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Developing conservation subdivisions: Ecological constraints, regulatory barriers, and market incentives

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ABSTRACT

The majority of people in the world now live in urban areas. Traditional urban development has threatened terrestrial and aquatic ecosystems through direct habitat destruction, various forms of pollution, and introduction of exotic species. Development practices that minimize ecological damage are becoming more prevalent in the United States. One of these development forms is conservation subdivisions (CSDs). CSDs are residential or mixed use subdivisions typically designed to minimize site disturbance and protect ecologically sensitive areas of a site. In practice, however, they sometimes do not accomplish ecological goals and many barriers exist to their widespread implementation. In this study, we evaluate how CSDs can be encouraged and effectively used to mitigate for traditional development impacts using the state of Georgia as a case study. We identify a number of environmental, institutional and market constraints that limit the effectiveness of CSDs and provide recommendations for how jurisdictions may overcome these constraints using both market-based incentives, such as marketing and income tax reductions, and regulatory initiatives such as expedited permitting and zoning code revisions.

1. Introduction

Over the recent decades as human populations have increased, urban land conversion has occurred at a rate disproportionately higher than the rate of population growth. From 1982 to 1997, the United States' population grew 17% while urbanized land increased 47% over the same time period (Benedict and McMahon, 2006). This urban expansion has been shown to have large ecological impacts on the land and related water resources of an area (Paul and Meyer, 2001). Impervious surface cover, a ubiquitous feature of urban areas, alters the hydrology in a watershed. This altered hydrology leads to many environmental problems including erosion of the soil and increasing sediment transport to the receiving water body (Wolman, 1967). Urban pollutants are introduced from a variety of sources including industrial discharges, vehicle emissions, and household wastes (Grimm et al., 2008). Urban energy demand and resource consumption has resulted in a city's "ecological footprint" encompassing a significantly larger land area than the spatial extent of the jurisdictional boundary (Wackernagel et al., 2002). Biodiversity has been affected as habitats are lost and many native species are replaced with exotic species particularly in low-density home development (Hansen et al., 2005).

These environmental impacts from urbanization have led to increased interest in sustainable land use policies and protecting undeveloped land in areas currently experiencing development pressure (Foley et al., 2005). One straightforward way for land to be protected is for the government to purchase the land for public use. Colorado, for example, added approximately 100,000 acres to its state parks and wildlife areas from 1998 to 2003 through direct land acquisition (www.conservationalmanac.org). Protection can also occur using other regulatory land planning tools such as urban growth boundaries (UGBs). UGBs are zoning controls that separate land targeted for development from rural land allowing the government to manage growth outside the boundary. Portland, Oregon has used both an UGB and an exclusive farm use district zoning class to manage growth since the late 1970s with researchers reporting mixed results on the use of the tool for encouraging land conservation (Jun, 2006; Marin, 2007).

Another type of zoning regulation that incorporates market forces is a transfer of development rights (TDRs) program. TDRs have been used around the country as voluntary controls to encourage open space preservation (Daniels, 1999). TDR programs in Montgomery County, Maryland and the Pinelands in New Jersey have effectively protected thousands of acres while simultaneously providing economic benefits to the landowners who sell the development rights of their property (Perlman and Milder, 2005). Georgia has also begun to utilize TDRs as the Chattahoochee Hill Country in south Fulton County became the first area in the south-

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east eligible for TDR transactions when enabling legislation was passed in 2003 (www.chatthillcountry.org).

While many land preservation tools attempt to protect land from development pressure, other strategies integrate both development interests and open space protection. Where traditional development often involves land consumptive subdivisions built to generate as many lots as possible on a given site and constrained by minimum lot sizes according to zoning classification, an alternative form of development has been emerging that operates under a different paradigm. This alternative form of development determines how the property will be developed based on ecological features of a site rather than simply the regulatory requirements established by zoning class and physical constraints of the land. This form of development is commonly referred to as "conservation development" as it reflects values associated with both conservation ecology and land conservation (Pejchar et al., 2007).

This report targets one form of conservation development known as conservation subdivisions (CSDs). We focus on what makes CSDs able to accomplish conservation goals, the institutional frameworks and economic incentives that both drive and discourage CSDs, and how CSDs can be encouraged by minimizing the barriers and maximizing the incentives through voluntary approaches and minimal regulatory requirements. While we loosely use the state of Georgia as a case study and refer to some policies specific to the state, many of the general principles and recommendations found in this study can be widely applied as many jurisdictions and developers nationwide are planning and constructing some form of conservation development.

2. Background to CSDs

2.1. What is a CSD?

CSDs protect land by shifting lots from being evenly distributed across a site based on zoning density to being grouped or clustered in a portion or portions of the site while retaining at least the same number of lots as zoning density would allow for the entire site. CSDs were popularized with the publication of Randall Arendt's book, "*Conservation Design for Subdivisions*" (1996). In this book Arendt describes conservation subdivision design in its purest form as residential development where half or more of the buildable land area is designated as open space. Since that time, however, CSDs have been grouped into a general class of development known generally as conservation development. Conservation development includes a number of other environmentally sensitive forms of development, not simply CSDs. Milder (2007) provides an excellent overview of what constitutes conservation development defining it as projects that "combine land development, land conservation, and revenue generation while providing functional protection for conservation resources." He identifies four types of conservation development: (1) conservation buyer projects, (2) conservation and limited development projects (CLDPs), (3) CSDs, and (4) conservation-oriented planned development projects. Pejchar et al. (2007) define conservation development as "a form of development that relies on scientific assessments of the ecological importance of a property's assets to identify what parts of a property should be protected and restored and how the remainder should be developed in a manner compatible with the protection of these assets."

In both of the more recent examples above, conservation subdivisions are defined as more than simply protecting a percentage of a site from development while clustering housing on the remaining portion. Establishing the ecological functions and assets of the site early in the development planning process are a critical feature of CSDs if they are to be successful. This planning stage is also a critical time to link the particular CSD into the community-wide network of conservation land or areas outside the site that have high quality habitat. Maps the document this context can be created at minimal cost and use existing data. While researchers may recognize the need for this clear distinguishing definition of a CSD, often the subdivisions that are built and marketed as CSDs may be more accurately characterized as "open space subdivisions" or "cluster developments" which do not necessarily reflect conservation goals in their design.

There are important ecological consequences as well as the potential for "greenwash" marketing of CSDs if this distinction is not made. Lenth et al. (2006) studied a cluster development regulation in Boulder County, Colorado where developers who restricted house lots to 25% of the site with the remaining 75% of the site placed in a conservation easement were allowed higher densities on the buildable site area. They found that while clustered housing contained significantly different flora and fauna from conventional housing, the distribution of plants and wildlife were more similar to a conventional subdivision than to an undeveloped area suggesting that additional ecological considerations would be necessary to create developments with greater conservation value (2006). A study in Wisconsin demonstrated that while cluster development limited habitat disruption, the houses were clustered around environmentally sensitive areas (i.e. lakeshore) and thus the development still had a significant ecological impact (Gonzalez-Abraham et al., 2007). If designs cluster development in the non-sensitive areas of the site, then the conservation value of the development can be greatly improved.

For the purposes of this document, CSDs are defined in the common, broad sense of open space or cluster subdivisions since this is how many of the CSDs in the literature are constructed. This is not to say that CSDs should be defined this way, merely that the lack of an ecological-focused definition has lead to a broader use of the term. As discussed above, a more robust description would include explicit language about of the ecological forms and functions of the site and the long term protection of these resources.

2.2. Defining CSD open space

If the key feature of CSDs is not just that open space is protected, but that *ecologically significant* open space is protected, how does a developer identify areas of the site that are ecologically significant? At the site scale, decisions about what constitutes ecological significance in conservation subdivisions has largely been determined by Arendt's (1996) classification of Primary Conservation Areas (PCAs) and Secondary Conservation Areas (SCAs). PCAs are lands considered unfit for development such as floodplains, wetlands and steep slopes and SCAs contain more locally significant features (Arendt, 2004). Building off this, in recommendations for conservation subdivisions in Georgia, Wenger and Fowler (2001) suggest PCAs include:

- the 100-year floodplain,
- riparian zones of at least 75 ft width along all perennial and intermittent streams,
- slopes above 25% of at least 5000 square feet contiguous area,
- wetlands that meet the definition used by the Army Corps of Engineers,
- populations of endangered or threatened species, or habitat for such species,
- archaeological sites, cemeteries and burial grounds.

SCAs may include:

- important historic sites,
- existing healthy, native forests of at least one acre contiguous area,

- other significant natural features and scenic viewsheds,
- prime agricultural lands of at least five acres contiguous area,
- existing trails that connect the tract to neighboring areas.

Other potential guidance for measuring successful conservation areas is found in Milder et al. (2008). They use eight indicators (e.g. edge effect, off-site connectivity) to identify whether conservation developments are successful in protecting impacts to terrestrial and aquatic ecosystems. While this type of analysis is useful for gauging the effectiveness of a project after the site is developed and provides excellent scope in the level of protection provided, the complexity and data-intensive nature of some of the indicators may limit its usefulness as a decision-making tool for developers or jurisdictions that do not have sophisticated spatial analysis capability. Depending on the priorities identified by jurisdictions instituting a conservation subdivision program, it may be more advantageous to maintain a prioritization strategy that is relatively simple and straightforward as described by Wenger and Fowler (2001). Jurisdictions in coastal areas may wish to expand these guidelines to include locally designated priority lands such as tidal creeks and wetlands, coastal salt marshes, bottomland hardwood swamps, beaches and estuaries. Additionally, habitat corridors and connectivity may be additional criteria to be included in the indicators based on local priorities.

The form of the open space in CSDs is important, but the allowable uses in the open space are also critical to maintain its desired ecological function. These uses may involve passive recreational opportunities such as a trail network constructed with minimal impact to the area. Some communities may allow higher impact activities, such as agriculture or forestry but large-scale disturbance to the open space should be subjected to ecological considerations. Golf courses and road construction are typically prohibited.

2.3. Linking CSDs to regional conservation area maps

At the regional scale, CSDs provide much more ecological value if they are linked to regional greenspace planning initiatives (Arendt, 1999). Including regional conservation area mapping efforts into a jurisdiction's comprehensive plan allows for plan reviewers to quickly evaluate how a proposed development relates to larger conservation priorities in the jurisdiction. A map designated as a jurisdiction's potential conservation lands (PCL) may be created based both on efforts produced by regional groups, and also with community stakeholder input and priority mapping efforts conducted by local planning staff. A CSD should have some requirements to link in with either regional planning efforts, or at least should consider natural resources of adjacent properties. This linkage could be created by requiring a site context map which would identify sensitive features within a predetermined distance of the development area.

3. Benefits of CSDs

There are many public and private benefits provided by CSDs (Table 1). Since public benefits, by definition, are not fully realized by the party that creates the benefit, the environmental benefits, while important, may not provide direct incentives for a developer to build CSDs. Local governments may attempt to account for these environmental benefits, however, in order to justify the allocation of public funds to support CSD incentive programs. One example of this public fund allocation for environmentally sensitive development is the waiver of stormwater system user fees in jurisdictions that contain a stormwater utility. Coastal Georgia currently only has a few stormwater utilities in place, but over 30 stormwater utilities exist throughout the state and many of these programs contain fee reduction mechanisms for parcels that reduce the burden on the stormwater system using structural stormwater controls.

3.1. Public benefits

The public benefits are primarily realized in the maintenance of ecosystem services and protection of habitat due to clustering development away from ecologically significant areas of the site for both aquatic and terrestrial ecosystems.

3.1.1. Stormwater management and aquatic ecosystem protection

Williams and Wise (2006) found CSDs with land preservation around stream corridors and high infiltration areas decreased reliance on stormwater management control practices and resulted in a developed watershed that more closely mimicked predevelopment hydrologic conditions than traditional development. Maintaining predevelopment hydrology for post-development conditions helps to maintain water quality and aquatic ecosystem conditions in urban areas (Walsh et al., 2005). Additionally, by protecting stream buffers which are part of the PCA designation, CSDs protect receiving water bodies from the typical urban influences such as a decreased riparian tree canopy that results in increased stream temperatures, reduced stream stabilization, and loss of nutrient processing (Pickett et al., 2001; Alberti et al., 2007).

3.1.2. Habitat protection and biodiversity

Benefits to terrestrial ecosystems are also a direct result of CSD implementation. Habitat protection is often significant in areas that might have been highly fragmented and degraded if they had been subject to conventional development. As forest reserve size increased in urban areas, particularly those greater than 40 ha, bird species richness increased due to a larger sample of individuals from the regional species pool (Donnelly and Marzluff, 2004). CSDs that are integrated into regional conservation area plans could help to protect forested tracts of this size if explicitly accounted for in the CSD design. Additional work has demonstrated that the "disturbance zone" or "zone of influence" created by developments has significant influence on biodiversity, and CSDs decrease fragmentation and perforation of habitat leading to more suitable conditions for wildlife (Odell et al., 2003).

3.1.3. Reduced demand for public parkland

Proximity to public parks has been shown to increase home prices in a variety of areas around the country (Weicher and Zerbst, 1973; Bolitzer and Netusil, 2000). To the extent that greenspace protected in a CSD substitutes for public park space, this supports the claim that demand would decrease as more protected open space is created. The type of open space matters in this case, however, as "natural area parks" have been shown to have a greater influence on home sales prices than "specialty" or "urban" parks (Lutzenhiser and Netusil, 2001).

3.2. Private benefits

Private benefits can be substantial to those considering CSD construction, and research has shown significant cost savings for CSDs (Caraco et al., 1998). Arendt (1999) identifies some economic advantages CSDs have relative to conventional subdivisions that will be discussed further below. These advantages include lower costs, marketing and sales advantages, value appreciation, and reduced demand for new public parkland.

3.2.1. Lower costs

Since CSDs shift development from being evenly distributed across a site to clustering development in one area of the site,

Table 1
Public and private benefits of conservation subdivision design.

CSD benefit	Study results	References
Stormwater management	Targeted land preservation on a site decreased stormwater management controls Maintaining predevelopment hydrology reduces impacts to aquatic ecosystems	Williams and Wise (2006), Paul and Meyer (2001), Walsh et al. (2005)
Sensitive habitat protection	Protecting stream buffers reduce urban impacts to water bodies Large habitat reserves in urban areas increase bird species richness Minimal site disturbance decrease landscape fragmentation	Pickett et al. (2001), Alberti et al. (2007), Donnelly and Marzluff (2004), Odell et al. (2003)
Lower infrastructure cost	Lots in a CSD cost less to build than traditional lots Over 25% savings in construction and infrastructure costs	Mohamed (2006), CRI (2005), Wenger and Fowler (2001)
Increased property values	Lots adjacent to permanently open space sell for a premium Views of open space add value to home sales Reducing distance to wetlands increased property values	Lutzenhiser and Netusil (2001), Mahan et al. (2000), Thorsnes (2002), Anderson and West (2006), Geoghegan (2002), Irwin (2002)
Property value appreciation	Homes in CSDs sell in half the time as those in traditional subdivisions 5- and 10-year appreciation rates are higher in CSDs	Mohamed (2006), Lacy (1990), Bowman et al. (2007)

the amount of infrastructure such as roads, curbs, sidewalks, and stormwater piping can be reduced. CSDs also greatly reduce the amount of site grading that takes place at the site, reducing dirt-moving costs significantly. These changes potentially lead to significant cost savings depending on the lot layout and configuration of the subdivision. Mohamed (2006) demonstrated that lots in CSDs in Rhode Island cost on average about $7400 less to produce than conventional lots. Wenger and Fowler (2001) report that a 380-acre project with 90% open space in Jackson County, Georgia had infrastructure costs nearly 60% lower than a similar-sized conventional design. Conventional development costs were estimated and compared to actual CSD costs in three subdivisions in Wisconsin with construction cost savings ranging from $563,764 to $1,288,646 with an average percent savings of 27% across the three sites (CRI, 2005).

Lower cost of CSD construction is only meaningful if the developer is receiving equal or higher returns on the lots. CSD home sales have been studied primarily using hedonic analyses, or revealed preference methods, that rely on the purchase prices of houses and control for other factors such as characteristics of the house and land features that may be important in determining home prices, thus isolating the effect that open space has in determining house price (McConnell and Walls, 2005). Research consistently shows that homes adjacent to natural areas and open space sell for more than other houses in the subdivision with proximity to the open space, access to views of open space, and neighborhood type helping to determine the relative value added by the open space (Lutzenhiser and Netusil, 2001; Thorsnes, 2002; Anderson and West, 2006; Mohamed, 2006).

3.2.2. Marketing and sales advantages

CSDs may fill a niche in the residential housing market to attract customers who may be more inclined to purchase homes that about greenspace or other environmental amenities of the CSD. A competitive advantage is important for developers particularly when market conditions favor the buyer, as is currently the case. Developments may set themselves apart using CSD and be uniquely positioned to capture a segment of homebuyers who are interested in alternatives to traditional development design. As mentioned above, much study has gone into evaluating how residents perceive open space in their communities, and in nearly all cases, the provision of some form of protected open space in a community has increased property values (Geoghegan, 2002; Irwin, 2002). A recent study was conducted in coastal Georgia using tax assessor and spatial data from Chatham County and the City of Savannah. Researchers found that homebuyers were willing to pay more for houses close to marshland as well as houses in subdivisions with large percentages of common areas (Kriesel and Mullen, personal communication).

Marketing may be a complicated benefit to realize, however. Promotion of a CSD may need to take into account features other than the environmental amenities of the site in order to attract residents. During interviews with 13 practitioners, Bosworth found that a number of interviewees felt that people did not relate well to the environmental benefits such as land conservation or habitat protection provided by CSDs and instead marketing should focus on quality of life aspects of the development such as scenic views of protected open space or potentially a healthy living component through promoting hiking access to an on-site trail system (2007).

3.2.3. Value appreciation

Another key private benefit claimed for CSDs is that homes tend to appreciate faster than ones in conventional subdivisions (Lacy, 1990). The most robust study completed on this issue was performed by Mohamed (2006), who analyzed the time interval between when lots are first recorded and when lots are sold and reported that lots in CSDs sell in approximately half the time as lots in conventional subdivisions. Absorption rates tend to be higher for CSDs, although not always as high as reported above. Bowman et al. (2007) report homes in CSDs selling within a more consistent time frame that was generally shorter, but not different enough from standard subdivisions to be statistically significant. An unstudied but interesting question in the current housing market slump is the degree to which CSDs are affected by general market conditions. One hypothesis is that there would be no disproportionate value depreciation on CSDs relative to general depreciation rates, although since they have been shown to appreciate faster, they may end up depreciating more slowly. This is an open-ended question that requires further study.

4. Challenges to CSD implementation

At first glance, there seems to be little reason why CSDs are not being constructed by developers around the country. With reduced costs of construction, higher sales prices for homes in CSDs, lower time for lots to sell, and increased consumer demand for open space,

why would a developer not capitalize on this opportunity? The reasons are both straightforward and subtle and involve regulations, real and perceived market barriers, and risk aversion.

4.1. Regulatory and institutional barriers

The most straightforward and prohibitive reason that CSDs are not built is that in many cases local zoning codes and subdivision requirements do not allow alternative designs to be considered, or jurisdictional requirements make the variance process too burdensome to outweigh the benefits provided by CSDs (Wenger and Fowler, 2001). Without a conservation subdivision ordinance that establishes CSDs as a "use-by-right" within all residential zoning districts or where zoning does not currently exist, minimum lot size requirements necessarily add additional permitting burdens for the developer interested in a CSD. Since variance procedures vary significantly between jurisdictions it is difficult to generalize about the process, but any additional procedure is clearly a disincentive to use a CSD, and complicated plan review even under a CSD ordinance may be enough to discourage applications.

Since the developer receives tax benefits from preserving land in a conservation easement, the appraisal of this part of the property may play a large role in the economic model used by the developer. Too much reliance upon this component of the development may be viewed unfavorably by banks and other investors interested in funding the development opportunity. The economic benefit from the easement should be more appropriately viewed as a potential bonus or cost offset for the development project rather than an essential component of the budget (Bayard, personal communication).

4.2. Market barriers

Disincentives to build CSDs are also endogenous to the market. While proximity to open space has been consistently shown to be a significant positive determining factor of home prices in a subdivision, there is evidence of a trade-off when lot size is considered. Reducing lot sizes is a salient feature of CSDs and therefore this consideration is central to a developer's decision to implement the practice. Kopits et al. (2007) found that the marginal effect of open space has less effect than the marginal effect of adding acreage to a private lot. They found no willingness of individuals to compromise their private lot size to compensate for adjacency to public open space. The open space evaluated this study was determined for a large area comprised of over 80 subdivisions and therefore the quality of the open space was not considered in the analysis, which may have affected their results. Peiser and Schwann (1993), in evaluating small strips of greenspace between lots in a subdivision, found an insignificant effect of this space on home prices particularly when compared to increases in lot size. These studies provide some evidence that developers may simply be responding to market demands when making a decision about whether to cluster or not on their site.

A number of other studies also support the notion that public appreciation for open space in residential development is complicated. Reichert and Liang (2007) compared two subdivisions in Ohio and found no significant price difference between a conventional and CSD concluding that homebuyers may prefer to own a larger parcel of land which allows for modest private open space rather than having access to larger common open space. The authors caveat their conclusions, however, noting that since land prices are relatively inexpensive, land is plentiful, and CSDs are few, developers may prefer the lower-risk option of traditional development over establishing a new market niche. A study in rapidly developing Howard County, Maryland demonstrated that individuals value permanently protected open space more than developable open space and these values are capitalized into residential land prices (Geoghegan, 2002). It has been consistently shown that significant disparity exists between lots fronting, or having a view of open space, and lots which front other developed property within the subdivision (Thorsnes, 2002). Since the developer must consider both types of property owners in a CSD, this will complicate the marketing strategy and sales approach within the development. A diverse marketing strategy emphasizing the community access to open space can help to alleviate this disproportionate benefit provided by the adjacent property owners.

Additional costs are also imposed by permanently protecting the open space in a CSD. Conservation easements are the most commonly used protection instrument and there are appraisal, attorneys', recording, and stewardship fees that must be paid up front to establish an easement on the property. Easements are often held by land trusts which may or may not be active in an area undergoing development, and the time associated with tracking down a willing and qualified easement grantee can be problematic for the developer. Covenant restrictions are a land protection instrument related to conservation easements. Restrictive covenants are somewhat limited in their effectiveness, however, as they often do not protect the land in perpetuity, and if they are linked to a homeowner's association, the covenant can be changed with a unanimous vote of the members. Also, there is typically no one directly responsible for monitoring the protected land under a restricted covenant. This eliminates the stewardship fee found under an easement, but also makes enforcement of any violations difficult.

4.3. Risk aversion

Real estate development is fraught with risk. From calculated risks such as creating construction schedules that may or may not be affected by weather to unforeseen risks such as the discovery of hazardous materials buried on the site after development commences, developers work to minimize risk to maximize returns on their investment. Bosworth (2007) found "uncertainty or the reluctance to try something new as one of the greatest challenges facing CSD." To overcome this, Bosworth recognized that individuals are more motivated to avoid loss than to achieve gain. An education message could target the development profit lost if a developer chose not to build a subdivision rather than simply focusing on the potential additional profit (2007).

5. Overcoming barriers and providing incentives for CSDs

This section focuses on a variety of methods to maximize the benefits and minimize the barriers in order to encourage CSD construction. We begin with a discussion about regulations, but primarily focus on voluntary incentives, economic programs, and other resources that can be made available for individuals desiring to build CSDs.

5.1. Regulations

Before strictly voluntary incentives can be discussed, the regulatory environment of a jurisdiction must be amenable to CSDs. As discussed earlier, in many cases zoning codes in local jurisdictions make it either impossible or extremely difficult for developers to construct CSDs. Kriesel and Mullen (personal communication), in their study in coastal Georgia, found that development sites that were unable to cluster development lost over $300,000 for a 100-home subdivision because they were losing lots when open space was added. When clustering was allowed, this kept saleable lots constant while reducing their size, and the economic gains from

adding common open space produced over $1 million in additional revenue.

Jurisdictions should ensure their current zoning and building codes allow for CSDs to be easily constructed and it is recommended they pass a CSD ordinance that creates a use-by-right of CSDs in residential zoning classes. Passing an ordinance helps to overcome costly delays due to variance requests and exemptions under local zoning ordinances. In a survey of developers in Georgia and Florida, Hall (2006) found in it "costly and difficult" for developers to receive approval to build CSDs based on the inconsistencies between local zoning codes and CSD design. Additionally, subdivision regulations should be updated to reflect the complexity of individual sites and require detailed site mapping to be submitted along with preliminary site or "sketch" plans that can be used as overlays on the existing site map. In this way, plan reviewers can see how a proposed development will be affecting the natural resources of a given project. These plans should be drafted by landscape architects or planners trained to recognize important natural landscape features. It is also helpful for site walks to be scheduled as part of the plan review process so that the review board can visualize and discuss changes to the site in the proposed development (Arendt, 1999).

A regulatory disincentive regarding traditional subdivisions would be for the non-CSD to have to justify why its use a conventional design that is unprotective of open space is should be allowed. In this case, the applicant would have to receive a special designation as a more destructive form of development under the existing zoning classification rather than the CSD which may be more consistent with the jurisdiction's stated public protection goals.

The bottom line is that for voluntary incentives to be effective, regulatory roadblocks must first be eliminated and is a necessary condition for CSDs to be successfully implemented (Arendt, 1999). This will need to be instituted at the local level, but regional and statewide model guidance documents, such as model CSD ordinances, can assist in local implementation. A model CSD ordinance should primarily be designed to allow for more flexibility on the design of the site rather than imposing additional constraints. While building codes such as reduced road widths, minimum building setbacks and curb and gutter requirements are important components of this revision process, the essential limiting factor is to eliminate minimum lot size requirements for zoning classes.

Model ordinances and regulatory guidance for CSDs are available from various state and local sources online (www.rivercenter.uga.edu; www.dca.state.ga.us). Key components of a CSD ordinance include the amount of open space required in a CSD, what land can be counted as part of the open space requirement, how the housing density is determined, what uses are allowed in the open space, and who is responsible for owning and maintaining the open space.

5.2. Federal income tax deductions

CSDs typically require the use of a conservation easement on the protected open space of the property. These easements may be held by land trusts with ownership of the property given to the homeowner's association (HOA). Once the easement is placed on the property, a reassessment of the property is made based on the restricted use and the easement donor is able to deduct the difference between the fair market value of the land without the easement and the assessed value of the land with the easement. Simply building less densely and placing an easement on the unbuildable land does not qualify a landowner for an income tax deduction, however, as section 170 of the Federal tax code requires the land to be a "qualified conservation contribution" and the easement to be donated "exclusively for conservation purposes". Developers need to take advantage of this federal tax deduction as there are significant opportunities to lower net costs of the development after the deduction is taken. The tax code favors entities with higher income, however, and income limitations often require the deduction to be taken over a number of years (McLaughlin, 2004).

5.3. State income tax credit

Georgia's Conservation Tax Credit Act that was passed in 2006 and modified in 2008 allows conservation donors the opportunity to deduct 25% of the fair market value of the donated property from their state income tax. The credit can be carried over for a maximum of 10 years. Georgia is one of the 15 states around the country which offers such a credit. This is an extremely important incentive for developers who protect part of the site in some types of CSDs with a conservation easement. The main limitation on the application of this incentive is that CSDs which increase development density are not eligible for the credit. The legal criteria for what land is eligible for the credit will also help define the protected areas of the site during the planning stages of the development. 2008 amendments to the law directed the Georgia Board of Natural Resources to create rules that better define conservation priorities for the protected land.

5.4. Density

Building a CSD does not necessarily imply anything about the overall legal density of a site other than having lots of clustered more densely in one area. Most CSDs are density neutral in that the lot yield is the same or similar to the number of lots that would be found if the site were developed as a conventional subdivision. Emphasizing this fact to developers considering a CSD can help overcome the misperception that they will necessarily have to build fewer lots and therefore decrease the revenue stream from the sale of these lots. In fact, depending on how the lot yield is determined (e.g. counting or not counting buildable areas in the lot yield, creation of a conventional yield plan or multiplying the underlying zoning with the conventional minimum lot size) there may be "de-facto" density bonus options for CSDs (Wenger and Fowler, 2001).

Some CSD programs are written to explicitly allow for density bonuses to encourage implementation. Arendt (2004) describes using density both as an incentive to CSDs and a disincentive to conventional developments. In the latter case, the density of a conventional subdivision would be reduced if its developers did not protect a required amount of open space on the site. If a jurisdiction chooses to use this approach, the default standard for full density, therefore, would be to follow the CSD design process. This would also avoid the problems of CSDs receiving more density than allowed in the zone and the developers would still be eligible for Georgia's Conservation Tax Credit.

Density bonuses have also been used for CSDs. In Athens-Clarke County, for example, CSDs are allowed in the AR zone where typical density is 1 unit per 10 acres and the CSD designation allows for 1 unit per 5 acres. Bonuses have also been proposed in more creative ways with a sliding scale that increases the amount of density based on the total area protected and potential linkages to larger greenspace plans (Pejchar et al., 2007). Density bonuses can be controversial, however, as surrounding residents may not be receptive to increased density and given other methods such as lot yield calculation that provide small density bonuses, enough incentives may already exist within a CSD program.

5.5. Permitting

Permitting is a time-consuming and often costly component of development. As discussed earlier, the use of CSD often increases the permitting time through increased variance requests and addi-

tional plan submittals for the alternative design. This extra burden is extremely difficult to overcome particularly when other additional requirements for the developer relating to conservation easements are already in place. While developers have reported that in jurisdictions that have a CSD ordinance permitting is not significantly more difficult (Hall, 2006), there is little evidence that, without review mechanisms that explicitly target CSDs, permitting in Georgia will be expedited as reported by Arendt (1999).

Opportunities exist, however, to create incentives in the permitting process for CSDs. Potentially, within the local jurisdiction plan review process, an expedited or discretionary review mechanism could be institutionalized and include special subdivisions like CSDs which would reduce the turnaround time for plan approval. Conversely, if stormwater requirements like a natural resources inventory and conceptual site planning are included in Georgia's Coastal Stormwater Supplement (CSS) currently under development, and local governments adopt a stormwater ordinance that references the CSS, the conventional developer may have the burden of demonstrating why they did not protect sensitive areas, thus giving an advantage to proactive protection measures found in CSD design.

Developers also benefit from having an individual either within the jurisdiction or permitting agency who understands the benefits provided by CSD and can articulate these to review authorities who may not be amenable to alternative site designs. This person may be responsible for working with CSDs from multiple jurisdictions, with funding coming from small contributions by participating cities and counties. While typically environmental consultants manage national and state permitting for developers, this advocate could help coordinate at all levels of government, linking federal and state permits with local permitting requirements.

An alternative approach would be to designate staff from the jurisdictions to specialize in CSD plan review. This will likely drive significant educational opportunities for plan review staff in local jurisdictions to become more aware of CSDs and the benefits they can provide the community, leading to more informed discussions at the local level with developers about their CSD plan submittal and review. The city of Atlanta, for example, has a staff member in the Department of Watershed Management who is tasked with assisting the department with innovative watershed protection strategies in its jurisdiction. CSD education and plan review assistance could be incorporated into this type of position. Smaller jurisdictions may have trouble financially supporting this expertise and therefore hiring an individual with regional funding may be more feasible for most of coastal Georgia.

5.6. Marketing

A key incentive for developers is the ability to differentiate their developments, particularly in a tightening housing market. This can occur only if the CSD is marketed properly. Hall's (2006) survey of developers building CSDs provides some insight into CSD marketing strategy. As discussed above, marketing strategy should not be exclusively focused on the conservation benefits, with the "added privacy" benefit and "larger-feeling lots" due to the lots backing up to protected areas a common marketing tool. The ability to access the greenspace was also recognized as an important marketing benefit.

Realtor education can also be helpful to successful CSD marketing. Bosworth (2007) reports realtors distinguish CSDs "as a unique subdivision due to the small lots", a strategy running counter to the true benefits of the CSD. Basic educational materials should be provided to both the realtors and the buying public in the marketing literature of a CSD. For smaller developments in particular where brokerage marketing is done external to the development company, home builders may want to seek out "ecobrokers" to market the property to ensure the appropriate clientele are exposed to the CSD product (www.ecobroker.com).

Public recognition and awards can also help developers with their marketing efforts. Annual green development awards for projects that are exceptional examples of CSD create further market distinctions. National and statewide groups such as the Urban Land Institute, American Institute of Architects, and Southface Energy Institute offer recognitions for conservation designs. Additionally, a green certification program for CSDs in general would allow all CSDs the opportunity to differentiate themselves from the rest of the market. While Leadership in Energy and Environmental Design (LEED) for Neighborhood Developments (ND) is still in its pilot phase and does not focus exclusively on CSDs per se, this type of certification program can be a key market differentiator.

5.7. Education

A significant barrier to developers entering the CSD market relates to the relative unfamiliarity with the requirements of a CSD. The risk-averse developer may prefer to operate using practices and methods they are familiar with rather than branch out into a new venture unless they can be shown the benefits will clearly outweigh the costs. Education is key in this regard and can come in a number of forms. Outreach materials can be developed and distributed at local planning offices, sent with permit application materials and posted on local governments' websites. Educational workshops specifically developed to allow developers to express their concerns about CSDs and actively participate in an incentive discussion may help to inform both the educators and the developers about what educational materials are lacking in the local development community. For example, the design expertise may already exist but problems may still remain with a developer's understanding of financial opportunities, and so educational efforts may shift from design concerns to monetary issues.

The general public should also be informed about the benefits that CSDs provide, particularly if a local jurisdiction is making efforts to link up the protected open space in the private subdivision with larger open space goals across the community. Website links from the local jurisdiction's greenspace site to the CSD's site would provide direct connections for the public to view the environmental benefits of the development. When a CSD is platted on a site, residents in nearby communities could be sent printed materials demonstrating how the new development protects sensitive ecological areas. This will help to overcome misperceptions about developments being allowed increased density when, in fact, the developer may simply be clustering development at the site closest to the areas that have already been disturbed and providing significant areas of open space adjacent to sensitive ecosystems.

6. Conclusions

CSDs provide an opportunity to merge development practices with environmental protection. Through permanently protecting areas of the site that contain sensitive habitat and perform key ecological functions, natural resource conservation can be achieved. The method for selecting open space within individual CSDs is an important process that may be integrated with preliminary plan review as plans develop a natural resources inventory before commencement of land disturbing activity. By linking protected open space in the subdivision to priority area plans in a jurisdiction or region, large linked tracts of functional greenspace can be permanently protected.

We reviewed studies that demonstrate how the design of CSDs reduce costs and increase benefits to developers. On the surface, this would imply that many developers would already be implementing conservation design in their subdivision plans, but this is simply not

the case. A thorough understanding of developer decision-making helps to explain the lack of developer interest in CSDs, even in areas that contain CSD ordinances. We addressed this lack of interest by providing recommendations that were targeted at both overcoming the barriers and maximizing the incentives for CSDs in Georgia. Local communities need to decide how best to incorporate CSDs into their regulations, ordinances, and land use plans based on stakeholder input and public participation. CSDs will not be the only mechanism that will encourage environmentally sensitive development and protection of ecologically meaningful open space, but if implemented properly they can be a valuable tool for protecting the state's natural resources while allowing economic development to continue.

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