CONSERVATION SUBDIVISION DESIGN: PERCEPTIONS AND REALITY

by

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Abstract

Rampant residential land development has resulted in major losses of open space and town character at the metropolitan fringe across the country. This study focuses on conservation subdivision design (CSD), an approach that addresses some of these issues through residential design. By conserving a major portion of the buildable land as permanent continuous open space and strategically placing the same number of lots as a conventional development in a more efficient manner, CSDs offer environmental, health, economic, and community benefits. Interviews with six practitioners in the conservation field provided a better understanding of differences between CSD and similar compact neighborhood development methods, such as new urbanism, cluster development, and performance zoning.

Interviews with 13 practitioners who are involved in CSD led to an analysis of major factors that help explain why CSD is not more prevalent. The greatest perceived barriers were misinformation, negative perceptions of high density, and reluctance to try something new. Despite these barriers, many communities have successfully implemented conservation subdivision design. The study provides comparative information on 261 CSDs in nine states in the Northeast and Midwest regions of the U.S in terms of six characteristics of CSDs: amount of land preserved, community size, lot size, type of units, common space management, and adjacency or connectivity to other open space. While CSDs have some common characteristics, they also exhibit substantial variability in the amount of land conserved, scale, open space management, and connectivity.

Combined with other conservation techniques, CSD can be an effective strategy in preventing sprawl in outlying areas. The study offers suggestions for ways to promote CSD through better monitoring and documentation, facilitation of long-term management of open space, and better marketing.

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I. Setting the Context

Will County is the tenth fastest growing county in the United States and first in new home construction in Illinois. Growth in Will County is three times the rate of the Chicago metropolitan area.[1] Located twenty to forty miles west of Chicago, Will County is under considerable development pressure given its convenient location, transportation infrastructure, job opportunities, and quality of life. While indicative of a thriving economy, growth trends in Will County pose a serious threat to several communities' sense of place, including its existing open space, scenic views, and natural resources. In an effort to address these issues, the county is investigating land use planning strategies that will prevent the rapid loss of open space and protect the rural character of townships in the county.

Across the country towns are struggling with the impacts of sprawl. Traffic congestion, loss of community character, lack of resources, and diminishing open space and scenic quality are but a few of the many problems plaguing these communities. As a result, many communities are exploring land use planning strategies that promote smarter growth and lead to the creation of a more sustainable, livable community.

The focus of this study is on a strategy that addresses some of the dilemmas caused by suburban residential development. Conservation subdivision design (CSD) is intended to increase the opportunities for nearby natural areas within ready access to the residents who share ownership of these preserved lands. While not a panacea, CSD has been shown to have numerous benefits – environmental, economic, and health. In light of its many benefits, however, it is puzzling why this approach has not become more widely adopted. This issue forms the main thrust of the thesis.

The sprawl predicament: The problem and current efforts in its prevention

Before discussing CSD it is important to understand some of the issues it is intended to address. This section presents development trends, problems associated with sprawl, potential causes of sprawl, and current movements in managing growth and preventing sprawl. It also discusses perceptions of density and the role it plays in growth management.

[1] (Will County Center for Economic Development, 2007)

Many planners and researchers consider sprawl to be a serious problem in the United States. Urban sprawl can be defined as "dispersed development outside of compact urban and village centers along highways and in rural countryside" (Planning Commissioners Journal, 2000). Sprawling development typically shifts away from existing structures and into wide open spaces, spreading growth from city to suburb, old suburb to new suburb, or suburb to rural area. Several statistics show a significant increase in land development over the past two decades. For example, between 1982 and 1997, the amount of urbanized land increased by 47 percent, while the nation's population grew by only 17 percent (Benedict & McMahon, 2002). In addition, according to these authors, the rate of land converted to development between 1992 and 1997 was 1.5 times the conversion rate from 1982 to 1992.

A high rate of sprawling development raises a number of environmental, health, and community concerns. Land development patterns are closely linked to environmental quality and public health (Alberti, 2005; Ewing & Kreutzer, 2006; Jackson & Kochtitzky, 2001). Sprawl can lead to the loss of open space and destruction of natural features, which perform important functions such as flood and erosion control and removal of pollutants from water and air. Also, sprawl can destroy plant and wildlife habitat and corridors needed for migration. Finally, impervious surfaces from road expansion can increase stormwater runoff, which reduces the quality of nearby streams and rivers and decreases groundwater recharge.

Sprawl fosters greater vehicle dependency, which is associated with many negative environmental and health impacts. Higher vehicle emissions result from increases in the number of vehicles on the road and number of miles driven. Vehicle emissions negatively impact air quality by releasing air pollutants and contributing to ground-level ozone (smog). They also contribute to greenhouse gases, an increase of which leads to climate change. Poor air quality aggravates health problems such as asthma and emphysema and increases susceptibility to respiratory infections (Illinois Environmental Protection Agency). Studies also show traffic-related impacts on lung development in children, increased heart problems, and increased prevalence of asthma (Metropolitan Area Planning Council, 2006). Next, stress caused by traffic congestion and opportunity costs of travel time can impact social and psychological well-being. One study showed the most sprawling cities had the highest rates of aggressive driving (Ewing & Kreutzer, 2006). Finally, lack of alternative transportation choices and recreational opportunities, such as biking and walking, could reduce physical activity.

Town character forever can be changed by the significant loss of open space and farmlands resulting from sprawl. As Lummis notes, without the open space and farmlands of the rural areas, the "very values which have attracted development will be irretrievably lost" (Lummis, n.d.). In a study by Ryan (2006), planners, developers, and residents indicated the importance of preserving rural character. In rating the degree to which certain landscape features contribute to rural character, all three groups rated natural areas the highest. Views of nature and farms also were considered important contributors to rural character. In addition, proximity to nature was rated the highest in positive qualities of rural life.

The attraction of rural areas raises an important issue regarding the trend of people moving out of the city and into the countryside. Open space and other positive qualities of rural living indicated in Ryan (2006) suggest this trend will continue. Kendig (1980) attributes the migration at least in part to people's dissatisfaction with the original community's character, of which open space is a critical element. Taking this a step further, some researchers suggest sprawling patterns of development are a response to the increasing demand for low-density, affordable housing in quieter neighborhoods (Carliner, 1999; Easterbrook, 1999).

Numerous other theories on the causes of sprawl exist. Several planners and researchers attribute sprawl to existing zoning practices that divide the land into land use zones or districts. Barnett (2001) says the original purpose of zoning was to separate residents from industrial factories and tall buildings. It was intended for established communities where the general pattern of development had already been set. However, applying this antiquated zoning to new communities has led to fragmentation. Also, Barnett believes the separation of different housing types (e.g. single family detached, apartment complexes) was implemented without adequate evaluation and has led to unnecessary segregation. Kendig (1980) and Arendt (1999a) also note problems with outdated conventional zoning and large-lot zoning, particularly their failure to protect the environment. Some towns set low-density standards (high minimum acreage per dwelling) with the hope to preserve rural character of the area. However, large lot zoning can result in vast expanses of private land that are not properly protected and maintained. Private landowners may not have the necessary ecological knowledge to manage high quality or sensitive natural areas. Also, large lot zoning could lead to large expanses of mowed lawns, which introduce other environmental concerns related to energy, water, and chemicals used in maintaining them. Fertilizers and pesticides can increase nutrient loadings of nitrogen, phosphorus, and potassium in stormwater runoff flowing to rivers and streams. Also, mowed areas do not provide the plant diversity or habitat that natural landscapes do.

Mitchell (2001) cites several public policies he believes contributed to sprawl. He states the major contributor was the Federal-Aid Highway Act of 1956, which established an interstate highway system and allocated funds to cover 90% of construction costs. Some towns continue to expand their highway systems with the intention of reducing traffic congestion by increasing capacity. However, as demonstrated in southern California, highway expansion can result in *more* traffic since more people choose to drive. The expansion only exacerbates the problem, leading to higher vehicle emissions and poorer air quality.

A Michigan Land Institute study on the causes of sprawl found sprawl in Garfield Township, MI not to be the result of the free market at work, but rather public policies (e.g. zoning, subsidies) and public investments (e.g. roads, sewers, electrical infrastructure). The results indicate that the town unintentionally planned for a "sprawling pattern of economic growth" (Schneider, 2000).

Great effort has been expended in finding ways to accommodate growth while at the same time preventing sprawl and associated problems. For example, EPA's Smart Growth program provides a set of tools for growing in ways that promote economic stability, protect public health and the environment, and create livable communities (U.S. Environmental Protection Agency, 2007a). The Smart Growth Network created ten basic principles to guide growth. They are based on the idea that urban sprawl can be mitigated by policies that promote compact urban growth, urban revitalization, public transit, mixed land uses, bicycle and pedestrian friendly communities, and preservation of natural areas and farmland (U.S. Environmental Protection Agency, 2006).

New Urbanism is another movement intended to address issues of sprawl. It encompasses traditional neighborhood development (TND), transit-oriented design, and pedestrian-friendly design concepts. New Urbanism strives for the creation of the ideal small town with a town center, walkability, and sense of community. It emerged from the ideas of Andres Duany, Elizabeth Plater-Zyberk's, and Peter Calthorpe, among others.

Knaap and Talen (2005) describe the similarities and differences between New Urbanism and Smart Growth. They are similar in that both strive for neighborhoods that are more compact, walkable, mixed use, transit-friendly, and offer a variety of housing options. New Urbanism has more of an architectural or planning design focus, whereas smart growth focuses more on policy and planning for growth management. Also, new urbanists have greater confidence in the potential of market forces than smart growth advocates (Knaap & Talen, 2005). Finally, new urbanism relates more to the context of designing new towns, whereas smart growth tends to focus on the urban context and its periphery.

Many smart growth and new urbanist advocates push for higher density development to address problems associated with urban sprawl. However, "high density" has a strong negative connotation among many residents and public officials. Some people perceive higher density as being correlated with the destruction of natural features. Development in wetlands and other unsuitable areas can increase the risk of flooding. It also raises concerns related to an increase in impervious surfaces and associated stormwater runoff. In some areas, higher density may not be feasible given the lack of sewer systems and the requirement of a certain amount of space for septic fields. In terms of market demand, some critics of high density argue that the American dream is a large home on a large lot, thus, there is no market demand for high density housing (Carliner, 1999).

An important piece that is missing in the discussion of density is the availability of open space within the community. If designed properly, higher density can result in open space preservation and greater access to nearby nature for residents. Kaplan, Austin, and Kaplan (2004) found that residents in conservation developments experienced a high level of satisfaction from nearby natural features despite smaller lots than conventional developments. They did not perceive the smaller lots as a trade-off. This indicates the support for higher density under certain conditions.

Kendig (1980) and Ryan's (2006) assertion that open space is a critical element in people's satisfaction of their community also supports the notion of incorporating open space in community development decisions. Given the trend of people moving out of the city and into the suburbs, three of the greatest challenges for the planning, conservation, and development community are (1) to make urban areas more appealing so people do not want to move out, perhaps partly by providing more access to nearby nature, (2) incorporate open space conservation in new community developments, and (3) protect open space and character in the outlying areas.

Overview

With this introduction to the problems raised by sprawl, the next chapter addresses some ways to counter it. This includes some general tools for land conservation as well as discussion of conservation subdivision design (CSD) as a potential strategy for countering sprawl.

Chapter III examines reasons why CSDs are not more prevalent, drawing largely on interviews with thirteen people with a background in CSD. It presents main themes that emerged related to challenges and concerns surrounding CSD.

Chapter IV provides comparative information about CSDs in nine states. While not a systematic treatment of CSD in these states, it draws on a substantial database offering insight into the diversity of characteristics that are subsumed by the CSD approach.

Based on the material in the preceding chapters, the final chapter offers suggestions for ways to promote CSDs and facilitate long-term protection of open space.

While the existing published literature is incorporated in the discussion, insights from interviews provide a major source of information. These interviews edify both the discussion of the larger issues related to land preservation approaches and, more specifically, to issues related to CSD. The interviews also are a critical source of ideas for the next steps discussed in the concluding chapter.

II. Tools for Countering Sprawl

Chapter II provides the context in which conservation subdivision design (CSD) exists. I first discuss the variety of tools currently used in managing growth and conserving land. CSD is then presented as a strategy for addressing some of the issues associated with sprawl. The section describes the CSD concept, distinguishes it from similar concepts, and discusses the benefits of CSD.

The broader context of conservation

Local planners, landowners, land trusts, and developers have approached conservation in various ways. In order to better understand mechanisms used for land protection, interviews were conducted with six practitioners in the conservation field. The interviews included two city planners, two local planning consultants, and two representatives from national conservation organizations, namely the Conservation Fund and Trust for Public Land. The purpose of the interviews was to identify existing strategies in order to inform the subsequent deeper analysis of CSDs. The following annotated list represents conservation tools described in the interviews, as well as information and additional strategies obtained through a literature review on conservation planning.

Green infrastructure plans and greenways

Green infrastructure is defined as "an interconnected network of green space that conserves natural ecosystem values and provides associated benefits to human populations" (Benedict & McMahon, 2006). The terminology supports the notion that natural systems are a necessity, rather than an amenity. Protected features include those of ecological, historical, cultural, health, recreational, and economic importance.

The Conservation Fund has worked with a number of towns in creating green infrastructure plans. The plan provides a framework for prioritizing lands for protection and determining what lands to develop, as well as deciding appropriate land uses. It also typically includes a non-motorized transportation component. The process involves identifying stakeholders, developing a vision and implementation plan, and setting priorities by weighing and evaluating various data layers and criteria (e.g. ecosystem significance, vulnerability to development.) Benedict and McMahon (2006) highlight the importance of considering the overall importance of various factors in achieving the goals and the relationship between factors. Tools for implementing the green infrastructure plan include land acquisition, conservation easements, purchase of development rights, and conservation subdivision design--all described in this chapter.

Many green infrastructure plans start as greenway projects (Benedict & McMahon, 2006). According to these authors, greenways differ from green infrastructure in that greenways are recreation and people-focused whereas green infrastructure emphasizes the natural system as a whole and ecological health.

Greenways can be considered a component of the larger green infrastructure system (Benedict & McMahon, 2002). One interviewee described a greenway as an interconnected network of trails that links parks or open space and is intended for non-motorized transportation and recreational purposes. However, some greenway projects, such as the Southeast Michigan Greenways, have a more general focus on ecological corridors and linking cultural, ecological, and recreational features.

Regarding a greenway project in Michigan, one interviewee noted the importance of a trail component in getting the public on-board and excited about the development of a green infrastructure plan. The greenway was an avenue for building support for the project and raising people's awareness of the ecological importance of natural area protection.

Greenprinting and conservation visioning

Similar to green infrastructure plans, greenprinting refers to a comprehensive conservation plan that assists local governments in managing growth and making conservation decisions. It includes developing a conservation vision, securing funds, and acquiring and managing conservation lands.

One interviewee noted the majority of greenprinting projects are initiated by communities under development pressure that are experiencing growth and seeing a loss of open space. Once a local government decides to develop a greenprinting plan, the process entails identifying key stakeholders, defining community goals, inventorying natural and cultural features, analyzing financial feasibility, assessing public priorities, and developing recommendations for implementing the conservation plan (Whiteford, 2003). Land acquisition is the primary tool for implementing the local greenprinting plan.

The Trust for Public Land and other land trusts have helped communities develop greenprinting plans to meet the specific goals of the community. The plan can be visually represented as a map with multiple spatial layers using Geographic Information System (GIS) software. This mapping is similar to the concept by Ian McHarg of evaluating map overlays representing different ecological and social factors for consideration in determining suitable land uses (McHarg, 1969). Commonly used criteria for prioritizing sites for preservation are location, financial status, development pressure, and public support. They also may include environmental, scenic, or productivity (e.g. agriculture) factors. Criteria applied depend on conservation goals and vary across communities (The Trust for Public Land & National Association of Counties, 2002).

Land acquisition

Many local governments have a park department or park programs whose mission is acquisition of land for preservation. Land acquisition is typically based on recommendations provided in the town's master plan or by the planning staff. As discussed in the previous descriptions of master planning techniques, towns use a variety of criteria in choosing which lands to conserve. For example, in Ann Arbor,

MI, staff recommendations for land acquisition are based on criteria for natural features protection and public demand for recreational parks. One interviewee noted land conservation initiatives also could be triggered by concerns about losing green space due to development pressure.

Land acquisition depends on local funding and the values and interests of elected officials and citizens. Although the plan makes recommendations about lands to acquire, the City Council makes the final decision about whether to acquire the land. Financing can be provided through budget appropriations from the legislative body, state or federal grants and matching programs, or taxing and borrowing options that require a citizen vote (The Trust for Public Land & National Association of Counties, 2002). Consequently, funding can limit the town's ability to acquire, protect, and maintain the land. In addition, as noted by one interviewee, dynamics within the community can play a significant role in conservation decisions, given the multiple parties involved. Therefore, alternative conservation tools are needed to ensure long-term protection of open space in towns facing budget deficits or lack of interest among public officials.

Conservation easements

A conservation easement is a "legal agreement between a landowner and an eligible organization that restricts future activities on the land to protect its conservation values" (Byers & Ponte, 2005). Eligible organizations typically include a land trust or government agency. They have been used to protect a variety of resources, including natural areas, ranches, farmland, historic features, wildlife habitats, and community gardens. The Land Trust Alliance believes conservation easements are the most effective tool for permanently protecting privately owned land (Byers & Ponte, 2005). Landowners voluntarily receive compensation or donate some or all of the value of the easement. Easements run with the property despite ownership transfers.

Conservation easements are the most commonly used conservation tool of land trusts. Public agencies also can hold conservation easements. According to the Trust for Public Land and Land Trust Alliance, the amount of acreage protected under easements grew by 1,624 percent between 1988 and 2003 (Byers & Ponte, 2005). Byers and Ponte (2005) indicate that land trusts more than doubled (743 to 1,537). Two interviewees noted that land trusts focus their efforts on large tracts of land as opposed to small, isolated pieces. On the other hand, land trusts with little funding may not be as selective if they are accepting donations of conservation easements rather than purchasing them. Public agencies need to be selective if they are spending public dollars.

Conservation easements offer an alternative to purchasing land, which generally costs more than an easement. The landowner continues to own and manage the land and pay taxes on the property, although tax deductions are available for charitable donations of perpetual easements. The easement holder has the right to protect the terms of the easement, usually in perpetuity. Long-term costs to the easement holder include easement management, monitoring, and enforcement. Some

agreements may transfer rights to restore wetlands and manage trees and plants to the easement holder (Wisconsin Department of Natural Resources & University of Wisconsin -- Extension, 2002). This may be preferred in cases where the landowner does not have the ecological knowledge or resources to properly care for the land or address environmental problems. Byers and Ponte (2005) warn that partnerships among easement holders, government agencies, and other nonprofit organizations will be necessary to uphold, defend, and enforce conservation easements and ensure protection of the land in the long term.

Deed restrictions and covenants

Unlike conservation easements, deed restrictions are placed on the property's title by the landowner during the sale of the property to another private landowner. The deed enables the seller to influence the way in which the land is managed or developed. Restrictions may include limiting the number of housing lots, preserving scenic views, or conserving natural areas (Lummis, n.d.). A covenant is a mutual promise between two or more landowners to follow a set of restrictions for all properties. For example, a subdivision developer may include a covenant in the property title to protect a common natural area and require agreement as a condition of sale (Lummis, n.d.).

Purchase of development rights

Rather than purchase the land, a government agency or private individual can purchase development rights from a landowner. In this agreement, landowners give up their right to develop the land in return for cash while maintaining ownership of the land.

The Conservation Fund and other conservation organizations provide assistance to cities and landowners in carrying out the purchase of development rights. In Ann Arbor, MI, the Greenbelt Program aims to protect farmland and open space in areas outside of the city of Ann Arbor. The strategic plan places a major emphasis on the purchase of development rights from farmers (The Conservation Fund prepared for The City of Ann Arbor, 2005). The program targets large expanses of property that offer the best protection for farming. One interviewee noted, because the land is under a different local jurisdiction, coordinating with the townships on these purchases has been a challenge.

Transfer of development rights

Transfer of Development Rights (TDRs) is one tool for preventing sprawl that uses market forces and incentives rather than public funds. TDR programs direct development away from rural areas, agricultural lands, or natural areas and towards existing cities and towns. The local government designates preservation areas to be protected (sending zones) and growth areas to receive development (receiving zones). Developers in the growth area can buy development rights from landowners in the preservation zone in order to build at a higher density than is normally permitted in the growth area. The town may place restrictions on additional density allowed in the receiving zone. Landowners in the preservation zone who choose to sell their

development rights give up their right to develop their property further. As a result, development is targeted to more suitable areas where there is existing infrastructure, and open space is preserved in outlying areas (EPA New England, 2001; Lummis, n.d.).

Urban growth boundaries

The EPA defines urban growth boundaries (UGB) as a "mapped line that separates land on which development will be concentrated from land on which development will be discouraged or prohibited" (U.S. Environmental Protection Agency, 2007b). UGB targets development inside the urban growth boundary where public services an infrastructure already exist. It promotes higher density and infill development. While the technique may be successful in protecting open space outside of the boundary, it fails to address the need for nearby nature within urban areas. Also, it can drive up housing prices as a result of artificially increasing the demand for land within the boundary (Staley, Edgens, & Mildner, 1999).

CSD as a tool for countering sprawl

Conservation subdivision design also serves as a conservation tool used to protect open space. However, it differs from the tools discussed in the previous section in that it does not prevent development in outlying areas, but rather provides an avenue for incorporating conservation into the design and approval of development proposals. In addition, CSD has been applied mainly to residential contexts, although its basic principles could be extended to other types of development. Because so much sprawl has been caused by residential development, CSD is particularly important to examine as a strategy to prevent sprawl. This section describes the CSD concept, its relationship to similar concepts, and its benefits.

What is CSD?

Conservation subdivision design (CSD) is one mechanism for protecting outlying areas from sprawl. Through the work of Randall Arendt, the concept emerged as a response to the rapid conversion of land to development and critical need to incorporate resource conservation into the development process. CSD not only protects important natural features such as wetlands, floodplains, slopes, and other unbuildable land, but also conserves sites of cultural and historical significance and other important natural features such as woodlands, buffers, farmland, and meadows. As a result, residents are provided with access to nearby nature, which can serve as community gathering places and recreational areas. In the case of preserved farmland, communities also may secure locally grown food sources and associated economic benefits.

According to Randall Arendt (1996), "in its purest form, the term 'conservation subdivision design' refers to residential developments where…half or more of the buildable land area is designated as undivided, permanent open space" (p.6). This is achieved by strategically placing the *same number* of housing lots as a

conventional development in a more efficient manner. The size of the individual housing lots is reduced, but the amount of open space per dwelling in the community is maintained or increased.

In his book, *Conservation Design For Subdivisions: A Practical Guide to Creating Open Space Networks*, Arendt delineates the steps involved in designing a conservation subdivision (Arendt, 1996). In the research stage, one must gain an understanding of the context; map natural, cultural, and historic features; integrate the various layers of information; and set priorities. Factors considered in the mapping of features include soil quality, hydrology, wildlife habitat, and views into and out of the site. Multiple layers of information are evaluated by overlaying the map sheets to determine the primary conservation areas, or unbuildable wetlands, floodplains, and slopes. This technique reflects the mapping and ecological principles of Ian McHarg (1969). Once goals and objectives are established, one can move on to the four-step design process. First, conservation areas (buildable and unbuildable) are identified and established as protection areas. Second, locations of the house sites within the remaining buildable land are determined based on maximizing scenic views. Third, streets and trails systems are established. Finally, lot lines are drawn. Lot size or density is determined by the number of lots that could have been built in a conventional development.

Relationship to other compact neighborhood development methods

CSD is one of several techniques used to achieve more compact neighborhood development. Performance zoning, cluster development, and new urbanism are other examples that strive for compact development. While these concepts share a common goal with CSD, they differ from CSD in several respects.

Performance zoning

Lane Kendig developed performance zoning in 1973 in Bucks County, Pennsylvania, also in response to the failure of land use zoning. The 1980's version of performance zoning eliminates districts for specific land uses and establishes performance standards for all land uses based on intensity of use. Performance standards include a minimum open space ratio, maximum density (or floor area ratio for nonresidential), and maximum impervious surfaces. The open space ratio is the proportion of designated open space (excluding private land) to the gross site area. The density factor is expressed as the number of dwelling units per acre of net buildable land. Impervious surfaces include buildings, roadways, sidewalks and any other surfaces that do not absorb rain (Kendig, 1980).

Performance zoning and CSD are similar in that both are primarily concerned with the protection of natural resources. Both approaches begin with an analysis of important features, including topography, drainage, vegetation, views, amenities, and access. Also, both strategies strive for maximum open space through more compact design. However, a major focus of performance zoning is flexibility in the types of dwelling units allowed. Although the buildable area is reduced as a result of open

space and natural resource protection, the maximum density can be achieved through a variety of housing options, such as townhouses and apartments. This not only allows developers to meet their interests, but also promotes diversity and affordability in housing (Kendig Keast Collaborative, 2007).

A few other notable differences between CSD and performance zoning exist. First, in performance zoning, the open space ratio compares open space to the *gross* site area, whereas in CSD, the minimum open space percentage is based on the *buildable* area. Second, performance zoning sets the reduction of impervious surfaces as a priority, whereas CSD identifies it as an additional benefit. Third, the two concepts place different emphases on views in that performance zoning focuses on blocking out views, noise, or other nuisances from adjacent intense uses, whereas CSD concentrates more on maximizing the number of homes with attractive views. Finally, performance zoning extends to all types of development; it is not intended solely for residential development.

Cluster development

Cluster developments are residential developments where houses are grouped together in clusters so portions of the site can be preserved as permanent open space (U.S. Environmental Protection Agency, 2007b). Many people use the terms cluster development and open space development interchangeably; however, Randall Arendt makes a strong distinction between cluster ordinances and conservation subdivision design (Arendt, 2004). CSD serves as a replacement for cluster ordinances, which typically resulted in small, isolated pieces of open space leftover after clustering. CSD emphasizes the designation of conservation areas at the earliest stages of the design process. It entails determining the conservation areas *first* through a comprehensive site analysis and *then* locating the housing sites, drawing lot lines, and aligning streets and trails. Careful consideration is given to hydrology, connectivity, wildlife habitat, and other factors in identifying conservation areas. In addition, minimum open space requirements are defined as a percentage of the *buildable* land. As a result, CSD makes conservation an integral part of the design, establishing significant portions of open space with the potential to become the foundation for a community-wide network of open space (Arendt, 2004).

New Urbanism

New Urbanism strives for more compact neighborhood development, but also emphasizes alternative transportation options. Arendt (1996) attributes the difference between CSD and New Urbanism to the contexts in which they are most appropriate. Arendt (1996) notes most New Urbanist towns are located along metropolitan corridors with established transportation systems or adjacent to traditional historic towns. On the other hand, CSD is intended for areas with a decent amount of existing land or natural areas that need protection due to development pressure. Thus, CSD is more applicable to rural or outlying suburban areas. Although the technique provides flexibility in choosing density options for a range of rural to semi-urban contexts (Arendt, 1999b), rural and outlying areas will be more successful in conserving a sizable amount of land with greater potential for open space connectivity. Arendt

(1996) believes the two approaches complement one another and together can protect a greater range of areas along the rural-urban continuum from sprawl.

What are the benefits of CSD?

Conservation subdivision design protects open space and provides greater access to nearby nature to residents. Research reveals a wide range of benefits associated with open space (Benedict & McMahon, 2006; Sherer, 2006). Benefits can be organized into five categories: ecological, economic, physical and psychological health, community, and scenic quality and quality of life.

Ecological

CSD results in the protection of sensitive natural features, including wetlands and floodplains, as well as other valuable natural resources, such as woodlots, prairies, and meadows. These natural features play an important role in healthy ecosystem functioning. For instance, wetlands and floodplains provide flood and erosion control (Alberti, 2005; Kane, 1997). Also, large open areas act as buffers and help remove pollutants and excess nutrients from stormwater flowing to nearby lakes, ponds, rivers, and streams (Arendt, 1996). The reduction of impervious surfaces resulting from CSD decreases stormwater runoff and improves water quality. It also allows for better groundwater recharge. Next, natural areas provide plant and wildlife habitat. Conservation subdivisions have the potential to enable species mobility and preserve biodiversity when designed within a system of interconnected parks and open space. They also can provide added protection to adjacent parks and natural areas.

Economic

Several studies have shown that homes in conservation subdivisions sell quicker and at a higher premium and appreciate faster than conventional developments (Arendt, 1999b; Lacy, 1990; Mohamed, 2006; Stanford, 1999). Another economic benefit is the cost savings from less installation and maintenance of infrastructure. Although the size of homes may be the same as conventional developments, fewer feet of streets and sidewalks are needed since houses are grouped together to preserve greater open spaces.

One interviewee believes conserving land through development, such as conservation subdivision design, is a cost-efficient and effective way for towns to achieve their goal of protecting natural areas and providing access to parks. Some planning departments require residential developers to donate a certain amount of land or cash equivalent for every lot or dwelling unit constructed in an effort to expand the town's network of parks and natural areas. If land is donated, the park department incurs the cost of maintaining the donated land. In conservation subdivisions, depending on the common open space management agreement, the homeowners' association, residents, or conservation organization incurs common open space maintenance costs. Thus, conservation subdivision design could lead to significant cost savings for the City in park maintenance. It also could reduce City funding

needed for park acquisition. Finally, the increase in property values in communities with open space can lead to greater property tax revenues for the city.

Physical and psychological health

Conservation subdivisions can promote physical activity by offering recreational opportunities, such as trails and playing fields. In some communities, neighborhood trail systems are linked to greater trail networks within and between towns. Jackson and Kochtitzky (2001) discuss the link between land use patterns and public health. They state physical activity depends on environmental factors such as the availability of sidewalks, safety, and scenery. Conservation subdivisions are likely to receive high ratings in these categories. Similarly, in a study by Kim and Kaplan (2004), residents indicated that open spaces, lakes, paths, and landscaped areas contributed to the attraction of walking in the residential community. Hiking, biking, walking, and, in some communities, horse back riding are a few of the recreational activities available to residents in CSDs.

House lots are strategically placed in conservation subdivisions in a way that maximizes scenic views. S. Kaplan (1995) and Frumkin (2001) cite several studies demonstrating the benefits of views to nature. Positive health effects of nature views include reduced sick-calls by prisoners (Moore, 1981), fewer headaches and greater job satisfaction from employees (R. Kaplan, 1993); faster recovery and less pain medication intake in hospitalized patients (Ulrich, 1984); lower blood pressure and anxiety in dental patients (Heerwwagen, 1990); and better self-care by cancer patients (Cimprich, 1993).

Natural areas and open space provided in conservation subdivisions can enhance psychological well-being by providing restorative experiences. A stroll in the park or hike along a nature trail offer opportunities for getting away from everyday demands, resting one's attention, and reflection. Many studies reveal people's strong preference for natural settings (R. Kaplan & Kaplan, 1989; S. Kaplan & Kaplan, 1978, 1982). These natural settings ranged from everyday nature to wilderness areas. Even people who are not actively using the natural setting rate the nature aspect as important (S. Kaplan & Kaplan, 1978).

Several research studies show that nearby nature can improve one's effectiveness and civility by restoring one's directed attention, a resource susceptible to fatigue and needed to focus and inhibit distractions (Kuo & Sullivan, 2001a; Taylor, Kuo, & Sullivan, 2001). For example, in a study involving children with attention-deficit disorder, researchers found children function better than usual after activities in nature. The "greener" the setting, the less severe the attention deficit symptoms were. Thus, contact with nature may support attentional functioning in children with attention deficits (Taylor, Kuo, & Sullivan, 2001).

Natural areas in conservation subdivisions provide opportunities for learning, exploration, and development. An empirical study by (Fjoroft, 2001) found greater improvements in motor skills for children playing in forests than those playing in a playground. The study revealed a strong relationship between the structure of a

landscape and functions of play. Diversity in the natural environment offers more opportunities for learning and development.

Community

Open space and community centers provide gathering places for social interaction, which promotes sense of community. In a study by Kuo, Sullivan, Coley, and Brunson (1998) related to inner-city neighborhoods, findings revealed residents near greener common areas knew more of their neighbors, had more visitors, and were more involved in social activities. Study participants also reported a sense of belonging and feelings of support from their neighbors. Another study showed informal social interactions can lead to greater social control and a reduction in crime as neighbors develop trust for one another and share the responsibility of surveillance (Kuo & Sullivan, 2001b). Finally, in a study by Kim and Kaplan (2004), residents ranked natural features and open space consistently high in terms of their importance in fostering community attachment and community identity.

Scenic quality and quality of life

CSD is intended to increase the opportunities for nearby natural areas within ready access to the residents who share ownership of these preserved lands. Kaplan, Austin and Kaplan (2004) studied some of the nature benefits provided by CSD in comparison to traditional subdivisions. They found that residents in conservation developments experienced a higher level of satisfaction from nearby natural features than residents in conventional developments. Also, participants in both groups considered "views from home" a top priority; however, the content of their views varied. The most preferred views, wooded areas, were rarely available to those in traditional developments.

One of the concerns surrounding sprawl is the loss of rural character or sense of place in towns facing development pressure. Ryan (2006) found that planners, residents, and developers were similar in rating natural areas as the most important landscape feature contributing to rural character. Farms and views of nature also received high ratings in this category. In addition, proximity to nature, along with the nature-related activities it affords, was considered the most positive quality of rural life. Another important finding of the study is that many of the scenes perceived as rural were clustered rural subdivisions with open space visible from the roads or entrance to the community. By protecting open space and farmlands, as well as cultural, historical, and natural features, conservation subdivisions help preserve the character of these places and the positive quality of life they provide.

III. Why CSD is not more prevalent

An understanding of the many potential benefits of conservation subdivision design led to the question of why CSD is not the standard process for residential development or at least why it is not more prevalent. In order to explore this issue, interviews were conducted with thirteen individuals involved in conservation subdivision design. Appendix A lists the interviewees along with their titles, organizations, and state. Leaders in CSD were identified through a literature review and web search. Remaining participants were identified mainly via references from others in the field. Of those contacted (Table 3.1), all willingly provided information regarding their perceptions of CSD. The majority of interviewees referred me to additional contacts, creating a network of over forty people involved in conservation subdivision design (Table 3.2). Together the two tables show the various parties that have been involved in CSD.

TABLE 3.1
CSD Interviewees by Profession

Count	Type
7	City Planners
2	Researchers
2	Planning consultants
1	Organization representative
1	Developer
13	**Total**

TABLE 3.2
CSD Network by Profession

Count	Type
21	City Planners
7	Researchers
5	Developers
3	Organization representatives
2	Planning consultants
2	Civil Engineers
1	Other City (Dept of Public Works)
41	**Total**

This set of interviews focused specifically on identifying issues surrounding conservation subdivision design. A semi-structured interview approach was used to permit a more relaxed, conversational exchange. An interview guide ensured main themes were addressed; however, flexibility was allowed for coverage of other issues that the interviewees found relevant and important. Main questions included the following:

- In your experience with CSD, have you encountered resistance to conservation subdivisions? If so, who displayed this resistance--planners, developers, residents, realtors, bankers, others? What were their concerns?

- In what ways can these barriers to CSD be addressed?

- What promotes the long-term protection and management of the open space in conservation developments?
- Where are existing conservation subdivisions?
- What additional research related to CSD do you feel is needed?

Overarching themes

Five major themes emerged from the interviews and shed light on why CSD is not more prevalent. These themes include misconceptions of CSD, density issues, uncertainty, long-term management of open space, and untapped support systems. This section summarizes the interviews and organizes comments according to these overarching themes.

Theme 1: Misconceptions

The majority of interviewees named misconceptions and misinformation as the greatest barriers to CSD. Misconceptions exist among several key players in CSD, including developers, planners, citizens, and realtors. These misconceptions are related to what constitutes a CSD, profitability of the CSD approach, and the process involved in creating a CSD.

The interviews revealed some confusion among residents and planners about what conservation subdivisions are. For example, one interviewee noted some residents are not aware they live in a conservation subdivision, while others think they live in one because there is a retention pond. Similarly, in a study by Göçmen (2006), residents living in CSDs were not aware of the distinctive features or intent of the CSD. Even within the group of interviewees, there were differences in opinion about how unique CSD is as a planning strategy. While most interviewees agreed CSD is not an entirely new concept, some equated CSD with older clustering strategies, while others described CSD as building on or improving these older strategies. For example, one interviewee used the terms cluster development and conservation development interchangeably. Other interviewees placed a strong emphasis on the difference between cluster and conservation development. The distinction was described as being made in response to negative perceptions of high density. The latter interviewees noted conservation subdivisions are more strategic in their design than cluster developments and other developments with open space. First, the type and quality of the land conserved in CSDs matter. Developments that set aside only unbuildable land, such as wetlands and slopes, as open space are not CSDs. Second, the open space is designed into the site rather than designated from pieces leftover after clustering. Third, CSDs require a site analysis, including a resource inventory and consideration of hydrological systems, interconnected spaces, and wildlife corridors. These characteristics set conservation subdivision apart from similar clustering strategies.

Two interviewees expressed concern regarding realtors' lack of awareness or improper advertising of CSD. They shared stories about realtors who failed to highlight the most notable features of CSD. For example, one realtor described CSD to a potential buyer as a unique subdivision due to the small lots rather than due to the extensive open space. Another incident was perhaps less harmful to CSD, but represented a lost opportunity for spreading the word about CSD. The realtor pointed out the trail system and nearby woods, but never mentioned the neighborhood was a conservation subdivision. Interviewees noted the crucial role realtors can play in increasing the demand for conservation subdivisions by advertising the idea, supplying correct information, and communicating the benefits to potential buyers.

Conservation developments vary in the degree to which they protect the environment. Some interviewees expressed concern about developers falsely advertising their developments as "conservation subdivisions." These developments preserved less than 40% of the land, whereas CSD is most often described as preserving more than 50% of the buildable land. Other interviewees did not perceive various shades of green as presenting a problem for CSD. In fact, one interviewee suggested focusing less on fine-tuning the concept of CSD and more on educating people on how to continuously improve development practices. Similarly, another interviewee believes CSD at any level of environmental protection is better than conventional development.

Misconceptions related to profitability of CSD are common among developers. One interviewee noted developers think conservation subdivisions will not be as profitable as traditional subdivisions. They fail to recognize the *same* number of houses are built in a CSD as a conventional subdivision. Also, profitability can increase due to reduced infrastructure costs from clustering and higher premiums on house sales.

Another concern among developers is the time and effort involved in the CSD process. Some developers perceive CSD as taking more time than conventional developments. However, one interviewee notes this is only found in certain cases. For example, CSD has taken longer in towns that do not have the proper open space regulations in place. Where regulations do exist, some municipalities have taken longer to approve projects due to their fear of implementing the regulation incorrectly. In other cases, planners have spent a considerable amount of time addressing public opposition resulting from misconceptions. The interviewee believes these issues can be addressed with training, education, and experience.

Theme 2: Density-related issues

Six interviewees discussed density issues as one of the greatest concerns surrounding CSD. Comments regarding density fall into four main categories: (1) negative perceptions of high density, (2) failure to include conservation in the discussion of density, (3) perspectives on density bonuses, and (4) relationship between density limitations (due to the type of septic or sewer system) and the feasibility of CSD.

Four interviewees discussed citizen resistance to CSD due to concerns about high density. One advocate of CSD found that neighbors of proposed conservation developments typically are concerned smaller lots in adjacent developments will decrease the value of their home. They do not realize the significant amount of open space nearby will add value to their home. Also, most citizens do not understand the technique is intended to preserve open space. CSD was developed in response to the negativity surrounding the "cluster" concept and high density. Once planners explain the same number of houses will be built but in a way that preserves open space and scenic views, citizens accept the idea. One interviewee shared a story about a township clerk who was vehemently opposed to open space development and thought it was a ploy of the city to get higher density. After gaining a better understanding of the objectives of CSD, she became one of the biggest advocates of CSD and currently promotes the concept at conferences.

Smart growth efforts by Illinois' regional planning body were initially not well received in the suburbs due to negative perceptions of high density. One interviewee noted these concerns seem to still exist in the Chicago area. However, with development pressure increasing, undeveloped areas and rural towns are beginning to see the value of planning strategies that protect open space and preserve rural character.

Two interviewees commented about the need to include conservation in planning to address sprawl. One interviewee believes the planning profession has misinformed local planners for decades about lot size and land use being the two most important considerations for planning. They fail to discuss conservation as an integral part of the planning process. Because planners and engineers may not be familiar with conservation, an interviewee suggested landscape architects conduct the site analysis for development projects. Similarly, another inteviewee believes density with amenities such as open space will be the savior in preventing suburban sprawl. In his experience, people's concerns about density relate mostly to the way the development will look. With attractive architecture, landscape design, and true conservation, the interviewee believes people are likely to stop arguing about density.

One way in which several towns motivate developers to try CSD is to provide a density bonus. Interviewees represented varying opinions on density bonuses. One said a density bonus was crucial in getting developers on board, whereas another interviewee suggested being more neutral on the issue of density in CSD projects. In the latter interviewee's opinion, greater flexibility leads to greater density, so a limit to the density bonus is necessary. In the former interviewee's opinion, it was always worth giving a little more density to get other things in return, such as greater amounts of open space, site cleanup, sewers, or preservation of certain features.

Two interviewees raised an issue related to density and the feasibility of CSD. Developments without sewer systems require houses to be farther apart in order for the grounds to accommodate septic systems. Public health departments often require two fields (one active and one reserve) for septic systems and prefer that both fields be located on the private lot of the house they serve. By including the reserve field on the

private lot, the field would be less likely to be developed. However, locating both fields on the lot requires a large lot size. Interviewees spoke of communities that convinced the public health department to allow smaller lots and to use some of the open space for the reserve field. Sewer systems, on the other hand, allow for higher density housing (2 ¼ - 4 units per acre). According to one interviewee, while sewer systems allow for smaller lots, undeveloped areas with sewer systems typically are slated for high density, making CSD harder to accomplish.

Theme 3: Uncertainty

Seven interviewees discussed uncertainty or the reluctance to try something new as one of the greatest challenges facing CSD. Reasons for this reluctance include inexperience, unfamiliarity, attachment to old ways, negative previous experiences, and risk aversion. Some interviewees' noted that developers who tried CSD once tended to do it again and embraced the concept. Therefore, an important step for CSD is encouraging people to test the approach.

Competence has a significant effect on one's willingness to try something new. One interviewee said planners may not be knowledgeable in natural resource management, which is an important aspect of CSD. This could apply to developers as well. Without the necessary skills and expertise, planners and developers may be reluctant to try CSD.

Old fogyism, or an attachment to old ways of operating, can lead to resistance to change residential development processes. One interviewee explained that a comfortable, stable system for standard conventional development exists among developers, lending institutions, and planners. Because people prefer doing what they know best, efforts are needed to educate them and make them comfortable with the idea of CSD.

Another interviewee attributed hesitance of planners to previous bad experiences with new zoning techniques. For example, an interviewee described situations where Planned Unit Developments resulted in a much higher density than expected compared to traditional developments. While some communities addressed the issue by tweaking the code, other communities panicked and pulled the ordinance out of the code vowing never to try it again.

A number of rural townships are hesitant about CSD because of financial liability concerns. In particular, the township fears that if the homeowners association goes bankrupt, then the town would be financially responsible for the common open space. In addition, bankers may not be willing to take on the risk of funding a new type of development project. As a result, developers cannot acquire the necessary loans to create the development. In addition, developers typically look for the path of least resistance in the plan approval process. If the default in the planning department is conventional development, developers are less likely to try CSD since it requires more thought and vision.

Theme 4: Long-term management of open space

One question surrounding CSD is whether the long-term maintenance and management of the common open space will be an issue in the future. Three interviewees do not perceive long-term maintenance as a problem for CSD. First, maintenance is typically low in CSDs. Also, residents likely will protect and enforce the open space since they pay a premium for it. One interviewee noted several cases where maintenance and protection were self-policed. Another interviewee believes those who live in CSDs choose to live there and will want to manage the open space.

A study by Austin and Kaplan (2003), however, revealed CSD communities with conflicts regarding open space management. These communities experienced low resident participation in maintaining the land and challenges associated with acquiring informational resources. Likewise, one interviewee noted encroachment on the common open space by residents and improper maintenance of the open space by the homeowners association in some CSDs. The town is currently looking into transferring the ownership of the open space in these CSDs from the homeowners to a local land trust.

One interviewee conducted a legal study to prove that a community or local government has the right to intervene if a homeowners association fails to follow through on open space maintenance and protection. In the interviewee's experience, the only problems encountered have been in older CSDs where covenants and restrictions were not written well. The CSD failed because the homeowners association was not set up properly in the first place. For instance, membership in the homeowners association was voluntary.

Interviewees expressed contrasting opinions regarding the quality of the land needed to ensure long-term protection. One interviewee believes the open space needs to be desirable enough so people want to preserve it and not request that it be divided. Another interviewee's experience supported this notion in that one community eventually redistributed the open space among the residents' backyards because there was little there worth protecting. On the other hand, one interviewee argued open space does not always have to be high quality or scenically beautiful for people to protect it. In this person's experience, people paid attention to and cared for open space that started as farm fields and ultimately became meadows and shrubs due to ecological succession.

One interviewee raised the issue of lack of planning for problems that may arise once the development is complete and residents move in. Typically, developers and planners leave when their jobs are done. One interviewee envisions invasive plants to be a potential problem for CSDs. Restoration and invasive species removal are huge efforts. Conservation organizations rely on a large volunteer base to perform these services. Homeowners associations may not have the knowledge or labor necessary to deal with an invasives problem.

Theme 5: Untapped support systems

Two interviewees discussed the name of conservation subdivision design and the way in which the idea is marketed. Benefits of conservation subdivisions are frequently expressed in terms of the environment; however, one interviewee noted the environment may not be a primary concern for many people. The CSD idea will not sell if people do not understand it or cannot relate to it. This interviewee believes intangible benefits, such as quality of life and leisure activities, play a critical role in increasing the demand for conservation subdivisions. Perhaps the numerous studies that provide evidence about the positive influence of nearby nature and nature views on people's satisfaction and perceived quality of life need greater visibility. People may be more likely to buy into conservation subdivisions if they are aware of these links to quality of life. Since health has been a growing concern among the public, another interviewee believes reframing CSD as a community that promotes healthy living by providing trails and nature could be effective in building support for CSD.

Three interviewees commented that land trusts have not been receptive to the idea of CSD. One indicates land trusts tend to focus their efforts on acquiring land from landowners, rather than affecting development patterns. Other interviewees attribute the land trusts' disinterest in CSD to the small, isolated pieces of land that are typical of CSDs. Land trusts are more inclined to purchase conservation easements for larger areas. Given their expertise in permanent conservation, land trusts could be a useful resource in implementing and maintaining CSDs. One interviewee commented that although land trusts are currently weak in funding, CSD allows for preserving space now with the possibility of a conservation easement in the future.

Summary and conclusions

The majority of interviewees were strong supporters of conservation subdivision design. These interviewees have significant experience with many CSD projects and actively promote CSD as an effective development strategy. All interviewees provided valuable insight into the challenges currently facing CSD, including misconceptions, density concerns, uncertainty, long-term management, and untapped support systems. Some interviewees provided suggestions about ways to break through some of these barriers and encourage CSD. These recommendations are incorporated into the final chapter of this report.

IV. Comparative Analysis of CSDs

Despite perceived barriers, conservation subdivision design has been implemented successfully in many communities. Through interviews with people involved in CSD and an internet search, the author identified 295 projects that fit under the guidelines of CSD (Arendt, 1996). Given the intention to identify a sample of CSDs rather than perform a systematic search, many more CSDs are likely to exist even in the states included in this analysis. Names of these communities varied, including conservation subdivisions, open space communities (as in EPA's Smart Growth Open Space Residential Design), and Open Space and Land Preservation Developments (Hopkinton, MA). However, all of these residential developments entailed setting aside a portion of the land for conservation by strategically placing housing lots in a more efficient manner. The number of housing lots was the same or more than conventional developments depending on whether a density bonus was provided to encourage developers to try CSD.

Data collection

The study draws on data available for 261 CSD projects located in the Northeast and Midwest regions of the United States. Some of these projects were highlighted in books, websites, and articles on conservation subdivision design; however, interviewees provided the majority of the data. Six datasets with an average of 40 CSD projects each were collected from one regional planning commission, two local planners, and one university program. Data for the remaining projects were obtained from case studies reported in Arendt (1999b), Belansky & Justis (2000), Lacy (1990), Town of Cary, NC Planning Department (2001), Natural Lands Trust (2005), LandChoices (n.d.), and ALPS Development Inc. (2007). These individual projects are located in New England, Pennsylvania, Illinois, and Minnesota.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) maintains databases that include seven counties (Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha), as displayed in Figure 4.1.[2] CSDs in this region are divided into two databases – those with sanitary sewer service and those without sanitary sewer service. The dataset for CSDs with sewers includes conservation subdivisions with a minimum of 25% open space, although SEWRPC recommends a minimum of 40% open space in CSDs served by sewers. The dataset for CSDs without public sewers includes CSDs with a minimum of 40%

Figure 4.1: Counties in Southeastern Wisconsin with Conservation Subdivision Design Data

[2] Southeastern Wisconsin Regional Planning Commission (SEWRPC), retrieved on January 3, 2007 at http://www.sewrpc.org/communityassistance/conservationsubdivisions/.

open space. For CSDs without sewers SEWRPC recommends 60% open space. The CSDs in the datasets were built between 1990 and 2004.

Data on conservation subdivisions are rarely collected at the regional level, since planning in most communities happens at the local level. Therefore, one method for collecting CSD data was to contact local planners in communities known to have existing CSDs. Two local planners were able to provide data on conservation subdivisions in their town. These towns include Hamburg Township, Michigan[3] and Hopkinton, Massachusetts.[4] The dataset from Hopkinton, MA lists Open Space and Land Preservation Developments built since 1990.

The Countryside Program in the Levin College of Urban Affairs at Cleveland State University maintains two databases of conservation development projects in northeast Ohio in the Lake Erie Basin area.[5] One database includes projects with 40% or more open space, while the other database lists projects that do not meet the 40% requirement but display characteristics the program believes are worth noting.

Appendix B lists the variables included in the comparative analysis. Common measures across all datasets were total acres preserved and total units. Not all measures were included in each dataset. For example, Hopkinton, MA was the only dataset that discussed adjacency to open space consistently for all projects. In contrast, Ohio and Wisconsin noted adjacency to open space or parks in the "comments" field for some projects. One should not assume that because adjacency was not included in the "comments" field for other projects, the project was not adjacent to open space. The same issue applies to long-term management, amenities, and natural features. These characteristics also were mentioned in an open-ended "comments" field in all of the datasets. As a result, the study is unable to assess the extent to which these features apply across projects, but does provide a sense of the variability in options available in CSD.

Another limitation of the data is the potential inconsistency in the way the variables are defined or calculated across datasets. First, the datasets may differ in the minimum percentage of open space required to be included in the CSD database. Second, open space may be defined differently across datasets. Conservation subdivision design emphasizes setting aside a percentage of the *buildable* land, in addition to wetlands, steep slopes, and other unbuildable areas. However, open space in CSDs in Ohio's datasets is defined as "all land that is not public or private road right-of-way, private lots, and multi-family or condominium landscaped living area."[6] On the other hand, Hamburg Township's dataset does not include wetland or non-

[3] Hamburg Township, MI spreadsheet provided by Leslie Meyers, former Zoning Administrator for Hamburg Township, MI. Map and updated information provided by Kathleen Semenuck, Zoning Administration Assistant for Hamburg Township, MI.

[4] Hopkinton, MA spreadsheet provided by Cobi Wallace, Administrative Assistant, Hopkinton Planning Department.

[5] Kirby Date, Countryside Program Coordinator, Maxine Goodman Levin College of Urban Affairs, Cleveland State University.

[6] The Countryside Program. Residential Conservation Development. Last updated Summer/Fall 2006.

buildable acreage in the open space acreage. The two figures are listed separately in this dataset. When provided in the dataset, definitions of terminology are explained in the relevant section of the analysis. Finally, the way in which the data are summarized for each project differs across datasets. For example, some projects list a range of lot sizes while others list an average lot size.

Results

A comparative analysis was performed within each dataset and across datasets and individual projects for six characteristics of CSD: land preserved, community size, lot size, type of units, common open space management, and adjacency or connectivity to other open space. Because of differences in available datasets, the tables in the analysis specify the number of projects included in each dataset for the specified measure. The number of projects for a given dataset may differ across tables because data for each measure were not available for every project. Datasets are listed separately throughout the analysis to enable a comparison of CSDs within the town or region. For instance, Hopkinton, MA is listed separately from the other projects in Massachusetts so one can evaluate the variability within the town of Hopkinton. The entry for Massachusetts (excluding Hopkinton) represents individual projects in Westborough, Amherst, Acton, and Concord, MA.

TABLE 4.1
Geographic Location of CSDs in Analysis

Northeast (n=45)	**sample size**
Maine	1
Hopkinton, Massachusetts	34
Massachusetts (excluding Hopkinton)	5
Rhode Island	1
Pennsylvania	4
Midwest (n=216)	
Hamburg Township, Michigan	46
Illinois	4
Ohio (at least 40% open space)	38
Ohio (less than 40% open space)	44
Wisconsin (with sewers)	35
Wisconsin (without sewers)	48
Minnesota	1
TOTAL	**261**

Geographic regions

The 261 CSDs in the analysis represent a sample of CSDs from nine states in the Northeast and Midwest regions of the United States. The U.S. Census Bureau defines the Northeast as the New England states (including Maine, Vermont, New Hampshire, Massachusetts, Connecticut, and Rhode Island), New York, New Jersey, and Pennsylvania. The Midwest consists of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. Figure 4.2 shows the states where data on CSDs were retrieved. Table 4.1 lists the number of CSDs for each dataset.

Total land conserved across all projects

Approximately 11,200 acres of open space have been permanently protected as a result of 255 conservation subdivision design projects with data on acres of land preserved. Common features protected across all regions include woodlots, wetlands, lakes and ponds. In the Northeast, orchards, quaking bogs, and pastures also were among highlighted protected features. Prairies and farmland were common in the Midwest. In addition to natural features, several communities preserved historic features including old barns, farmhouses, and stonewalls. Some historic buildings were restored and transformed into community centers.

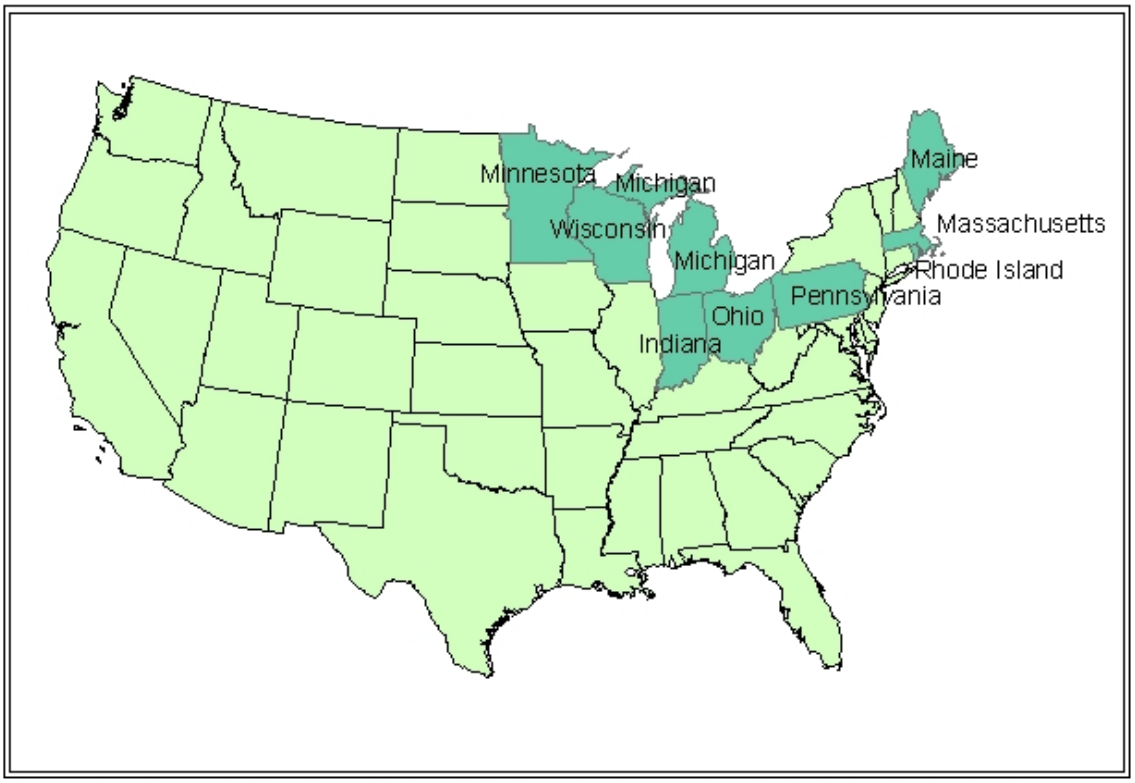

Figure 4.2: Map of Northeast and Midwest States with Conservation Subdivision Design Data

Trails are a common amenity in CSD communities. Sixty-three projects listed walking, hiking, or biking trails as a community feature. Eight projects in Wisconsin, Illinois, and Ohio have equestrian trails. Although recreation areas such as tennis courts, ball fields, and playgrounds were noted in CSDs in Michigan, Ohio, and Wisconsin, recreation areas are not unique to CSDs. Traditional subdivisions often offer similar recreational areas. Also, one may question whether such areas should count towards open space requirements intended to protect natural resources and other special features.

Amount of land conserved

Acres preserved

Definitions of open space vary greatly across towns and typically can be found in local ordinances. As previously mentioned, Ohio's dataset defines open space as "all land that is not public or private road right-of-way, private lots, and multi-family or condominium landscaped living area." Open space acreage in Hamburg Township's dataset does not include wetland or non-buildable acreage. A summary of ordinances for conservation subdivisions in southeastern Wisconsin reveals a wide disparity in open space definitions (Southeastern Wisconsin Regional Planning Commission (SEWRPC), 2005). For example, Walworth County allows privately owned conservation lots used for farming to count towards open space requirements. Others require a certain percentage of the total site to be permanently protected without specifying buildable versus unbuildable land.

The amount of open space preserved, as defined in each dataset, ranges widely within each dataset. In datasets with more than thirty projects, the common range is between five acres and approximately 200 acres with the exception of Hopkinton, MA, which tops out at 86 acres. Table 4.2 provides the average and range of acreage preserved across CSDs in each dataset. The average is calculated by adding the open space acreage for each project in the dataset and dividing by the number of projects with data on open space acreage. The range represents the lowest and highest value of open space acreage in the dataset.

TABLE 4.2
Land Preserved (Acres)

Dataset	Avg. Acres Preserved	Range (Acres preserved)	*n*
Illinois	208 acres	54 to 450	*3*
Minnesota	136 acres	--	*1*
Ohio (at least 40% open space)	76 acres	4.7 to 240	*37*
Northeast (excluding Hopkinton, MA)	63 acres	7.5 to 213	*11*
Ohio (less than 40% open space)	39 acres	6 to 207	*43*
Wisconsin (without sewers)	38 acres	7.7 to 183.5	*48*
Wisconsin (with sewers)	34 acres	5.2 to 146.6	*35*
Hamburg Township, MI	33 acres	3 to 194	*43*
Hopkinton, MA	25 acres	5.7 to 86	*34*

Percentage of open space

CSDs typically are described as preserving more than 50% of the buildable land. However, the analysis shows the percentage of total acreage preserved ranges between 10% and 87%. The percentage of open space is defined in the Hamburg and Wisconsin datasets as the percent of gross development area preserved as open space. The average and range of open space percentages in Table 4.3 are based on open space percentages provided in the dataset. The average percentage of open space is the sum of the percentages of open space divided by the number of projects with data on open space percentages. Aside from CSDs in Ohio with less than 40% open space, the average percentage of open space across datasets is greater than 43%.

It is not surprising that open space requirements for CSDs vary across communities since planning typically occurs at the local level. Conservation goals and priorities are likely to differ across towns. While some advocates define CSD by the percentage of open space preserved, others emphasize the importance of continuous improvement in development rather than a strict open space percentage minimum. They believe any development that takes conservation into consideration is better than one that does not.

TABLE 4.3
Percentage of Open Space

Dataset*	**Avg % open space**	**Range (% open space)**	***n***
Illinois	66%	57-71%	*3*
Northeast (excluding Hopkinton, MA)	64%	35-86%	*11*
Minnesota	60%	--	*1*
Ohio (at least 40% open space)	53%	40-72%	*32*
Wisconsin (without sewers)	51%	38-78%	*48*
Hamburg Township, MI	49%	30-87%	*32*
Wisconsin (with sewers)	43.5%	25-74%	*35*
Ohio (less than 40% open space)	25%	10-38%	*43*

* Total development area and percent open space for Hopkinton, MA are not available.

Community size

Total acreage

Approximately 26,000 (25,974) acres of residential development are represented in the analysis. The scale of CSD projects varies greatly within states and across regions. As displayed in Table 4.4, the total acreage ranges from five acres to 1600 acres across datasets.[7] On average, CSDs in Ohio tend to be larger (173 acres) than CSDs in Wisconsin (77 acres) and Hamburg Township, MI (60 acres.) Some of the larger CSDs in the datasets include New Albany Country Club Community in Ohio (1600 acres), Prairie Crossing in Illinois (667 acres), and Farmview in Pennsylvania (418 acres).

TABLE 4.4
Total Acres in CSD

Dataset	Avg. Total Acres	Range	*n*
Illinois	274	95 to 667	*4*
Minnesota	226	--	*1*
Ohio (less than 40% open space)	191.7	21 to 1600	*45*
Ohio (at least 40% open space)	153	9.6 to 604	*38*
Northeast	104	10 to 418	*11*
Wisconsin (CSDs with sewer)	77.5	8.8 to 237	*35*
Wisconsin (CSDs without sewer)	75.7	17.5 to 260	*48*
Hamburg Township, MI	59.5	5.75 to 252	*46*

Number of units

An analysis of the number of units in the community reveals disparity across CSDs. Number of units range from two to 1700 units. Table 4.5 presents the average and range of number of units for CSDs in datasets with more than 30 CSD projects.

TABLE 4.5
Number of Units

Dataset	Avg. # units	Range	*n*
Ohio (less than 40% open space)	293 units	11 to 1700	*43*
Ohio (at least 40% open space)	142 units	8 to 679	*37*
Wisconsin (CSDs with sewer)	65 units	20 to 143	*35*
Hamburg Township, MI	44 units	5 to 210	*46*
Wisconsin (CSDs without sewer)	20 units	5 to 60	*48*
Hopkinton, MA	17 units	2 to 69	*34*

[7] Excluding Hopkinton, MA. Total acreage for projects in Hopkinton, MA was not available.

Lot size

The CSD concept calls for placing the same number of lots as conventional developments in a more strategic manner. By reducing individual lot sizes and grouping them together, one can maximize the amount of continuous open space. Some communities provide density bonuses as an incentive for developers to design sites in a way that preserves open space. Although individual lot sizes may be smaller than conventional developments, the amount of open space per lot is maintained or increased. Many houses are adjacent to woodlots or other types of open space. Also, the design maximizes scenic views of the open space.

Arendt (1999b) provides a table of density options for different contexts (rural, suburban, urban) and conservation goals. According to the interviewees, CSD occurs most often in rural contexts. The comparative analysis shows a wide range of lot sizes both within and across projects. Most CSDs provide a variety of lot sizes within the community. In the Wisconsin and Ohio datasets, lot size is defined as privately owned lots excluding open space. Table 4.6 shows the range of minimum lot sizes, range of maximum lot sizes, and average range of lot sizes for projects in each dataset. The average range represents the median of the lower bound to the median upper bound across projects in each dataset. It also includes entries with average lot size or minimum lot size.

CSDs in the Northeast and Michigan tend to have smaller lot sizes than Ohio and Wisconsin. CSDs in Ohio average close to one acre per lot to four acres per lot. CSDs in Wisconsin average almost ½ acre to 1¾ acres in communities with sewers, and 1¼ to just over 3½ acres in CSDs without sewers. Density is limited in neighborhoods with septic systems due to the amount of space needed for septic fields.

Table 4.6
Lot Size (Acres)

Dataset	**Min Range**	**Max Range**	**Avg. Range**	***n***
Wisconsin (without sewers)	0.69 to 2.52	1.12 to 34.28	1.22 to 3.64	*48*
Ohio (less than 40% open space)	0.14 to 5.00	0.23 to 20.0	0.96 to 4.04	*17, 19**
Ohio (at least 40% open space)	0.11 to 5.00	0.20 to 40.0	0.80 to 3.60	*16*
Hamburg Township, MI	0.27 to 0.67	0.42 to 1.24	0.43 to 0.74	*29*
Wisconsin (with sewers)	0.062 to 0.92	0.07 to 28.8	0.41 to 1.71	*35*
Northeast (exc. Hopkinton, MA)	0.23 to 0.50	0.28 to 2.0	0.33 to 0.86	*5,4**
Illinois	0.14	0.46	0.14 to 0.46	*1*

* The first sample size refers to projects with range data. The second sample size represents projects with range data and projects with data on only average lot size or minimum lot size.

Type of units

The datasets specify detached single-family homes for the majority of CSDs. While almost all CSDs include single-family homes, a few CSDs in Ohio, Wisconsin, and the Northeast also offer other types of housing options. In Ohio, these include townhouses, condominiums, multi-family duplexes, triplexes, and quadraplexes. Also, Ohio distinguishes between single-family and single-family cluster housing, although the definition of each is not provided. In Wisconsin, four CSDs in the study offer multi-family homes, apartments, or commercial/office space, in addition to single-family homes. Three projects in the Northeast highlight townhouses and/or two-family housing. One project, Canterbury Farms in Amherst, MA, specifically mentions affordable housing.

An analysis of housing prices across CSDs is beyond the scope of this study. However, site visits to CSDs in Hamburg, MI, Hopkinton, MA, and Westborough, MA provided a sense of the affluence in these neighborhoods. The majority of the homes were large, estate-like homes. Figures 4.3 - 4.14 provide photographs of homes in conservation subdivisions.

Figure 4.3: Hunters Pointe, Hamburg Township, MI

Figure 4.4: Setters Pointe, Hamburg Township, MI

Figure 4.5: Solitude Pointe, Hamburg Township, MI

Figure 4.6: Spencer Woods, Hamburg Township, MI

Figure 4.7: Commons at Hopkinton, Hopkinton, MA

Figure 4.8: Olde North Mill, Hopkinton, MA

Figure 4.9: Olde North Mill, Hopkinton, MA

Figure 4.10: Olde North Mill, Hopkinton, MA

Figure 4.11: Roosevelt Farms, Hopkinton, MA

Figure 4.12: Assabet Estates, Westborough, MA

Figure 4.13: Prentice Forest, Westborough, MA

Figure 4.14: Prentice Forest, Westborough, MA

Common open space management

Homeowners associations own and maintain the common open space in the majority of CSD projects in the sample. This includes 81 of 83 CSD communities in Wisconsin and in all CSDs in Hamburg Township, MI. Towns and land trusts also manage a portion of the open space in some projects. Donations of land to the township, city, or state were mentioned for projects in Ohio, Wisconsin, and Minnesota. Land trust ownership was noted for projects in Ohio (3), Wisconsin (1), Maine (1), and Minnesota (1). At Farmview in Pennsylvania, land was donated to the Farmland Preservation Corporation, which leases cropland to farmers.

In Hopkinton, MA, ownership of open space varies across projects. Hopkinton town departments, homeowners associations, and Hopkinton Area Land Trust own and manage a portion or all of the open space in the conservation subdivisions. Table 4.7 presents the number of CSDs managed by the different organizations. Town ownership is spread across multiple departments, including the Hopkinton Conservation Commission, Water Department, Open Space Preservation Commission, and Parks and Recreation. The Hopkinton Conservation Commission focuses on protecting natural resources, watersheds, and wetlands. Also, it coordinates with other towns on conservation issues in the area ("Hopkinton Conservation Commission"). The Open Space Preservation Commission's goal is to acquire and protect land from development and preserve the rural character of Hopkinton ("Open Space Preservation Commission").

TABLE 4.7 Open Space Management in Hopkinton, MA (n=34)	
Homeowners Association	14
Town of Hopkinton Hopkinton Conservation Commission (5) Water Department (5) Open Space Preservation Commission (2) Parks and Recreation (2)	14
Hopkinton Area Land Trust	9

Common open space is managed in a variety of ways. Most CSDs require trail maintenance. Some homeowners associations establish community workdays where residents participate in trail maintenance. Other CSDs have community gardens or community-supported agriculture, which provide opportunities for residents to care for and invest in the land. Community gardens were mentioned for two CSDs in Illinois and one CSD in Ohio. Prairie Crossing in Illinois is well known for its community-supported organic farm. Working farms also exist in Tryon Farm in Illinois and Prairie Hollow and Hidden Prairie in Wisconsin.

Adjacency to other open space

Few towns maintain information on adjacency or connectivity of CSDs to other open space. Hopkinton, MA tracks adjacency for all projects. Of the 32 sites in Hopkinton with data on adjacency, 18 are adjacent to other open space. Information on adjacency or connectivity for some Ohio CSDs is provided in the "notes" field of the datasets. Five CSDs in Ohio are identified as being adjacent to other open space, including a city park, golf course, National Recreation Area, Audubon land, woodlots, and land owned by the state and Conservation Fund. Another project, Canterbury Farms in Amherst, MA, highlighted its location next to a state park. In addition, seven projects in the Northeast, Wisconsin, and Ohio noted community trails that connect to existing trail networks.

Summary and conclusions

Many of the CSDs included in the analysis have made a big difference in conserving land, protecting important features, and providing nearby nature to residents. While CSDs have some common characteristics, they also exhibit variability in scale, amount of land conserved, lot size, common open space management, and adjacency to other open space. The analysis demonstrates that CSDs lie at various points along a continuum of environmental protection and

conservation. While some CSDs preserve significant portions of continuous buildable land, others set aside relatively small pieces of isolated land or count unbuildable wetlands and lakes towards its open space requirement.

An advantage of conservation subdivision design is the ability to customize the design to the priorities, needs, and interests of the community. Density can be chosen from a variety of options based on the context and community's conservation goals. Also, the community prioritizes the natural, cultural, and/or historic features to be conserved. Due to the unique conditions of each site, the CSD process enables decisions to be made on a case-by-case basis.

A disadvantage of this customized approach, however, is the lack of a broad ecosystem-wide framework within which conservation decisions should be made. Continuity and relationships among conserved spaces in different CSDs are important factors in determining the efficacy of the approach. Also, the prioritization of features to protect should be based partly on the role the feature plays in ecosystem functioning. Thus, this determination requires a certain level of ecological knowledge.

The flexibility of the CSD approach leads to great variability across CSDs. Given most planning occurs at the local level, the variability across towns or regions is hardly surprising; however, variability within towns reflects the flexibility that can be provided in local ordinances. It also may indicate that adherence to the local ordinance varies. Although implementation issues are not unique to CSD, the wide range of differences found for CSD characteristics are notable given CSD's intention to be more mindful of these characteristics.

Photographs of open space in conservation subdivisions

Figure 4.15: Setters Pointe, Hamburg Township, MI

Figure 4.16: Setters Pointe, Hamburg Township, MI

Figure 4.17: Olde North Mill, Hopkinton, MA

Figure 4.18: Roosevelt Farms, Hopkinton, MA

Figure 4.19: Assabet Estates, Westborough, MA

Figure 4.20: Assabet Estates, Westborough, MA

Figure 4.21: Prentice Forest, Westborough, MA

Figure 4.22: Hopkinton Meadow, Hopkinton, MA

V. Conclusion

Land development statistics reveal an alarming rate of land consumption across the country. This growth raises concerns about the loss of open space within urban areas and in outlying areas, as well as the loss of town character in rural or suburban communities in the metropolitan fringe. Given the negative environmental, health, and social consequences of sprawl, planners, researchers, and government agencies have been developing and researching tools and techniques for managing growth in a more efficient and sustainable manner. They have approached growth management and conservation in various ways. Some have focused on policy-based tools, such as urban growth boundaries, zoning ordinances, and design standards. Others emphasize a more market-based approach, such as transfer or purchase of development rights. These strategies involve different players and types of agreements, and, therefore, may provide different levels of long-term protection of open space depending on enforceability and terms of the agreement.

A strategy for preventing sprawl should strive to meet a number of key objectives. First, it should allow developers to meet consumer demands, accommodate growth resulting from a thriving economy, and maintain a profitable business. Second, it should minimize the environmental impacts of development and ensure the protection of important natural features needed for healthy ecosystem functioning. Third, it should promote public health and safety, which is directly linked to the protection of natural resources. Finally, it should provide citizens with housing and commuting choices and protect their privacy.

Encouraging development in areas with existing public services and infrastructure is a reasonable strategy for preventing sprawl. However, it does not address the recent trend of people moving out of the city and into the suburbs. Why are people moving out of the city? To what are they drawn in the outlying areas? The most likely answers are abundance of open space, small town character, and affordability. Until ways of making cities more desirable and affordable are realized, new development in outlying areas is inevitable as population grows.

Conservation subdivision design is one mechanism for protecting the open space and town character of communities in the metropolitan fringe. It promotes a balance between development and conservation by allowing the same number of housing lots as conventional developments but placing them in a more strategic and conservation-friendly manner. By setting aside a significant portion of open space and protecting natural, cultural, and historic features, conservation subdivision design can promote environmental protection, increase residents' access to nearby nature, and preserve the town or rural character of the community. Additional benefits can include reduced infrastructure costs, improved water quality of nearby water bodies, reduced flooding and erosion, greater wildlife habitat, maximized scenic views, and greater opportunities for recreation, restoration, and social interaction. Although CSD does not address transportation-related problems associated with sprawl, it does promote better development practices that take into account open space preservation

and access to nearby nature for residents. In this way, CSD integrates conservation into the development process.

Combination of Conservation Techniques

Conservation subdivision design coupled with other conservation tools can be an effective strategy for protecting open space in the long term. One interviewee noted the strong role for local government in conservation given its ability to influence land use. Other interviewees stressed the importance of involving multiple parties in order to provide several layers of protection and enforceability. Combining CSD with other conservation methods and legal tools can help achieve this goal.

Master planning and zoning

Master planning, such as greenprinting or green infrastructure planning, can provide the foundation on which informed decisions about development and conservation can be made. Regional or town master plans can help communities identify their goals, set priorities, and develop an implementation strategy. Conservation subdivision design is one tool that can be used to implement the plan.

While creating a long-term vision and growth management strategy is an important step in conserving land, communities with master plans are not without challenges. Inconsistencies between the master plan and zoning ordinances pose serious problems for achieving the goals of the plan. An interviewee noted that zoning typically takes precedence over the master plan. If the developer meets current zoning, then it is very difficult for the planning commission or council to reject the project. Therefore, a master plan initiative should be matched with an equally strong initiative to revise the zoning ordinances, since zoning is the means by which the master plan is implemented. Through an open space ordinance or performance zoning, the town can offer conservation subdivision design by-right, or without requiring a special permitting or approval process. Taking this a step further, the town could require conservation subdivision design for all residential development proposals. Density bonuses or other incentives may be used with caution to promote CSD where it is not required.

Multiple layers of protection

Multiple layers of protection are needed to protect the open space in the long-term. Since zoning ordinances and master plans can be revised and land can be rezoned, private agreements may increase the likelihood of long-term protection. On the other hand, the city typically has no power to enforce private agreements. Involving multiple parties and establishing both private and public legal safeguards would provide the greatest level of protection. Applying one or more of the following conservation tools to CSD could achieve these goals.

Conservation easements

Once the conservation subdivision is built, a conservation easement can be placed on the common open space and held by a third party land trust or government agency. Involving a third party provides the advantage of ensuring long-term protection in the event of a homeowners association disbanding or changes in ownership. Also, the third party could provide expertise and support in managing and maintaining the land.

Deed restrictions and covenants

Covenants and restrictions should establish legal authority of the homeowners association to levy funds for open space maintenance and exact those funds if residents do not pay (e.g. put a lien on a house). Also, language should be included that gives the local government the right to intervene, maintain the open space, and bill the residents for it if the homeowners association falls apart.

Open space management plan

The city can require the developer to submit an open space management or maintenance plan as part of the zoning and plat process. The plan could describe intended use of the common open space (i.e. organic farming, community garden, native planting, prairie restoration, etc.), as well as proper maintenance techniques. Landscape architects, ecologists, or others with the necessary expertise should be involved in the creation of the management plan.

Plat subdivision

If the area is platted as an open space lot and residents own a fraction of the open space, then any proposals to divide up the open space or change ownership would require the approval of all residents, which is highly unlikely.

Land acquisition programs

Developers or homeowners can choose to donate a portion or all of the open space in the conservation development to a local government or nonprofit organization, which would then own the land. Land acquisition funds could then be reserved for acquiring sensitive, high quality natural areas, green space within urban areas, or other high priority areas. Although the city or non-profit would not need to purchase the land in conservation subdivisions, funding would be required for maintaining the open space. This may be preferred in situations where ecological knowledge or expertise is needed to maintain the land. Also, since the government or land trust would own the land, access to the open space could be granted to the public, thus offering nearby nature to a greater population.

Ways to Promote CSDs

Despite its documented benefits, the CSD concept is widely misunderstood. Interviews with developers, planners, and conservation organizations revealed many misconceptions about conservation subdivisions. Also, barriers related to uncertainty and perceptions of density exist. However, results of the comparative analysis show the successful implementation of conservation subdivision design in many communities. These projects demonstrate achievements in conserving land, protecting important features, and providing nearby nature to residents. The comparative analysis reveals great variability across projects in terms of community size, total acres preserved, lot size, common open space management, and adjacency to other open space. The wide range of environmental protection is not surprising given the flexibility of CSD, or the ability to customize the technique to address the community's concerns and priorities. This variability is not a problem for CSD as long as it encourages continuous improvement in development practices. Also, CSD should be implemented within a regional landscape plan and should aim to achieve open space connectivity.

This section provides recommendations on ways to address misconceptions and barriers and promote more widespread use of CSD. Some of these suggestions were made by the interviewees, while others evolved from the analytical findings and literature review. Recommendations are categorized into three main areas: better monitoring and documentation, strategies to encourage long-term management of open space, and better marketing.

Better monitoring and documentation

One way to increase competence and confidence in conservation subdivision design is to improve the visibility of conservation subdivisions by providing numerous examples and analyses of CSD. The more familiar a concept is, the more likely a community will try it. Sharing success stories and lessons learned would provide valuable information to communities interested in exploring CSD. Data should be collected on variables including total acres preserved, common open space management, density, quality of land preserved, natural features protected, and connections to greater networks of open space. Data collection would enable an analysis of aggregate statistics across many projects to determine total land conserved and types of features protected through CSD. An open space acreage counter could demonstrate the success of CSD in conserving land.

Most of the research on conservation subdivision design thus far has focused on the intended benefits and how to go about creating a conservation subdivision. Less attention has been given to the timeframe following the project's completion. In order to better understand the impacts of conservation subdivision design and determine whether this is a strategy worth scaling up, more research is needed on residents' awareness of their unique surroundings, benefits realized, and long-term management of the common open space. Site visits after the project's completion and monitoring over the long term are crucial in evaluating the success of CSD. Databases should be updated with this information on a regular basis.

Strategies to encourage long-term management of open space

In addition to monitoring and documenting CSDs, steps can be taken to increase the likelihood of successful maintenance and protection of the common open space. One important step is the development of a common open space management or maintenance plan, as previously discussed. Even with a plan in place, however, the homeowners association or residents may not have the necessary knowledge or expertise to properly manage the land. In these situations, workshops and information resources should be provided. Partnerships with conservation organizations and land trusts also would be valuable, given their expertise in managing and maintaining conservation land.

Increasing residents' participation in caring for the land may be a powerful tool in ensuring long-term protection. Residents may be more likely to value, enforce, and protect the common open space if they are invested in it, either through use or participation in its maintenance. Examples include community workdays, community gardens, and community-supported agriculture. In a study on community garden programs, participants noted feelings of empowerment and ownership (Glover, 2003). Also, community-supported agriculture may provide a local food source and additional community income.

Kaplan and Kaplan (2003) discuss the important role that meaningful participation plays in feelings of personal satisfaction and effectiveness. People have a strong motivation to make a difference and feel they are needed and are a valuable member of society. Activities that allow for participation can enhance sense of belonging and helpfulness and promote reasonable behavior. Also, interactions with nature can lead to greater feelings of connectedness (Irvine & Warber, 2002) and improved psychological and physical health, as discussed in chapter II.

At the same time, some CSDs have experienced problems with low resident participation in open space maintenance. This raises the question of why stewardship opportunities work well in some CSD contexts and not in others. Future research on this issue would be useful in understanding the source of this lack of participation and how one might address it. Additional research also could explore other problems encountered in maintaining the open space.

Better marketing

Two interviewees emphasized the need for more or better marketing of CSD by planning consultants, realtors, and organizations promoting smarter growth. They suggested customizing advertising to specific groups and reframing the way in which CSD is marketed. Key players in pushing CSD forward are planners, realtors, and developers.

In order to address the misconceptions of CSD, continuous outreach and education is needed. First, given the frequent turnover of planning boards and city council, the CSD concept and its benefits need to be communicated to planners on a regular basis. Second, developers need to be informed about studies showing quicker sales and higher premiums for CSD than homes in conventional developments. This information can be provided through trade publications, websites, and conferences. Both small residential and larger developers should be targeted. Third, realtors need to be educated about CSDs so they can distinguish conservation subdivisions from high density housing by highlighting the open space amenities and nature views. They can play a critical role in advertising, spreading information, and communicating the benefits of CSD.

Psychology studies show a greater motivation to avoid loss than achieve gain. Thus, developers' costs could be phrased in terms of the amount of money they could lose if they do not design a conservation subdivision, since this is more compelling than the additional money they could make. Similarly, in response to the failure to get land trusts on board, reframing the issue as a lost opportunity may be effective. Land trusts typically target private landowners in their land acquisition efforts. Since the majority of landowners sell their land to developers, land trusts could have access to more land acquisition opportunities if they promoted CSD and partnered with developers and planners.

Two interviewees suggested changing the name of conservation subdivisions to something with less of an environmental focus, since conservation or protecting natural features may not be a primary concern for many people. The interviewees believe a healthy living initiative is more likely to peak the interest of a wider range of people. Further research is needed to determine whether this perspective is more widely shared. However, highlighting the health benefits of CSD and linking them to environmental protection likely would help in marketing CSD. Also, disseminating research studies on the relationship between nearby nature or views and quality of life or satisfaction could aid in promoting CSD.

In response to negative perceptions of density and its relationship to CSD, the problem needs to be reframed from one of density to one of lack of open space. In evaluating density, one should think about what density accomplishes. Does the clustering provide greater open space within the community? Is the density appropriate for the context? Once the difference between density and density with open space is made more apparent, support for CSD is likely to increase. Furthermore, CSDs can do more to highlight the nature views afforded by the placement of homes as these are likely to play an important role in offsetting the perception of density. One interviewee believes arguments about density will end when communities provide attractive architecture, landscape design, and true conservation.

The spread of CSDs has been hindered by the uncertainty associated with implementing a new technique. There are several ways to increase communities' willingness to try CSD despite uncertainties. In addition to outreach and education on

CSD, providing multiple examples and guided tours of existing CSDs can increase people's familiarity and experience with the concept. Second, communities can try CSD with one or two small-scale projects before including CSD in zoning ordinances or other regulations. These small experiments carry less risk while offering opportunities to test the approach in the context of a specific community. Third, landscape designers and ecologists can provide the necessary expertise and help guide the CSD process. Finally, incentives can be provided, including a streamlined and quicker approval process, privatization of streets, and density bonuses. Given the opposing opinions of density bonuses among the interviewees, care should be taken in providing density bonuses. A limit on the density bonus may be warranted.

Conservation subdivision design is a promising tool for preventing loss of open space and community character in towns under development pressure. While it does not address all of the issues associated with sprawl, CSD does provide nearby nature to residents and protects natural resources. It is associated with many important environmental, health, and community benefits. Coupled with other conservation techniques, CSD can be powerful in ensuring the long-term protection of open space. With better marketing, documentation, and long-term monitoring, CSD has the potential to become more widespread and effective. The sustainable development practices it promotes make it possible to meet the need for housing, while preserving the natural landscape and the many benefits it provides.

Appendix A: Interviewees

Name	Title	Organization	State or country
Randall Arendt	Senior Conservation Advisor Landscape Planner, Lecturer	Natural Lands Trust Greener Prospects	PA RI
(Anonymous)	Principal Planner	Washtenaw County Dept of Planning and Environment	MI
Rod Cortright	Former County Extension Director	Charlevoix County Michigan State Univ. Extension	MI
Norman D. Cox ASLA	President	The Greenway Collaborative, Inc.	MI
Kirby Date, AICP	Coordinator	The Countryside Program Levin College of Urban Affairs Cleveland State University	OH
Colin Duesing	Planner	Will County Land Use Dept.	IL
Caryn Ernst	Associate Director of Conservation Vision Services	Trust for Public Land	Washington DC
Kendall Jackson	Planner	Joliet Planning and Zoning Dept	IL
Michael Kelly	Director	Great Lakes Office The Conservation Fund	MI
Amy Kuras	Park Planner	Park Planning and Development City of Ann Arbor	MI
Philip C. Laurien AICP	Executive Director Former Executive Director	East Central Florida Regional Planning Council Delaware County Regional Planning Commission	FL OH
Ginny Leikam	Program Manager	Ann Arbor Greenbelt The Conservation Fund	MI
Douglas J. Lewan, AICP, PCP	Principal and Planner	Carlisle/Wortman Associates, Inc.	MI
Barry Lonik	Land Protection Consultant Former Executive Director	Private consulting firm Washtenaw Land Trust	MI MI
Kirt Manecke	Founder and President	LandChoices	MI

Appendix A: Interviewees (continued)

Leslie Meyers	Planning Consultant Former Zoning Administrator	Private consulting firm Hamburg Township	MI MI
Derek Saari	Assistant Town Planner & Assistant Conservation Commission Officer	Westborough Planning Dept	MA
Daniel Savard	Senior Planner Department of Environment	Province of New Brunswick,	Canada
Doug Savidge	Principal Advisor	Savage Green Development, LLC LandChoices	MA MI

Appendix B: Variables in Database

1. Town or Program
2. State
3. # projects
4. # projects with data
5. Total Acres
6. Total Units
7. Type of Units
8. Total Open Space (acres)
9. Total Open Space as %
10. Lot Size
11. Long-term Management
12. Natural Features
13. Amenities
14. Connectivity or Adjacency

References

Alberti, M. (2005). The Effects of Urban Patterns on Ecosystem Function. *International Regional Science Review, 28*(2), 168-192.

ALPS Development Inc. (2007). ALPS' Communities. Retrieved September 15, 2006, from http://www.alpsdevelopment.com/communities.html

Arendt, R. (1996). *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*. Washington D.C.: Island Press.

Arendt, R. (1999a). Creating Greener Communities Through Conservation Subdivision Design. In C. Kilbert (Ed.), *Reshaping the Built Environment: Ecology, Ethics, and Economics*. Washington D.C.: Island Press.

Arendt, R. (1999b). *Growing Greener: Putting Conservation into Local Plans and Ordinances*. Washington D.C.: Island Press.

Arendt, R. (2004). Linked landscapes: Creating greenway corridors through conservation subdivision design strategies in the northeastern and central United States. *Landscape and Urban Planning, 68*(2-3), 241-269.

Austin, M. E., & Kaplan, R. (2003). Resident Involvement in Natural Resource Management: open space conservation design in practice. *Local Environment, 8*(2), 141-153.

Barnett, J. (2001). *Planning for a New Century: the regional agenda*. Washington D.C.: Island Press.

Belansky, E. G., & Justus, S. L. (2000). *Open Space Residential Development: Four Case Studies*. Retrieved. from http://commpres.env.state.ma.us/content/publications.asp#casestudies.

Benedict, M. A., & McMahon, E. T. (2002). *Green Infrastructure: Smart Conservation for the 21st Century* (monograph). Washington D.C.: Sprawl Watch Clearinghouse.

Benedict, M. A., & McMahon, E. T. (2006). *Green Infrastructure: Linking Landscapes and Communities*. Washington D.C.: Island Press.

Byers, E., & Ponte, K. M. (2005). *The Conservation Easement Handbook* (2nd ed.). Washington D.C. and San Francisco, CA: Land Trust Alliance and The Trust for Public Land.

Carliner, M. S. (1999). Comment on Karen A. Danielsen, Robert E. Lang, and WIlliam Fulton's "Retracting Suburbia: Smart Growth and the Future of Housing" *Housing Policy Debate, 10*(3), 549-553.

Cimprich, B. (1993). Development of an intervention to restore attention in cancer patients. *Cancer Nursing, 16*(2), 83-92.

Easterbrook, G. (1999). Comment on Karen A. Danielsen, Robert E. Lang, and WIlliam Fulton's "Retracting Suburbia: Smart Growth and the Future of Housing" *Housing Policy Debate, 10*(3), 541-547.

EPA New England. (2001). *Transferable Development Rights: Using Market Forces and Master Planning to Manage Growth and Environmental Quality*. Retrieved March 17, 2007. from http://epa.gov/Region1/ra/sprawl/tdr2.pdf.

Ewing, R., & Kreutzer, R. (2006). *Understanding the Relationship Between Public Health and the Built Environment*: Design, Community, and Environment, Lawrence Frank and Company, Inc.

Fjoroft, I. (2001). The Natural Environment as a Playground for Children: The Impact of Outdoor Play Activities in Pre-Primary School Children. *Early Childhood Education Journal, 29*(2), 111-117.

Frumkin, H. (2001). Beyond toxicity: Human health and the natural environment. *American Journal of Preventive Medicine, 20*(3), 234-240.

Glover, T. D. (2003). The story of the Queen Anne Memorial Garden: Resisting a dominant cultural narrative. *Journal of Leisure Research, 35*(2), 190.

Göçmen, Z. A. (2006). Land development patterns, environmental perceptions, and residential preferences in Southeast Michigan (unpublished dissertation).

Heerwwagen, J. H. (1990). *The psychological aspects of windows and window design.* Paper presented at the 21st Annual Conference of the Environmental Design Research Association, Oklahoma City.

Hopkinton Conservation Commission. Retrieved April 1, 2007, from http://www.hopkinton.org/gov/conservation/index.htm

Illinois Environmental Protection Agency. A Guide to the Illinois Vehicle Emissions Inspection Program: Air Pollution. Retrieved April 4, 2007, from http://www.epa.state.il.us/air/vim/guide/air_pollution.html

Irvine, K. N., & Warber, S. L. (2002). Greening healthcare: Practicing as if the natural environment really mattered. *Alternative Therapies in Health and Medicine, 8*(5), 76.

Jackson, R. J., & Kochtitzky, C. (2001). *Creating a Healthy Environment: The Impact of the Built Environment on Public Health.* Washington D.C.: Centers for Disease Control and Prevention

Kane, R. P. (1997). The Ecological and Biological Benefits of Open Space. In L. W. Hamilton (Ed.), *The Benefits of Open Space*. Madison, NJ: Great Swamp Watershed Association.

Kaplan, R. (1993). The role of nature in the context of the workplace. *Landscape and Urban Planning, 26*(1-4), 193-201.

Kaplan, R., Austin, M. E., & Kaplan, S. (2004). Open Space Communities: Resident Perceptions, Nature Benefits, and Problems with Terminology. *Journal of the American Planning Association, 70*(3), 300-312.

Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. Cambridge University Press. (Republished by Ann Arbor, MI: Ulrich's. 1995.)

Kaplan, S. (1995). The restorative benefits of nature: toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169-182.

Kaplan, S., & Kaplan, R. (1978). *Humanscape: Environments for People*. Belmont, CA: Duxbury. (Republished by Ann Arbor, MI: Ulrich's. 1982.)

Kaplan, S., & Kaplan, R. (1982). *Cognition and Environment: Functioning in an Uncertain World*. New York: Praeger. (Republished by Ann Arbor, MI: Ulrich's. 1989.

Kaplan, S., & Kaplan, R. (2003). Health, Supportive Environments, and the Reasonable Person Model. *American Journal of Public Health, 93*(9), 1484-1489.

Kendig Keast Collaborative. (2007). Innovation: Performance Zoning. Retrieved March 18, 2007, from http://www.lanekendig.com/innovation/performancezoning.html

Kendig, L. (1980). *Performance Zoning*. Chicago: American Planning Association.

Kim, J., & Kaplan, R. (2004). Physical and Psychological Factors in Sense of Community: New Urbanist Kentlands and Nearby Orchard Village. *Environment and Behavior, 36*(3), 313-340.

Knaap, G., & Talen, E. (2005). New Urbanism and Smart Growth: A Few Words from the Academy. *International Regional Science Review, 28*(2), 107-118.

Kuo, F. E., & Sullivan, W. C. (2001a). Aggression and Violence in the Inner City: Effects of Environment via Mental Fatigue. *Environment and Behavior, 33*(4), 543-571.

Kuo, F. E., & Sullivan, W. C. (2001b). Environment and Crime in the Inner City: Does Vegetation Reduce Crime? *Environment and Behavior, 33*(3), 343-367.

Kuo, F. E., Sullivan, W. C., Coley, R. L., & Brunson, L. (1998). Fertile Ground for Community: Inner-city Neighborhood Common Spaces. *American Journal of Community Psychology, 26*(6), 823.

Lacy, J. (1990, June 11, 1995). An Examination of Market Appreciation for Cluster Housing With Permanent Open Space. Retrieved October 11, 2006, from http://www.umass.edu/larp/crm/Lacy/LacyMarket.html

LandChoices. (n.d.). Conservation Design Subdivisions: Creating Better Places to Live. Retrieved September 3, 2006, from http://www.landchoices.org/conservation_design.htm

Lummis, C. M. (n.d.). *Wyoming, Like No Place on Earth: Ways to Conserve Wyoming's Wonderful Open Lands: A Guidebook*: Wyoming Governor's Office.

McHarg, I. L. (1969). *Design with Nature*. New York: Natural History Press.

Metropolitan Area Planning Council. (2006). Transportation Emissions & Air Quality: Implications for Public Policy Retrieved April 4, 2007, from http://www.mapc.org/transportation/Air_Quality/Air_Quality.html

Mitchell, J. G. (2001). Urban Sprawl. *Official Journal of the National Geographic Society, 200*(1), 48-73.

Mohamed, R. (2006). The Economics of Conservation Subdivisions. *Urban Affairs Review, 41*(3), 376-399.

Moore, E. O. (1981). A prison environment's effect on health care service demands. *Journal of Environmental Systems, 1981-1982*(11), 17-34.

Natural Lands Trust. (2005). Growing Greener Case Studies. Retrieved October 30, 2006, from http://www.natlands.org/categories/article.asp?fldArticleId=38

Open Space Preservation Commission. Retrieved April 1, 2007, from http://www.hopkinton.org/gov/openspace/index.html

Planning Commissioners Journal. (2000, June 9). How Do You Define Sprawl? *Sprawl Guide* 3rd. Retrieved May 4, 2006

Ryan, R. L. (2006). Comparing the attitudes of local residents, planners, and developers about preserving rural character in New England. *Landscape and Urban Planning, 75*(1-2), 5-22.

Schneider, K. (2000, March 2000). Breaking the Sprawl Addiction. *Great Lakes Bulletin (Magazine of the Michigan Land Institute), 11*.

Sherer, P. M. (2006). The Benefits of Parks: Why America Needs More City Parks and Open Space. San Francisco: The Trust for Public Land.

Southeastern Wisconsin Regional Planning Commission (SEWRPC). (2005). *Summary of Ordinance Requirements for Conservation Subdivisions in Southeastern Wisconsin*. Retrieved April 1, 2007. from http://www.sewrpc.org/communityassistance/conservationsubdivisions/pdfs/summary_of_conservation_subdivision_regulations.pdf.

Staley, S. R., Edgens, J. G., & Mildner, G. C. S. (1999). A Line in the Land: Urban-growth Boundaries, Smart Growth, and Housing Affordability. *Reason Public Policy Institute, November*(Policy Study No. 263).

Stanford, R. (1999). *An Analysis of the Open Space-Designed Subdivision Concept As Applied in Hamburg Township, Michigan.* Michigan State University, East Lansing.

Taylor, A. F., Kuo, F. E., & Sullivan, W. C. (2001). Coping With ADD: The Surprising Connection to Green Play Settings. *Environment and Behavior, 33*(1), 54-77.

The Conservation Fund prepared for The City of Ann Arbor. (2005). *Ann Arbor Greenbelt District Strategic Plan*. Retrieved March 16, 2007. from http://www.ci.ann-arbor.mi.us/greenbelt/STRATEGIC%20PLAN%202005-2006.pdf.

The Trust for Public Land, & National Association of Counties. (2002). *Local Greenprinting for Growth: Using Land Conservation to Guide Growth and Preserve the Character of our Communities* (Local government guide to greenprinting, 4 volumes). San Francisco: The Trust for Public Land.

Town of Cary Planning Department. (2001). *Town of Cary Open Space and Historic Resources Plan: Conservation Subdivision Design*. Retrieved October 31, 2006. from http://www.townofcary.org/depts/dsdept/P&Z/openspace/oshrpplan.pdf.

U.S. Environmental Protection Agency. (2006, March 8). About Smart Growth. Retrieved April 24, 2006, from http://www.epa.gov/dced/about_sg.htm

U.S. Environmental Protection Agency. (2007a, March 9). Smart Growth. Retrieved March 17, 2007, from http://www.epa.gov/dced/index.htm

U.S. Environmental Protection Agency. (2007b, March 18, 2007). Smart Growth Policies Glossary. Retrieved March 18, 2007, from http://cfpub.epa.gov/sgpdb/glossary.cfm?%20type=strategy

Ulrich, R. S. (1984). View through a Window May Influence Recovery from Surgery. *Science, 224*(4647), 420-421.

Whiteford, C. (2003, September 21-24). *Creating a Conservation Vision.* Paper presented at the Mid America Trails and Greenways Conference Green Infrastructure: A Natural Framework for the Future, Indianapolis, IN.

Will County Center for Economic Development. (2007). Will County Facts and Figures. Retrieved March 22, 2007, from http://www.willcountyillinois.com/Default.aspx?tabid=245

Wisconsin Department of Natural Resources, & University of Wisconsin -- Extension. (2002). Conservation Easements. Retrieved April 4, 2007, from http://www.dnr.state.wi.us/org/water/wm/nps/pdf/easement_brochure.pdf