Evaluating the Potential for Conservation Development: Biophysical, Economic, and Institutional Perspectives

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Abstract: *The widespread conversion of rural land to low-density residential development poses an immediate threat to biodiversity and to the provision of ecosystem services. Given that development will continue and environmental stakes are high, analyzing alternative growth strategies is critical. Conservation development is one such strategy that has the potential to benefit ecosystems and diverse stakeholders including developers, homebuyers, governments, and society as a whole. Conservation development clusters homes on one part of a property to manage the most ecologically important land for the conservation of biodiversity and ecosystem services. We draw on lessons learned from landscape ecology, open-space development, and regional planning to weigh the biophysical, economic, and institutional evidence for and against conservation development. Conservation development offers many potential environmental and economic advantages: relatively high home values and appreciation rates, lower development costs, and social and ecological benefits to society including landscape connectivity, protection and active stewardship of important ecological assets, and the maintenance of ecosystem services. But this approach also has shortcomings: it may require enlightened institutional regulations and regional planning (and/or ecologically aware developers), it is not always more profitable than conventional development and thus may require subsidies or incentives, and additional research is required to fully understand its benefits and drawbacks. With more information on the effects of clustering, the development of flexible zoning laws, and effective regional planning, conservation development could be a viable strategy for sustaining biodiversity and ecosystem services in changing landscapes.*

Keywords: biodiversity, cluster development, economic incentives, exurban, open-space development, regional planning, rural sprawl, zoning

Evaluación del Potencial de la Desarrollo para la Conservación: Perspectivas Biofísicas, Económicas e Institucionales

Resumen: *La conversión generalizada de terrenos rurales a desarrollos residenciales de baja densidad es una de las amenazas inmediatas para la biodiversidad y para el suministro de servicios ambientales. Debido a que el desarrollo continuará y que las apuestas ambientales son altas, el análisis de estrategias alternativas de crecimiento es crítico. El desarrollo para la conservación es una de esas estrategias que tiene el potencial para beneficiar a los ecosistemas así como a los actores diversos, incluyendo urbanizadores, compradores, gobiernos y la sociedad en conjunto. El desarrollo para la conservación agrupa a las casas en una parte de la propiedad y maneja la parte ecológicamente más importante para la conservación de la biodiversidad y los servicios ambientales. Se parte de lecciones aprendidas de la ecología del paisaje, el desarrollo de espacios abiertos y la planificación regional para sopesar la evidencia biofísica, económica e institucional a favor y en contra del desarrollo para la conservación. El desarrollo para la conservación potencialmente ofrece muchas*

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Paper submitted January 11, 2006; revised manuscript accepted June 8, 2006.

Conservation Biology Volume 21, No. 1, 69–78
©2007 Society for Conservation Biology
DOI: 10.1111/j.1523-1739.2006.00572.x

ventajas ambientales y económicas: casas con valor y tasas de aprecio relativamente altas, menores costos de desarrollo y beneficios sociales y ecológicos para la sociedad, incluyendo conectividad del paisaje, protección y administración activa de valores ecológicos importantes y el mantenimiento de los servicios ambientales. Pero este enfoque también tiene defectos: puede requerir de regulaciones institucionales y planificación regional bien informadas (y/o urbanizadores con conciencia ecológica), no siempre es más rentable que el desarrollo convencional y por lo tanto puede requerir de subsidios o incentivos y se requiere de más investigación para comprender sus beneficios e inconvenientes completamente. Con más información sobre los efectos del agrupamiento, la promoción de leyes de zonificación flexibles y la planificación regional efectiva, el desarrollo para la conservación podría ser una estrategia viable para mantener la biodiversidad y los servicios ambientales en paisajes cambiantes.

Palabras Clave: biodiversidad, desarrollo de espacios abiertos, expansión rural, exurbano, incentivos económicos, planificación regional, urbanización agrupada, zonificación

Introduction

The growth of sprawl in the United States today is unprecedented and unlikely to diminish. Over 80% of housing development in the past decade was in rural areas, and nearly 60% of these homes were on lots $\geq$1.6 ha (4 acres) (Heimlich & Anderson 2001). These numbers reflect a profound shift in land use: the conversion of rural lands to low-density "exurban" developments (Odell et al. 2003; Maestas et al. 2003; Theobald 2004). This is the fastest growing development style today (Crump 2003), and it has dramatic ecological and socioeconomic consequences (Wilcove et al. 1998; Marzluff 2001; Huston 2006) that are global in scope (Friesen et al. 1995; Tjallingii 2000; Liu et al. 2003). Conversion of rural land is likely a greater threat to conservation than either urban or suburban development because its environmental impacts—habitat loss and fragmentation (Theobald et al. 1997), loss of ecosystem services (Daily 1997), and the introduction of exotic species (Conway & Lathrop 2005)—occur over relatively large and unaltered areas (Radeloff et al. 2005).

Given that substantial growth is inevitable and the environmental stakes are high, it is critical to evaluate the merits and shortcomings of alternative development strategies. Conservation development, which we define and describe in this essay, appears to have potential for conserving biodiversity and ecosystem services. We assessed the opportunities and challenges of conservation development from critical biophysical, economic, and institutional perspectives.

We focused on residential development in the exurban landscape, also known as rural sprawl (Daniels 1999; Radeloff et al. 2005). In contrast to urban or suburban development, exurban development occurs at low densities and over large areas of agricultural land or relatively intact native habitat (Theobald 2004). Some of the forces behind current rural development trends stem from deeply held personal and cultural preferences (Sullivan 1994) and may prove difficult to overcome. We focused instead on the forces that are quantifiable, can be addressed directly, and have tremendous unrealized potential for conservation.

Contrasting Approaches to Development

Conservation development is difficult to define because it has been used to describe everything from projects with some open-space amenities to projects that deliberately set out to protect and restore important parts of ecosystems. We used the following definition of *conservation development* here and propose it for use in the field: Conservation development is 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. For a project to qualify as a conservation development, it must provide for ongoing stewardship of the protected portion of the parcel. Conservation developments most often maintain approximately the same or lower overall home density (as measured by the ratio of building lots to total area) as conventional development in a region (Table 1, Fig. 1).

In contrast, conventional development, as we define it here, refers to development that occurs without the identification, restoration, and protection of a property's conservation values. These developments often consist of single-family detached homes in exurban areas on lots of the minimum size allowed by local zoning regulations. Conventional developers tend to develop the maximum number of saleable lots or homes allowed, weighing the demands of the local housing market and the physical features of land. This calculus frequently results in a subdivision or ranchette design that fills parcels wall-to-wall with evenly spaced lots, each with its own single-family home, with allowances only for roads and features deemed unbuildable for physical or regulatory reasons. Natural elements that remain in final conventional development

Table 1. A comparison of hectares developed and preserved in a potential conservation development compared with a potential conventional development on the same parcel of land.*

	Conservation development	*Conventional development*
Maximum percentage of land converted to residential use (%)	50	85
Maximum number of individual lots	100	85
Spacing of individual lots	clustered	diffuse
Size of individual lots (ha)	≤0.5	1
Wetland preserved (ha)	10	10
Forest preserved (ha)	30	5
Agricultural land preserved (ha)	10	0
Homes adjacent to protected land (%)	100	0
Infrastructure required	less	more
Relative sale price per home	higher	lower

**Parcel size, 100 ha; minimum lot size allowed by local zoning, 1 ha; natural features, 50-ha agricultural area, 10-ha forest, and 10-ha wetland.*

plans typically play a largely aesthetic role and are disconnected from other natural elements in the broader landscape and region. The basic differences between conventional development and conservation development are illustrated in Fig. 1 and Table 1.

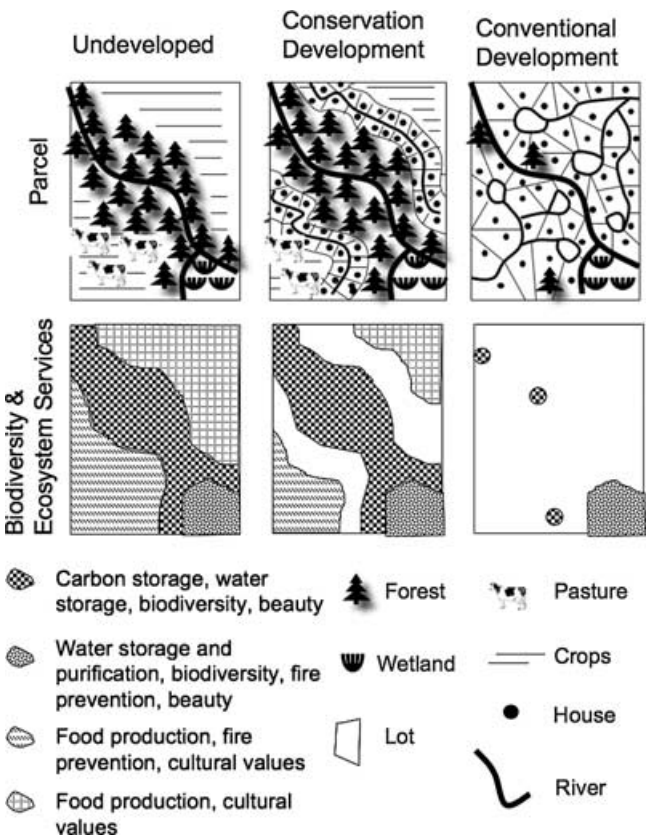

Figure 1. A comparison of the land use and land cover of a parcel and the ecosystem services provided under three possible development scenarios: undeveloped, conservation development, and conventional development. As shown, developers can enhance the relatively small individual lot size by making each lot contiguous with the protected area.

Conservation development should be distinguished from open-space development, a form of cluster development designed primarily for aesthetic values and recreational opportunities. Open-space development has been widely used for more than 3 decades in the U.S. Midwest and Southeast as a means of combating sprawl and protecting the character of rural communities (Arendt 1992). Although open-space development is increasingly referred to as conservation development, it is often only the name that has changed, and these projects rarely meet their limited conservation goals (Hale et al. 2005; Hastings et al. 2006). Hereafter, we refer to conservation development as we envision it—a potential but rarely realized development strategy that integrates conservation of biodiversity and ecosystem services with development.

Overarching Questions

Although conservation development holds promise as a tool for protecting biodiversity and ecosystem services, and for combating the negative effects of sprawl, careful analysis is needed to demonstrate the benefits and drawbacks of this approach. We divided the key overarching questions and more-focused subquestions (numbered below) into three categories of inquiry: biophysical, economic, and institutional.

Biophysical: What changes can be made to exurban development to achieve positive conservation results? (1) In what ways does conventional development negatively impact biodiversity and ecosystem services? (2) What changes in development design and management would best mitigate these harms?

Economic: What economic factors encourage, or discourage, more widespread use of conservation development? (1) What do stakeholders—developers, municipalities, homebuyers, and neighbors—need in order to understand the benefits of this approach and overcome the risks? (2) Does conservation development result in higher

home values and higher return on investment for real estate developers? What factors determine value?

Institutional: How can planning and zoning regulations be used to promote conservation development and associated regional conservation planning? If existing regulations serve as barriers to implementing conservation development, what modification would remove the barriers? (1) What are the legal and political barriers to enacting such changes? (2) Can the desired conservation results be achieved through conservation development absent regional conservation planning? (3) What lessons do various forms of regional-scale conservation planning—such as the U.S. Endangered Species Act's (ESA) habitat conservation plans (HCPs)—offer conservation development?

These questions are largely unanswered in the scientific, policy, and development literature; thus, the ecological and economic consequences of conservation development are almost entirely unknown. We addressed the above questions by drawing on the best available evidence: results from existing studies and lessons from other fields. Perhaps most importantly, this analysis illuminates the biophysical, economic, and institutional aspects of conservation development that require further analysis. Because the greatest opportunities and biggest potential roadblocks to conservation development appear to lie with institutions, we devote much of our discussion to them.

Biophysical Considerations

Land conversion for housing development is a leading cause of habitat loss and fragmentation (Theobald et al. 1997; Wilcove et al. 1998; Marzluff & Ewing 2001) that threatens both biodiversity (Ehrlich 1988; McKinney 2002) and the provision of ecosystem services (Balmford & Bond 2005). Although there is abundant evidence that conventional development degrades natural systems, the ecological benefits of conservation development remain largely unstudied and therefore less clear (Maestas et al. 2003). We suggest that the ecological impacts of development could be reduced by modifying three dimensions of development design: (1) site selection, (2) housing density, and (3) landscaping and land management. We present ecological arguments for each and then discuss how conservation development could incorporate these elements.

Site Selection

Landscapes are spatially heterogeneous with a variety of habitat types that serve diverse ecosystem functions (Turner 1989). Ideally development would occur outside areas with especially unique ecological characteristics or capacity to provide key ecosystem services (Svoray et al. 2005). Traditionally, however, growth follows exactly the opposite pattern; conventional developments are sited in or near highly productive areas that are rich in biodiversity, thus having a disproportionate impact on natural systems (Romme 1997; Scott et al. 2001; Hansen & Rotella 2002; Hansen et al. 2002; Odell et al. 2003; Radeloff et al. 2005).

Regional conservation planning can be a valuable tool for protecting key ecological assets while accommodating development (Lathrop & Bognar 1998; Beatley 2000). Effective land-use plans include greenways or habitat networks that control sprawl and preserve or restore connectivity between natural communities (von Haaren & Reich 2006). Maintaining contiguous habitat through these mechanisms is widely recognized as necessary for the preservation of species and services (Simberloff & Abele 1982; Wiersma & Urban 2005).

In contrast to conventional development, conservation development acknowledges spatial heterogeneity by protecting areas with key habitat or ecological functions. When knit together through effective land-use planning, conservation development can enable the creation and maintenance of integrated networks of protected land that collectively provide for the protection of biodiversity and the provisioning of critical ecosystem services (Arendt 1996, 2003). Through simple mechanisms such as clustering homes away from ecologically sensitive areas, conservation development has the potential to provide crucial benefits to natural communities (Donnelly & Marzluff 2004) and is a new and powerful tool that allows regional planners to meet landscape level conservation goals. If conservation developments are to achieve these goals, a better understanding of the ecological effects of various patterns of housing density is required.

Housing Density

Increasing housing density to reduce the "footprint" of development may or may not have net benefits for biodiversity and ecosystem services (Nilon et al. 1995). Results of several studies show that reducing housing density in favor of open space can reduce the impact of exurban residential development on biodiversity and enhance the flow of some ecosystem services. In Colorado, for instance, empirical work shows that clustered developments are less harmful to songbird and mammal communities (Odell & Knight 2001; Odell et al. 2003). The abundance of human-tolerant biodiversity increases in developed areas and the abundance of human-sensitive species decreases, thereby creating a zone around each home in which the community composition is altered, favoring human-tolerant species. In developments where houses are clustered, each house's zone of influence overlaps with others, thereby reducing the area affected and retaining more species that are sensitive to humans (Odell & Knight 2001; Odell et al. 2003). Similarly, in a theoretical exploration, cluster developments produced the least volume of water runoff compared with three other

development types, including conventional development (Brander et al. 2004).

Conservation developments may not, however, always have greater biodiversity conservation value than conventional low-density developments. Hastings et al. (2006) show that clustered housing developments have a plant and wildlife community much more similar to low-density developments than to undeveloped areas. Clustered housing developments and dispersed developments shared two critical characteristics that undermined their capacity for conservation: small protected areas and high non-native vegetation cover relative to undeveloped areas. Nilon et al. (1995) also found that clustered housing developments support fewer forest birds and more nest predators and brood parasites than either undeveloped land or dispersed single homes.

Additional reasons why, despite a smaller footprint, conservation development may not realize the potential of higher conservation value for biodiversity and ecosystem services include (1) the history of land use can profoundly influence the current and potential conservation value of a site and the magnitude of interventions required to restore conservation value; (2) neighboring land use and regional or global changes can have a substantial impact on conservation value, overriding actions taken at the scale of the conservation development; and (3) development of any kind (conservation or otherwise) inevitably favors species with a higher tolerance for human disturbance, including invasive species in numerous direct (e.g., importing species) and indirect (e.g., changing fire regimes) ways.

Landscaping and Land Management

The preservation and restoration of indigenous species in and around developments is key to minimizing conservation impact and adding ecological value (Mckinney 2006). In addition to causing direct habitat loss, development often facilitates biotic homogenization through the introduction of non-native plants and animals and the elimination of native species (Knight & Clark 1998; McKinney & Lockwood 1999; Miller et al. 2001; Hansen et al. 2005). Developments may even function as ecological traps, luring animals to places with attractive food or cover, but causing population declines with inflated predation rates or other impacts of human settlement (Hansen & Rotella 2002; Maestas et al. 2003; Battin 2004).

Although some impact in the immediate vicinity of any development appears inevitable, there are demonstrated ways of mitigating these impacts. Retaining or planting native vegetation instead of lawns and other non-native plants (Bormann et al. 1993; Marzluff & Ewing 2001; McKinney 2006), minimizing road density (Vos & Chardon 1998; Hawbaker & Radeloff 2004), controlling invasive plants and introduced predators (i.e., cats; Danielson et al. 1997), reducing the impacts of human recreation (Knight & Gutzwiller 1995) and encouraging natural processes such as pollination, hydrology, and fire (Marzluff et al. 1998) on adjacent undeveloped lands could enhance the conservation value of development.

Economic Considerations

Even when ecological benefits exceed those of conventional development, conservation development will only be widely adopted if it is profitable and prudent for developers to do so (i.e., if the economic benefits outweigh the costs and real or perceived risks). The potential economic benefits of conservation development take two forms: direct benefits to private developers and broader benefits to society. If conservation development can be shown to be more profitable than conventional development—that is, if the increase in value per unit area created through conservation development more than offsets the decrease in otherwise developable area lost to conservation—then developers should adopt this practice of their own accord. Widespread adoption could be accomplished by removing any existing institutional barriers to the use of conservation development. It is not clear, however, that conservation development is necessarily more profitable than conventional development. Nonetheless, even when it is not profitable, conservation development may still provide a net benefit to society. In this case local or regional governments may choose to offer economic incentives to encourage the use of conservation development to create these public goods.

Conservation development has a number of economic benefits for developers. The most direct is a decrease in the amount (and thus cost) of infrastructure required to support a given amount of development, assuming that roughly the same number of houses are built within a smaller area (Table 1). The National Association of Home Builders found that an average cluster development cost 34% less to develop than a conventional subdivision (Thomas 1991).

In addition to cost savings, there is evidence that parcels in a conservation development can be more valuable than those in a conventional development. There is abundant evidence that proximity to open space, such as parks, increases property values (Heal 2003). For instance, one developer found it was most profitable to build 15% fewer houses on his parcel to ensure that open space was visible from each property. This less-is-more strategy resulted in homes with 25% higher values than a conventional development approach (McAliney 1993). In addition, when a hedonic pricing method is applied proximity to open space has a measurable positive impact on housing prices (Lutzenhiser & Netusil 2001; Irwin 2002), and the highest increases in property value are observed for homes within approximately 455 m of permanently protected natural areas, the same open-space features

associated with conservation development (Lutzenhiser & Netusil 2001; Irwin 2002).

Conservation development may also allow developers to compete more effectively against other developments in the region for buyers. In competitive markets conservation development offers developers a means of differentiating their homes from those in other developments that tend to offer limited variations on a common theme. In addition to the open-space benefits discussed above, homebuyers may be attracted to conservation developments because home values have been demonstrated to appreciate faster in conservation developments compared with those in conventional developments (Lacy 1990). These potential benefits of conservation development should, however, be viewed in context. Any benefits may be offset by higher perceived risks on the part of both developers and homebuyers. In addition, conservation development may be perceived as less advantageous than conventional development because the identification and protection of important ecological assets could eliminate the best potential home sites on a property.

Regardless of whether conservation developments can offer direct economic benefits to developers, local communities may recognize the potential for greater public benefits and reduced social costs. Local jurisdictions benefit from conservation development by protecting open space without raising taxes, maintaining property tax revenue (which is not the case for traditional conservation approaches such as nonprofit or public acquisition of open space), incurring fewer public costs, such as maintenance of infrastructure, and avoiding the loss of ecosystem services (Thomas 1991; Brabec 1992; McAliney 1993). Preserving ecosystem services may save communities' money in the long term through the provision of local benefits such as flood control, provisioning of clean water, and landscape stabilization (Daily 1997; Daily & Ellison 2002). These services are often assumed to be free, and the areas that provide them are often not recognized as being of value. Therefore it may be some time before communities recognize the value of protecting areas that provide these services.

The private benefit to developers will not always be enough to encourage conservation development, despite demonstrable benefits to society. In these cases governments may use incentives to close the gap and encourage more widespread use of this approach. Some such incentives are already available to developers and private landowners. For instance, federal and state agencies such as the Natural Resource Conservation Service and U.S. Fish and Wildlife Service offer payments and/or tax reductions in exchange for setting aside land for conservation or agriculture. Although conventional developers are poorly positioned to access these profit streams, conservation developments, especially those proposed for existing agricultural lands, are eligible for many of these programs.

Local governments can also avail themselves of other incentives at no additional cost, although the use of such incentives may require greater institutional support. Developers currently incur high costs from the attorney fees and lost economic opportunities associated with the land-use approval and permitting process. When local jurisdictions wish to compete with one another to attract desirable economic development to their area, they may do so by implementing a system to "fast track" selected developments (Abrams 1994). This technique can be adapted to promote conservation development by making fast-track permitting available to developers seeking to implement conservation development plans. Similarly, local boards or planning agencies can offer developers a "density bonus" (Abrams 1994), whereby developers who adopt a conservation development approach are awarded additional lots than otherwise allowed under traditional zoning.

As is illustrated by the potential of density bonuses and other planning tools, institutions play a pivotal role that is difficult to overestimate. The institutions most relevant to this discussion are state and local governments, especially their planning agencies. The positive economic incentives detailed above apply only if the institutional infrastructure is in place to facilitate the use of conservation development.

Institutional Considerations

Conservation development has the potential to offer both ecological and economic benefits, but this strategy is unlikely to be viable unless institutional barriers are removed and institutional incentives, as needed, are in place. Furthermore, to the extent that ecological benefits require the protection of extensive contiguous areas, conservation development approaches will need to be undertaken in the context of regional planning.

Although many counties and municipalities possess planning regulations that explicitly or implicitly permit conservation development, some jurisdictions contain planning regulations that discourage or even prohibit it. Local jurisdictions generally utilize four primary tools for regulating new developments: comprehensive plans, zoning ordinances, subdivision regulations, and building codes (Jurgensmeyer & Roberts 1998; Ellickson & Been 2000). In many cases, conservation development requires certain variances from these regulations including exemptions from the minimum lot size, set back (i.e., distance from the street), and frontage (or length of lot contiguous to the street) requirements. Without variances for these regulations, developers cannot cluster lots and manage the remaining areas as agriculture or native habitat (Table 1, Fig. 1) (Ellickson & Been 2000).

These variances and exemptions must be approved by the local planning agencies and may require changes to

local zoning ordinances, which may in turn require new enabling legislation at the state level, depending on current laws and distribution of power within the state (Ellickson & Been 2000). In most jurisdictions, however, clustered conservation development will be permissible within existing zoning because the resulting development will still comply with overall density and permissible use requirements (Jurgensmeyer & Roberts 1998). Indeed, developers and planners are already working in several different communities to implement conservation developments or other forms of open-space development.

As described above some jurisdictions may choose to create incentives to encourage the use of conservation development. One opportunity to create such an incentive comes with the process of determining the number and location of developable lots. Planning regulations that enable conservation development should identify the minimum ratio of conserved land to developed land that will qualify the project as a conservation development. If that ratio is set at 1:1, developers must set aside 0.4 ha of land for every hectare developed. Regulations may also require that the conserved area be contiguous. In creating these guidelines for conservation development, the local jurisdiction must determine whether otherwise undevelopable areas, such as wetlands, flood plains, and steep slopes, can be credited toward the protected area or whether they should be removed from consideration before dividing up the rest of the land. A local government may choose to create a "de facto density bonus" by crediting the area of these undevelopable parcels as conserved land and thereby allowing developers to build more total lots than they would be able to under conventional zoning.

Jurisdictions that wish to offer an even greater incentive for conservation development may create an additional density bonus by allowing developers to include more lots in their conservation development than would be allowed by existing zoning regulations. This density bonus may also be linked, on a sliding scale, to the total area protected. This approach has the added benefit of encouraging the conservation of larger contiguous blocks of land.

Transferable development rights are another incentive available to planners. These allow development rights to be transferred out of ecologically important areas to receiving areas (potentially with density bonuses for moving development where it should be).

None of these incentives, however, necessarily encourage conservation development to happen in the most ecologically important areas. Local jurisdictions can encourage the conservation of large blocks of important habitat via large-scale multijurisdiction regional conservation planning. Perhaps the most important thing that can be done to maximize the biodiversity and ecosystem service benefits of conservation development is to create regional plans—extending beyond the political boundaries of cities, counties, and possibly even states—that define areas that should be included in extended networks of protected land. With regional plans in place, local jurisdictions can target incentives for conservation development in high-priority areas.

The most important element of regional planning for conservation development is the identification of these priority conservation areas and the linkages required to connect them in a regional network. Creating such a map and planning tool faces little risk of resistance from local governments because it preserves all current zoning powers at the local level and merely provides data that allow greater coordination and accountability (Lundgren 2004). Regional-scale planning in this form should appeal to local governments afraid of losing power or planning authority because maps of areas of conservation priority offer guidance without compelling action. Rather than dictate action or condemn properties that fall within designated conservation areas, these maps instead provide a basis for evaluating new regulations and proposed development plans, especially plans for conservation developments.

Although some communities have successfully developed regional plans, despite the potential for combating sprawl and avoiding negative externalities, large-scale regional planning remains a difficult prospect under the current legal and regulatory regime (Bray & Silkin 2000; Lundgren 2004; Harvard Law Review 2005; Jackson 2005). Incorporating ecological principles into regional planning has proven even more difficult, as demonstrated by the mixed success of regional-scale HCPs under the ESA (Caldwell et al., 2006).

Many existing examples of regional conservation planning rely on the threat of negative consequences to encourage or require local participation. For instance, regional HCPs have emerged as a way to manage the strict development restrictions imposed on areas hosting endangered species (Stanford Environmental Law Society 2001). Both individual landowners and municipalities can work with regulatory agencies to create HCPs that exempt landowners from the ESA's take prohibitions in exchange for protection of habitat elsewhere, thus clearing the way for development (Stanford Environmental Law Society 2001). Developing areas that host endangered species without an HCP invites the full range of penalties provided for by the ESA.

Rather than rely on the threat of negative consequences for noncompliance, as in the HCP example, states and regional authorities can instead offer positive incentives for local governments and developers who participate in regional conservation planning. Conservation developments that protect significant portions of designated conservation areas could be eligible for positive incentives, encouraging the use of conservation development over conventional development in the same area.

These positive incentives can come at little cost to the state when they take the form of streamlining the regulatory approval process. Fifteen states have statutes similar

to the federal National Environmental Policy Act (NEPA), which requires agencies to undertake environmental impact assessments (EIAs) for any actions that pose potential significant environmental impacts. State NEPAs, however, may allow categorical exclusion of certain actions from EIA requirements (Sive & Chertok 2005). For instance, a state may grant a local government a categorical exclusion from that state's environmental impact statement requirements for new actions, including the issuance of development permits, consistent with regional conservation plans (Lundgren 2004).

Under the current land-use approval regime, development projects can take 5–10 years to move through the stages of zoning and subdivision approval, finding of consistency with the comprehensive plan, environmental permitting, utilities approval, and compliance with other local ordinances (Frece 2005). The length of this approval process affects both the holding costs of developers, the risks of their investments, and the confidence of their investors. Because developers must contend with basic regulations in any jurisdiction, the ability to enter into a streamlined process for planning and environmental reviews presents a significant incentive (Ellickson & Been 2000).

One final issue for the local jurisdiction to address is who will own and manage the protected space and who will pay for ongoing management. Possibilities include local government, the homeowners association, the developer, the original landowner, or a land trust or other nongovernmental conservation organization. Individual jurisdictions will need to determine which group possesses the right combination of technical capacity, access to resources, and ability to represent the public interest.

By accommodating further growth, but doing so in an ecologically responsible and regionally appropriate manner, conservation development has the potential to avoid the negative consequences of sprawl and current ad hoc attempts to control this sprawl. As long as attempts to control sprawl remain local in scale, the actions of individual jurisdictions will have unintended negative consequences, including increased development pressure on surrounding communities (especially those with smaller tax bases) (Jackson 2005) and a shortage of affordable housing resulting from inflated home values as demand grows faster than supply (Weinberg 2000). Conservation development addresses some of these externalities by protecting ecosystems and wildlife habitat while still providing housing. Conservation development guided by regional planning addresses even more of these negative consequences by accommodating appropriate levels of development for the region in less ecologically valuable areas. Unfortunately, the current legal and regulatory regime does not encourage or reward such coordination (Bray & Silkin 2000; Lundgren 2004; Harvard Law Review 2005; Jackson 2005).

Conclusion

Rampant low-density residential development is taking a critical toll on biological diversity and ecosystem services. We now have the opportunity to counter this crisis head on by linking development design to conservation. There are two big challenges to making conservation development an ecologically and economically successful alternative to conventional development. (1) Conservation developments will not achieve conservation goals unless they are designed specifically to protect and restore biodiversity and ecosystem services. Simply increasing housing density and setting aside land may be insufficient. Instead, conservation developments must occur in the context of regional planning, and their design and management must be informed by property-level ecological resource assessments. (2) Institutional change necessary to enable conservation development will not occur until stakeholders recognize the full value of this approach. In some cases the benefits will accrue to the developer in the form of higher home values and lower infrastructure costs. In other cases local jurisdictions will need to use incentives to more closely align the private benefits of conservation development with the social goods it provides, including protected and potentially increased ecosystem services.

These challenges can be met, but developers and communities will not be convinced of the ecological and economic benefits possible with conservation development until they see on-the-ground examples. Environmental entrepreneurs can play an important role in testing the potential of conservation development by implementing and documenting conservation development projects. These initial projects will also provide conservation biologists a much needed opportunity to test the actual conservation benefits of this approach (Radeloff et al. 2005).

Conservation organizations and jurisdictions also have great potential to change the path of rural development. By working with local governments, conservation organizations can promote changes in zoning laws and approval processes where economic benefits alone are not enough to drive the spread of conservation development. Conservation organizations can also play key roles by catalyzing and executing regional conservation plans in collaboration with government agencies. Jurisdictions can take steps by initiating resource assessments to identify priority conservation areas and engaging in regional planning to provide linkages between these conservation areas.

Although regional planning has long been recognized as a necessary part of efforts to combat sprawl, there has not yet been sufficient political momentum to enact the necessary changes. Conservation development, with its capacity to benefit multiple, diverse stakeholders, could serve as the catalyst for this change. Harnessing

development to benefit both natural systems and human communities may be the most effective means we have of maintaining the conservation and cultural value of our rural landscape.

Acknowledgments

The first two authors contributed equally to this manuscript. We thank the following people for helpful comments: K. Chan, S. Davis, J. Garman, R. Goldman, J. Goldstein, R. Hooper, R. Knight, V. Morgan, R. Pringle, and an anonymous reviewer. We are grateful to the Stanford Woods Institute for the Environment, the Winslow Foundation, and Peter and Helen Bing for financial support.

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