this area: the closed-loop vertical and horizontal systems. The horizontal system is generally most cost-effective but requires sufficient land. The vertical minimizes landscape disturbance. Typically, large commercial buildings and schools use this

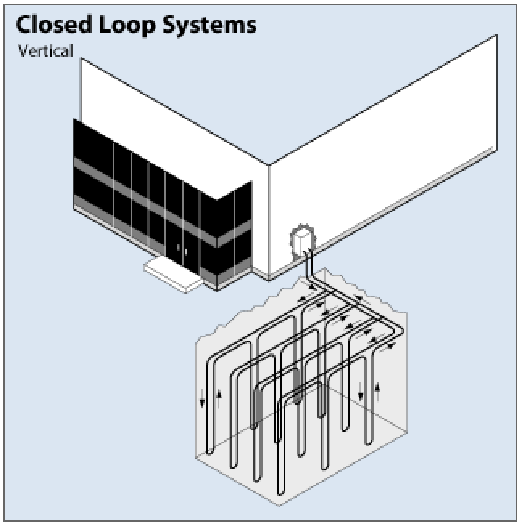

Figure 37. **A closed-loop vertical GHP system consists of holes drilled about 20-feet apart and 100- to 400-feet deep. Note: Source of picture is (U.S. Department of Energy, 2009).**

system (U.S. Department of Energy, 2009). These systems require a high-density polyethylene pipe buried horizontally at 4-6 feet deep or vertically at 100-400 feet deep. Environmentally friendly antifreeze/water solution filled in these pipes acts as a heat exchanger (see *Figure 37*).

Similarly, a creative system developed by Jørgen Løgstrup acts as a natural air conditioner while providing cool air for food and beverage storage at low energy costs. The "natural cooling cabinet and ventilation system" utilizes cool air found below the ground (see Figure 38). To obtain the cooling effect, air is first filtered through a humid plant wall and then through a drain below the ground level. The cooled air is pulled upwards, forcing warm air to pass through an exhaust (Jackson & Svensson, 2002, pp. 52-53).

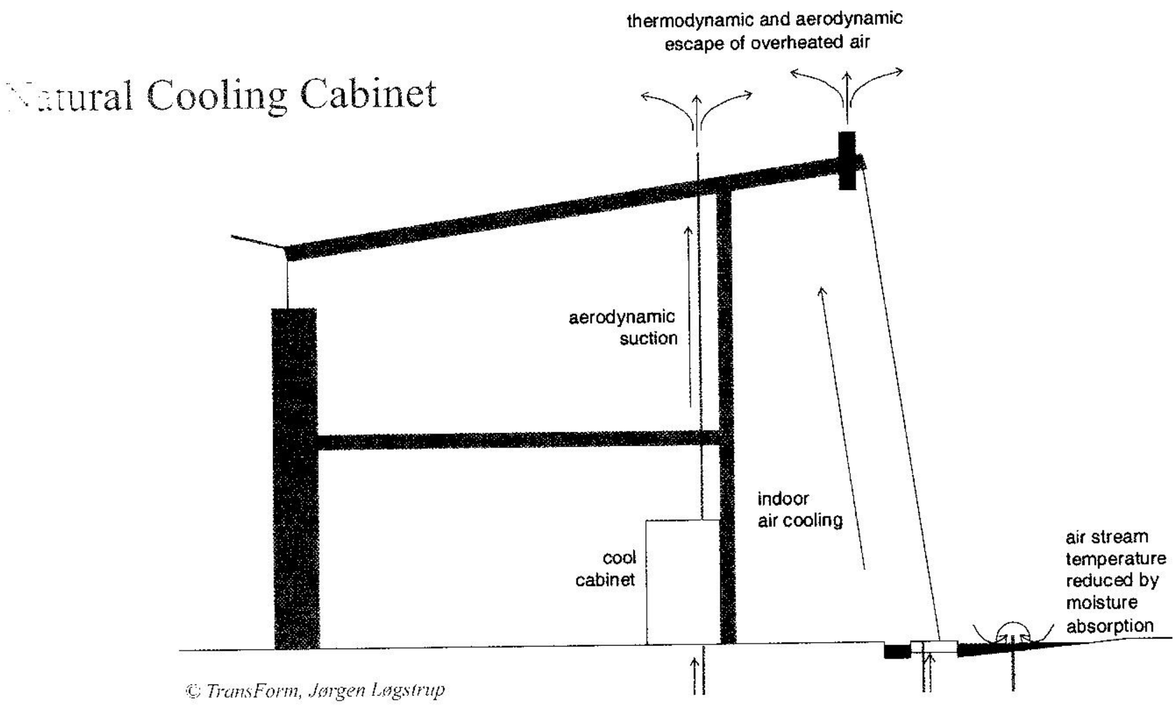

***Figure 38.* Natural Cooling Cabinet developed by Jørgen Løgstrup to cool food and indoor air.**
***Note.* Source of the picture: © TransForm, Jørgen Løgstrup in <u>Ecovillage living: Restoring the earth and her people</u>. Edited by: H. Jackson and K. Svensson (2002). UK: Green Books Ltd.**

Biomass

Biomass energy produces heat, electricity, and gas "through gasification and digestion of wastes and liquid fuels through fermentation and through synthesis after gasification" (Mega, 2005, p. 99). Biogas energy sources include landfills, sewage, and agriculture waste, and since the gases retrieved from these sources are primarily methane, biogas use reduces greenhouse gas emissions (Mega, 2005; Brown, 2008). Thus, this versatile energy source utilizes emissions from a waste product, transforming a problem into a solution. The use of animal waste in anaerobic digesters that produces methane (natural gas) is also gaining popularity (Brown, 2008). Once the methane gas has been extracted, the remaining manure can be used as a fertilizer (Bang, 2005).

The Dåva power plant in Sweden solely uses the city's own solid waste. Obtaining city waste is far less costly than dumping it at the local landfill. Waste used for fuel includes household waste, business and industry waste, building materials, organics, food, plastic, and rubber. The benefits from this system include reduced fossil fuel use, greenhouse gas emissions, and fuel costs for the city (James & Lahti, 2004). This power plant became "known as the world's most energy-efficient and environmentally acceptable waste-burning power plant" (James & Lahti, 2004, p. 44).

In the United States, the majority of nearly 10,000 megawatts from plant-based electrical generation comes from burning forest waste (Brown, 2008). The best way to obtain forest waste is to collect fallen trees, thinning, and dead branches (Bang, 2005). In St. Paul, Minnesota, tree waste from the city, local industries, and other sources heat some 80 percent of the downtown through its combined heat and power plant (Brown, 2008). Locally, Radian Bioenergy out of Salt Lake City developed a hybrid gasifier "that integrates multiple gasification processes into a single reactor" (Radian Bioenergy, n.d.). Benefits include:

- CO_2 emission reduction
- Criteria pollutant reduction
- Waste mitigation
- Renewable energy.

The modular unit designed for heating and power projects using up to 500 tons per day (Radian Bioenergy, n.d.).

Individual Household Opportunities

Roughly 76 percent of the total energy in the home is used for furnaces, light bulbs, air conditioners, water heaters, and refrigerators (Murphy, 2008). Many options allow individuals to take control with very simple solutions. Compact fluorescent lighting uses 75 percent less electricity and lasts 10 times longer than incandescent light bulbs, saving roughly $26 over the light bulb's life (Utah State University Extension, 2003). Energy smart appliances—dishwashers, clothes dryers, refrigerators, ovens, etcetera—can reduce a household's energy costs by at least 30 percent (Hawks & Peterson, 2005). Besides money savings, air pollution and CO_2 emissions from a coal-fired power plant are reduced (Hawks & Peterson, 2005). Highly insulated windows also reduce energy costs since the greater percentage of energy passes through window glass rather than walls. Simple passive solar techniques include housing orientation, window placement and size, and overhangs provide a great means for solar gain in winter and solar reduction in summer, thus reducing heating and cooling energy costs (Bang, 2005) (see Figures 39 and 40).

The EcoVillage at Ithaca is one example of a community that reduced its energy costs by using various passive techniques. In the first phase of development, the First Residents Group (FROG) houses face south to maximize solar gain in winter, while roof overhangs reduce solar gain in the summer. During colder months, large south-facing window walls, either double- or triple-glazed, allow for heat absorption from the sun (Walker, 2005). Duplexes sharing one exterior wall reduce heating and cooling costs by reducing the surface area (Walker, 2005). Shared boiler systems maximize heating efficiency. Through these techniques, FROG uses 40 percent less gas and electricity than the average house in the northeastern United States.

The Berea College Ecovillage also reduced its energy use through various techniques. These techniques include:

- Passive solar design
- Walls and roofs constructed of Structurally Insulated Panels (SIPS) for high insulation
- High insulation, low emissivity windows
- Heat exchanger to reduce energy loss in ventilation
- Concrete floors for thermal mass
- Compact fluorescent bulbs
- Solar light tubes
- Ceiling fans
- Clerestory windows for stack ventilation
- Ground-based heat pumps for heating, cooling, and hot water
- Energy-efficient front-loading clothes washers

- Clothes lines for drying.

Compared to nearby residential units, the ecovillage reduced its energy use by 46 percent (Briggs & Olson, 2005).

Alternative Energy Summary

Domestic energy is homeland security. The many alternative energy options—wind, solar, geothermal, and biomass—give individuals and communities flexibility. All buildings at Dancing Rabbit Ecovillage in Missouri are "off the grid," using solar and wind power for electricity (Pierceall, 2009). Unfortunately, the start-up costs for many alternative energy options can deter individuals and communities. The Eco Village at Ithaca desired off-grid, alternative energy systems but realized during the planning stages that the price tag was too high (Walker, 2005). As a result, many communities add various systems over time. Communities can start by applying low-tech, local solutions first before investing in high-tech solutions (Murphy, 2008). Demand should be analyzed

***Figure 39.* The Farm School uses large, south-facing windows with overhangs for winter solar gain.**

***Figure 40.* Large windows provide added lighting at The Farm School.**

first to determine needs, and then communities need to look for local sources (Jackson & Svensson, 2002). Unpredictable energy sources, such as solar and wind energy, should be combined with other alternative energies that can be stored such as biomass (Jackson & Svensson, 2002).

Open Space

Open space provides many benefits to the people and the land. Generally, ecovillages plan building placement in relation to open space. These undeveloped lands act as natural drainage areas, absorbing precipitation, including runoff; they also provide habitat for living organisms, a food source, a place for relaxation, and a place for socializing. This section discusses the various types of open space, along with their uses and benefits. For the purpose of this study, "open space" includes parks, conservation lands, gardens, and agricultural lands.

The community of Civano in Arizona planned from the beginning to incorporate parks and natural open spaces into their layout; they view those areas as "vital for relaxation, enjoyment, and preservation of the area's natural landscape and heritage" (Civano Neighbors, 2009). Public squares and parks need to be strategically placed near workplaces and residences (Register, 2002). Open spaces in close proximity to workplaces and residences offer convenient opportunities for residents to socialize and relax (see Figure 41). Open space can also reduce energy needs. Landscaping around buildings can reduce energy costs in

***Figure 41*. Kids play area at Cascadia Commons, Portland, Oregon.**

heating and cooling (O'Meara, 1999). For example, vegetation absorbs radiation in the summer, resulting in less energy needed for cooling (Olgyay, 1963). Large trees, suitable for the climate, offer shade, improved air quality, and water storage (Olgyay, 1963; O'Meara, 1999) (see Figure 42). Open spaces left undisturbed or revegetated with native, drought-tolerant plants increase runoff storage (Western Resource Advocates, 2009).

Conservation lands protect water quality and quantity (O'Meara, 1999). They also protect various life forms (i.e., pollination, seed dispersal, insect control, and nutrient cycling) that provide irreplaceable services (Brown, 2008). Vegetation provides shade, wind breaks, food, and fix nitrogen (Brown, 2008). Conservation easements provide a way for farmers to transfer the usage of their agriculture land into preservation land. Conservation lands can also function as educational tools, a source for handicrafts, a place for ecotourism programs, and a location for research (Madaune, 2002). As an educational tool, nature preserves can serve local schools, the inhabitants, and visitors, building a higher sense of connection and respect of nature (Madaune, 2002). The idle land can bring in money from tourists and create jobs for the locals who provide services such as serving as tour guides. Handicrafts, such as necklaces and carved animal figures, can be made from sustainable, local materials and sold for profit (Madaune, 2002). The Farm in Tennessee provides an example of an ecovillage that values

Figure 42. **Place to relax at The Farm in Tennessee.**

conservation lands. The community formed a non-profit called Swan Trust to preserve the Upper Swan Watershed (Bates, 2009). Currently, the Swan Trust, Nature Conservancy, and other groups protect about 4,000 contiguous acres within the watershed. Even within the community, biodiversity is the holistic goal for The Farm (Bates, 2009).

Many people, including children and adults, do not know where their food comes from, how it is processed, and who is providing it (Murphy, 2008). Today, foods travel a great distance to make it to the dinner table; it also goes through numerous steps: assembling, handling, processing, packaging, transport, storage, wholesaling, and retailing (O'Meara, 1999). Local food production allows people to reconnect with their health and well-being (Murphy, 2008). The kinds of food we eat also play a central role in our customs, heritage, and culture (Hodgson, 2009). However, food production is not normally part of community planning, and healthy communities require healthy food systems (Hodgson, 2009).

Home gardens are becoming more popular, as tough economic times have made people more conscious of food costs. Gardens save people money since purchasing food accounts for up to 10-15 percent of household expenditures. Community gardens are becoming increasingly popular as they provide an area for those individuals who like to grow their own and do not have the land themselves for a garden (Bang, 2005) (see Figure 43).

Figure 43. **Community garden at Columbia Ecovillage, Portland, Oregon.**

While rooftop gardens are also increasing in popularity, buildings must be designed specifically to hold the extra weight (Walter, 1992). The roof makes the “perfect spot” for growing food since it is in our immediate environment, a private place, and likely receives extended sunlight (Walter, 1992). Rooftop gardens also provide open space with the added benefits of a cool environment (especially in urban settings), added insulation, stormwater runoff control, carbon dioxide sequestration, habitat for birds, invertebrates, and plants (Beatley, 2000). Native plants including grasses can also be planted on rooftops. Green roofs usually cost more than traditional roofing materials, which prevent an initial barrier.

For this study, agricultural lands include orchards and livestock grazing lands (see Figures 44 and 45). Local agriculture is a large component in ecovillages. It supplies local jobs while providing the community with healthy, local foods (Bang, 2005). Locally produced foods are less susceptible to price hikes and other disruptions (O'Meara, 1999). Current trends show that people want to know their farmer, making local production more popular (DeWitt, 2010). Farmers’ markets and Community Supported Agriculture (CSA) give the opportunity for growers and customers to interact, while cutting out the middleman (Bang, 2005). Essentially, a CSA is where consumers pay the grower in advance and, in return, receive a certain share of the produce, usually on a weekly basis (Van En, 1995). These systems provide savings to customers and increase profit for the growers (Bang, 2005). In CSAs, the grower and consumer share the risks and the benefits (Bang, 2005). For example, a rainstorm dumped eight inches of rain in three hours, causing the grower to pick their winter squash early. The consumers froze, dried, and ate what they could, but it was a $35 loss to each share, which would have been a loss of

Figure 44. **Livestock agriculture, Cache County.**

Figure 45. **Agriculture lands provide various uses.**

$3500 to an individual farmer (Van En, 1995). CSA farmers benefit through a more secure income, a higher and fairer return on produce, and direct connection to the community (Bang, 2005). Consumers benefit through fresh produce, increased knowledge of growing seasons, and a better diet along with a feeling of belonging to a community (Bang, 2005). There is also the opportunity for education and dialogue for both grower and consumer (Van En, 1995).

Farmers can practice organic, biodynamic growing techniques instead of relying on herbicides, pesticides, fungicides, and fertilizers (Murphy, 2008). Compared to conventional operations, organic farms and ranches in the United States have higher sales and higher production expenses than conventional operations' sales and expenses (Herald Journal staff report, 2010). Utah falls behind the nation in organic production with only 95 organic producers. Utah organic producers average roughly $134,284 in sales compared to all farms which average $84,771 in sales; they also spend on average $75,795 for production expenditures compared to all farms expenses of $72,789 (Herald Journal staff report, 2010). Many people speculate that production decreases as organic techniques are applied. However, this is not always the case; Cuba is a prime example, demonstrating how organic farming can be successful. Cuba farmers were forced to switch to organically-grown agriculture due to a rapid decline in energy supplies during the 1990s. At first, crop yields started decreasing, but once the land recovered, farmers experienced an increase in yield (Murphy, 2008). Additionally, new evidence shows that the longer land is in organic, the better the health benefits from those foods (DeWitt, personal communication, 2010).

In summary, open space such as parks, conservation lands, gardens, and agricultural lands provide many uses and benefits. Educational and economic opportunities exist within open spaces, and both the land and the people reap many rewards. Ecovillages realize the importance of open space within a community and strive to incorporate it throughout the ecovillage.

Garbage

Waste is inevitable. James and Lahti (2004) found U.S. citizens disposed an average 1,642 pounds per person during the year 2000. When it comes to trash, ecovillages try hard to produce as little as possible, thus reducing the demand for landfill space and recycling of waste. At the EcoVillage at Ithaca, 106 people fill up a 108-cubic-foot dumpster every week; this is roughly a quarter of what U.S. housing developments of the same size produce (Walker, 2005). Murphy (2008) says, “The key action is to *curtail*. That means buying less, using less, wanting less, and wasting less” (p. 113). With the waste that is produced, responsibility needs to be taken. Ecovillages are very efficient at waste management, using different processes to cycle the majority of resources back into use. The different processes include composting, recycling, and reusing resources.

Composting shows up in nearly all, if not all, ecovillages. This easy method of waste reduction turns organic matter such as food scraps, paper, and lawn clippings, into a very valuable material that revitalizes agricultural soils (O'Meara, 1999). Organic matter increases water retention (DeWitt, personal communication, 2010). The EcoVillage at Ithaca adds compost to home gardens (Walker, 2005). The large, bulkier wood material can be shredded and chipped to break down easier or to make landscaping materials. Composting is even catching on in large cities; San Francisco mandates its residents compost food scraps that area farms and vineyards will later use (Associated Press, 2009). Ecovillages tend to promote both backyard composting along with supplying a centralized composting bin (see Figure 46). Composting is a cyclic method for waste management.

Figure 46. **Compost bin outside a house at Cascadia Commons, Portland, Oregon.**

Next, recycling prevents inorganic materials—such as glass, metals, and plastics—from entering the landfills (O'Meara, 1999). In some locations, curbside recycling is available while others rely on individuals to take recyclables to nearby recycling bins. Residents at the EcoVillage at Ithaca can take paper, cardboard, glass, metal, and plastics to a community recycling shed (Walker, 2005). Implementing recycling programs from the start can increase overall efficiency. Daybreak, a community in Utah, had builders and contractors who recycled more than half of their construction waste (Kennecott Land, 2007). Sadly, in some places, it is still cheaper to dump solid waste than to recycle it. In addition, “the recycling market is unstable” (James & Lahti, 2004, p. 145). With this in mind, ecovillages still promote recycling but really impress upon residents the need to use less.

Lastly, reusing prevents resources from becoming waste, saving the environment and money. Many ecovillages set aside areas designated as reuse sites. At Columbia Ecovillage in Portland, the community laundry room also serves as a site where residents can donate or claim used clothing items. The EcoVillage at Ithaca designates a closet in the Common House for reuse items—clothes, shoes, and toys (Walker, 2005). Lately, even landfills offer reusable items. For example, the City of Logan Environmental Department provides a site to drop off items in good working order that can be reused by someone else (City of Logan Environmental Department, 2010). Construction materials and even buildings can be reused. Enright Ridge Urban Eco-village is a great example of a community that reuses old buildings, retrofitting them to be more ecologically sound (Schenk, 2009). Reusing provides a great, cost-efficient way to manage waste. As the old saying goes, "One man's trash is another man's treasure." However, it may not always be cost effective to reuse older materials due to processing and removal costs.

Ecovillages strongly support proper waste management to greatly reduce trash. Recycling does not solve problems by itself (James & Lahti, 2004), nor does composting or reusing, but when composting, recycling, and reusing are all implemented, waste can be greatly reduced. Education is a critical component to provide information for all residents. In some communities, "eco-teams" teach households how to reduce waste through various shopping practices (i.e., choosing products with little or no packaging) and composting (James & Lahti, 2004). In addition to the waste management techniques mentioned, many communities support the sharing of tools and resources, decreasing demand.

Local History and the United Order

Today certain ecovillages subsist as communes and do so successfully. This section explores past communes that existed near the location of this project's study site. Similarities exist between these historic, religious communes and today's ecovillages. Members of the Church of Jesus Christ of Latter-day Saints, also called the Mormon Church, settled several communities throughout Utah. These settlements, similar to an ecovillage in layout, purpose, and composition, began as communal communities. Joseph Smith's Law of Consecration and Stewardship, followed by Brigham Young's United Order, encouraged church members to live this way.

On February 9, 1831, Joseph Smith revealed the "Law of the Church" or "Law of Consecration and Stewardship," depicting the desire for communal economic order (Pitzer, 1997). Each member was to "consecrate" or give their possessions to God or the church, and each member was to perform all earthly endeavors as service to God, also called "stewardship." All church members' land, machinery, and skills were to be used "for the common good" (Arrington, Fox, & May, 1976). Equality was to be enforced. Then, in 1833, Joseph Smith tried to enforce order with the Plat of the City of Zion. Pitzer (1997) described the Plat of the City of Zion as:

> "An ambitious plan for a mile-square city of 15,000 to 20,000 inhabitants with a central complex of twenty-four temples to serve as educational and religious centers. Half-acre lots were to be laid out in a rectangular grid of ten-acre blocks, with streets oriented toward the cardinal points of the compass. Citizens were to build brick or stone homes on town lots and commute to fields on the outskirts" (p. 141).

However, on June 22, 1834, Smith suspended the operation of the Law of Consecration and Stewardship (Arrington, Fox, & May, 1976).

After Smith's death, the Mormon Church appointed Brigham Young as leader. Young's utmost goal was self-sufficiency for Utah economic life while also believing in social equality; he desired a lifestyle that would make and raise enough goods for eating, drinking, and clothing the community's residents with enough goods to sell and bring money into the community (Arrington, Fox, & May, 1976). In 1874, Brigham Young started the United Order as a step towards Joseph Smith's dream. Many communities failed to become independent within their first year; however, a few communities lasted for a decade or more, following Smith's vision with extreme devotion (Arrington, Fox, & May, 1976). Hyrum, Utah became one of the most successful settlements under the United Order. Settled in 1860, Hyrum became home to 145 families, totaling 708 individuals within a decade. Due to its location in Cache Valley, the high altitude and mountainous terrain brought long winters and short growing seasons. Hardy crops—oats, corn, potatoes, and hay—proved most successful, along with producing dairy products of butter and cheese. Other businesses included a retail store, sawmills, a livestock ranch, and a dairy (Arrington, Fox, & May, 1976). Within years, the trees of Blacksmith Fork Canyon were "lumbered out," so residents increasingly had to find employment outside of their community. Hyrum continues today as a satellite community with 7,636 residents who mainly seek employment either in Logan or south of Cache Valley (Onboard Informatics, 2010).

The most famous community under the United Order is Orderville, Utah. It nearly achieved complete self-sufficiency (Arrington, Fox, & May, 1976). Orderville served as a model communal United Order (Pitzer, 1997). The layout nearly resembles that of an ecovillage. Each family lived in a separate home arranged around the town square, inviting neighbors to socialize with one another (Arrington, Fox, & May, 1976) (see Figure 47). Arrington et. al (1976) quotes a visitor's experience to Orderville; they wrote:

> "The houses are found, the most of them built facing inwards upon an open square, with a broad side-walk, edged with tamarisk and mulberry, boxelder and maple trees, in front of them. Outside the dwelling-house square are scattered about the schoolhouse, meetinghouse, blacksmith and carpenters' shops, tannery, woolen mill, and so forth, while a broad roadway separates the whole from the orchards, gardens, and farm lands generally. Specially noteworthy here are the mulberry orchard—laid out for the support of the silkworms, which the community are now rearing with much success—and the forcing ground and experimental garden, in which wild flowers as well as "tame" are being cultivated. Among the buildings the more interesting to me were the schoolhouse, well fitted up, and very fairly provided with educational apparatus; and the rudimentary museum, where the commencement of a collection of the natural curiosities of the neighborhood is displayed" (p. 270-271).

About 400-acres of land were devoted to food production. A 20-acre fenced garden and orchard plot was placed near the town center, containing a variety of fruit trees, vegetables, and a nursery for growing seeds. Locally produced foods were served at the dining hall. Members made various products, from soap to wooden buckets and barrels. The surplus products were sold, providing income for supplies that they could not produce or do without. Orderville also proved to have a large social component. People ate, worked, played, and studied together. Arrington, Fox, and May (1976) quote one person for saying:

> "I have lived in Utah, Arizona, California, Idaho and in many different towns and was never so much attached to a people, I never experienced greater joy nor had better times than during the period of time I was connected with the United Order in Orderville…"(p. 293).

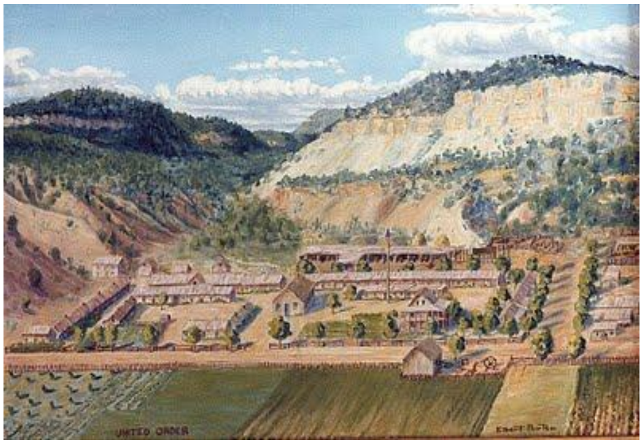

Figure 47. **Picture of an old painting by Everett Thorpe depicting Orderville, UT.**

Mormon communities strived for self-sufficiency similar to the ecovillage goal of a full-featured settlement obtained through localizing many resources, jobs, and goods. Roughly 200 United Orders were organized in both rural and urban settings (Arrington, Fox, & May, 1976). Ecovillages also occur in both rural and urban settings, and they seek to maintain a large social component. Conversely, ecovillages are unique in that they try to maintain balance with the world around them, and the ecological dimension becomes equally important to the socioeconomic and cultural dimensions. Ecovillages are a relatively new concept, but one cannot ignore the past. United Orders provide a background to the functions of this geographic area, and the Mormon Church plays a huge part in the cultural background of the people and this place.

Pre-Analysis—Field Research

Site Visits

The intended purpose of visiting existing ecovillages and intentional communities, along with interviewing people from various communities, was to gain a greater understanding of how these communities differentiate from other developments. The hope was to see, feel, and hear firsthand more about these communities. The first stop was at Wasatch Commons—a cohousing community in Salt Lake City, Utah. Next, a trip to The Farm—a rural community in Summertown, Tennessee—proved very beneficial. The Farm, founded in 1971 as an intentional community, later became an ecovillage (Bates, 1995). While visiting The Farm, the Tenth Continental Bioregional Congress took place there over the span of nine days. Last on the agenda was a bus tour in Portland, Oregon. The bus tour made stops at five ecovillages and cohousing developments in one day, presenting how different each community can be. All these site visits provided experiences that could not be obtained from a book; they supplied depth and understanding to this research project.

Wasatch Commons Cohousing

Wasatch Commons Cohousing provided an introduction to intentional communities. The visit included participating in their Sunday evening potluck, followed by a tour of the community. Established in 1998, Wasatch Commons is Utah's first cohousing community. Located on 4.5-acres, Wasatch Commons provides easy access into downtown Salt Lake City, Utah. There are 26 homes, including flats and attached townhouses, that range from 900-square feet for a one-bedroom unit to 1,500-square feet for a four-bedroom unit (Wasatch Commons Cohousing, n.d. a). All units face a central path that also serves as access for emergency vehicles (see Figure 48). The community has raised garden beds for residents, along with fruit trees. Native, drought

Figure 48. **Site plan for Wasatch Commons Cohousing in Salt Lake City, Utah.**
Note: **Image was obtained from Wasatch Commons Cohousing website: http://www.econ.utah.edu/~ehrbar/coho/site.htm.**

tolerant plant species landscape the units. Birds, snakes, and skunks are often visible in the “Wild Area”—a place preserved as natural habitat where kids explore nature and build forts. Parking exists on the outskirts of the community.

The tour discussed many green elements, along with various social aspects (see Appendix C for a list of its green elements). Each unit was designed to consume less energy and water through various features such as passive solar, extra ceiling and wall insulation, and on-site stormwater collection for groundwater recharging (Wasatch Commons Cohousing, n.d.b). The common house was designed not only to bring residents together and help maintain cohesiveness, but also to accommodate the smaller unit sizes by providing guest rooms, a children’s room, sitting room, laundry, crafts room, and a kitchen with dining room (Wasatch Commons Cohousing, n.d.b). Wasatch Commons also emphasizes resource use reduction and efficiency. The community promotes the sharing of resources through car-pooling, shared childcare, exercise equipment, and other resources. Other group and/or individual initiatives such as composting and rain collection barrels, are strongly encouraged (Wasatch Commons Cohousing, n.d.b).

Wasatch Commons promotes a strong social connection. Baird (2002) quoted Wasatch Commons resident Vaughn Lovejoy, an attorney: “The thing that drives all of us who live here is that we want to build a real community, something that we think has been lost in the suburbs” (p. E1). With parking on the perimeter, walking paths within the community were “designed to encourage neighborly interaction” (Baird, 2002, p. E1). The common house provides a central meeting place for both kids and adults. The community also promotes diversity among its residents through race, age, and income level. This brings forth Wasatch Commons’ defining characteristic—its participation in the “CROWN” program. CROWN, which stands for CRedits – to – OWN, is a program developed by the Utah Housing Finance Agency to allow households with very low income to obtain ownership through a lease-to-own method (Utah Housing Finance Agency, n.d.).

The Farm

An eleven-day visit to The Farm in Tennessee provided a more extensive experience, including many interactions with residents, shared meals, consensus-based decision-making, and a workday devoted to give back to The Farm. The Farm is located on six square miles in south-central Tennessee (The Farm, n.d.). Founded in 1971, The Farm has become a well-known ecovillage. The population peaked at 1,400 residents in 1980, but now roughly 200 people live there (Bates, 1995). Housing units, as well as businesses, are spread throughout the land (see Appendix D for a map of The Farm). Other buildings include a school, community center, store, hostel, dorms, and welcome center (see Figures 49, 50, 51 and 52). However, much of the land is preserved as natural habitat.

A number of economic, social, and ecological features coexist on The Farm. To begin with, many green features pepper the community. Solar panels provide some of the electricity, along with hot water. Fenced-in organic gardens, protecting the fruits and vegetables from wildlife, provide fresh produce to residents. The Swan Conservation Trust aims at restoring and preserving the natural resources and wildlife habitat, while the Ecovillage Training Center educates visitors about topics such as natural building materials and alternative energy (The Farm Ecovillage, n.d.).

A variety of businesses and non-profits offer jobs and opportunities to residents. S.E. International—a company that develops, manufactures, and sells nuclear radiation detection equipment—makes about $1 million every year and employs 20 full- and part-time workers who receive full benefits (Stevenson, 2009). Other businesses include The Law Offices of Alan Graf, Village Media, FarmSoy Company, The Book Publishing Company, and The Mail Order Catalog. Non-profits such as the Ecovillage Training Center, Swan Conservation Trust, Plenty International, and Kids to the Country provide both paid and volunteer positions, and they also embody the ideals of The Farm (The Farm Ecovillage, n.d.).

Socially, The Farm flourishes, offering many opportunities for its residents to come together and express themselves. The Community Center hosts shared meals and events for residents, with some events available to the public.

Figure 49. **The Farm recycled this building to become the Welcome Center.**

Figure 50. **The Farm's dorm where interns and visitors stay.**

Figure 51. **The Farm Eco-Hostel gives visitors a place to stay.**

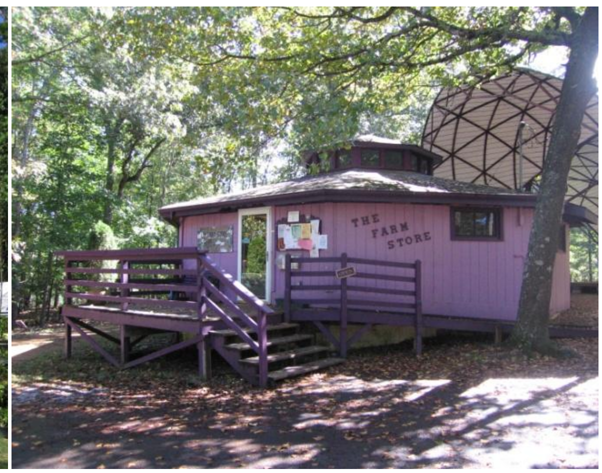

Figure 52. **The Farm Store sells food and locally made gifts.**

Portland Bus Tour

The Portland Area Cohousing Bus Tour visited five urban communities: Cascadia Commons, Columbia Ecovillage, Daybreak Cohousing, Peninsula Park Commons, and Trillium Hollow (see Figures 53, 54, 55 and 56). While time spent at each community was limited, the experience proved very valuable by seeing how different and unique each place was. Table 1 lists facts such as year completed, population, number of housing units, and unit prices, and Table 2 lists amenities available at each community.

While each place had its own character and varied in terms of layout, size, technology, and features, a few common themes became apparent throughout these communities. Five common themes included:

1. All the communities are newer with Trillium Hollow, the oldest, starting in 1998. As a result of newer developments, newer technology and construction materials were used.
2. Easy access to public transportation reduces the need for vehicles and parking.
3. Each community is comprised of high-density housing units (i.e., Daybreak cohousing has 30 homes on 2/3-acre) while making the most out of what open space is left for gardens, fruit trees, kids' play areas, and picnic tables.
4. The city of Portland provides many jobs to residents. Location and public transportation make it easy to commute to work.
5. The social aspect is greatly emphasized through community meals, a community center/house, kids' play area, central courtyards, and activities.

Despite these commonalities, these five ecovillages demonstrated the diversity among intentional communities.

Portland Bus Tour						
	Year Completed	Size - Acres	Adults/ Elders	Children/ Teens	Homes	Prices
Cascadia Commons	Phase 1: July 2000 Phase 2: May 2001	3	35	4/3	4-one bd; 19-two bd; 5-three bd; (~700-1350 sq ft)	$150K-$250K (2009)
Columbia Ecovillage	2009	3.73	50	11	500-1100 square feet	$150K-$330K (2009)
Daybreak Cohousing	2009	2/3	20/9	4	1-, 2-, and 3-bd flats & 2-bd townhouses (640-1110 sq ft)	$258K-$380K (2009)
Peninsula Park Commons	Phase 1(rehab): 2005 Phase 2 (new construction): 2008	135' x 100'	15	6	500-1100 sq ft	$150K-$330K (2009)
Trillium Hollow	1998	3.6	38 total		Studio to 4-bd (550-1670 sq ft)	$100K-$310K (2009)

Table 1. **List of communities visited on the Portland Area Cohousing Bus Tour along with some quick facts.**
Note: **Information on each community was taken from handouts received on the bus tour that took place on November 7, 2009.**

Ecovillage Amenities							
	Common House	Parking	Garden/ Orchards	Green Space	Workshop	Storage Facility	Childrens' Play Area
Cascadia Commons	X	X	X	X	X	X	
Columbia Ecovillage	X	X	X		X	X	X
Daybreak Cohousing	X		X	X			X
Peninsula Park Commons	X		X			X	X
Trillium Hollow	X	X (Under-ground)	X	X			X

Table 2. **List of amenities available at each community.**
Note: **Information taken from handouts received on the bus tour that took place on November 7, 2009. Communities may offer more amenities that were not listed on these handouts.**

Figure 53. **Cascadia Commons in Portland, Oregon.**

Figure 54. **Peninsula Park Commons in Portland, Oregon.**

Figure 55. **Daybreak Cohousing in Portland.**

Figure 56. **Trillium Hollow in Portland.**

Figure 57. **Cascadia Commons in Portland, OR.**

Interview Results

All interviews were conducted in-person while attending the Tenth Continental Bioregional Congress, held October 3-11, 2009. The interviews gave further details about individual communities. Three out of the four interviews were from people in different communities. Two people from The Farm were interviewed, providing two very different views; one person focused more on the social aspects while the other person went into detail on the ecological aspects. The results from these interviews provide further information about different options in forming and running a community. (See Appendies E and F for interview questions and notes.)

The first interview was with Vickie Montagne, a member of The Farm since 1977. Vickie was initially drawn to The Farm because it provided a place for like-minded people. Throughout the interview, she emphasized the nature of The Farm as an extended family. Vickie views this sense of community as the main reason people choose to live there. She also stressed the importance the non-profits (i.e., the midwives, Swan Conservation Trust, and Kids to the Country) play as members work together and help others (Montagne, 2009). Throughout the interview, Vickie greatly emphasized the social benefits. As people came together, great things happened. This is what separates an ecovillage from another community.

The second interview with Albert Bates provided an in-depth look at the ecological aspects within an ecovillage. Albert Bates came to The Farm in 1972 and has played an enormous role in the ecovillage movement. He has been involved with the Institute for Appropriate Technology, launched the Ecovillage Training Center at The Farm, helped organize the Global Ecovillage Network, and wrote a few books

(Wikipedia, 2010a). Bates provided an extensive history of The Farm, including both the struggles and the triumphs, and how it progressed over time.

To begin with, Bates proclaimed the holistic goal for The Farm is "biodiversity." He expressed the importance The Farm plays in the local ecology by stating that, "we are a flyway for the monarch butterflies; we are the northern terminus for a Summer Tanager species; we are the only remaining location for a species of sunflower" (Bates, 2009). Bates' (personal communication, 2009) main concern deals with climate change; he states that,

> "We are in a place where we can mark the change in the seasons differently than 40-years ago. During that time, we watched the isotherm migration on average about 30-miles per decade. So the climate we had here in 1971 is up near Lexington, Kentucky. The climate we have now was in Neshoba County, Mississippi in 1971. We moved two USDA planting zones in that time. Our regional goal when we inhabited the land, when we bought land from the companies that were making paper, was to put in traditional trees, heirloom varieties, and that is totally wrong. That is fighting the last war. We need to be thinking what grows well in southern Mississippi and being the midwives of the next forest that is going to be here because these trees can't move that fast. These trees will die before they move. We are already seeing that with oaks, hickories, and dogwood. We are starting to see armadillos and fire ants and scorpions, all that stuff we never used to have. We lost our quail and other things that moved further north."

One way The Farm focuses on land preservation is through its non-profit, the Swan Trust. Over the years, the Swan Trust has acquired roughly 4,000 contiguous acres, protecting parts of the Swan River watershed (Bates, 2009).

The third interview was with Jim Schenk. In 2004 Schenk founded Enright Ridge Urban Eco-village in Cincinnati, Ohio, where he currently resides. According to Schenk (2009), the support system to live sustainably separates their community from another. The community consists of about 80 units/buildings that are 75- to 100-years old. The goal is to retrofit the buildings to be more ecologically efficient. At least two-thirds or more of the community has already been insulated with newly installed, energy-efficient windows and furnaces. Another feature of Enright Ridge Urban Eco-village is that the community started a full-fledged CSA in the city. Experienced farmers utilize backyards and vacant spaces in six different locations while being paid. Subscribers to the CSA live inside and outside their ecovillage (Schenk, 2009).

The final interview was with Charlene, a member and founder of Wisteria in 1996. The community is located on 620-acres in Southern Ohio. Over 200 acres were once a former coal strip mine. The community mainly focuses on the social aspects of living with like-minded folks. When asked how her community differs from the typical housing development, Suggs (personal communication, 2009) replied:

> "We are responsible for our own decisions and funding. Our decisions are based on creating value and meaning for us all rather than for profit for profit sake. For instance, we might take care of a place that will take care of us in our old age, so that might not make us a lot of money, but it could save us a lot of money not having to work and make thousands of dollars just to spend with someone else at the end of our life. We are very interested in creating value."

Despite not recognizing themselves as an ecovillage, the community includes a 220-acre nature preserve. Some residents live off the grid with features such as composting toilets, rainwater harvesting, and solar power (Suggs, 2009).

All interviewees mentioned the importance that their community plays to surrounding communities. One community hires from the local workforce whenever possible (Suggs, 2009). Other communities shop in surrounding communities, contributing to the local sales tax (Montagne, 2009). Two communities attempt to influence neighboring communities to improve their sustainability and viability (Bates, 2009; Schenk, 2009). Interviewees also noted that their communities saw a low turnover rate in residents.

Analysis—Defining the Area

Study Site

The study site lies within Cache County, Utah. It encompasses the New Town that was selected in the report *CV 2030* (Toth et al., 2006). Located in southern Cache Valley, Utah, this site lies west of Hyrum City and east of Wellsville City, with a small sliver of the Wellsville municipality extending into the New Town (see Figure 58). The New Town is 5,400 acres in size (Toth et al., 2006). The land is primarily undeveloped and currently in use as farmland.

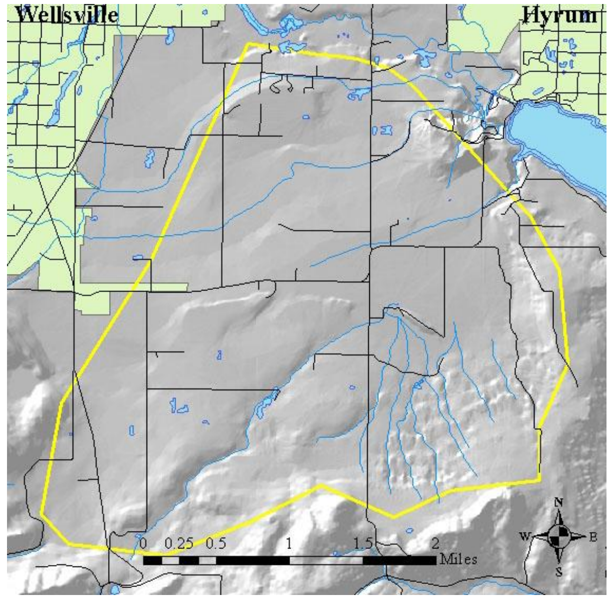

Figure 58. **Map of the study site showing the Wellsville and Hyrum municipalities.**

Assessment Models

The Assessment Model Process

Identifying an area's characteristics and quality are essential to a sound plan. Visual assessments, which are important for a planner to grasp the site's character and amenities, only capture a fraction of what is present. Assessments made using GIS data assist greatly in a land analysis. The assessment models capture what is present at the site. These conditions may not be visible to the naked eye. For example, GIS data identify soil types, linking their characteristics such as susceptibility to landslides or soils deemed suitable for agriculture. This information not only helps identify area characteristics but also allows the planner to make decisions based on real data.

The study's objective(s) determines what GIS assessment models to use. For example, the *CV 2030* report focused on addressing growth and land preservation issues in Cache Valley, Utah (Toth et al., 2006). They prepared assessment models on public health, safety, and welfare, surface water, groundwater, wildlife habitat, visibility assessment, Cache Valley identity, working lands, residential, commercial/industrial, and transportation. These assessments helped produce alternative futures. The alternative futures provided various solutions to the growth and land preservation issues in the valley.

Since this study continues where *CV 2030* left off, much of the background work was completed; the New Town site was selected. The goal of the current project is to develop a plan for an ecovillage in the New Town site. Since ecovillages are mainly split into zones of buildings, nature preserves, and agriculture (including orchards, gardens, and livestock grazing), three assessment models—Potential Building Sites, Conservation Lands, and Agriculture—were developed. A tiering process was then applied to the models (see Figure 59).

A *three-part tier system* has been proposed as a way to mix and match elements from different categories in a way that reflects the goals, values, and interests of potential alternative futures (Toth, Edwards, & Lilieholm, 2004). Tier 1 provides the most crucial elements in the category, Tier 2 includes additional elements, and Tier 3 includes all the elements deemed important to the category. For this study, the separate tiers assisted in the future layout of the ecovillage.

Agriculture Assessment Model		
Tier 1: Farmsteads Century Farms Prime Farmland	Tier 2: Farmsteads Century Farms Prime Farmland Farmland of State Importance	Tier 3: Farmsteads Century Farms Prime Farmland Farmland of State Importance Farmland of Local Importance
*This model excludes state lands and developed lands.		

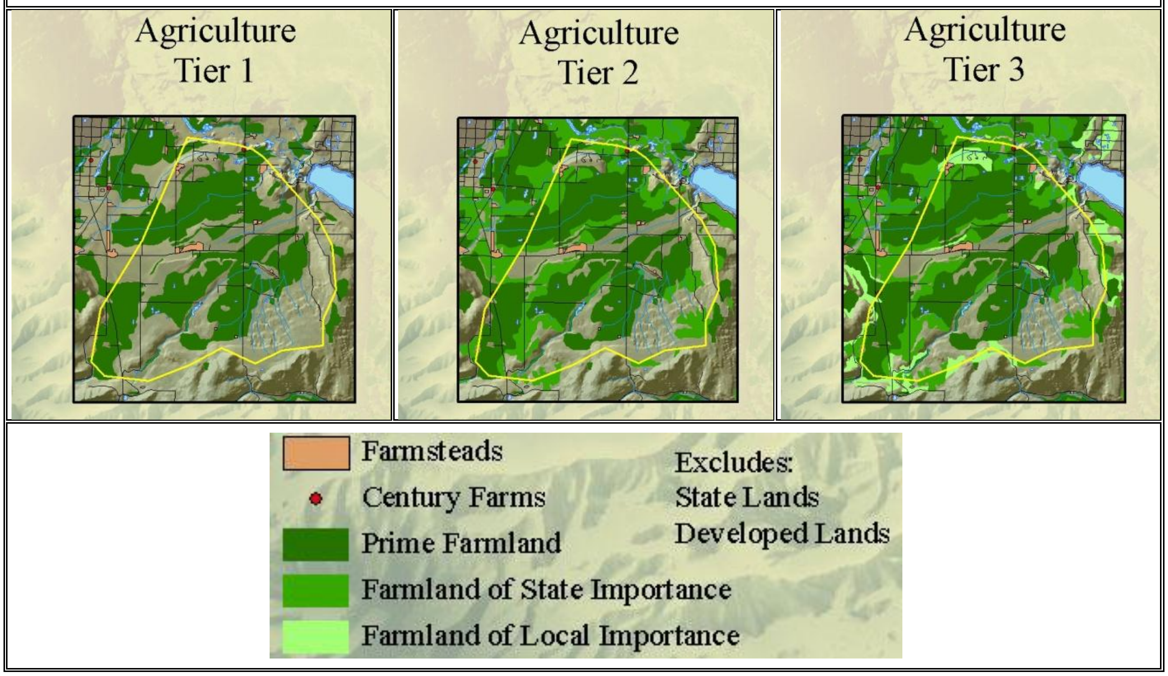

***Figure 59*. Example of tiering an assessment model.**

Agriculture

Agricultural lands are disappearing at an increasing rate. Cache County is estimated to have lost over 25,000 acres (9 percent) of agricultural lands between 1997 and 2002 (Toth et al., 2006). Besides providing local crops, agriculture is part of Cache Valley's identity; it helps define this area. Cache Valley is becoming increasingly reliant on other sources for its agricultural goods. Here, the agriculture assessment model attempts to preserve this valuable land use and its resources. The Natural Resource Conservation Service (NRCS) divides farmland into three classes: prime farmland,

farmland of statewide importance, and farmland of local importance. The study site contains all three classes.

Tier 1 presents “prime farmland” (see Figure 60). The Soil Survey Division Staff (1993) of the NRCS defines prime farmland as:

> “Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It must be available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.”

Prime farmland covers 2,416 acres of the study site. Since agriculture and farming play such a large role in this area’s history, farmsteads and “century farms” were also added to Tier 1. Century farms recognize farm families “that had operated the land for one hundred years or more” (Olsen, 1999). Two century farms exist within the study site, along with sixteen farmsteads. The model excludes developed lands and state lands.

Tier 2 contains all the elements found in Tier 1 plus “farmland of state importance” (see Figure 61). Farmland of state importance is almost prime farmland producing high yields of crops—food, feed, fiber, forage, and oil seed—when acceptable farming practices are used. State agency or agencies determine what is considered statewide important farmland (Natural Resources Conservation Service, 1973). Farmland of state importance adds another 1,709 acres to the agriculture model, bringing the total to 4,125 acres.

Tier 3 contains all the elements found in Tier 2 plus “farmland of local importance” (see Figure 62). These additional farmlands contribute to the production of food, feed, fiber, forage, and oil seed crops but do not meet prime farmland or farmland of state importance standards. They are of local concern. Local agency or agencies identify these lands (Natural Resources Conservation Service, 1973). Farmland of local importance adds another 475 acres to the agriculture model, bringing the total to 4,600 acres.

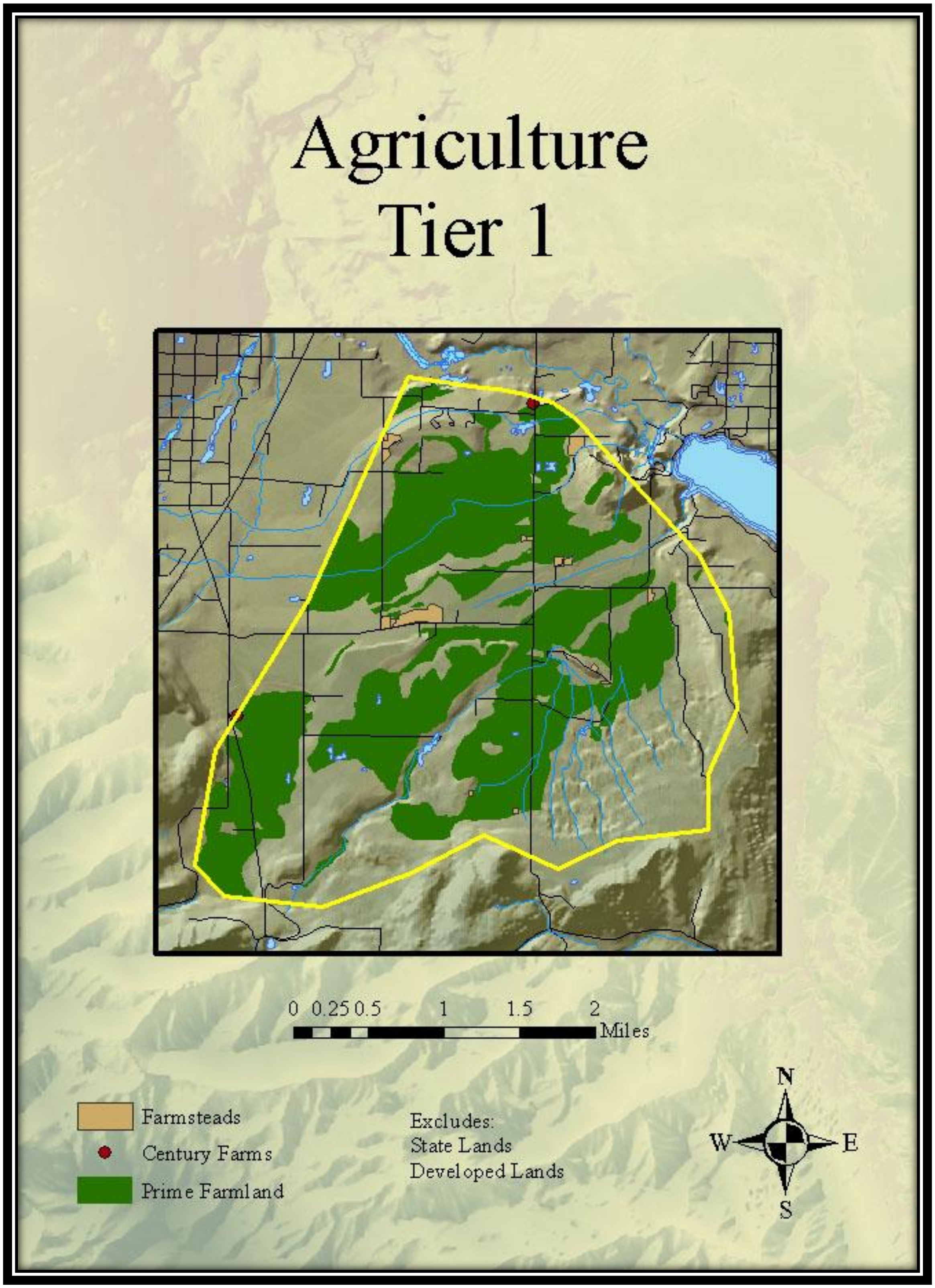

Figure 60. **Agriculture Assessment Model - Tier 1.**

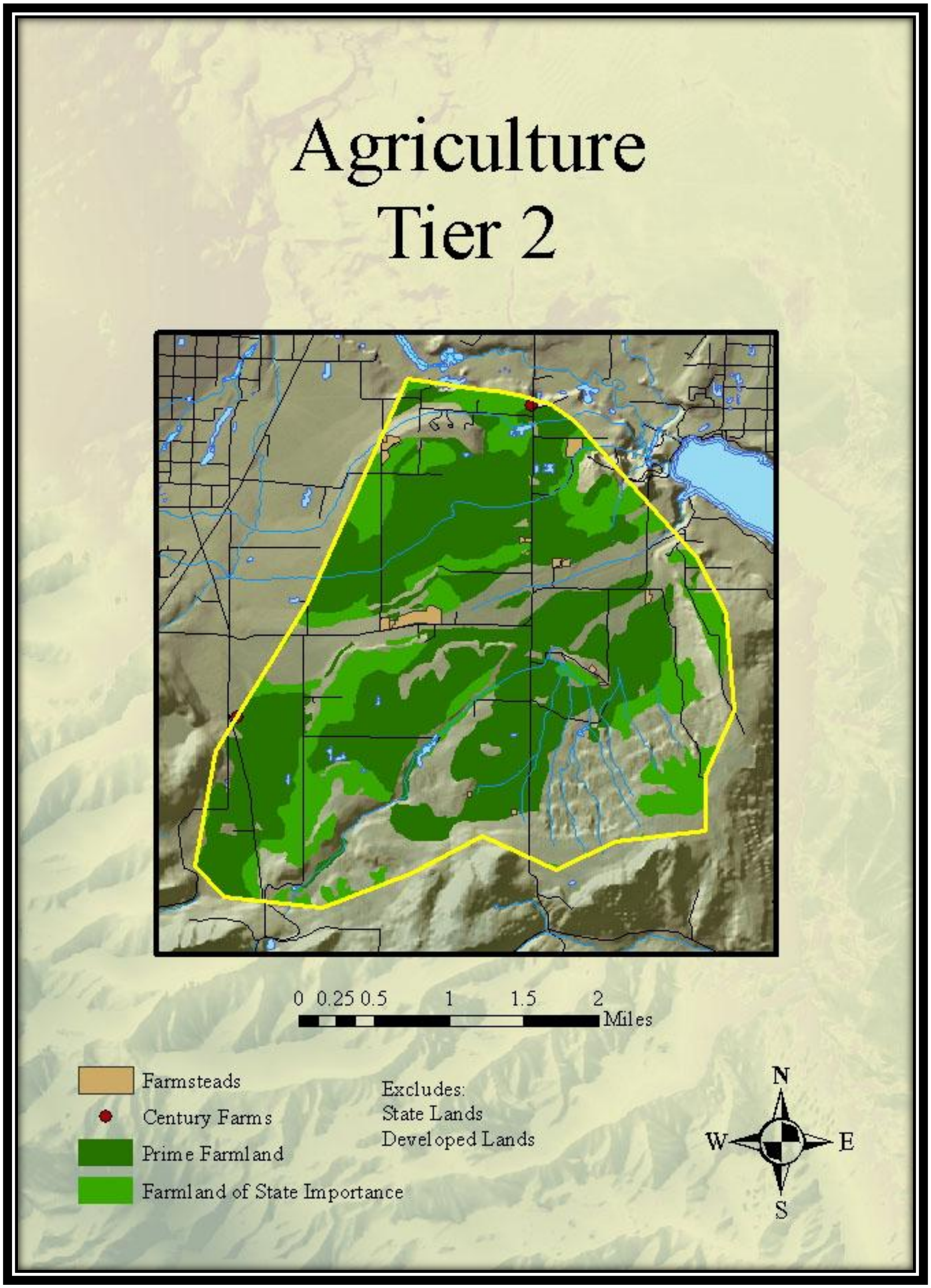

Figure 61. **Agriculture Assessment Model - Tier2.**

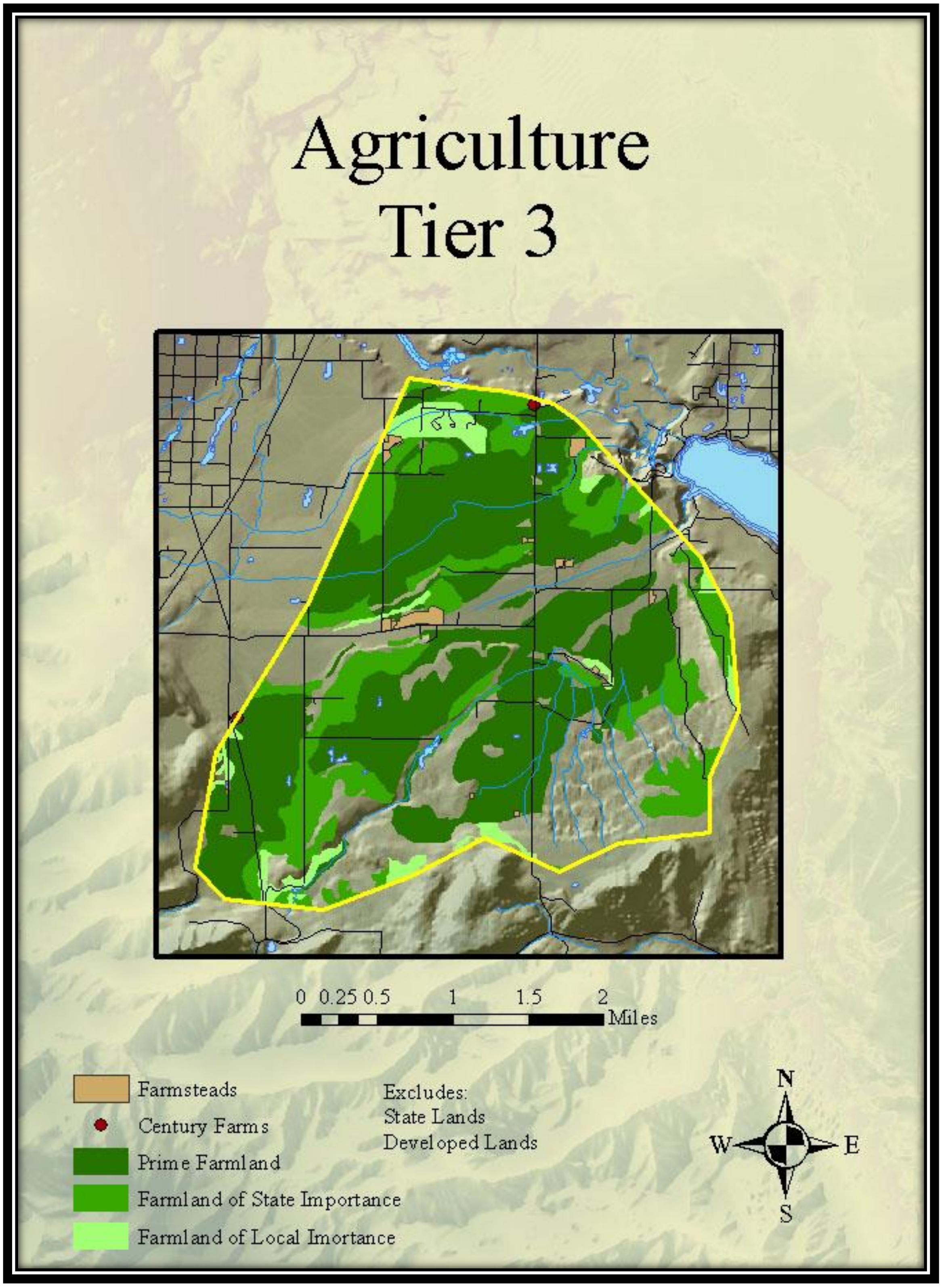

Figure 62. **Agriculture Assessment Model - Tier 3.**

Conservation Land

Similar to agriculture, natural habitat is being lost at an increasing rate due to development pressures. Development takes habitat away and fragments what is left. The conservation lands assessment model locates both terrestrial and aquatic habitats. For terrestrial habitat, the model identifies areas where individual species' habitats overlap with that of other species. The species used for the analysis included black bear, chukar, elk, Hungarian partridge, moose, mule deer, ring-necked pheasant, and sharp-tailed grouse. These species were selected based on their importance to the state's recreation (Toth et al., 2007). Wetlands and streams provide aquatic habitat, making the preservation of water bodies essential. Various recreational activities rely on these lands; hunting, fishing, and wildlife viewing are very popular in this area. Sound management practices, including habitat preservation, will help keep these activities available for generations to come.

Tier 1 contains important wildlife habitat. By overlaying each species' habitat, areas where six or more species exist were identified. The total area where six or more species exist covers 609 acres. This model also aims at protecting the fish, plants, and other species that rely on water sources. Wetlands and streams are protected, along with a 100-meter buffer to include riparian zones surrounding the water bodies, totaling approximately 2,000 acres. The 100-meter buffer was selected based on a previous study looking at potential sites for ecological villages (Aranon, Sinha, & Wall, n.d.). This model also protects state lands, which accounts for 17 acres. In this study site, all state lands are part of Hyrum State Park (see Figure 63).

Tier 2 contains all the elements in Tier 1 and extends the area of wildlife habitat. By identifying areas where four or more species exist, this model adds an additional 3,299 acres (see Figure 64).

Tier 3 contains all the elements in Tier 2 and extends the area of wildlife habitat. This tier identifies wildlife habitat where three or more species exist, adding an additional 974 acres (see Figure 65).

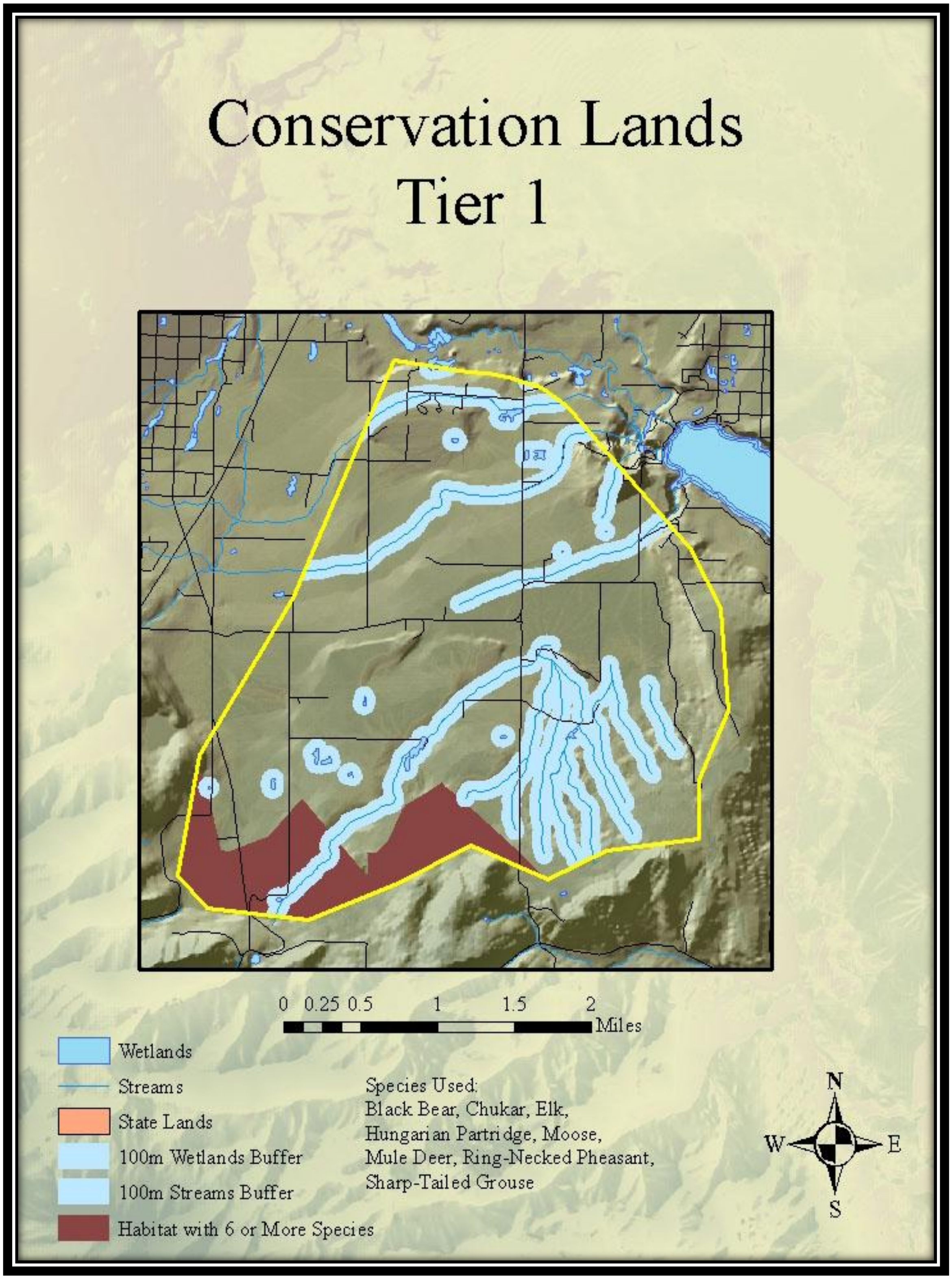

Figure 63. **Conservation Lands Assessment Model - Tier 1.**

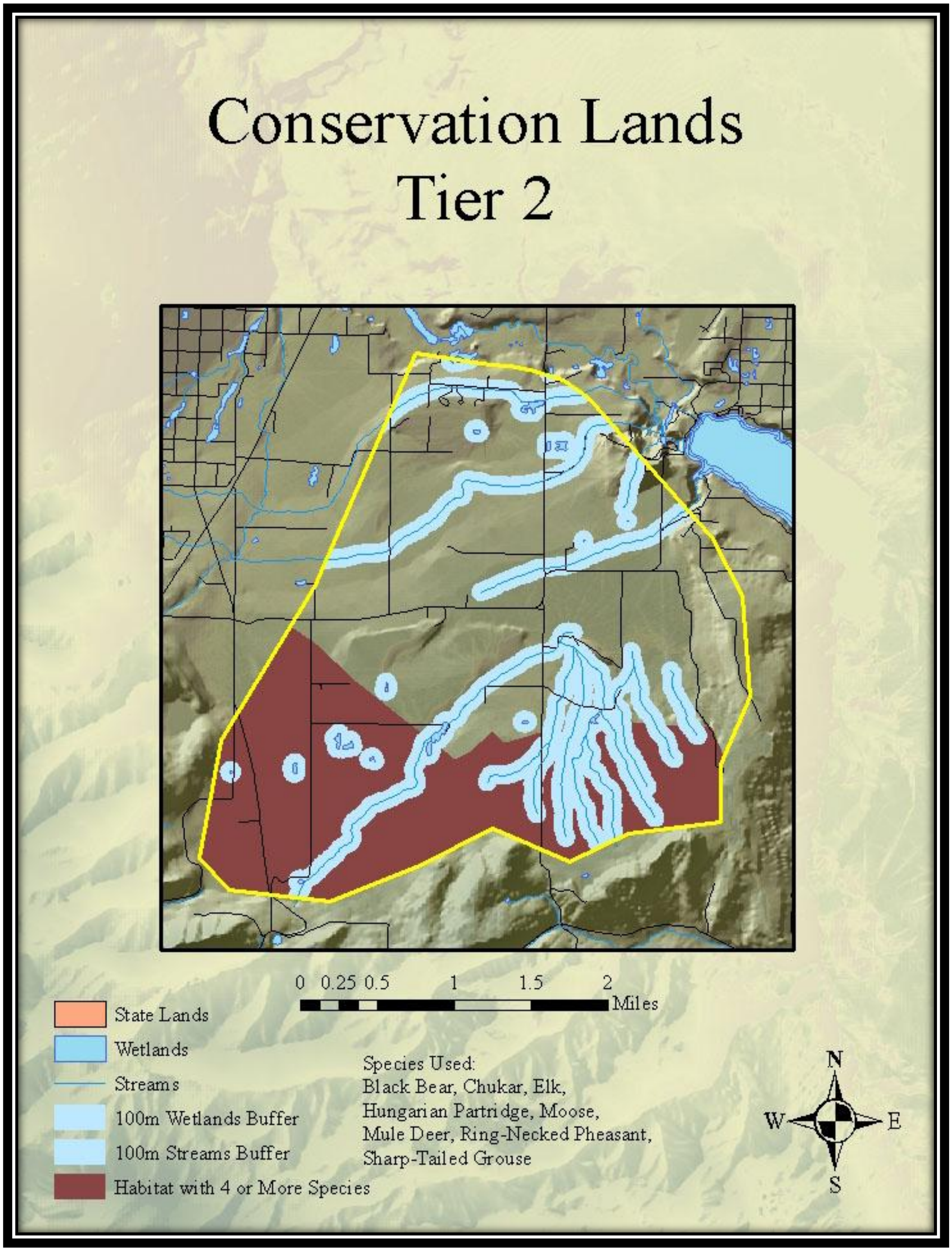

Figure 64. **Conservation Lands Assessment Model - Tier 2.**

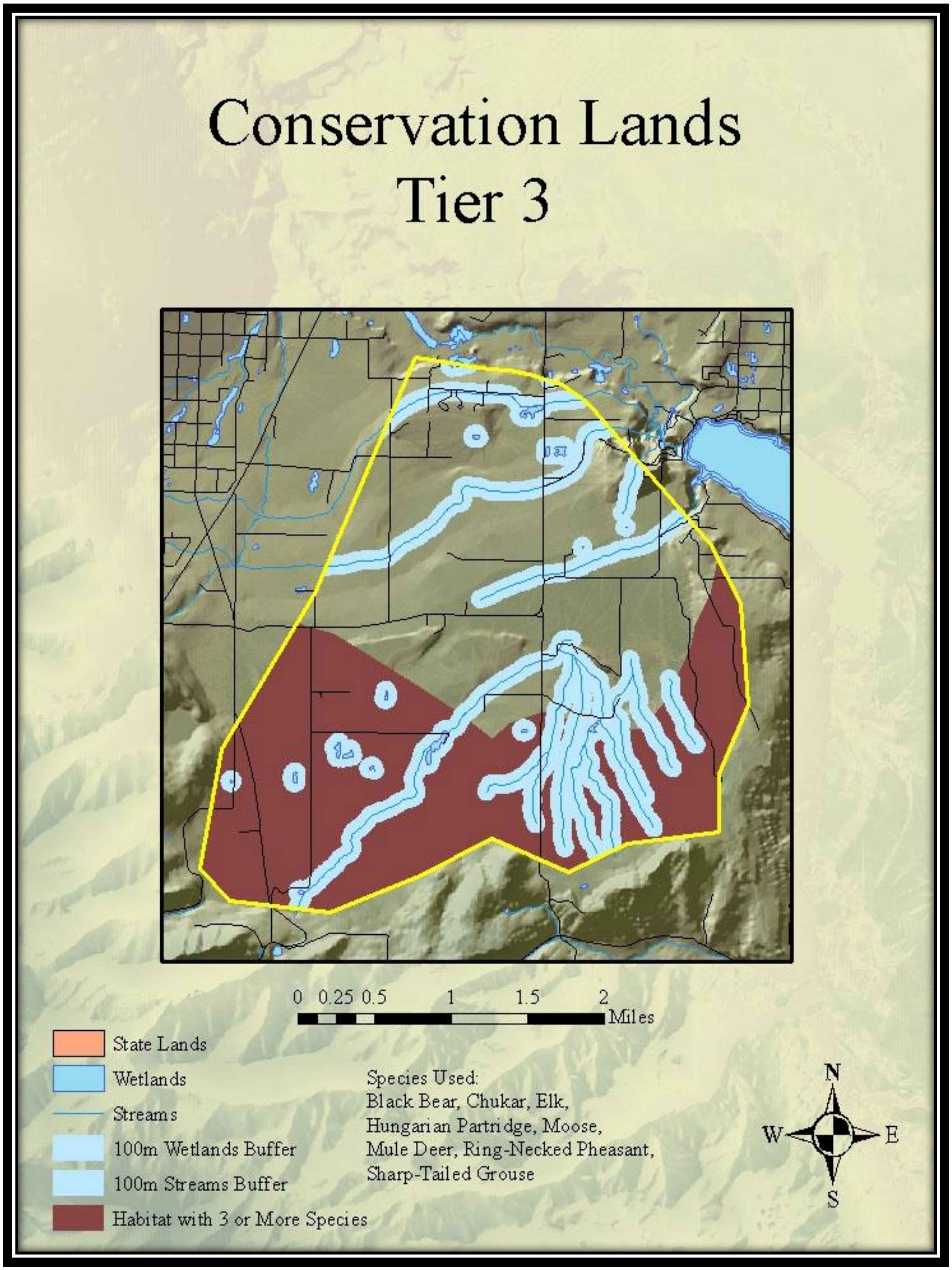

Figure 65. **Conservation Lands Assessment Model - Tier 3.**

Potential Building Sites

Population growth demands more space for development. The goal is to locate an area where 3,000 people can reside along with needed schools, businesses, office space, and other service buildings. The potential building sites model depicts areas suitable for development. A number of factors went into identifying these sites.

In this model, the individual components in the criteria were given the same value; no single element was regarded more worthy than another. The assessment model then adds the suitable qualities. As each element overlaps, the site value keeps increasing by a value of one, meaning that a higher value is more desirable for building. Areas regarded unsuitable for development were removed from the potential sites.

Tier 1 contains sites suitable for dwellings with or without basements that have no limitations imposed on them. Areas within 400-meters of existing roads were also included to reduce additional infrastructure costs. Areas within 200-meters of existing structures were identified to keep buildings closer together, thus decreasing infrastructure costs and damage to surrounding agricultural and conservation lands. Sites that contained a fair amount of sand to be used for on-site construction were also identified. Soils that were not hydric were included to avoid any flooding or other potential hazards resulting from areas that consistently hold water in the upper layer of soil. The model excludes areas believed to be unacceptable for potential buildings sites. In an effort to construct buildings to take advantage of passive solar, this model excludes areas that have aspects of northeast or northwest. Areas posing landslide risks were also eliminated from potential building sites. This model also excludes state lands, streams, and wetlands. A 100-meter buffer surrounds the water bodies in an effort for buildings to have minimal impacts on water quality, along with the animals and plants that thrive there (see Figure 66).

Tier 2 contains all the elements in Tier 1 plus some additional elements. The area surrounding existing structures was expanded to include areas within 400-meters of existing structures. This tier adds areas without a limitation on paths and trails since ecovillages encourage the use of non-motorized travel. This tier adds soils that have some limitations to local roads and streets in an effort to identify areas that may be possible for new roads. Tier 2 excludes for its model all the components listed in Tier 1 (see Figure 67).

Tier 3 contains all the same elements in Tier 2 plus a few more components. Dwellings with or without basements, along with paths and trails that are somewhat limited, were included. This tier also adds partially hydric soils. Tier 3 does not exclude areas with northeast or northwest aspects; it includes areas regardless of aspect (see Figure 68).

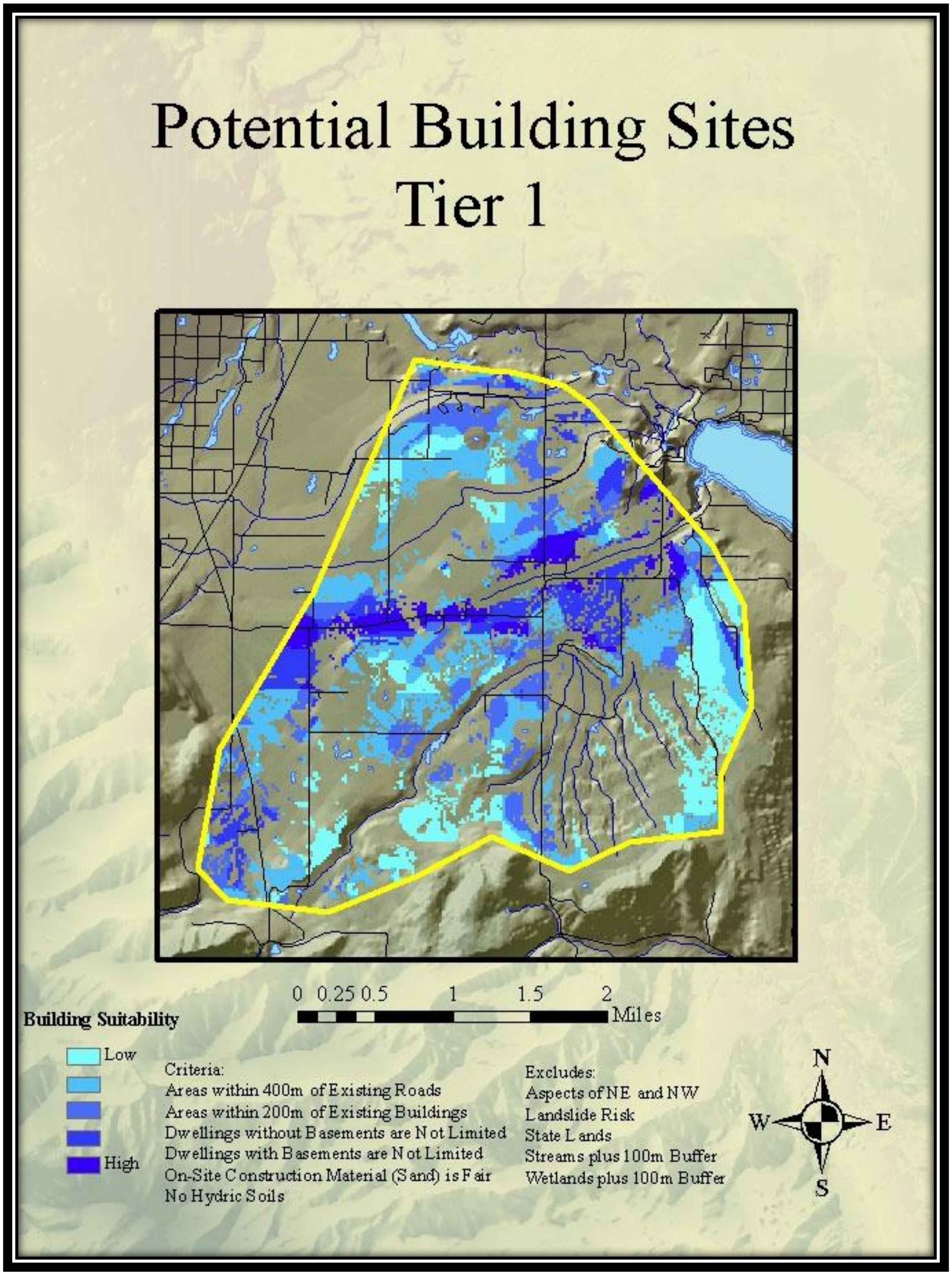

Figure 66. **Potential Building Site Assessment Model - Tier 1.**

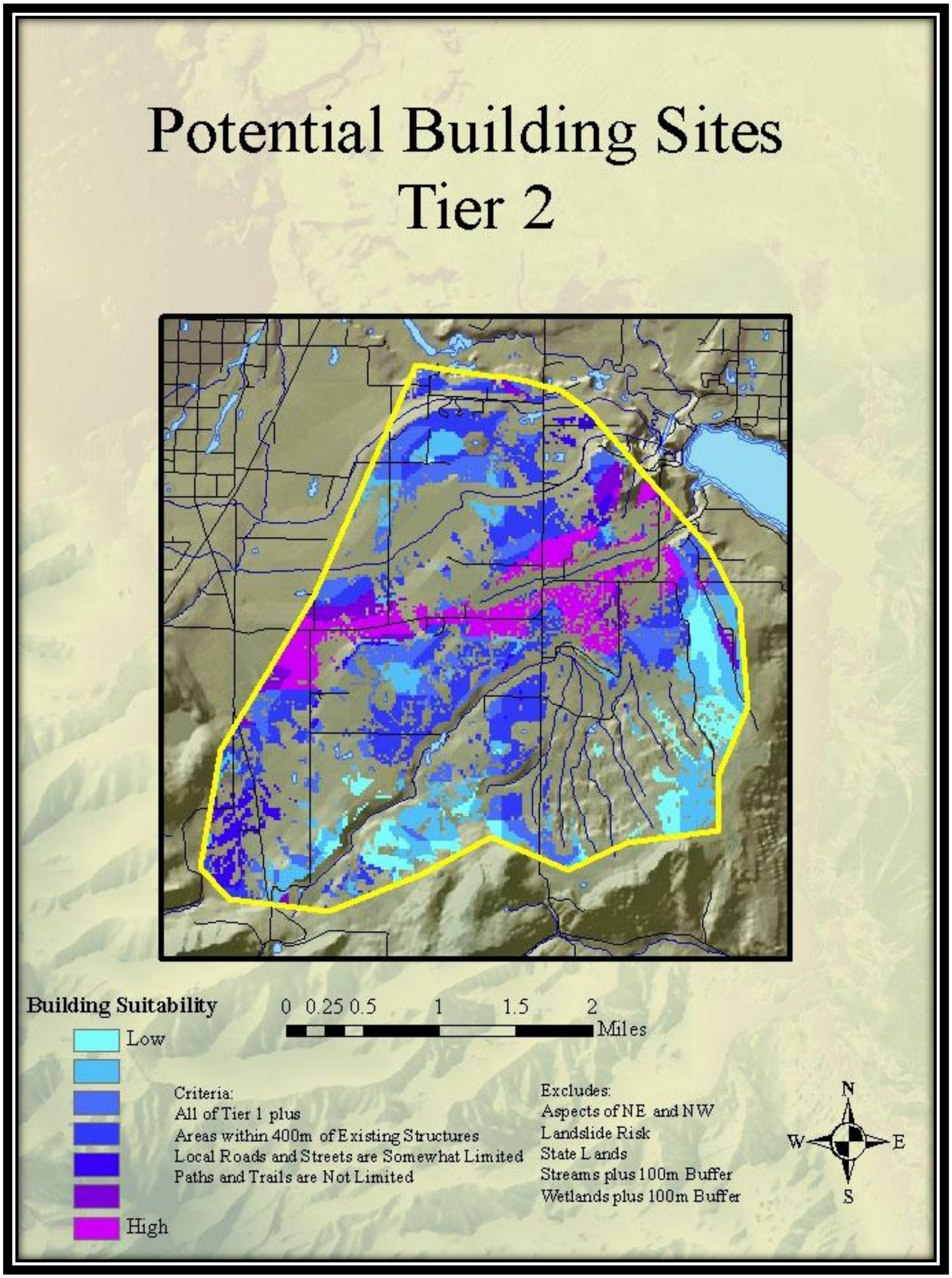

Figure 67. **Potential Building Sites Assessment Model - Tier 2.**

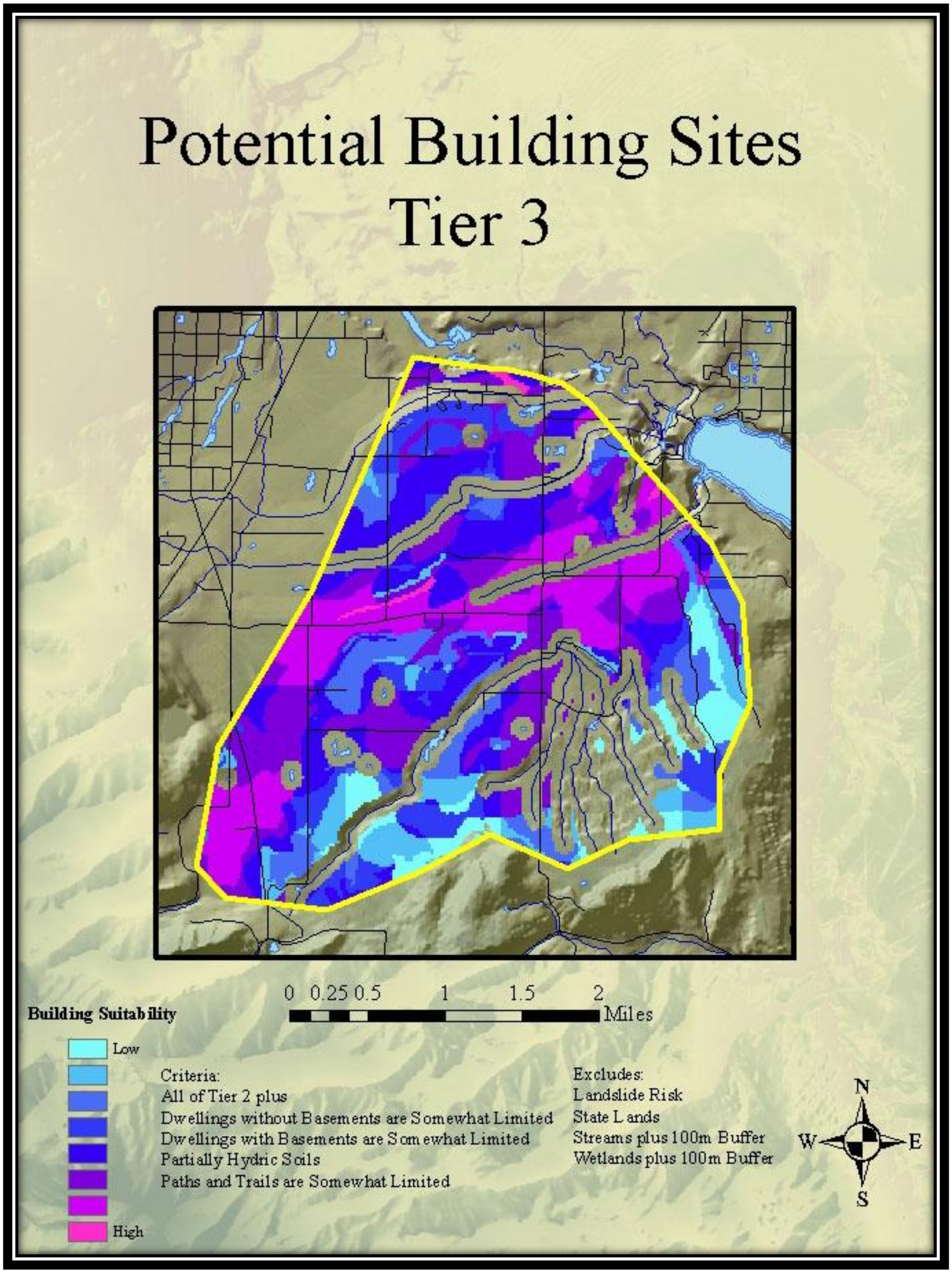

Figure 68. **Potential Building Sites Assessment Model - Tier 3.**

Assessment Model Summary

Agricultural lands, potential building sites, and conservation lands all exist within this study site. The assessment models clearly show some main themes within the study region. Themes include:

1. Agriculture nearly dominates the entire study site with the exception of the southern edge and developed lands.
2. In the Conservation Lands model, wildlife habitat prevails in the southern portion of the study region, which is not developed and has minimal agriculture.
3. The best Potential Building Sites occur along main roads where most of the existing structures exist.

These themes lay the foundation for an ecovillage layout, identifying zones for agriculture, nature preserves, and development. To make sure the models were accurate, a visual assessment confirmed site-specific similarities (see Figure 69 andFigure *70*).

Since development of an ecovillage is the main focus, further analysis on potential building sites reveals ecovillage site suitability. Using GIS, areas were identified where only potential building sites exist, reducing conflicts between development, agriculture, and/or conservation lands. To do this, a tier from the potential building sites assessment model served as the base. Then areas identified as being

	Tier 1		Tier 2		Tier 3	
	Acres	% of Total	Acres	% of Total	Acres	% of Total
Agricultural Lands	2416	45%	4125	76%	4600	85%
Conservation Lands	2344	43%	3349	62%	3727	69%

Table 3. Size of agriculture lands and conservation lands within the study site. Note: Percent of total refers to the percent of the study area.

suitable for agriculture and/or conservation lands were extracted from the potential building sites. The resulting map identifies those areas where conflict with potential building sites does not exist (see Figure 71 and 72).

Since much of the New Town site has conflicting land use suitability, ecovillage placement was not exclusive to those areas where only potential building sites exist. Ecovillages often include conservation lands and agricultural lands. The idea is to cluster development within an ecovillage in order to preserve its agricultural lands and conservation lands. Therefore, some overlap of suitable land uses or land uses that embrace the existing physical characteristics is acceptable. Other factors such as proximity to the main road, Mount Sterling Road, and proximity to an existing public bus route, were also taken into consideration for the ecovillage layout.

***Figure 69.* Housing found in sites suitable for development.**

***Figure 70.* Conservation lands with agriculture in the foreground.**

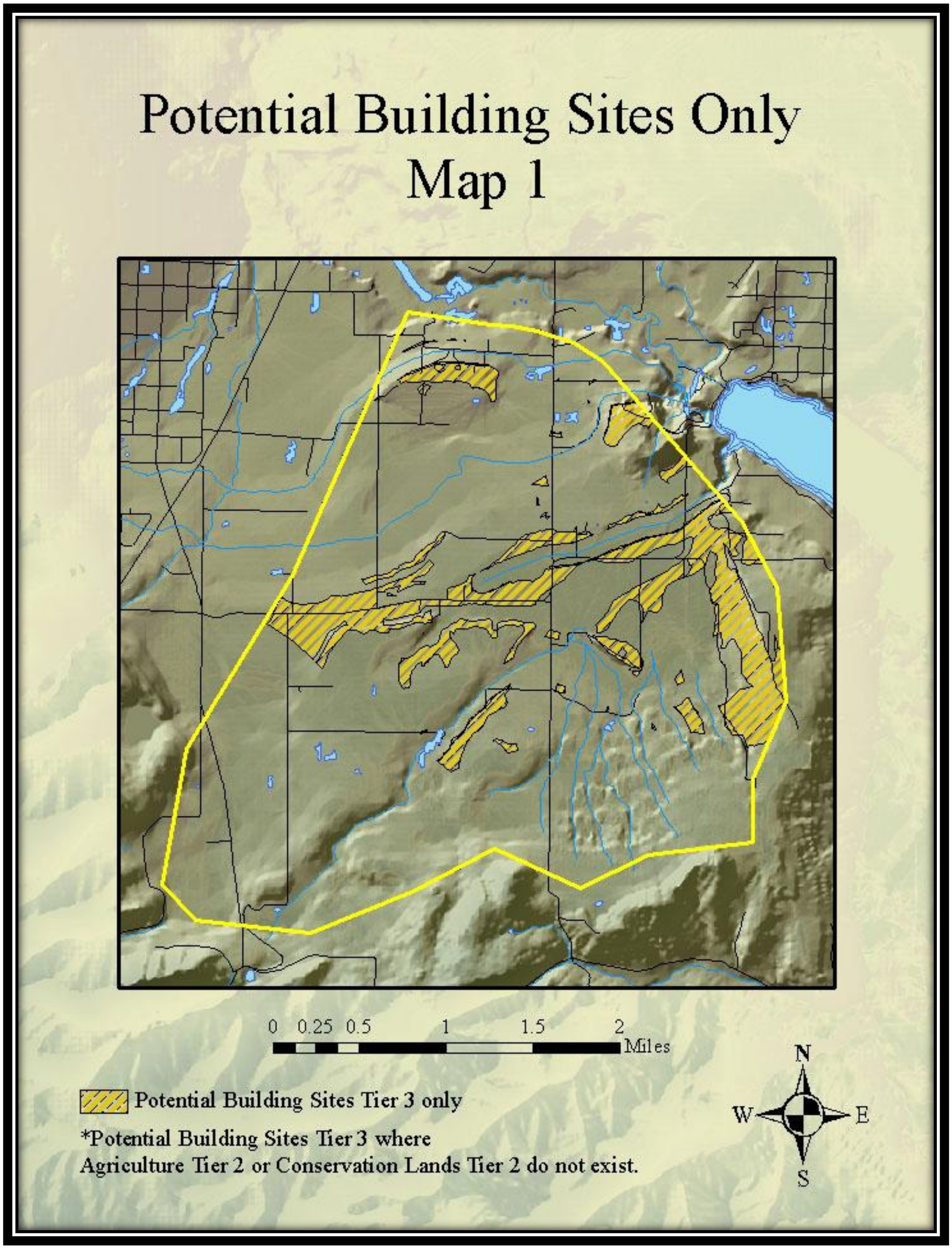

Figure 71. **Potential building sites only – Map 1. Potential Building Sites Tier 3 where Agriculture Tier 2 or Conservation Lands Tier 2 do not exist.**

Figure 72. **Potential Building Sites only – Map 2. Potential Building Sites Tier 2 where Agriculture Tier 2 or Conservation Lands Tier 1 do not exist.**

Results

Two different layouts are presented as possible options for the South Cache Ecovillage. Similar to Auroville in India, both options use the idea of clustering separate ecovillages to accommodate a larger population. South Cache Ecovillage is comprised of five separate ecovillages, ranging in different sizes. Both layouts contain an ecovillage that serves as a learning center in the same location. The South Cache Ecovillage Learning Center offers a place where students and interns can learn about ecovillages and participate in building and maintaining it. The difference between layouts is in the placement of the individual ecovillages, excluding the learning center. The first option includes the other four ecovillages located around a central district, and the second option allows some distance between the individual ecovillages while clustering them in a general area within the study site.

Learning Center

The South Cache Ecovillage Learning Center is located close to Highway 89/91. It is 133 acres in size and houses about 200 people, mainly students and interns, in a mix of two-bedroom and studio-type units. The Common House provides the main functions of everyday living such as eating, showering, and socializing. A welcome center allows the public to learn more about the ecovillage. The learning center encourages a simpler way of living to meet the goals for a highly sustainable community. To accomplish this, various tactics include:

- Straw bale and cordwood, utilizing two natural building techniques suitable for this area based on available materials and climate.

- The Common House offers a place to cook meals, shower, do laundry, and socialize.
- The Common House uses a Living Machine located in an adjacent greenhouse to treat wastewater.
- The Common House recycles all greywater for irrigation use on nearby gardens.
- Maintained open space provides areas for gardens, fruit trees, native plants, and livestock, allowing precipitation to re-enter the hydrologic cycle.
- Composting toilets are available in the two-bedroom units while people living in the studio units share composting toilets located throughout the community.
- Alternative energy includes the use of solar (PVs and solar hot water), geothermal (specifically the GHP and Natural Cooling System), and later biomass, which will accommodate all the ecovillages within the South Cache Ecovillage.
- Outdoor solar showers accommodate all residents in summer.
- Rainwater barrels collect water from buildings.
- Paths made of crushed stone spread throughout the ecovillage, making walking and biking the primary mode of transportation.
- For public transportation, a bus stop at the learning center connects it to Logan.
- One parking lot is located at the entrance to serve as a place for visitors and some residents to park. Gravelpave serves as the base for the parking lot.
- The learning center highly encourages recycling and composting at the community bins.

The learning center needs to connect to the adjacent Wellsville municipality to meet water needs and possible electrical and heating needs. However, this allows the ecovillage to sell back any extra renewable energy it produces. In both layouts, this learning center ecovillage makes up Phase I, allowing future ecovillage residents to see what this type of community has to offer.

Layout Options

The first layout is based on Olgyay (1963), where development is suited to the climatic region (see Appendix H). For the climatic region in this study, the layout combines four “residential colonies” surrounding a central core. Layout Option 1 contains four ecovillages surrounding the central core with the fifth ecovillage, the learning center, laying adjacent to the four (see Figure 73). All the ecovillages are adjacent to each other, preserving the agricultural lands and the conservation lands surrounding them. Each of the five ecovillages has a daycare and a community center or common house where shared meals, activities, and events take place. The central core contains: (a) a commercial area for stores and offices; (b) an administration area for a post office, administration facilities, and offices; and (c) a cultural and recreational area for an elementary school, theatre, and restaurants. Other possibilities include a resort/events center, bed and breakfast, library, place of worship, a nursery and garden center, medical clinic, and an elderly care complex.

Layout Option 2 contains five ecovillages located off the main road, Mount Sterling Road, providing quick access to Highway 89/91 or Hyrum (see Figure 74). The ecovillages are spread across the landscape with paths connecting the individual communities. Each ecovillage contains a daycare and a community center or common house where shared meals, activities, and events take place. This layout does not contain a central core, rather services and amenities are dispersed among the five ecovillages.

Ecovillages share a branch library, drug store, medical clinic, and place of worship in either their ecovillage or a neighboring ecovillage. Other possibilities include a post office, office buildings, elementary school, elderly care complex, and restaurants. Layout Option 2 contains all the same ecovillage features as Layout Option 1 except for variations in the transportation routes.

The goal of both layouts is to accommodate 3,000 people sustainably. Both layouts for the South Cache Ecovillage encompass roughly 1,700 acres (see Table 4 and *Table 5*). As mentioned previously, 200 people occupy the learning center, leaving the remaining four ecovillages to house 2,800 people. Assuming an average of 3.5 people per household, 800 units extend throughout the South Cache Ecovillage. (The average of 3.5 people per household was derived from the surrounding communities' household average size with Wellsville at 3.5 people per household and Hyrum at 3.8 people per household). Therefore, 480 single-family detached houses (60 percent), 160 row units (20 percent), and 160 apartments (20 percent) make up the ecovillages. Both layout options provide a place where people can feel included in their community while offering services and amenities of a larger city. They are not intended to be a self-sustaining community. The ecovillages need to tap into either the Wellsville or Hyrum municipalities for water and electricity. Since South Cache Ecovillage is located in Cache County, the county requires developments that are outside of city municipalities to buy appropriate easements and rights-of-way (Cache County Corp., 2010).

South Cache Ecovillage: Layout Option 1			
	Size (acres)	Population	Density (people/acre)
Ecovillage 1-1	308	700	2.3
Ecovillage 1-2	342	700	2.0
Ecovillage 1-3	372	700	1.9
Ecovillage 1-4	397	700	1.8
Learning Center	133	200	1.5
Central Core	142	n/a	n/a

Table 4. **South Cache Ecovillage: Layout Option 1 description. *Note:* Density does not depict true housing density within an ecovillage. The density includes areas where agricultural and conservation lands exist outside of compact development.**

South Cache Ecovillage: Layout Option 2			
	Size (acres)	Population	Density (people/acre)
Ecovillage 2-1	430	600	1.4
Ecovillage 2-2	336	600	1.8
Ecovillage 2-3	435	800	1.8
Ecovillage 2-4	339	800	2.4
Learning Center	133	200	1.5

Table 5. **South Cache Ecovillage: Layout Option 2 description. *Note:* Density does not depict true housing density within an ecovillage. The density includes areas where agricultural and conservation lands exist outside of compact development.**

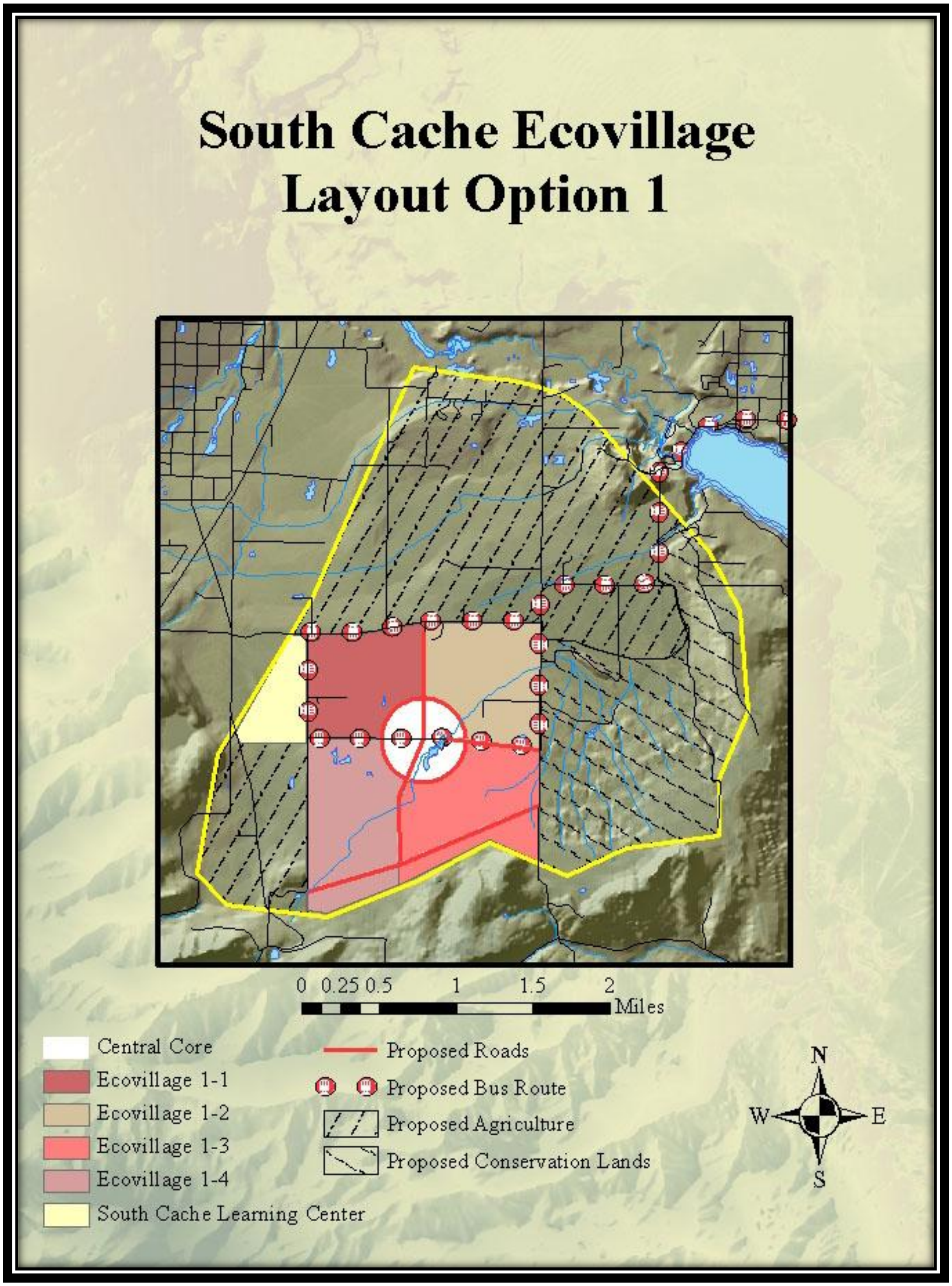

Figure 73. **South Cache Ecovillage - Layout Option 1.**

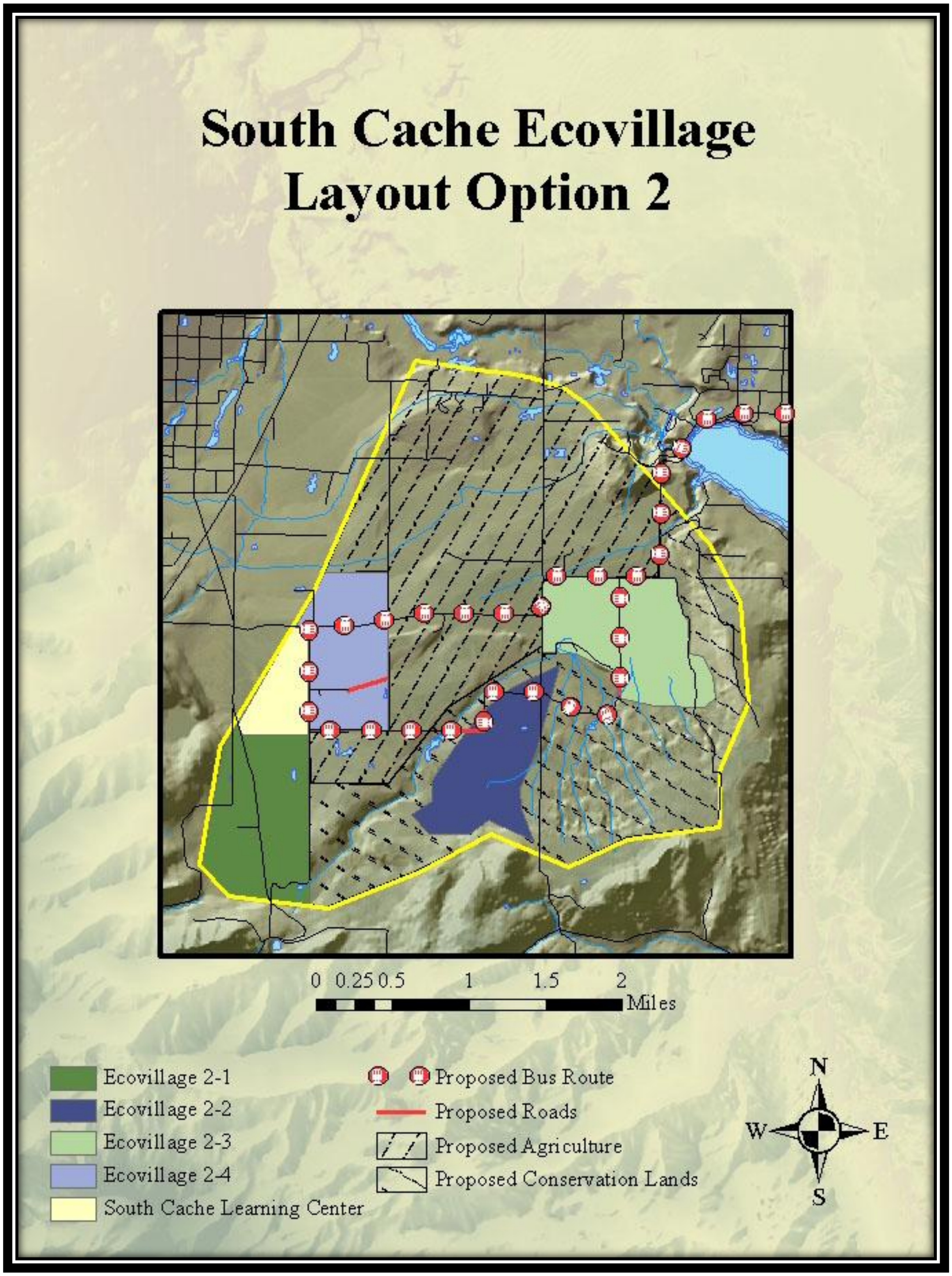

Figure 74. **South Cache Ecovillage - Layout Option 2.**

Transportation

Both layouts require additional residential roads, allowing easy access to buildings while serving as roads for emergency vehicles. Additionally, a network of paths weaves throughout the landscape. For Layout Option 1, the transportation system includes a circumferential road surrounding the central core. Traffic calming techniques keep vehicle use to a minimum. The road that surrounds the central core is narrow to keep traffic slow and minimal, and the road material consists of pervious concrete to prevent excess stormwater runoff. For Layout Option 2, a few existing roads are extended for easier access. Both layouts use pervious concrete for residential access roads and gravelpave as the base for parking lots placed on the perimeter of buildings. Other LID techniques such as bioretention and grass swales will be placed along main roads to help decrease impacts from use. Trails connecting the ecovillages, agriculture, and conservation lands are made of crushed stone found locally to withstand walkers, bikers, and golf carts. Car- and bike-sharing programs are highly suggested. Public transportation via bus offers stops throughout the South Cache Ecovillage.

Currently, a public transit bus system exists in Cache Valley, making it the project's focus for a public transportation option. The Cache Valley Transit District's mission is "to become the premier public transportation agency serving the Cache Valley Region" (Cache Valley Transit District, n.d.). Busses run throughout Cache Valley, offering fare-free travel. Expanding the public transportation system to include stops in the ecovillage would allow access to other cities and towns. Currently the Cache Valley South route provides access to the main transit center in Logan from Hyrum with stops in Nibley, Millville, Providence, and River Heights (see Appendix H). The Cache Valley

Transit Center, located in downtown Logan, is also a stopping point for the Salt Lake Express. This shuttle service offers 24/7 access to many places including Salt Lake City, Boise, West Yellowstone, and Jackson, Wyoming (Salt Lake Express, 2005).

Building Materials

Although cordwood and straw bale homes have been effectively utilized in this climate, for the purpose of this study, it is assumed that few people would be interested in living in these types of homes. The four ecovillages, excluding the learning center, utilize various mainstream methods to keep units healthy with lower energy and water usage. Also, the South Cache Ecovillage promotes the use of local products whenever possible. Methods used include:

- Metal roof
- High insulation walls and roofs using a combination of SIPS, recycled blue jeans, and spray-in foam or newspaper
- High insulation windows
- Low VOC paint
- Stucco siding
- Concrete mixed with recycled fly ash
- Recycled lumber and lumber that is FSC certified.

However, natural building materials such as straw bale or cordwood, are not completely ruled out. By building the South Cache Learning Center first, future ecovillage residents may embrace those techniques, resulting in natural building techniques throughout South Cache Ecovillage.

Water

To reduce water needs initially, water saving appliances are installed in every unit. This includes dual flush toilets, low flow showerheads, and high-efficiency washing machines. Other means to help reduce water needs include:

- Rainwater barrels collect water from the roofs of all buildings for irrigation purposes.
- Bioretention and swales pepper the landscape, controlling runoff and increasing infiltration.
- Greywater reuse systems capture, filter, and disinfect sink or shower water for use of toilet flushing.
- A Living Machine system processes waste in the elementary school.
- A sequencing batch reactor (SBR) processes all wastewater with the exception of the elementary school.
- Open space and individual yards are xeriscaped with native and drought-tolerant plants.

These methods greatly reduce water needs. However, South Cache Ecovillage residents need to be educated through information packets and informational meetings held at the Learning Center.

Alternative Energy

The South Cache Ecovillage draws on a combination of alternative energy options and various techniques that reduce energy needs. These energy saving techniques include:

- Energy efficient appliances and lighting

- Passive solar design
- Solar light tubes
- Ceiling fans

These simple methods decrease individual energy needs by utilizing simple, off-the-shelf tools.

In terms of alternative energy, the South Cache Ecovillage uses solar and geothermal. Solar energy provides the main alternative energy source, utilizing PV panels and rooftop hot water systems for heating water. Commercial buildings, the elementary school, and multi-unit complexes utilize ground source heating and cooling as the base for heating and cooling needs. Additionally, individual housing units use Jørgen Løgstrup's Natural Cooling Cabinet and Ventilation System. The ecovillage will be connected to the electricity grid when alternative energy sources cannot meet demand. This also allows the ecovillage to sell back its surplus when produced.

Open space

The South Cache Ecovillage contains open space throughout its landscape. Each individual ecovillage has open space surrounding the community center to encourage people to socialize in addition to the environmental benefits it has to offer. Housing units that are clustered together also contain open space for children to play in and families to grow gardens. Conservation lands located east of Layout Option 1 and southeast of Layout Option 2 offer learning opportunities, along with providing recreational value. Agricultural lands spread throughout the study site. These provide a place for grazing livestock, growing crops, and developing a Community Supported Agriculture system. A suggested location for a CSA in Layout Option 1 is in the SW corner of the study site;

this allows easy access for students living at the South Cache Ecovillage Learning Center. For Layout Option 2, the land between the three western communities and the two eastern communities provides suitable agricultural lands and is the suggested location for a CSA. Overall, this study site contains an abundance of suitable agricultural lands, allowing residents to grow food in various places for themselves and for profit.

Garbage

Garbage management starts at each individual household. The South Cache Ecovillage strongly emphasizes composting. Most units include an outside compost bin, while other units require residents to take organic materials to the community compost site located near the agriculture lands. Each household has a recycling bin that can be emptied at the community's recycling center, located at its central core. The ecovillage will pay the City of Logan to empty the community's recycling bins, along with garbage bins. Reusing will be a large component of waste management. A reuse site located near each ecovillages' common house or community center serves as a place where people can donate various clothing, shoes, toys, and household items, along with hazardous waste products. Hazardous waste is disposed of at the Logan City Household Hazardous Waste Facility.

Discussion

It takes a lot of dedication and persistence on behalf of the people involved to form any intentional community; an ecovillage is no exception. For this project, issues of ecovillage origin and community size were apparent from the beginning. Another potential challenge at this site deals with the number of private landowners in the area. For the majority of ecovillages, zoning and initial costs provide a major challenge.

To begin with, the origin and community size of this proposed ecovillage is unlike the typical ecovillage. People usually create ecovillages as members come together with common ideas and goals (Holman, 2002). Then they choose their land. In contrast, this is completely a student-led project; there is no actual group of people wanting to form an ecovillage. A previous land planning study chose the site based on its results. However, it has been proven that an ecovillage can be successful even if a local government or developer initially started it. For example, the municipal government in Övertorneå, Sweden wanted to attract people back to a town that lost its people to the city. The Ruskola Ekoby ecovillage was born when the local government first purchased the land, then subdivided it, and finally sold individual lots to families. The original nine households did not know each other but soon found common interests and goals between them (James & Lahti, 2004). More recently, developers or local governments have created ecovillages. Some recent examples include: (a) a 260-acre ecovillage in New York's Hudson Valley initiated by TechCity Properties (TechCity Properties, Inc., 2009); (b) the Maharashtra Government's proposed ecovillage in Mumbai, India (Press Trust of India, 2010); and (c) the Utah Valley Commons south of Salt Lake City, Utah (Nuckolls, 2009).

Next, the South Cache Ecovillage plans to accommodate 3,000 people. This is an enormous challenge. It is unclear whether an ecovillage of this size will succeed or not. Ecovillages generally have an upper limit of 500 people with some less than 100 people (Gilman, 1991). Nevertheless, Auroville, India, has 2,160 residents (Auroville Foundation, 2004). Instead of one ecovillage by itself, residents live in a cluster of ecovillages with the hope of becoming a city comprised of many ecovillages totaling 50,000 residents (Dawson, 2006a; Mueller, 2002). In addition, a few ecovillages roughly the size of the proposed South Cache Ecovillage are currently in development. For example, Cerro Gordo Ecovillage in Cottage Grove, Oregon, encompasses 1,200-acres and will have capacity for 2,500 people (Canfield, 1992; Urban Ecology, 1990).

There is the potential that various landowners might fight the development of this ecovillage. This is common for many ecovillages as they begin. People oftentimes have the NIMBY (not in my backyard) syndrome. For this location, resistance might be higher than normal. Through many visual assessments of the area, many large, upscale houses are scattered throughout the landscape, and parcel data show roughly 300 separate parcels make up the New Town site. As the results show, the South Cache Ecovillage does not encompass the entire New Town as defined by *CV 2030.* Therefore, it is not important to buy up the entire study site for the South Cache Ecovillage. The northern section consists of highly productive agricultural lands. This area enhances the sustainability of the region by providing agriculture and open space and should be protected from further development.

Zoning issues and current building and health codes stop many ecovillages from developing or using the most sustainable ecovillage features. Cities, towns, and counties have legitimate reasons for zoning. For instance, an increase in density may overwhelm the area's school, fire, and police services. Changing a zoning classification for an area does not come easy. This study area is zoned for agriculture, causing a future hurdle. Natural building techniques, such as straw bale and cordwood, are often illegal since most places do not deal with them or have the specifications for these techniques. In many locations, health codes also prevent using greywater recycling systems and/or alternative wastewater treatment options (Christian, 2002).

Another big challenge occurs when the initial costs accrue from purchasing the land and providing needed infrastructure. It takes a great deal of private investments on behalf of the members. Ecovillages also need to decide if they will function as a non-profit or for-profit corporation. Another decisions ecovillage members need to make is how to own shared property; options include homeowners associations, condominium associations, and cooperatives.

The ecovillage features described here only touch on a fraction of available options. In addition, the social aspects play a huge factor in ecovillage living and were only touched on briefly.

Conclusion

Ecovillages could be the new "golden ticket." These communities prove living with and on less can be very rewarding. Worldwide, ecovillages are arising in all places, including urban and rural as well as in developing and developed countries. Ecovillages strive to maintain a balance between the land and its people by using the best practices of land preservation, agriculture, green building, and renewable energy while maintaining a strong community. Benefits include ecological, social, and economic sustainability.

This project attempts to plan an ecovillage in the site identified in a previous study, *Cache Valley 2030—The Future Explored* (Toth et al., 2006). The site of the proposed "New Town" offers an abundance of prime agricultural lands. Clustering homes together within an ecovillage allows for greater preservation of these valuable lands. Five separate ecovillages make up the South Cache Ecovillage with plans to house 3,000 individuals. This project shows that it can be done with room to spare. Two layout options provide different opportunities for the South Cache Ecovillage. Layout Option 1 centers all five communities within the study site, allowing for the individual ecovillage to share resources and services. Layout Option 2 spreads the five individual ecovillages throughout the study site; this layout helps maintain the rural feel of this landscape in Cache County, Utah. Different ecovillage features were selected with the idea of starting with more low technology options and a few high technology options. A move to more high technology options can happen over time, but may be more costly.

Local foods, jobs, schools, and other services provide a place where Cache Valley residents can live and prosper. This is not a new concept. During the late 1800s, communities started by members of the Church of Jesus Christ of Latter-day Saints strove to maintain complete sustainability. Some United Orders proved successful by sharing resources and living on less; they did this while experiencing the benefits of community living.

As each day goes by, it becomes more and more apparent that change needs to happen. “The planning field is well suited to help reform self-serving, unsustainable behavior, as it represents the local part of thinking globally and acting locally” (Berke, 2008, p. 402). Ecovillages focus on local sustainability while remembering the larger picture. These communities provide an alternative way of living while compromising little. Ecovillages focus on sustainability for their residents and the land for generations to come.

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Appendix A—Alternative Futures Defined

This definition for *Alternative Futures* came from a handout by Richard E. Toth (Toth R. E., RE: Alternative Futures, 2008).

RE: Alternative Futures

The fundamental conceptual approach in alternative futures planning includes two important planning activities. They are: 1)the establishment of assessment models and 2) the development of alternative scenarios. The assessment issues are determined through stakeholder meetings, public surveys and scoping sessions. These biophysical and cultural issues are further researched in order to understand their various attributes and to identify what data are needed in order to construct assessment models representing their description. There are two basic types of assessment models: environmental and land use. The assessment models can be used for the evaluation of any plan or scenario.

The alternative futures also have a similar point of origin as the assessment models in their identification and description. They may represent areas of interests in either the environmental or land use realm. It should be clear that the futures may be constructed from both environmental and land use areas. In all cases the researchers provide an array of 3-6 futures in order to provide a spread of development opportunities ranging from those which may be reasonably permissive to those which are more restrictive in their scope and content.

The various futures are then compared with the assessment models in order to gage their performance in meeting the issues identified earlier. It is the most fundamental means to determine which of the futures are more appropriate than others. Additional and more detailed modeling techniques can be enjoined at the assessment and/or the futures levels so that in the study area the potential for addressing special needs or sensitivities can be addressed. The versatility and adaptive capacity of alternative futures modeling represents an effective decision-making planning strategy.

R.E.T./ 26 March '08

Appendix B—GIS data references

Computer Software

Environmental Systems Research Institute (ESRI) Arc GIS version 9.3

Map Projection Data

Projected Coordinate System: NAD 1983 UTM Zone 12 North

Projection: Transverse Mercator

Geographic Coordinate System: GCS_North_American_1983

Datum: D_North_American_1983

Grid Data Resolution: 10-meters

Primary Scale: 1:24,000

Primary Data Sources

Utah Automated Geographic Reference Center (AGRC)

http://agrc.its.state.ut.us/

Soil Survey Geographic (SSURGO) database by the Natural Resource Conservation Service

http://soils.usda.gov/survey/geography/ssurgo/

Appendix C—Wasatch Commons' Green Features

* Handout received on August 2, 2009 from Wasatch Commons.

"Green" Features at Wasatch Commons Cohousing

- Unit and Site Design and Construction
  - Passive Solar (engineered overhangs, slab-on grade heat sink, heat chimney/ clerestory windows, south side window glazing maximized, cross-ventilation)
  - Double paned low-E casement and awning windows only
  - Interior windows in clerestory stairwell for increased natural light and cross-ventilation, optional clerestory fans
  - Extra ceiling (R-44) and wall (R-24) insulation
  - Clustered development and parking areas in order to minimize hard scape and help mitigate urban heat, preserve existing shade trees and other natural features, vegetation and wildlife, and make pedestrian and child friendly
  - On-site collection of storm water allowing for ground water recharging
  - Use of traditional stucco and pale wall and roof colors for sun/heat reflection
  - Extensive common facilities allowing for smaller individual unit sizing
  - Chemical, light and noise pollution control (no CCA-treated lumber, natural rodent and pest control, downward directed hooded lampposts, quiet appliances)

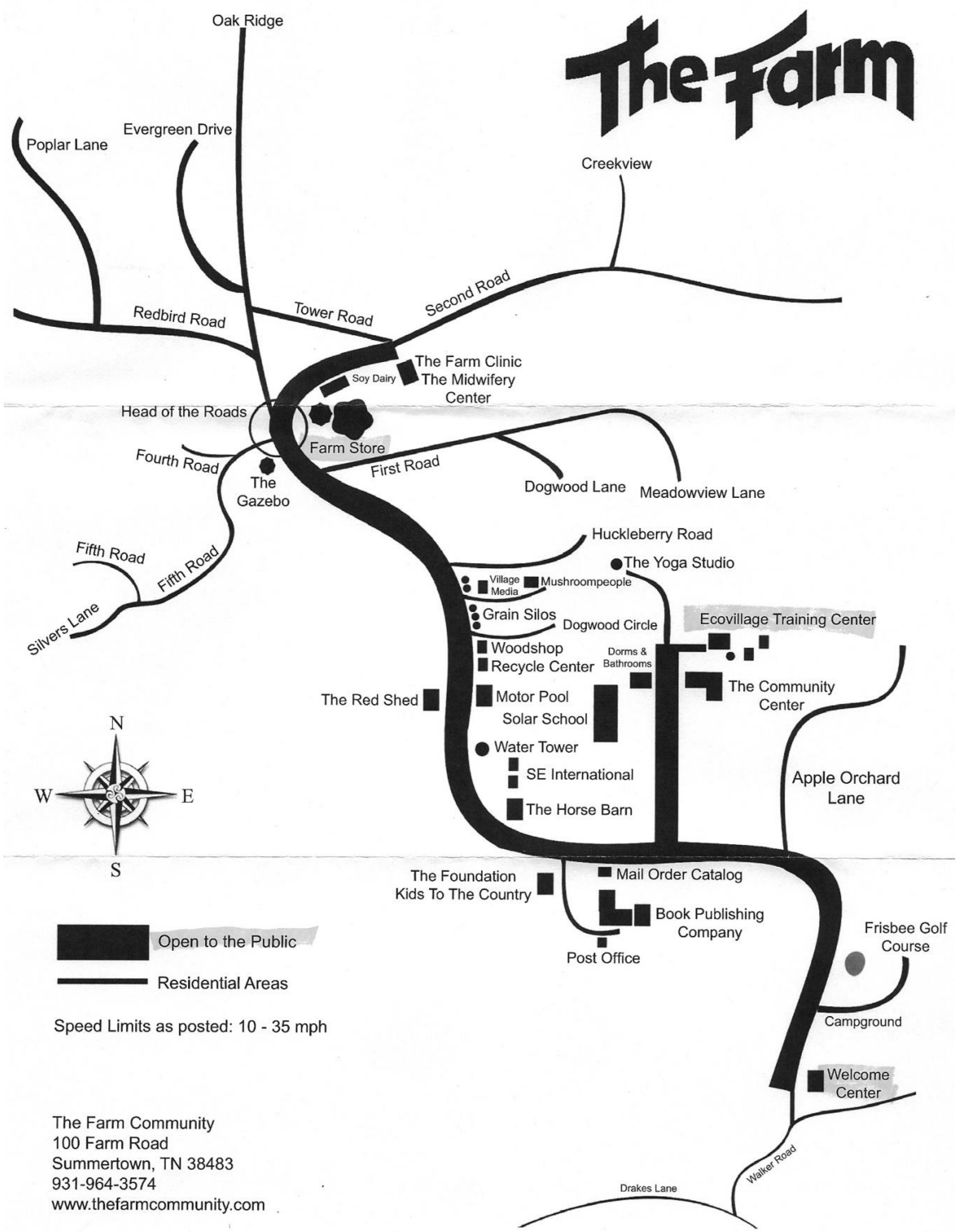
- Resource Use Reduction and Efficiency
  - Use of recycled, scrap and waste materials (tressle wood, playground structures and areas, storage units, garden beds, landscaping, soil amends, grassy pavers)
  - Structural insulated panel (SIP/R-Control Panel) construction
  - Radiant heat option combined within single domestic hot water appliance
  - Location appropriate landscaping (xeriscaping, min. grass, drip irrigation)
  - Evaporative cooling, gas appliances, front loading washers, low flush toilets
  - Floodlight motion sensors

- Community Based Sharing of Resources
  - Common House (guest rooms, laundry facilities including outdoor clothes line, kids room, library, sewing room, various other gathering and use spaces)
  - Workshop (work, landscaping, and garden tools, equipment and materials; car repairs, build and/or repair projects)
  - Shared child care and shut-in care
  - Exercise and music room and equipment, outdoor and recreational equipment
  - Car pooling
  - Shared vegetable and herb garden and orchard space and produce
  - Variously shared internet access
  - Recycling center

- Other Group and/or Individual Initiatives
  - Programmable thermostats, tree and vine plantings to shade stucco and/or roofing
  - Various food and garden co-operatives
  - Composting, rain collection barrels
  - Purchase of wind power blocks
  - Use of wood composites and other alternative building materials (e.g., Trax, cork)

Appendix D—Map of The Farm in Summertown, TN.

(Received while visiting October 3, 2009)



Appendix E—Interview Questions

1. Could you please give a brief description of your ecovillage such as size, location, nearest large city, and climate?
2. What is your ecovillage comprised of (i.e., organic farms, protected lands, housing, community buildings, etc.)?
3. What is the makeup of people such as age, gender, race, and religion?
4. What are the goals and objectives for your ecovillage?
5. How does your ecovillage differ from the typical housing development?
6. Does your ecovillage have any standout features? (i.e., alternative energies, recycled building materials, etc.)
7. Did you use any building materials from the site?
8. What was involved in the site selection?
9. Where did the money come from to pay for the site?
10. Do you provide different housing options for people of varying economic levels?
11. What do you view as the main reason people choose to live in your ecovillage?
12. Why do you live here?
13. What do you think makes your ecovillage successful?
14. How do you think the people benefit? Economic benefits? Social benefits?
15. How do the surrounding communities benefit?
16. How does the ecological community benefit?
17. What have been some challenges for (a) you and (b) your community?
18. What have been some failures, if any?
19. Do you have a high turnover rate?
20. Do you have anything else to add?

Appendix F—Interview Notes

*****Off topic conversations during the interviews were not included in this text.

Interview with Vickie Montagne—2 October 2009

Vickie has been a Farm community member since 1977 in Tennessee and currently works in the welcome center.

1. Could you please give a brief description of your ecovillage such as size, location, nearest large city, and climate?
   Since 1972 it has been 1,750 acres and has been the same. One of the non-profit organizations has land next door, and that is 1,100 acres.

2. What is your ecovillage comprised of (i.e., organic farms, protected lands, housing, community buildings, etc.)?
   Inside The Farm we have protected lands. North of one creek, it is protected and west. No we don't [currently do organic farming]. Back before 1985 we did some.

3. What is the makeup of people such as age, gender, race, and religion?
   103 adults over 18, 8 seniors; and 1-parents living with us.

4. What are the goals and objectives for your ecovillage?
   We are into a lot of different things. There are the non-profits, the ecovillage, Plenty International, the midwives, Swan Conservation Trust, Kids To The Country, and so different people in the community participate in those projects. Our goal is to take care of the land. Manifest is our work. Manifesting positive businesses and doing projects together.

5. How does your ecovillage differ from the typical housing development?
   We are like an extended family. We got a lot of history together.

6. Does your ecovillage have any standout features? (i.e., alternative energies, recycled building materials, etc.)
   High percentage of our housing is built with recycled material—like the solar school, community center, the main old building of the ecovillage, [the dorms], and a lot of our houses are.

7. Did you use any building materials from the site?
   No…I don't think so. The ecovillage has some places.

~~8. What was involved in the site selection?~~ (Question not asked)

9. Where did the money come from to pay for the site?

The first 1000 acres, we went to the bank. The person that owned the land signed the loan with us. It was the largest loan the bank had done in '71. We just pulled our money together and started working on our payments.

10. Do you provide different housing options for people of varying economic levels?
    No, we are working on it though.

11. What do you view as the main reason people choose to live in your ecovillage?
    To get to live in community.

12. Why do you live here?
    Living in community with like-minded people and all the different things that are going on here.

13. What do you think makes your ecovillage successful?
    That we have all different types of businesses and projects going on here.

14. How do you think the people benefit?
    Having extended family around here. Living in the country.

15. How do the surrounding communities benefit?
    Yes, we bring a lot of tourist dollars into the area. We pay taxes. We do shopping out there.

16. How does the ecological community benefit?
    We do not clear-cut. We do not hunt. We don't use poisons on the land. There is woods all around the house to keep the land cooler and help the wildlife around here.

17. What have been some challenges for (a) you and (b) your community?
    There are always different challenges that come along, and we learn from them. We share in them at times and help each other through them and figure things out together.

18. What have been some failures, if any?
    Of course so [there has been failures]. We are human. Back in the '70s and '80s, the farmers did different projects. At times, they did good and at times they didn't. Probably books the book publishing did that thought they would do good but didn't do good. There is different things our businesses did that have worked out and haven't worked out.

19. Do you have a high turnover rate?
    No, majority of us are here. This is home.

20. Do you have anything else to add?

I have seen lots of changes over there. A lot of positive changes: land is ours, businesses are doing good, we share in the cycle of life with the family. The wildlife is really beautiful.

Interview with Albert Bates—4 October 2009

Albert has been a Farm member in Tennessee since 1972 and has been involved in the Institute for Appropriate Technology, The Ecovillage Training Center at The Farm, and the Global Ecovillage Network.

1. Could you please give a brief description of your ecovillage such as size, location, nearest large city, and climate?

   The farm landed in the area in 1971, spring. The fall of that year and into the winter, they moved into this land, and that was in spring 1972. We have things in several different compartmentalized land holdings. The original acquisition was 1050 acres in 1971. Then there was a 2nd acquisition of a 700+ in 1972. That is how it remained for about 20 years.

   In the early '90s we started acquiring land for conservation easements—buying land from the surround forest companies that were logging. We were trying to buy land from them but only after they logged, would they sell. Then we got the 1st continuous piece which was 400 acres that was through a subscription deal. The subscription was that if you paid $400, you could liberate 1-acre. So we put that out to old friends and relations and anyone who lived here. We set up a corporation called *The Farm Net Corporation* to gather in these subscriptions and we raised $400,000 in 5-months and bought that piece which is now called Highland Woods. There is different ways that it was pieced together and at the last minute because we had a deadline. Some of that had to be turned into roadside housing and sold off as individual lots but still intact as 800- some acres. That is a conservation easement around the farm. That is a riparian area where the creek flows out of the farm and also very prone to damage because the soil is highly erosive and mis-managed and overgrazed over the years. That is going back into deep forest land.

   After that we created the Swan Trust, which was designed as a 501(c)3 to get donations and grants. Once we got that we could get also get matching funds from the Nature Conservancy and others to continue acquiring land. We have a goal of 25,000-acres which is the upper watershed of the Swan River. We would like to sequester the entire Upper Swan from development. We are up to about 4,000-contiguous acres, mostly through the swan trust and nature conservatory and others. We still owe $1 million in loans from various entities. The Nature Conservatory gave us a low interest loan. There is another 1,000-acre that has been gifted to us that we will use as exchanges. They are gifts to Swan Trust so we will try to patch, sell, or trade those to get the large contiguous pieces we need.

Sometimes is seems like a very ambitious goal, but I look at other communities historically that have done similar efforts, and I know the Amana communities that began in the 1840s up in Iowa started as one colony and then they branched out. They became 8 villages. They are no longer communal but are still very closely tied through religion and history. They have been acquiring land continuously, and after 55 separate purchases they are up to 35,000-acres. They have huge amounts of forest, river, farmland, and things like that. They manage as a whole all 8 villages together managing through a company as that they call the *Amana Society Incorporated*. That has people contracted as foresters, contracted farmers, and things like that to keep the things in sustainable management. Beautiful examples of what can be done, but they have been working at for 150 years. That is long-term planning.

2. What is your ecovillage comprised of (i.e., organic farms, protected lands, housing, community buildings, etc.)?

   I am on the land use committee. When the farm first settled, the farmer had cattle on the ridge tops. That was thin soil. We started a large composting operation. We would go out and get sawdust from the local mills and manure from the farmers around the area and kitchen scraps and made compost. Spread with manure spreaders until we got 200-acres covered with about 4-inches of really good soil. By the third year, we had very rich loam all over 200/300 acres, but because we were going for agriculture, we were going for protection of that upper cleared area.

   The houses got moved down into the forest. In some communities, you see this kind of earth haven where you are at the bottom of the bowl, and you are all clustered around. Welcome back! You are at the bottom of the bowl, where the road goes down and you have the community center at the bottom, the kitchen, school and what not, and the people spread up the hillsides. Here we are spread along this long ridge. The topography dictated our city plan. We are protecting our ag fields first and foremost, and secondly we passed a town ordinance back in 1973 or 1974 that said that nobody could build within 200-meters of a water course that was year around. All the dwellings do not have any home owners insurance because they are all completely vulnerable to forest fires.

   Our pattern of food production has shifted and use of ag lands. Back in the ’70s and ’80s we were serious commercial farmers. First we grew for ourselves. By our third year, we were growing pretty much everything we could eat except for rice, salt, and some fruits because it takes a long time to establish orchards. We were mostly growing everything we ate. We had pretty much everything that grew in this climate was grown here. Then we realized that wasn’t a very smart way to go. We should grow the things that grow well here and sell a little of that and trade and buy the things that do not grow well here. That is how it shifted in the ’70s.

In the early ’80s, interest rates were so high. The banks would come to us. They would say “you got all this land, you should have some bigger tractors. Interest free the first year.” We were thinking “shit man, one year we could pay that off, think of what we could grow.” Then we got into the high interest rates, and that really broke us. That really changed the character of the farm because people had to go out and work to pay off the land. What changed was how we did our food. We were networkers. Let’s help out the food co-ops and help move food around. Our food model shifted to selling for the market and taking a portion of our own food. That greatly improved our diet but also changed the land use management here. In the crisis of the ’80s, we basically cancelled the farming operation as non-commercially viable. We evolved to neighborhood gardens, home gardens, the occasional CSA [community supported agriculture] and that has sort of been that way for the last 15-years going from one experiment to another. We may have to belong to more than one CSA. The largest CSA in the state is now in our county.

3. ~~What is the makeup of people such as age, gender, race, and religion?~~ (Question not asked)

4. What are the goals and objectives for your ecovillage?

   The community began in 1968 or 1967 so you take that back. There was a process there of forming what we called *The Agreements*, and they were oral. The first time they were put on paper was in 1974.

5. ~~How does your ecovillage differ from the typical housing development?~~
6. ~~Does your ecovillage have any standout features? (i.e. alternative energies, recycled building materials, etc.)~~
7. ~~Did you use any building materials from the site?~~

8. What was involved in the site selection?

   Talk by Stephen called the “The Sermon on the hot scalding trough”—scouts were sent out trying to find cheap land…Some people went into a guitar store in Nashville to buy some guitar picks. The lady behind the counter, Rose Martin, said “My daddy’s got some land in Louis County. He would let you stay there for a dollar a year.” So we came down here and saw the land of the Martin Farm. Living there for a year, we got to know the farmers in the area, and when this piece of land came up, we bought it from a neighbor. We replaced the 70 cows with 320 hippies.

9. ~~Where did the money come from to pay for the site?~~
10. ~~Do you provide different housing options for people of varying economic levels?~~
11. ~~What do you view as the main reason people choose to live in your ecovillage?~~

12. Why do you live here?

    My mother gave me a copy of Monday Night Class that was a transcript of 20 students talking in San Francisco. They were assembled and sold in the late

'60s/early '70s. So I hiked the Appalachian Trail one summer and took it along and read it then filed that away…After graduation, I was going to do a thru hike on the Appalachian Trail. [Along the trail] I hitch-hiked to The Farm. I arrived here on the night of November 3rd, 1972 at the gate house…This first winter was called *Wheat Berry Winter* because there was no food, but no one died.

~~13. What do you think makes your ecovillage successful?~~

14. ~~How do you think the people benefit?~~

15. How do the surrounding communities benefit?

    We are very deeply involved in the surrounding system in many ways to improve their sustainability and viability in the current crisis.

16. How does the ecological community benefit?

    Part of the land use pattern that we have had since our beginning has been wanting to be a benefit to the natural world rather than a leech. We want to restore wildlife and be a safe-haven to the birds and butterflies. We created a holistic goal over a year of community meetings and re-envisioned the farm. We got it down to one word: Biodiversity—holistic goal for the farm. We are a flyway for the monarch butterflies; we are the northern terminus for the Summer Tanager species; we are the only remaining location for a species of sunflower. If we want to build a house for example, we want to go in and survey the land first…

~~17. What have been some challenges for (a) you and (b) your community?~~

~~18. What have been some failures, if any?~~

~~19. Do you have a high turnover rate?~~

20. Do you have anything else to add?

    Climate change. We are in a place where we can mark the change in the seasons differently than 40-years ago. During that time, we watched the isotherm migration on average about 30-miles per decade. So the climate we had here in 1971 is up near Lexington, Kentucky. The climate we have now was in Neshoba County, Mississippi in 1971. We moved 2 USDA planting zones in that time. Our regional goal when we inhabited the land, when we bought land from the companies that were making paper, was to put in traditional trees, heirloom varieties, and that is totally wrong. That is fighting the last war. We need to be thinking what grows well in southern Mississippi and being the midwives of the next forest that is going to be here because these trees can't move that fast. These trees will die before they move. We are already seeing that with oaks, hickories, and dogwood. We are starting to see armadillos and fire ants and scorpions, all that stuff we never used to have. We lost our quail and other things that moved further north.

Interview with Jim Schenk—6 October 2009

Jim is a community member and also founder of Enright Ridge Urban Eco-village in Ohio.

1. Could you please give a brief description of your ecovillage such as size, location, nearest large city, and climate?

   We are in the city of Cincinnati. The city itself has about 350,000 [people]. We are in an inter-ring neighborhood which is the first ring of neighborhoods outside the downtown area. It is about 100-years old. Most of the houses are 75- to 100-years old. We started in 2004, and we had attempted another ecovillage earlier in 1998—called *Seminary Square Urban Eco-village*—which did not succeed. It did not succeed because: 1. We chose too big of an area, 2. It was too depressed. It was the most depressed area in Riceville, 3. We didn't have a strong support system in that neighborhood.

   In 2004, it dawned on me one morning; we were at Enright Avenue, not too large, about 80-units/buildings. It is not depressed. All the houses are in relatively good shape. People there are working class, but [it] is a stable neighborhood. Homeownership in the city was at 40 percent, but we were at 80 percent.

   We had IMAGO which stood for ecological education organization that my wife and I founded 30-years ago located in the neighborhood, and many people moved to that area because IMAGO was there. So we had about 20 percent households in support of IMAGO, and we knew [they] would support an eco-village type concept. We decided to hold a meeting in June 2004. Nineteen people came together with the idea of creating an ecovillage. At the meeting we talked about what we could work on to develop an ecovillage. We brainstormed a list of 40 or 50 things and in the end chose 4 or 5 things that we were focused on. So that was the beginning.

2. What is your ecovillage comprised of (i.e., organic farms, protected lands, housing, community buildings, etc.)?

   (See brochure.) The primary thing we have is a group of people supporting each other to live a more sustainable life. On top of that we purchased a number of homes that we renovated.

   We have a set of 5 task forces that are working on different aspects. The housing task force is to preserve houses that go into foreclosure or that are in danger of becoming investment property. We bought 4 houses that we renovated. We brought 2 families in to purchases houses that were in bad shape that they would fix up themselves. Another house that was foreclosed on was purchased and rented out to the family that lost the house and [we] have now offered to sell back to them on a layer contract if they can't get a loan. We also purchased a building at the entrance to the neighborhood that was an after-hours club including apartments with a number of people selling drugs out of it. We purchased it, rehabbed the store front ecologically, and rented it out. In apartments we rent out to people interested in the ecovillage. It is a brick building, so difficult to make energy efficient, but we are working on it. This housing task force is one of the reasons we do not have any opposition the neighborhood. People have seen the things we have done. It has kept their house values up and keeps the neighborhood safe.

Another task force is the promotions task force which promotes the ecovillage both within the neighborhood and without: 1. To help people within the neighborhood to know what we are doing and involve them, 2. Market the ecovillage as a way to educate the way as a possibility to do an urban ecovillage and to draw people into the ecovillages.

The Communication Task Force does the newsletter and the website for the ecovillage.

The long range task force is planning. We have a green task force that is focused on educating each other within the ecovillage itself and how we can become greener. It involves a lot of things from energy conservation to alternative energy sources.

3. What is the makeup of people such as age, gender, race, and religion?
   We have men and women. I have lived on this street for 35-years now and the ratio of children changes. For a while, we have mostly little boys and then mostly little girls, but right now we have a balance. We have a strong contingency of working class people and a strong contingency of highly educated people. We have a couple African-American families, 1 or 2 Latino families, but mostly Caucasian.

4. What are the goals and objectives for your ecovillage?
   We are in the process right now in developing new goals and objectives. In January each of the task forces came up with goals for themselves for the year, but we have had some disruptions in the last few months that we are working through and finally got through them, so that planning process is still in flux.

5. How does your ecovillage differ from the typical housing development?
   Several Things: 1. People come together to support each other and living lives connected to the planet. We hold the planet as primary rather than the economic system as what is primary. 2. Recognizing that the ecovillage is made up of all species that live there and when we do things, we keep all species in mind. 3. We are doing retrofits and helping each other figure out technique, how to retrofit our homes and neighborhood to become more ecologically.

6. Does your ecovillage have any standout features? (i.e., alternative energies, recycled building materials, etc.)

The buildings we purchase and recycle. We try to do them more ecologically but also try to preserve within that building to recycle it. The strongest feature of the neighborhood, at least 2/3 or more, have been insulated, energy efficient windows and furnaces and that sort of thing.

We have begun looking at alternative energy. We have a couple passive solar hot water heaters and 1 photovoltaic and using those as a way to educate people on about the systems and cost so other people will have the information to do the same thing. Because it is not a culture thing, people are really intimidated by energy conservation techniques and especially alternative energy techniques. There is a great deal of intimidation there so to help people overcome those. We are in the process right now with IMAGO to develop some models or sustainable techniques and energy that we would use as a demonstration for those within the ecovillage and outside.

We are a non-profit. We also choose to not retain the houses or land that we purchase and sell. We looked at a concept at doing a housing association that people would join. If people would join, it would go into their deeds.

The whole idea of being a support system to each other is very critical. Also to bring people along to support what we are doing. We have brought a number of people along.

Another we have done is started a CSA [community supported agriculture]. It is a full-fledged CSA in that we have subscribers and with that money we hire farmers. The alternative to this is we are using backyards and vacant spaces. Right now, the farmers are going to 6 different places. It has been an extremely successful CSA. About a third to one-half of the subscribers live within the ecovillage. Our goal is to expand [this program]. The reason it worked is because we had a farmer who has done this type of work for about 35-years and an incredible coordinator. We put in for stimulus money and got some for AmeriCorps workers.

7. ~~Did you use any building materials from the site?~~
8. ~~What was involved in the site selection?~~

9. Where did the money come from to pay for the site?
   Where we borrowed money is we rehabbed houses—4 houses plus the building on the corner we purchased. We (IMAGO) created an organization called “Price Hill Will” that we split off in 2004 because they were not as ecologically oriented as we wanted. We contacted our membership and asked them to loan us $500 or more for 1-year at 0-7 percent interest, and they could choose the interest rate. We ended up raising $60,000 that day, and so we were able to purchase and renovate the house. When we sold it, we were able to pay people back.

We want to pull Price Hill Will in to help us do the housing and deal with gap financing. Over the last 15-years we renovated about 8 houses in the ecovillage and sold them all and ended up in the black.

As an ecovillage, we have a budget of about $25,000 and have about 3 FT and 3 PT staff. We use Vista and AmeriCorps. A good deal of it we raise through housing, but that will probably change in the future.

10. Do you provide different housing options for people of varying economic levels?

    The neighborhood is a transition neighborhood so, in general, housing is very reasonable. For example, we totally renovated a house (new plumbing and electric) and this 3-bedroom is selling for $80,000. We have rental apartments that 60 percent of the people within them must be considered within an income range. Most of these low-income people are educated, in college, and some are working class. We have a number of gay/lesbian—at least 4 lesbian households. I think people feel comfortable moving onto this street because of the diversity.

11. ~~What do you view as the main reason people choose to live in your ecovillage?~~

12. Why do you live here?

    I have lived there for the past 35-years. I think the whole community concept draws people. Living in a neighborhood where all the resources are close by [is appealing]. The largest job market in Cincinnati is 7-minutes away.

13. ~~What do you think makes your ecovillage successful?~~

14. How do you think the people benefit?

    Here we are in the wealthiest country in the world, and people are not happy. Why? We feel that the basic values of people, which is to be loved and cared for. Once we get the basic necessities in life it will take very little. What we are looking at is how we can reconnect ourselves to the planet and support each other. What draws people is wherever they are in their lives.

15. How do the surrounding communities benefit?

    Absolutely! We are expanding the ecovillage into other neighbors. Our goal is to expand into all the streets that are contiguous to IMAGO. IMAGO has 16-acres of land that a number of streets surround. We had Price Hill declared as the "greenest neighborhood in Cincinnati." Our goal is to influence the entire community.

16. ~~How does the ecological community benefit?~~

17. What have been some challenges for (a) you and (b) your community?

The Mack Truck syndrome. Until this year, if I got hit by a Mack truck, the ecovillage would have fallen apart. This is the first year that it could survive, but it would struggle. People in the ecovillage try to take control, which is great.

18. ~~What have been some failures, if any?~~

19. Do you have a high turnover rate?

    [We] only lost 1 woman from our core group through a divorce. We have a turnover about 4 houses a year. Our goal is to draw people in who are interested in the ecovillage.

20. Do you have anything else to add?

    What we are trying to develop is not an ecovillage but a model. That, to me, is critical. Just to develop an urban ecovillage is very self-serving, but to develop a model on how it can be done and how it can be supported in another neighborhood is very critical.

Interview with Charlene Suggs—6 October 2009

Charlene belongs to Wisteria and also is a founder of that community.

1. Could you please give a brief description of your ecovillage such as size, location, nearest large city, and climate?

   The intentional community I am associated with is Wisteria. It is situated on 620-acres in Southern Ohio in Meigs County.

2. What is your ecovillage comprised of (i.e., organic farms, protected lands, housing, community buildings, etc.)?

   We formed as a for-profit corporation in 1996. One of the first acts of Wisteria was to purchase the land. We are a threefold project. We are a nature preserve, 220-acres, which is a park we all share and slated to not be developed. The other portion is residential. The other part is our business, which is our event site. Our community business is to hold festival and gatherings of an eco-spiritual or eco-educational nature. We are all responsible for our own income. Residence is not mandatory and neither is participation in the business.

3. What is the makeup of people such as age, gender, race, and religion?

   It [age] would be from late-20s to 60-some. We tend to be white, ex-suburban wanting to be rural. We are mostly couples, some single moms, and single individuals.

4. What are the goals and objectives for your ecovillage?

   We knew each other through an eco-spiritual festival movement. We were very interested in land-based sustainability. Music is a real fundamental basis. Our mission is very eco-educational outreach. We like to share the land with people.

We feel like we steward the land, and in return we share it with people who pay to come to the events. We have a large, extended community that is volunteer staff for events, and they help us hold these gatherings. We learn through holding these gatherings; we are not experts.

5. How does your ecovillage differ from the typical housing development?

   We are responsible for our own decisions and funding. Our decisions are based on creating value and meaning for us all rather than for profit for profit sake. For instance, we might take care of a place that will take care of us in our old age, so that might not make us a lot of money, but it could save us a lot of money not having to work and make thousands of dollars just to spend with someone else at the end of our life. We are very interested in creating value.

6. Does your ecovillage have any standout features? (i.e., alternative energies, recycled building materials, etc.)

   We had one farmhouse that was on the property. As people built, it was a place for people to come and have running water and kitchen and is kind of a jumping off place. We have some people that are living off grid with composting toilets, catching own rainwater, solar powered, and with cell phone signal coming in, and I see them with a value in their life. Like a single mom that can work a couple days a week and own a house in this setting. There is no way she could do this in the other world. That is the combined power of people bothering to figure out how to cooperate and share resources but still keep their individualness. We have another person building a cordwood home. He is really interested in making it simple as possible and out of local materials. Another person, for example, was a construction worker that saved scraps for years that were headed to the dumpster, and was able to have a beautiful place.

7. ~~Did you use any building materials from the site?~~

8. What was involved in the site selection?

   My husband and I are the primary founders, and I am the founding president. We were drawn to southern Ohio. People came from all directions and converged. We kept visiting parcels of land and each visit helped us decide what we would need for the next piece such as water and access, but you can study it. When you see your home, you will know it. We had that phenomenon very much.

9. Where did the money come from to pay for the site?

   We are a for-profit. Cooperation classically sheltered businesses, so why can’t it shelter families? So we decided to use that structure, modify where needed, to address all the existing issues of people co-owning a common interest together.

   We decided, instead of using the events to raise money, we decided to get contracts from all the investors which were shareholders, and we basically pledged through subscription agreements that we would pay our share toward buying the land with additional assessments for property taxes. Then we decided our business efforts, if they succeeded, would build the facilities of the business itself, but that way we had the fall-back position of the land. If the business didn't get off of the ground, then we would have land.

10. Do you provide different housing options for people of varying economic levels?

    Basically Wisteria, in owning the 620-acres, it is 1 deed. So we do not own the land, but you own the rights to a building lot. There is a minimum building requirement. What you put up is at your expense and is your house. If you want to cart it away, cart it away. You have a minimum of 5 shares for a building lot, so our shares are linking to housing. If you ever sold your shares, you would have to sell your house. Just like if you were in the city, you have improved and unimproved lots. It is no different.

11. What do you view as the main reason people choose to live in your ecovillage?

    [People are] drawn to the land, drawn to community, drawn to what we created there, and finding a kinship with like-minded folks.

12. Why do you live here?

    [I] love the land, love the people, and have bonds of trust with people. That is what I want around me.

13. What do you think makes your ecovillage successful?

    We were very practical in the beginning. You have to work with reality. You have to start with what works. Ownership helped us. Within an ownership model, we are trying to re-establish what stewardship means. Work with existing systems and work with them to suit your needs. We work with the locals. We do not hide what we are doing. We are compliant with local laws so that we are not a pain in the local functioning of the area. We have now bought our land at a very low debt and having ownership [results in] invested interest. You will stick it out. You work with where we are as a culture and then we get healthier.

14. How do you think the people benefit?

    I think we really benefited from we truly had to learn that way past theory and what should and all that. When you are in intentional community, you are living it. The theory falls at the wayside. It is a good place to start, but then through the practical and all the things you learn, you become more fully human. We really learned how to create cooperate culture; we did not realize how hard it is for people to cooperate. I think I learned more in community than I ever learned in university. Living life with people teaches you the most.

15. How do the surrounding communities benefit?

    We are in a lucky pocket. They benefited immediately because we tried to hire them whenever possible, and people always love you more when you give them some money. We show up at the Chamber of Commerce and talk to people, and they see that we are just people trying to contribute positively to the area.

16. How does the ecological community benefit?

    We are on a former coal strip mine. Over 200-acres was mined for coal. We keep working with the state of Ohio that did a major reclaiming on the land before we bought it. We are working with them to continue to reclaim the land.

17. What have been some challenges for (a) you and (b) your community?

    One of my personal challenges with being a founder is finding me reluctantly in a leadership role having my own issues with authority, to find myself at that edge with other peoples' ideas projected at me. That process was often painful in the early years, trying to be as fair as possible and balancing all input versus action. Always balancing the needs of the land, the needs of the individual, and the needs of the group is very challenging for me.

18. What have been some failures, if any?

    I most regret, in the beginning, we did not really talk out labor and labor equality because everyone kept saying, "this is my life dream," "I will help," "I will be there." We foolishly thought that everyone would participate equally and found out that people did not understand that they had to put forth effort that they put long hours talking about. Then had some people say that they did not sign anywhere that I was going to work. If I could change one thing, it would have been to have understood that better and addressed that much early on in the group because it led to a few years of a downward spiral in the group. One person can really get in there and disrupt the subtle beautiful energies of a lot of trusting people and back people in their corners where it is hard to come together in that trust.

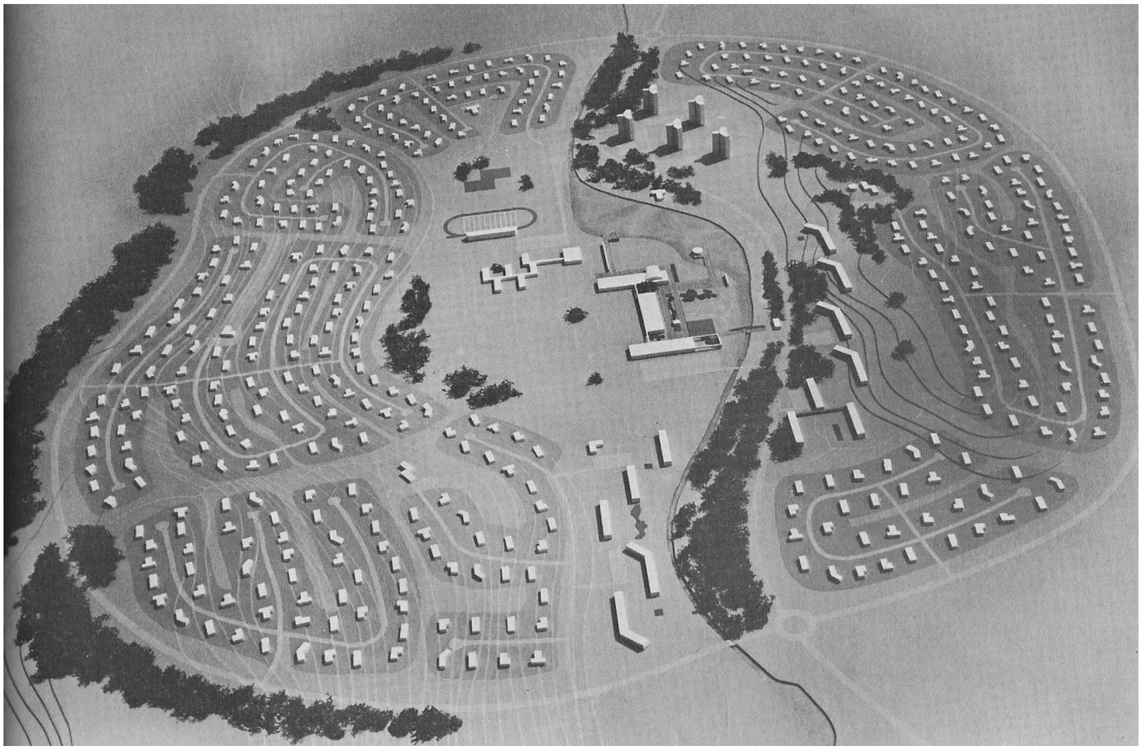
19. Do you have a high turnover rate?

    I do not really consider it a high turnover rate because it is complicated to get in. In the beginning, we had a wave that bolted quickly. It goes in waves. Communities are a bus station. If someone wants to leave, they must sell their shares.

20. Do you have anything else to add?

    I really like it; it is good for my life, but is not the choice for everybody. It is a lifestyle with drawbacks and benefits like any lifestyle. You must be independent in a community, no co-dependent. It takes maturing and boundaries.

Appendix G—Olgyay's Design



Note: Olgyay's design for a temperate zone.

Source: Olgyay, V. (1963). *Design with Climate*. Princeton, NJ: Princeton University Press.

Appendix H—Cache Valley South Transit Bus Route

Source: Cache Valley Transit District. (n.d.). *CVS Express.* Retrieved 16 December, 2009, from Cache Valley Transit District website: http://www.cvtdbus.org/schedulesandmaps/route_cvsexpress.php