

PROTECTING WILDLIFE CONNECTIVITY THROUGH LAND USE PLANNING: Best Management Practices and the Role of Conservation Development



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Executive Summary

Private lands play a critical role in protecting connectivity for wildlife. However, land is being converted to residential development at twice the rate that it is being protected. Exurban development, characterized as low-density development on large lots (5-40 acres), has disproportionate effects on wildlife due to the amount of land consumed and fragmentation of land ownership and management. Many rural towns in northern New York, Vermont, New Hampshire, and Maine have high rates of land development due to the influx of retirees, part-time residents, and people seeking to live close to natural amenities.

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Exurban development (on left) consumes land more rapidly than suburban (on right) or other types of development.

Local land-use regulations can influence development patterns and mediate the deleterious impacts of residential development on wildlife. A variety of land use planning and conservation tools can achieve these results. One tool, Conservation Development (CD), is an alternative approach to the design, construction, and stewardship of a development property that achieves functional protection for wildlife, while also providing social and economic benefits to people. When implementing CD and other tools, it is important to use the best available information to ensure that building and management guidelines result in development patterns that meet local conservation goals.

This report was prepared by the Wildlife Conservation Society (WCS) for the Staying Connected Initiative (SCI), a four-state partnership whose goal is to conserve, maintain and enhance priority habitat linkages in the northern regions of New York, Vermont, New Hampshire, and Maine. The goal of the report is to provide an analysis of land use planning tools and practices in the northeastern United States as they relate to habitat connectivity.

Objectives:

1. Assess and evaluate the potential for conservation development to facilitate protection of wildlife habitat connectivity and benefit species of greatest conservation need (SGCN) in the northeast.
2. Identify key barriers and opportunities to influence the adoption and implementation of CD ordinances.
3. Synthesize best management practices from current science to inform development guidelines within land-use regulations and ordinances.

Summary of Approach

WCS collected 423 CD ordinances from towns in northern New York, Vermont, New Hampshire and Maine and evaluated the ordinances using detailed review criteria to quantify their conservation objectives, conservation design and land protection requirements, and development restrictions. We conducted 8 case studies of towns with CD ordinances to understand factors contributing to the adoption and implementation of CD ordinances. We reviewed recent scientific literature to summarize best management practices and inform future changes to CD ordinances and other land use planning tools.

Results and Implications

1. CD ordinances were adopted by fewer than one-half (37%) of the jurisdictions we surveyed. Yet, the rate of adoption has increased rapidly in the last decade.
2. Most CD ordinances are voluntary (90%), and they are often adopted alongside incentives for developers to participate. Density bonuses are most commonly provided as an incentive by more than one-third of the ordinances (36%); however, a density bonus creates potential for a substantial increase in development intensity. With this intensity may come increased population, more people recreating in the undeveloped portion of the property, more pets on the landscape, more cars, and other associated uses that may outweigh the ecological protection the CD is intended to provide.
3. On average, 41% of the site is left undeveloped under CD.
4. Minor adjustments to existing regulations may have a large positive benefit for wildlife. For example, requiring an ecological site analysis prior to the development design will more effectively identify and enable the protection of key resources. We found that only 18% of the ordinances that we reviewed with CD require a site analysis for ecological features. Further, this analysis was required prior to designing the developed area by only 11% of the ordinances.
5. Ordinances lack a strong standard for expert consultation to guide conservation design. It would have tremendous benefit to private land stewardship for municipalities to have better mechanisms in place to access expertise in land use planning and design for conservation to assist in the conservation design process; this could take the form of consultative partnerships with agencies, land trusts, or private consultants, or through dedicated staff.
6. Ten communities in the northeast had 'strong' CD ordinances for wildlife and ecological protection based on meeting at least three of the following criteria: (a) specific objectives related to wildlife, habitat, species, or connectivity conservation; (b) $\geq 50\%$ of site area required to be protected; (c) ecological site analysis required; and (d) management plan required.
7. We highlight many examples of conservation protections incorporated into northeastern CD ordinances. These include elements such as ensuring protection of the open space in perpetuity, and keeping open spaces contiguous within the site and with adjacent parcels.
8. Community adoption and implementation of CD requires the right mix of motivation, capacity, dialogue, agreement, and legitimacy for action. Insight on the key conditions and circumstances under which CD ordinances were adopted and implemented will inform future on-the-ground interactions with communities with critical connectivity lands within town boundaries.
9. Ecological studies of how land use can help conserve biodiversity and ecological connectivity are still somewhat rare. However, the majority of studies we reviewed conclude that clustered rather than dispersed housing is more effective at protecting biodiversity and ecological connectivity. Most all of them suggest stronger conservation outcomes from various types of conservation development when compared to conventional development.
10. Conservation development techniques and policies represent an entire toolbox of potential methods for protecting biodiversity in the face of residential land use change, and the greatest likelihood of success will come from employing a variety of techniques. Many best management practices exist for developers, landowners, and community planners to implement that help protect wildlife values. We highlight a variety of these opportunities in order to strengthen a full spectrum of projects.

Introduction

Private lands play a critical role in protecting connectivity for wildlife. Although private land conservation efforts have grown rapidly in recent years, the total area of developed land in the U.S. is still 10 times that of privately-conserved lands, and land is being converted to residential and urban development at twice the rate that it is being protected. One type of development with disproportionate effects on wildlife due to the amount of land consumed is exurban development. Exurban development is characterized as low-density rural residential development or large lot subdivisions that are less dense than suburban households yet denser than traditional resource management uses. At a national level, exurban development occupies 7-10 times more land than that of urban areas (Theobald 2005), with one third of housing units in the US located in exurban areas where wildland vegetation is interspersed with housing (USDA and USDI 2001). As a result, the impacts of this type of housing can almost go undetected as the landscape visually appears very similar to the original landscape or that of nearby protected lands. Exurban development is prevalent throughout the Northeastern United States (Brown et al. 2005). More importantly, exurban development is increasing more rapidly in areas of high conservation value (Suarez-Rubio et al. 2011) such as within forests (Radeloff et al. 2005), adjacent to protected lands (Rasker and Hansen 2000), and along lakeshores (Radeloff et al. 2001).

This type of land use pattern has the potential to fragment the forest and impact the ability of wildlife to move across the landscape. It is not economically feasible nor is it always possible to protect key habitat lands through conservation easements or public land acquisition. More private landowners and municipalities are realizing the importance that private lands play in conserving a landscape. In the four state study area in the northeastern United States (northern NY, VT, NH, and ME) much of the land is in private ownership, and therefore decisions on conservation action are driven from the bottom-up. Conservation practitioners and natural resource managers have an opportunity to provide scientific data, tools, technical guidance and other resources needed to help guide land use decisions that protect wildlife habitat and connectivity and promote land stewardship.

Stewardship on private lands results from decisions made by the landowner who determines what activities occur on the land, when the activities occur, and how and where the activities are implemented. These decisions may be informed through the local regulatory process (i.e., zoning



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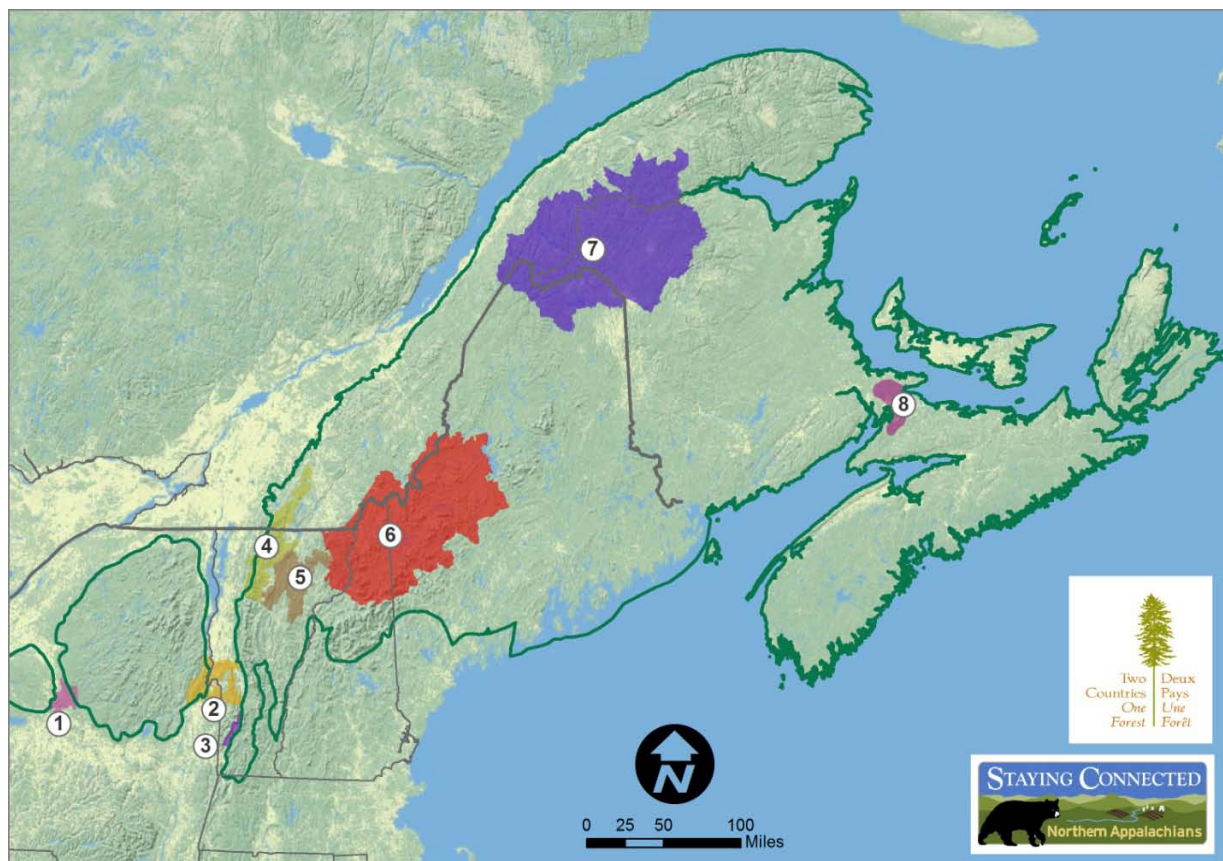
bylaws, subdivision regulations, Homeowner Association covenants) that permits or restricts activities on a given piece of property. In the northeast, the local regulatory process generally happens at the municipal town, village, or city level. Local land-use regulations can influence development and minimize the negative impacts of development on wildlife. Within local land-use regulations a variety of tools may be employed to achieve these results. One such tool is Conservation Development (CD) which aims to protect or restore natural features of a site by limiting development to a subset of a parcel.

Background

This report was developed for the Staying Connected Initiative by the Wildlife Conservation Society (WCS) which has been working to protect wildlife and wild lands in the northeastern United States since 1996, with the establishment of a community-based conservation program in the Adirondacks, and later the development of a regional scale conservation program. In 2003 WCS was a lead partner in the formation of the conservation collaborative Two Countries One Forest (2C1Forest, www.2c1forest.org) of NGO's, researchers, foundations and land trusts to protect wildlife habitat, wildlife connectivity and long term health of the Northern Appalachian/Acadian ecoregion. In 2009 WCS became a key partner in the Staying Connected Initiative.

The goal of the Staying Connected Initiative is to conserve, maintain and enhance the priority habitat linkages in the Northern Appalachian/Acadian Ecoregion (Map #1) to ensure landscape scale connectivity across the region from the western edge of the Tug Hill Plateau in New York through Vermont, New Hampshire and Maine and on to Quebec's Gaspé Peninsula and into Nova Scotia.

This report is meant to inform partners in the Staying Connected region and in rural areas across the northeast about how Conservation Development can protect wildlife connectivity on private lands and how the science can inform and improve the practice of CD and other land use planning tools.



Map #1: Landscape Linkages identified by 2C1Forest and the Staying Connected Initiative in the Northern Appalachians. 1. Tug Hill Plateau – Adirondack Mountains (NY), 2. Adirondack Mountains – Green Mountains (NY, VT), 3. Taconic Mountains -- Southern Green Mountains (NY, VT), 4. Northern Green Mountains (VT, Canada), 5. Worcester Range – Northeast Kingdom (VT). 6. Northeast Kingdom – Northern New Hampshire - Western Maine Mountains (VT, NH, ME), 7. 3-Borders (ME, QC, NB), 8. Chignecto Isthmus (MB, NS).

Project Goals

Wildlife Conservation Society (WCS) staff have studied the impacts to wildlife on private lands from development for over a decade (Glennon and Porter 2005, Glennon and Porter 2007a and b, Glennon and Kretser 2005, Kretser et al. 2008, Wildlife Conservation Society 2009, Reed et al. 2012, Glennon and Kretser 2013, Reed et al. *In review*, Wildlife Conservation Society *In press*). As part of the Staying Connected Initiative, WCS set out to achieve three broad goals and a number of objectives in order to understand how land-use regulations and local ordinances can better protect wildlife connectivity and to guide future land use planning in the Staying Connected region and in other rural areas across the United States. Those goals are:

- Assess and evaluate the potential for conservation development to facilitate protection of wildlife habitat connectivity and benefit species of greatest conservation need (SGCN) in the northeast. Our approach was to:
 - Collect data on local land use regulations in northern New York, Vermont, New Hampshire, and Maine;
 - Identify specific ordinances or sections of those regulations that provide guidelines or incentives to encourage CD; and
 - Review the content of the CD ordinances using a detailed set of criteria to quantify their conservation requirements and development restrictions.
- Identify key barriers and opportunities to influence the adoption and implementation of CD ordinances. Specifically we present:
 - Sample conservation development ordinances in the northeast,
 - Document factors influencing a community's process for adopting a CD ordinance, and
 - Identify opportunities to protect biodiversity and ecological connectivity through enhanced conservation development ordinances.
- Synthesize best management practices to inform land-use regulations and ordinances from current scientific literature in order to illustrate:
 - Best management practices in land use planning that protect ecological integrity and help maintain wildlife connectivity, and
 - Examples where land use management practices have been measured or empirically evaluated in terms of their ability to maintain biotic integrity and/or wildlife connectivity.

We address each of the three goals in separate chapters. In Chapter One, we describe our work in surveying all jurisdictions in northern New York and all of Vermont, New Hampshire, and Maine for CD ordinances in the local regulations. In Chapter Two we summarize the interviews we conducted in 8 case study towns that have experience adopting and in some cases implementing CD regulations. In Chapter Three we present a current scientific literature overview and synthesis of empirical data testing the impacts of various land-use practices on wildlife. In each chapter we describe the general background, methods, results, and conservation implications.

The audience for this report includes conservation practitioners in the four-state region of northern New York, Vermont, New Hampshire, and Maine; however the information presented should be helpful to other rural areas looking for this information. The report documents the state of conservation

development and regional private land stewardship currently in the region and is meant to help demonstrate the benefits of CD.

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Chapter 1

Review of Conservation Development Ordinances in the Northeast

Heidi Kretser and Sarah Reed

Introduction

Conservation development (CD) is an alternative approach to the design, construction, and stewardship of a development property that achieves functional protection for natural resources, while also providing social and economic benefits to human communities. Often, CD protects or restores the biodiversity, ecosystem services, or other natural resources by limiting development to or clustering housing on a subset of a parcel (Figure 1). CD includes a wide range of project types, ranging from single homes on large forested rural lots, to suburban conservation subdivisions, to large master-planned communities. Many different terms are used to describe CD, including cluster development, cluster subdivision, conservation subdivision, open space subdivision, or conservation and limited development project. Although CD accounts for a growing proportion of private land conservation and residential development in North America, little is known about its social, economic, and ecological outcomes.

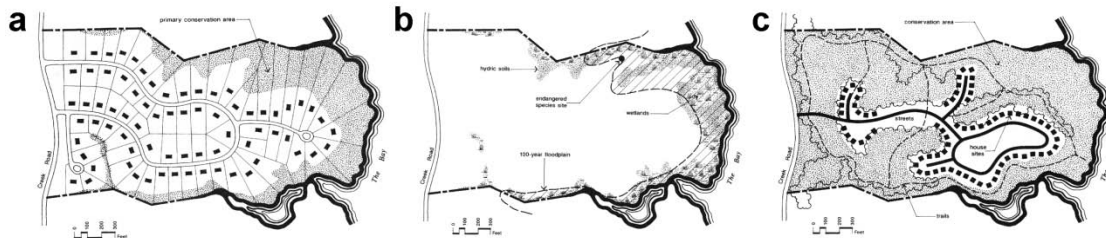


Figure 1 Illustration of (c) a conservation development in contrast to (a) a conventional dispersed development. In a conservation development, (b) the natural resources of the property mapped and protected prior to citing the locations of the home sites (Arendt 1996).

In order to understand the potential for CD to be an effective tool for conservation, we first need to know whether towns have CD ordinances in the local codes and if so what provisions for protection of natural resources exists within these ordinances. Conservation development projects currently account for up to 25% of private land conservation activity in the US (4 million ha per year) (Milder and Clark 2011). CD is roughly estimated to comprise 3% of new residential development (50,000 housing units per year), but in rural areas experiencing high rates of amenity-driven development, that proportion may be much higher (up to 10-20%). Conservation development is an important tool for land and wildlife conservation because it addresses a major threat to biodiversity (i.e., residential sprawl), it has the potential to promote connectivity by protecting a large amount of private lands at little to no cost, and is growing in popularity among land use planners and developers.

Most guidelines for how to implement CD have come from the planning and design communities. There are three main places where you can find guidelines for how to design a CD project: (1) general guidebooks for developers and designers; (2) emerging third-party certification programs, such as the Sustainable Sites Initiative and LEED for neighborhood development; and (3) local land use regulations. To date, with few exceptions, most books have been written by planners, mostly for the planning community and discuss elements important to proper CD without clear guidance on provisions for managing natural resources such as native flora and fauna. To date, conservation scientists have had little to no involvement in developing the standards and guidelines for how CD projects are

implemented and managed; in addition, the resulting projects are rarely evaluated for their conservation effectiveness. We chose to focus on land use regulations because they have the potential to influence implementation of CD for the greatest number of development projects and local regulations offer the possibility to coordinate conservation design among multiple projects across multiple jurisdictions. Much recent science provides insight as to which land-use management practices lead to desired conservation outcomes. By linking the science to what exists in current regulations, conservation practitioners will be able to contribute broadly to wildlife habitat connectivity on private lands in the northeast.

Methods

In 2009, Smith Conservation Research Fellow and now full-time WCS staff member, Dr. Sarah Reed, initiated a project to examine the potential for CD to facilitate protection of wildlife habitat connectivity on private lands via a review of local land use regulations in 414 counties of 11 western states. Following the methods developed by Dr. Reed, we searched for land use regulations including subdivision and zoning regulations, in 1,660 local jurisdictions in northern New York, Vermont, New Hampshire, and Maine. Our analysis includes the more populous areas in the southern portions of each state (except for New York), given that CD ordinances are often more common in areas with higher populations and the entire region could benefit from understanding what already exists in codified regulations. The jurisdictions we reviewed are mostly towns but there are also villages, cities, and unincorporated lands.

We first searched for documents online on community websites and municipal code databases and, if that did not yield results, we emailed or called each town a minimum of two times. If no response was received as a result of our inquiry, we listed the town as 'unknown' with regard to whether or not a CD ordinance was adopted. For the regulations obtained, we read through them to a specific ordinance or section that provides guidelines or incentives for CD. We also reviewed all planned unit development (PUD) regulations and included those in the analysis only when the statement of purpose for the PUD included goals and objectives related to conservation and the ordinance explicitly required open space protection. When we found a CD ordinance or qualifying PUD, we reviewed it according to a set of detailed criteria to quantify its conservation objectives, conservation design and land protection requirements, and development restrictions (Appendix A).

Results

We successfully determined whether or not regulations existed in 1,548 jurisdictions (93%) in the four-state region. The rate of adoption of CD ordinances is 37% of towns overall, with substantial variation by state (Figure 1). The map provides an illustration of the extent of land in the northeast where development can be influenced by existing CD ordinances. The Maine Land Use Planning Commission (LUPC) has one land-use plan containing a CD that guides development in all of the unincorporated townships (n=461). For the purposes of our analysis, we reviewed the LUPC ordinance once, and 14 communities had more than one ordinance that qualified as a CD, thus a total of 423 (30%) ordinances out of an adjusted sample of n=1208 were reviewed in the analysis (Table 1).

As noted above, CD ordinances may have a variety of names and the ordinances appear in a variety of places within a land-use plan. In our review CD ordinances were most often found in the zoning regulations (68%) but also appeared in the subdivision regulations (19%) and in the unified development code (Table 2). Regulations that qualified as CD were referred to by a variety of terms including cluster development, conservation subdivision, and open space zoning (Table 3). We recorded the year of adoption for each ordinance for which it was possible to determine. The mean year of adoption for the northeast was 1996. Overall, we see an increasing trend in adoption over time, with a peak in the last

decade (Figure 2). Although a recent trend, these ordinances are updated frequently; on average, two-thirds of the regulations (66%) have been revised at least once. Of the 366 ordinances with stated objectives (87%), most were designed to promote flexibility in design (76%), protect open space (74%), protect viewsheds and scenic resources (53%), and minimize infrastructure development (51%; Table 4). Protecting wildlife was the 11th most commonly stated objective and was found in only 30% of those ordinances with stated objectives. Specific mention of imperiled species occurred in only 3% of the ordinances with stated objectives.

Figure 1. Map of northern New York, Vermont, New Hampshire, and Maine jurisdictions that had CD or qualifying PUD ordinances. Communities under Maine Land Use Planning Commission and Adirondack Park Agency Act jurisdictions are noted.

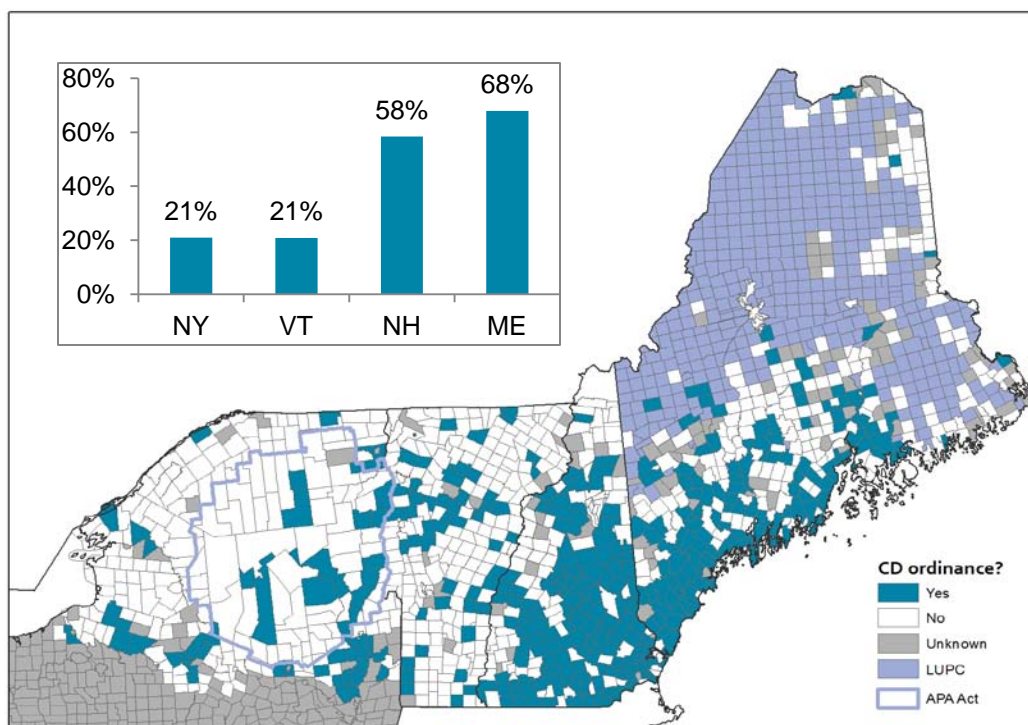


Table 1. Overall response rates for all jurisdictions defined as those communities who responded to our request for land-use regulations. Response rates by state and the jurisdictions with a CD; numbers adjusted to reflect Maine unincorporated lands as one jurisdiction.

State	Total jurisdictions		Response rate by state		Had a CD ordinance	
	n	%	n	%	n	%
New York	258	21%	239	93%	54	21%
Vermont	255	21%	244	96%	53	21%
New Hampshire	257	21%	245	85%	150	58%
Maine	438 (890)	36%	367	84%	152	35%
TOTAL	1208 (1660)	100%	1095		409*	
Overall Response Rate				91%		
Percent of Jurisdictions with Ordinances				37%		

*Some communities had multiple regulations that qualified as CD, thus n=423

Table 2. Part of the local code where the conservation development regulation appears

Part of Regulation	Number of CDs appearing in different parts of local code	Percent (n=423)
Subdivision regulations	81	19%
Zoning regulations	289	68%
Unified development code	58	14%
Special regulation	8	2%

Table 3. Conservation development in the study area appears under a variety of names in the local regulations.

Name of the Regulation*
Cluster development overlay district
Cluster housing development
Clustered residential development
Conservation development
Conservation lands development
Conservation subdivision
Conservation subdivision design ordinance
Floating planned development overlay district
Open space preservation ordinance
Open space subdivision
Open space zoning
Open-space standards
Planned development districts
Planned residential development
Planned unit development
Residential open space conservation subdivision development
Resource-based subdivision development
Single-family cluster

**not a comprehensive list*

Figure 2. Decade of adoption for CD ordinances in four-state study area.

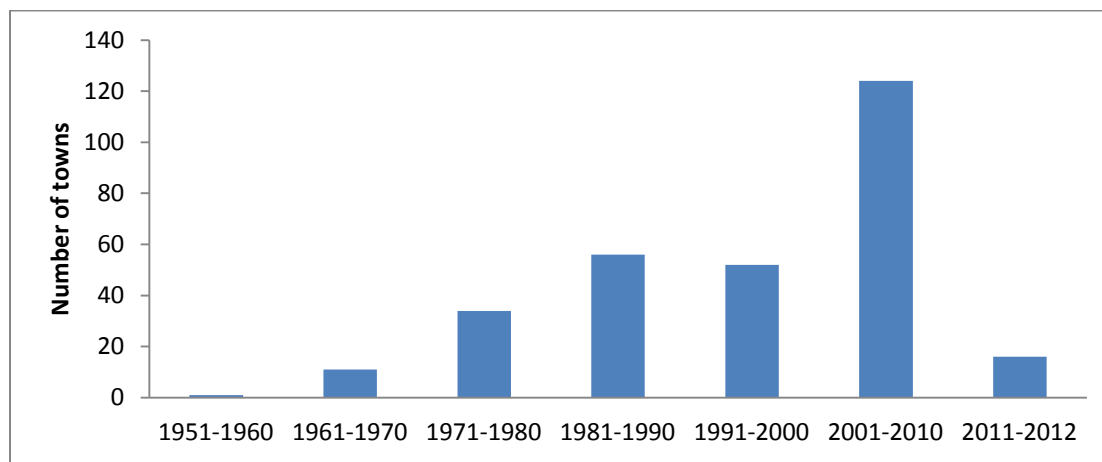


Table 4. Among those conservation development ordinances that state an objective, purpose or goal (n=366), many ordinances noted common objectives broadly related to conservation of natural resource values, conservation of community or cultural values, or promotion of design and economic values.

Focus of Stated Objective	# of ordinances with stated objective	Percent of all ordinances with objective (n=366)
<i>Natural resource values</i>		
Protect local open space	271	74%
Protect natural features	230	63%
Protect wildlife habitat	111	30%
Maintain vegetative cover	81	22%
Sensitive areas	76	21%
Contribute to regional open space network	67	18%
Protect water quality	59	16%
Reduce erosion	54	15%
Minimize impacts of development	50	14%
Protect aquatic habitat	38	10%
Protect migration routes or corridors	19	5%
Minimize impervious surfaces	15	4%
Protect imperiled species	9	3%
Buffer protected lands	8	2%
<i>Community or cultural values</i>		
Protect viewshed or scenic resources	195	53%
Provide recreation opportunities	190	52%
Protect agricultural lands	145	40%
Protect rural character	116	32%
Historic or cultural lands	89	24%
Provide affordable housing	60	16%
Promote public health & safety	55	15%
Increase community connectivity	29	8%
Provide a sense of community	8	2%
<i>Design and economic values</i>		
Permit flexibility or creativity in development	277	76%
Reduce development infrastructure	188	51%
Promote efficient land use	176	48%
Promote cost-effective development	118	32%
Promote compatible land use	76	21%
Encourage cluster	63	17%
Discourage sprawl	44	12%
Encourage mixed uses	34	9%
Promote energy efficiency	17	5%
Increase property values	12	3%
Decrease auto dependence	8	2%

In our detailed review, we evaluated the collected regulations for the key dimensions of conservation design likely to influence the effectiveness of this tool for protecting wildlife habitat and connectivity. Most CD ordinances are voluntary (90%), and so are often adopted alongside incentives for developers to participate, 163 (39%) CD ordinances provided an incentive. Some of the incentives include streamlined review (4.3%), reduced fees (1.2%), and a host of other incentives (13%). Most commonly, a density bonus is provided as an incentive by more than one-third of the ordinances (36%). A density bonus is an increase in the development yield, or number of units, a developer would be permitted to develop on the property. Of those ordinances providing a density bonus, the mean increase in development yield permitted as a bonus is 26%. This means that if a developer were permitted to develop 100 units on a property based on underlying zoning, following the planning process in the CD ordinance would allow them to develop up to 126 units. Although CD requires a decrease in development footprint, there is potential for a substantial increase in development intensity. This intensity may be accompanied with increased population, more people recreating in the undeveloped portion of the property, more pets on the landscape, more cars, and other associated uses that may have implications for how well the open space within a site offers ecological protection.

We asked a series of questions about requirements for conservation design and ecological site analysis. As expected, compared to typical developments, CD in the four-state region requires more land to be set aside as undeveloped or protected in some way. On average 41% of the site is left undeveloped under CD. In the four-state region, CD requires a site analysis for ecological features in 18% of the ordinances. However, a site analysis for ecological features was required prior to designing the developed area by only 11% of the ordinances. The lack of emphasis on ecological site analysis hints that the protected portions of CD projects may be serving more of an open space role than meaningful protection of species habitat or other natural resources, a suspicion that has been supported in one empirical study (Lenth et al. 2006). This finding is not surprising given the stated objectives of the CD ordinances noted in Table 4. Nonetheless, without a site analysis prior to the design phase, it will be difficult to protect the important natural features at these CD sites.

We also inquired about where information to guide the design of the conservation area should come from. We found that design of the conservation area requires consultation with an ecological expert or conservation plan in 21% of the ordinances. In the review criteria we defined ‘ecological expert or conservation plan’ quite broadly, and when we looked more closely at the data we saw that the vast majority (70%) of required consultations were with the town planning or development review board. Other research has demonstrated that local government boards, particularly in rural areas, lack adequate capacity to address biodiversity conservation issues (Miller et al. 2009).

The review criteria included questions pertaining to the ownership and management of the protected or undeveloped area. The majority of the regulations provide guidelines for ownership (86%) and management (77%). Some regulations specified who could own the protected area: most commonly, homeowner associations (HOAs, 75%), local government agencies (62%), and non-profit organizations (55%) followed by individual owners (24%) or the developer (12%). Some regulations specified what types of land protection instruments were permitted including conservation easements (50%), restrictive covenants (44%), public dedication (35%), and fee-title ownership (9%). Fifty-four percent of the regulations specified that the duration of protection must be in perpetuity while 46% offered only limited or did not state the required longevity for protection. Fifty-five percent of the regulations required a management plan for the protected area. For those regulations requiring management plans, guidelines for managing conservation targets (88%), a funding source for management and monitoring of targets (50%), stipulations for enforcement (23%) and guidelines for monitoring targets (17%) must

be included as elements of the plan. Nearly three-quarters (70%) of the ordinances specified activities permitted in the protected area (Table 5). Notably, non-motorized recreation (85%) and conservation purposes (75%) followed by agriculture (59%) were most frequently mentioned. Only 6% of plans indicated which land uses or activities were prohibited in the protected area, and of those listing prohibited activities only parking lots (46%), roads (41%), and public access (4%) were mentioned.

Table 5. Permitted uses within the protected area

Land uses or activities permitted	Number of plans allowing activity	Percent (n=296)
Non-motorized recreation	250	85%
Conservation purposes	221	75%
Agriculture	174	60%
Timber harvest	110	38%
Parks/ playgrounds	96	32%
Municipal purposes (utilities easements)	92	31%
Access by residents	80	27%
Motorized recreation	31	11%
Public access	21	7%
Septic systems/ leach fields	20	7%
Golf courses	13	4%
Grazing	6	2%
Parking lots	3	1%
Hunting	4	1%
Pets	1	0%
Roads	0	0%
Other	46	17%

Conservation implications of conservation development review

CD in Northern New York, Vermont, New Hampshire and Maine may be an important tool influencing biodiversity and wildlife connectivity on private lands in the region. Our review unveiled several potential implications of CD for conservation practitioners and planners in the region.

- First, conservation practitioners have an opportunity to provide input on CD ordinances in the northeastern states. CD ordinances were adopted by fewer than one-half (48%) of the jurisdictions we surveyed. Yet, the rate of adoption has increased rapidly in the last decade, meaning that more towns are seemingly ready to engage. In addition, CD is an opportunity to generate land and revenue for conservation; a recent study in Colorado demonstrated that the sales price of homes in CD subdivisions is 20-29% greater than the price of homes in comparable conventional subdivisions (Hannum et al. 2012). However, as CD gains popularity, conservation practitioners must engage in the adoption and implementation process in order to influence CD ordinances to maximize conservation benefits.
- Second, our review indicates that the requirements for conservation design and ecological site analysis are relatively weak. Moreover, there is a potential for development intensification as a result of implementing these ordinances, via the density bonuses that are provided as incentives. The ordinances lack a strong standard for expert consultation to guide conservation design. Having a dedicated person who is well versed in design for conservation who could be a resource for towns would be a tremendous benefit for private lands stewardship. For example, during the grant period for the Staying Connected Initiative, SCI Technical Assistance Coordinators played an important conservation role by engaging directly with towns in wildlife linkages on various planning endeavors. As the results of our study demonstrated, amending simple aspects of the design guidelines—for

example, how the protected land is configured in relation to development on the property and on adjacent properties, and when in the process an ecological site analysis occurs—could have a large influence on conservation outcomes. Thus, having technical assistance-like positions available to consult and work with towns on incorporating these types of recommendations will be invaluable for future improvements to conservation development tools in the region.

- Third, when determining the best methods for managing the protected portions of a site, consider conservation easements and work with a local land trust and natural resource professional to determine the best options for an easement agreement (Jenkins 2008). These practitioners working may often be the best resource to determine which permitted uses may have deleterious impacts to wildlife and make recommendations about the extent of permitted uses and areas that are identified as priority wildlife corridors. For example, in those developments utilizing density bonuses, what is the impact on wildlife of even more homeowners recreating on the protected portions of a site?
- Fourth, the results of our review have important implications for how we discuss CD with the general public. Many existing ordinances prioritize the protection of open space and perhaps were successfully adopted because of that stipulation. It is important to consider linking designs for protecting open space with an understanding of ecology and wildlife science. Even with improved tools for protecting biodiversity, mobilizing communities to adopt and implement conservation development may remain closely tied to the desire to preserve open space or working landscapes, thus successful communication about CD must continue to emphasize these elements and long-term benefits.

Land Use Planning Implications of conservation development review

Several key lessons have emerged from our work and discussions with partners in the northeast about land use planning and best approaches to implementing these principles with local planning agencies.

- Given that land use planning decisions happen at the local level, practices and policies related to land use planning across the northeast may differ greatly and as a result multiple approaches may be necessary for implementing improved land use measures.
- Conservation practitioners working in this region can benefit from analytical approaches and land-use tools that have been systematically implemented successfully elsewhere.
- Measuring the success of various CD's at protecting connectivity is difficult; however tools are rapidly developing to measure the effect of conservation designs. Practitioners could take advantage of these advances to prioritize such work in the region.
- In terms of the content of CD ordinances, although CD requires a decrease in the overall development footprint, via density bonuses, there is potential for these to result in a substantial increase in development intensity and should be part of the discussion with planners and landowners.
- Minor adjustments to existing regulations may have a large positive benefit for wildlife. For example, requiring an ecological site analysis prior to the development design will more effectively identify and enable the protection of key resources.

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Chapter 2

Conservation Development Ordinances in the Northeast: Examples and Lessons Learned

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Introduction

Chapter One demonstrates that municipalities in the northeastern United States have a high level of variability of adoption of Conservation Development (CD) ordinances, as well as important variability regarding the content of the ordinances that do exist in these towns. In order to obtain a more qualitative understanding of the status of adoption and implementation of CD ordinances in the northeast, we conducted case studies of eight communities in the four-states (NY, VT, NH, ME). We sought to document the context, conditions, and stories of communities that have adopted and in some cases implemented CD ordinances in their regulations, and determine what conditions provided the needed capacities and resources for successful adoption and implementation of these ordinances. A primary objective of our project was to evaluate the key barriers and opportunities to adoption and implementation of CD ordinances.

We recognize that stories and examples can be powerful tools for learning – both for conservation practitioners and for the communities with which we work. This Chapter offers many such examples and thus, we hope, valuable resources for conservation practitioners and state wildlife staff to reference when working with communities and planning agencies in corridor and linkage areas in the northeast to protect connectivity.

Methods

In Chapter 1, we described the methods used to collect and evaluate 372 CD ordinances from municipalities in northern New York, Vermont, New Hampshire, and Maine. Using this selection of communities as our starting point, in Chapter 2 we conducted case studies for a sample of communities from that original database. To select the case study communities, we first chose towns from the original 372 with “strong ordinances.” The four criteria we looked for in performing this filter were: (a) objectives related to wildlife, habitat, species, or connectivity conservation; (b) $\geq 50\%$ of site area required to be protected; (c) ecological site analysis required; and (d) management plan required. Ten communities’ ordinances met at least three of these four criteria. We also randomly selected 12 additional towns with CD ordinances not meeting at least three of these criteria. Once we had this set of 22 towns, we called each of these communities to determine whether their CD ordinance had been implemented (i.e. whether a project had been permitted under the terms of the town’s CD ordinance.) To represent communities with different requirements for conservation in their ordinances and experiences with implementation, our final sample of eight communities included four meeting our “strong” criteria and four taken from the general pool. We chose communities reflecting diversity across the four-state region as well as some communities with experience in implementing their CD ordinances.

For section 1 of this chapter, we reviewed the CD ordinances in place in the ten communities with “strong” ordinances for elements of particular interest to conservation practitioners working in the four-state region of NY, VT, NH, ME. For section 2 we conducted interviews with individuals in our final sample of eight communities who were well-positioned to speak to the adoption and implementation of the community’s CD ordinance. We identified the individuals by first speaking with a representative of the town zoning or planning department to get an initial recommendation of someone with knowledge of the adoption and implementation of the CD ordinance, and then used snowball sampling to identify at least three people in each community. The case studies from the northeast will be compared to similar case studies in the west as part of a broader assessment of conservation development to evaluate:

- 1) What are the key barriers and opportunities to adoption and implementation of CD ordinances?
- 2) What are important sources of variability in these processes within and among communities?
- 3) What is the future of CD in these communities?

For this report, we highlight elements of the larger study specific to the region and useful to conservation practitioners working on the ground with town planning processes. Specifically we:

- 1) Provide a narrative description of the conservation requirements and development restrictions associated with a sample of CD ordinances in the northeast,
- 2) Document factors influencing a community’s process for adopting a CD ordinance, and
- 3) Recommend opportunities to protect biodiversity and ecological connectivity through enhanced conservation development ordinances.

1. Sample conservation development ordinances in Northeastern municipalities

Though this sample is not intended to represent a comprehensive nor necessarily a fully representative sample of CD ordinances, it is intended to give a flavor of some of the ordinances that provide the current context of habitat protection and the future context for conservation-oriented land use planning in the northeast. The summaries below highlight the CD ordinances of the 10 communities whose ordinances met most or all of the criteria of being ‘strong’ in terms of the protections for wildlife and ecological process. Each summary represents just a small subsection of the content of these ordinances.

Bethel, ME

Bethel’s open space development ordinance is included within Section 150-9 of the town’s subdivision regulations. It can be accessed via the town planning website at: http://www.bethelmaine.org/Pages/BethelME_Planning/index. One of the objectives of the ordinance is to: “blend new development with the traditional open and wooded agricultural and village landscapes of Bethel.” It “allows the Planning Board to waive or reduce certain otherwise applicable standards and provisions of this (subdivision requirements) chapter if such landowners commit to the permanent preservation of important open space resources.” It provides a 10% density bonus if the Planning Board “makes a written finding that the open space subdivision satisfies the policies of the Comprehensive Plan and achieves the applicable purposes contained in Subsection B.” Under this scenario, if the developer proposes a 10-lot subdivision and meets the requirements, one additional lot will be

permitted. The ordinance provides siting standards, saying that “priority should be given to the preservation of the open space for its natural resource value.” In further elaborating, the ordinance describes specific guidelines to particularly preserve agricultural lands and soils, among other values. The ordinance describes specific mechanisms that are acceptable for the ownership of the protected open space, and says that “the Planning Board shall, in its review, require as a condition of approval, provisions for the ongoing maintenance and associated costs for such maintenance of the open space.”

Newry, ME

Newry’s cluster development provision is Section XVIII of the town’s Unified Development Review Ordinance. It can be accessed via the town’s website at: www.newrymaine.org/OnlineDocuments.php. It states that “A cluster subdivision achieves the purposes of this Section by reducing the lot size, frontage and setback requirements. It locates structures and accompanying uses in those areas where they have the smallest impact on identified meadow uses, woodlands, environmental, wildlife and other open space resources. These resources are then permanently preserved by the use of covenants and restrictions or conservation easements.” It requires “a minimum of 50% of the buildable area must be designated as open space.” In guiding the open space uses, providing particular guidelines for parcels that contain land suited to “meadow” and “woodland” uses. It also states that “the plan shall clearly show that the open space land is permanently reserved for open space purposes, and shall contain a notation indicating the book and page of any conservation easements or deed restrictions required to be recorded to implement such reservations.”

Phillips, ME

Phillips’ open space subdivision standards are included as Section VIII – G of the town’s subdivision ordinance, which can be found online at: <http://www.phillipsmaine.com/facts/SubdivOrdinance.pdf>. The standard is intended to provide incentives to implement the town’s policy of encouraging open space subdivisions. The standard stipulates that a minimum of 50% of the subdivision’s buildable area must be designated as open space. The standard includes siting principles for the building lots, which emphasize protection of agricultural soils and visual impacts (as opposed to forest, habitat, or connectivity preservation). However the standard also includes guidance about the open space designation, and in this it states that “open spaces should include natural features located on the parcel(s) such as, but not limited to, forested land and wildlife habitat.” In addition, the idea of connectivity is referenced through the language “open space areas shall be contiguous, where possible, to allow linking of open space areas throughout the Town.” The standard addresses the intensity of development in the cluster arrangement in part by saying that: “distances between residential structures shall be a minimum of the height of the tallest adjacent structure” and that the minimum land for the building envelope “shall be 20,000 square feet,” which cannot include 100 year floodplains, widespread steep slopes, or wetlands. (20,000 square feet is a little less than half an acre.) The standard includes a discussion of the uses of the open space, including the following: “when the principle purpose of preserving portions of the open space is the protection of natural resources such as wetlands, steep slopes, wildlife habitats, and stream corridors, open space uses in those portions may be limited to those which are no more intensive than passive recreation.” The standard gives the planning board explicit discretion to restrict open space uses.

Enfield, NH

Enfield’s open space/cluster development standards and regulations appear as Section 405 in the town’s Zoning and Floodplain Development Ordinance, the most recent Amendment of which was in March, 2012. The ordinance is available online at: <http://www.enfield.nh.us/>. Section 405 begins with a concise overview of the goals and structure of the standard, which begins, “In order to preserve open

spaces, particularly forestland, natural habitats, wetlands and scenic views, for the enjoyment of the general public, a residential subdivision of a parcel of land may cluster the dwelling units on lots of reduced dimensions for the purposes of preserving fifty percent of the gross buildable land as Common Open Space.” The standards stipulate that a cluster development tract shall be at least ten acres in area. In proposed developments of ten or more dwelling units, the standards of Cluster Development must be adhered to unless the development achieves the goal of Section 405 without strictly following the standards, and in developments of less than ten dwelling units, the Planning Board can request a traditional plan and a clustered plan, and may reject the traditional plan “if the plan appears so contrived as to make the proposed cluster development the best choice.” The standards describe that lot dimensions and setback requirements in a Cluster Development may be reduced by up to 55% over conventional lot requirements. Utilities are required to be underground. Cluster Developments’ required Open Space must be entrusted to a Homeowner’s Association and the standards lay out reasonably specific guidelines about the covenants and management elements of the HOA and its relationship to the Open Space and the residential lots. The standards require that the Open Space Land “shall be placed in undivided preserves that are equal to, or greater than three acres. All Open Space Parcels between three and ten acres shall have a length to width ratio equal to, or less than four to one.” (This standard is presumably intended to maximize the connectivity and interior forest size of Open Space parcels rather than having a thin strand of open space with limited habitat value.) The guidelines empower the Planning Board to designate “at its discretion” the location and placement of features including specific areas for Common Open Space, the design of internal streets, and the location of the home cluster. Wetlands and surface waters are required to be buffered with fifty feet of natural vegetation. Section 405.2 of Enfield’s zoning goes on to describe an alternative form of clustered development, called the “Village Plan Alternative,” under which a developer can choose to consolidate the entire density of permitted development for a parcel on a fifth or less of the parcel, and grant the municipality a conservation easement for the remaining 80% or more, which is dedicated to agriculture, forestry, conservation, or public recreation. The Village Plan Alternative removes all dimensional requirements.

Wakefield, NH

Wakefield’s Open Space Conservation/Cluster Development standards are included as Article 12 in the town’s zoning ordinance, which can be found online at: <http://www.wakefieldnh.com/>. Wakefield allows Open Space Conservation/Cluster Development by Planning Board approval, and encourages it in a variety of named cases, including when the development site contains: rare or threatened species, or known habitat for these species; important water resources; snowmobile trails; or historic sites or structures. Density bonuses are not provided for conforming developments. At least 50% of the buildable area of the lot is required to be “permanently designated as Open Space area by covenant recorded at the Registry of Deeds and shown on the recorded subdivision plan.” The standards include fairly detailed open space area location and design guidelines which are worthy of quoting at length in terms of their relevance to habitat connectivity. To wit:

In evaluating the acceptability of a proposed Open Space area, the Planning Board shall consider the extent to which the location and design of the area achieves the following objectives:

- 1. Large enough areas of land are conserved to retain ecosystem function and habitat integrity.*
- 2. Large enough areas of land are conserved to sustain agriculture or forestry operations and buffer them from nearby development.*
- 3. Trail, or stream corridors and shoreland buffers are provided from building lots.*
- 4. Linkages or contiguity with existing or potential conservation areas on abutting properties are provided.*

5. *Scenic views from public roads and prominent ridgelines are conserved.*
6. *Purposes of this section...are achieved.*
7. *Areas(s) of sufficient size that is suitable for active recreational use.*

Reasonable efforts must be made to locate Open Space adjacent to Open Space in an adjoining property or properties to the satisfaction of the Planning Board.

The guidelines continue, describing different types and portions of the Open Space and defining “Open Space Conservation Area” and “Open Space Homeowners’ Recreation Area.” The standards include a number of options for the ultimate ownership and management of the Open Space areas, as well as fairly detailed provisions regarding how the Planning Board is to assess these options in approving the management scheme.

Wolfeboro, NH

Wolfeboro’s conservation subdivision ordinance appears as Article XXIV of the town’s zoning regulations. It can be accessed online via the town’s website at:

http://wolfeboronh.us/Pages/WolfeboroNH_Planning/index. One of the objectives of the ordinance is to: “Discourage development sprawl and consumption of rural and/or agricultural land. To protect areas of the community with productive agricultural soils for continued or future agricultural use by conserving blocks of land large enough to allow for efficient farm operations.” The ordinance is required for subdivisions of certain specified sizes, although under four circumstances that are identified in the ordinance applicants may be exempted from the requirement. At least 50 percent of the tract area is required to be permanently dedicated as open space, and the ordinance specifies that the planning board shall require all environmentally sensitive areas be dedicated as open space. Regarding the protected area planning, the ordinance specifies that “conservation lands should be laid out in general accordance with Wolfeboro’s Master Plan Natural Resource Chapter Maps to ensure that an interconnected network of open space will be provided.”

Inlet, NY

Inlet’s Conservation (Cluster) Subdivision standards appear as Article 4 of the town’s Subdivision Control Law, accessible online at: http://inletny.com/gov/?page_id=18. The standards grant the Planning Board the discretion to require a conservation subdivision design “in order to protect and preserve valuable natural and cultural features of the site and/or to avoid developing on environmentally sensitive areas or adversely impacting neighboring properties” including when particular resources such as significant wildlife or plant habitat exists on the site. The standards do not provide a density bonus vis a vis a conventional development under Inlet’s zoning or the Adirondack Park Agency (APA) Act. (Inlet is in the Adirondack Park and therefore the APA development intensity guidelines apply to some developments in the town.) The design requirements are minimal and many of them pertain to roads; however there is also a requirement that the Conservation Subdivision standards cannot be used to increase the intensity of shoreline development (i.e. the number of principal buildings fronting on water cannot increase.) The standards do not include any guidelines regarding the portion of the development to be left in Open Space. A number of options are outlined for the ownership of the Open Space. These are not especially prescriptive except in the case of a Homeowner’s association; under this option the guidelines put forth a number of requirements, including a process for approximating the full costs of open space including its annual maintenance costs, to be levied on members of the HOA. In defining the deed restrictions for the Open Space, the standards stipulate specifically that the “covenants and restrictions are enforceable by the Town.”

Malta, NY

Malta's Open Space Development & Preservation provisions appear as Article XI of the Town's Zoning Law. It is available under the "Government" tab of the town's website at: www.malta-town.org/ The ordinance states that "It is the intent of this article to require open space development ... for any subdivision of land 20 acres or greater within the Town." Applicants proposing subdivisions of less than 20 acres "may request consideration for an open space development project." Among the intentions listed for the ordinance is the idea that "it is imperative to incorporate quality of life elements such as linking wildlife corridors, protecting watersheds, ... providing links to existing and future Town parks, ... linking pedestrian access, and preserving trees and vegetation." The ordinance describes four applicable development types that meet the requirements of the provision: 1) greenway development, where the greenway is "50% of the developable lands"; 2) estate development, which allows for 1/3 of the residential density that would otherwise be permitted; 3) cottage home development, which describes clusters of four or more small homes; or 4) some combination of the other options. "In all cases, land to remain undeveloped as greenway should be determined by the Planning Board." The application process calls for a preapplication conference for the various engaged parties to "walk the site and hold a workshop to discuss procedures and to obtain advice from the Planning Board on feasibility, layout, location of greenways and open space and any special considerations for the subdivision design." Further, the ordinance states that "it is recommended that a sketch of the open space cluster be presented at the workshop from a professional cluster subdivision team." Requirements for the sketch are described, and these include the identification of a large number of specific natural resources if they occur on the site or within 200 feet of the site.

Kirby, VT

Kirby's Planned Unit Development ordinance appears as Article X in the town's zoning law, available online at: <http://kirbyvermont.org/>. One of the goals of the PUD ordinance is to "Provide for the conservation of open space (and) features recognized as worthy of conservation in the municipal plan and bylaws, such as the preservation of agricultural land, forest land, trails, and other recreational resources, critical and sensitive natural areas, scenic resources, and protection from natural hazards." The minimum lot size for a PUD is ten acres, and the density of a PUD "shall not exceed 200% of the permitted density within the district in which the Planned Unit Development is located." 50% of the property must be reserved for "public and/or common usage and open space." The PUD ordinance stipulates that the open space must be owned and maintained by an organization or trust, and that the land cannot be sold or disposed of without first being offered to the municipality for dedication. The ordinance is silent as to the open space being permanently free of development.

Elmore, VT

Elmore's Planned Residential Development (PRD) ordinance is Section 5.4 of the town's Zoning Bylaw, which is available online at the town's website at: <http://www.elmorevt.org/town/forms/index.php>. PRDs are intended to "encourage innovative and flexible design and development" and among the objectives cited, two are clustering of development for protection of open space, and protecting significant natural, cultural or scenic features. PRDs "shall represent an effective and unified treatment of the development site, including provisions as appropriate for the preservation or protection of surface and ground waters;" and a lengthy list of additional natural features includes "natural and critical habitat areas; and open spaces, including scenic views and vistas." In general PRDs do not permit density bonuses, except in cases where 75% or more of the land is set aside as open space, or "for the provision of affordable or elderly housing." Density can be concentrated in the PRD and smaller-than-otherwise-permitted lots acceptable "provided that there is an offset by a lesser concentration in other sections, including the reservation of no less than 50% of the remaining land as open space." The PRD

ordinance includes detailed guidelines about the preservation, dedication and maintenance of open space. Multiple options are identified as acceptable for long-term ownership. “The location, size and shape of lands set aside to be preserved for open space shall be approved by the (Development Review) Board, in accordance with” criteria that include: “Open space land shall provide for the protection of identified resources, including farmland, productive forest, wildlife habitat, natural areas, aquifer protection areas, surface waters, stream banks, lake shore, historic and archaeological sites, and scenic views and vistas;” “Management plans for forests, wildlife habitat, and shorelands may be required by the Board as appropriate;” and “Open space land shall be located so as to conform with and extend existing and potential open space lands on adjacent parcels.”

2. Factors influencing communities’ ability to adopt and implement conservation development ordinances

We have identified a number of factors from current literature on collaboration that results in successful natural resource management that may influence the likelihood that communities adopt a CD ordinance and affect the manner in which their ordinances are implemented. The factors include motivation, relationship building and dialogue, agreement or common agenda, capacity and legitimacy (Lauber et al 2008, Lauber et al 2011, Kretser et al, *submitted*). We feel that it is important for conservation practitioners interested in influencing land use planning practices to understand these factors, as they provide insight into opportunities to strengthen land use planning activities, as well as some cases in which land use planning tools are not sufficient for achieving conservation goals. These factors are discussed in greater detail below, with quotes from our case study communities to illustrate how these influence the adoption and implementation of CD ordinances.

Motivation

Motivation refers to the importance of outcomes to stakeholders. This may be influenced by cultural, biological, ethical or economic drivers. In the case of the adoption and implementation of CD ordinances, we identified potential motivational factors such as: 1) A controversial development was proposed or built, leading the community to revise their land use regulations; 2) A nearby Town or County adopted a similar ordinance; 3) A successful CD project is developed in a nearby Town or County. 4) There is evidence of demand for CD projects among home buyers or perceived economic benefits of CD projects to developers.

One thing we repeatedly heard from people in our initial surveys for our town comprehensive plan was “We just love the way [our town] is and we want it to stay the same; We want that little small-town feel.” So we are actively working to maintain that, and this is just one mechanism that we think will help in that regard.

~New York community #1; Interviewee #1

I think until such time that demand picks up again there probably isn’t going to be a lot of pressure to make any changes. I think that a lot of these changes occur when demand is strong and the planning board is faced with the need to make some decisions that they are not comfortable with....When demand is strong for building there may be people who want to see some set-asides for Open Space. That would prompt people to look at the ordinance and say “What can we do to the ordinance to allow us to require these open spaces?” But if there is no demand I don’t think that it is a very strong influence.

~Maine community #1; Interviewee #1

Obviously (conservation subdivisions) are less expensive to develop than the conventional cookie cutter (developments). There's less road. There's less frontage because the lots are smaller so there's less utilities. ... We're still feeling the pain from the collapse of the economy, so I think that is sort of helping. ... I think because they have less money that they have to outlay to get these things going – if you are in favor of development that has a positive influence. And as a homeowner, the houses are a little cheaper to develop ... so hopefully the developers pass those savings on to the homeowners.

~New York community #2; Interviewee #1

Relationships

The informal networks between stakeholders can play a significant role in how ideas are disseminated and received. For example, relationships are important if: 1) participants in the planning process know individuals or organizations with particular land-use planning expertise; 2) leadership dynamics within the planning group allowed important relationships to develop; 3) collaboration is needed for the design and development of CD projects; 4) an advocate for CD projects brings the necessary partners together to make a project happen.

There was a private [consultant] ... I believe the town board hired them to do some research ... There is also an advisory group to look at our trail system. There were probably some professionals on that committee... But whatever professional hat they wore -- when they were on that committee it was as a volunteer. A lot of time we'll use nonpaid professionals who live in the town as a volunteer to help keep costs down.

~New York community #2; Interviewee #1

Dialogue

Dialogue refers to the exchange of ideas, which has clear significance in the adoption and implementation of new planning techniques. Dialogue plays a particular role when: 1) planning discussions allow ample opportunity for dialogue among diverse groups; 2) meetings are especially dedicated to provide time for discussion, questions, or the development of a CD ordinance; 3) the public provides input on the design of CD ordinances or CD projects; 4) community discussion fosters interest in CD development.

This was a special group composed of people from the Planning Board, from the Zoning Board of Appeals, from the general public, from the environmental groups, that sat down as a committee for two years Everything was taken into account: public meetings, town-wide mailings, questionnaires.

~New York community #2; Interviewee #2

Under Maine Statute a Planning Board can adopt Subdivision Regulations itself without going to Town Meeting ... In some towns the planning board adopts its own regulations after public hearing. Probably a third of the towns say that even though the state statute allows the planning board to adopt its own regulations we still prefer to go to town meeting. ... We have this fabulous innovation of the 1600's called Town Meeting. All of our communities [in our region] still are doing the town meeting form of government. At least one time per year a public meeting is held to adopt or amend public ordinances and to adopt a budget. Any change... is voted upon by a majority of those present. ... The legislative body is anyone who shows up at a public meeting... It is very democratic. Alexis De Tocqueville wrote about this in the 1820's when

he visited the United States... At times it is downright beautiful [to watch ideas being discussed amongst members of the community.]

~Maine community #1; Interviewee #2

[The lands that were to be developed here] were a very nice piece of property. The developer did everything [the planning board] asked. ... He has let us go in and do the trail work so that we can connect the trails. So we've already gotten that benefit from the project, whereas if it was a cookie-cutter subdivision or even just a cluster with a Homeowner's Association, we probably would not have been given access until the project was started or even completed. ... I'm seeing it since we got everything that we asked for in the conservation subdivision – it's just a good fit for the area.

~New York community #2; Interviewee #1

[It is important] to be frank about what you are looking for and what the developer is looking for, and you'll get there a lot quicker. When you are dealing with a subdivision you are dealing with a developer's right to develop that land.

~New York community #2; Interviewee #2

Agreement

The presence of a common agenda or objectives can be important to the development of CD ordinances and projects. Evidence of agreement or lack of agreement in the CD process may manifest as: 1) a Comprehensive Planning process lays the groundwork for a CD ordinance, thus making the ordinance process less controversial; 2) A public hearing reveals vocal opposition and high profile media coverage; 3) the permitting and approval process for a CD project goes smoothly; 4) community members are generally satisfied with the outcomes from CD projects.

[The genesis for the PUD law] showed up in our town plan as to directions we were looking to go in the future. We are trying to save the rural community and limit the outreach of sprawl, so we are trying to keep development concentrated closer to the center of town.

~Vermont community #1; Interviewee #1

We have a lot of people who come in to the planning board meetings [when CD projects are proposed near to them] because now it's in their back yards. ... Most of their concerns have to do with seeing smaller lots, and they say "well gee, when I built here I needed two acres, and now you're letting these people in on one acre" so we explain to them, "well that is true, but the density is the same; they are not getting any more houses than if it was two acre zoning. What you are getting is instead ... their back whatever feet is forever wild...so you now have a buffer between your property and their property. ... As soon as they hear that ... once they buy into it, once they truly understand that, they like the idea because no one is getting any more lots ... and they are now going to have a buffer built in there that will be maintained.

~New York Community #2; Interviewee #1

Capacity

Capacity refers to the full set of elements needed to be able to act on a particular issue; these include knowledge, skills, and resources. Capacity might be a key factor if: 1) funds are allocated for supporting the development of a CD ordinance; 2) a professional Town or County planner is available to work on drafting the ordinance; 3) outside resources on CD are utilized (e.g. books, trainings, web resources); 4)

during the implementation of a CD project, designers and developers with prior CD experience are engaged; 5) biological experts conduct an ecological site analysis; 6) funds are allocated to the monitoring and/or management of open space of a CD project.

The credit for suggesting [the CD ordinance] and including it in our original draft all goes back to [our consultant]. He is in my opinion kind of the godfather of local land use planning in [the area.]

~New York community #1; Interviewee #1

Everything had to be approved by the town, and the committee, if I recall, was pretty widely represented. ... The [Regional Planning Commission] was contracted to work with the creation of an ordinance, and I think that they also participated in the creation of the comprehensive plan, which preceded that.

~Maine community #1; Interviewee #1

The applicants generally have a professional design person come in. ... Any time we require them to provide those types of studies (such as a traffic study) they always need to hire a licensed professional. ... [An ecological site analysis] was conducted [in this example] ... What we look for are wetlands, [endangered species], etc. ... It would be up to the applicant's professional [to complete that analysis.]

~New York community #2; Interviewee #1

[Our county] is fairly sophisticated in planning. There are a lot of professional firms and engineering firms around that are in the business of development.

~New York community #2; Interviewee #2

These [rural] boards are practiced so infrequently [in reviewing subdivisions] that when they do get a case they're not really qualified to handle it. ... It's a little like a cop who hasn't arrested someone in fifteen years. They don't do too good a job if they don't get any practice. ... We [the regional planning commission staff] provide technical review. We review the application, spend hours going over it, we write up memoranda about completeness issues, talk to the developer, review all of the submittals, go to the meetings, and help the board decide how to act. ... A lot of times we wind up helping the developers by [steering the planning board back on track.] This is what I've been doing for about twenty-five years.

~Maine community #1; Interviewee #2

Legitimacy

Legitimacy refers to the individuals who have legal authority to approve or prevent a particular course of action, as well as those who can determine whether or not a project gets certain resources. Legitimacy might play a role in CD development if: 1) the Town or County government initiates the ordinance process; 2) local leaders with decision-making authority are involved in deliberations about the ordinance; 3) permits for CD projects are issued efficiently; 4) a land trust or a municipal entity is willing to partner in the ownership of a CD project's protected open space; 5) a developer gets adequate financing to implement a CD project.

As town supervisor [my role] was helping the board understand the Planning Board's work – they were charged with creating the overall subdivision regulations ... We also have a lot of overlying rules and regulations from [our regional planning agency] ... and our county clerk was wanting to

know why we didn't have any overall subdivision regulations in place ... So we wound up finding ourselves in a position of having to please two entities above us ... We took recommendations from the Planning Board and brought them forward. ... My role was explaining the process to my town board, making sure that they understood it, and moving forward.
~ New York community #1; Interviewee #2

3. Opportunities to protect biodiversity and ecological connectivity through enhanced conservation development ordinances

Our Chapter One assessment indicated that even among those municipalities with CD ordinances in place, many lack provisions that are important for biodiversity protection. Here we provide a list of criteria that influence how effective a CD ordinance is likely to be in protecting biodiversity (Reed et al., in review), along with examples of ways that conservation development ordinance language in our sample of communities addresses these factors.

WCS will be continuing to work with partners at a national scale to further develop this list of criteria and provide conservation practitioners with additional tools and guidance for improving the use of CD ordinances to achieve conservation. One element of this ongoing work will be a US Forest Service-funded workshop to be held in 2013, facilitated by WCS and Colorado State's School of Global Environmental Sustainability. This will likely benefit conservation practitioners in the northeast through direct involvement with a national-level process and through the products and resources generated through this work.

Table 1: Criteria determining the effectiveness of CD ordinances with examples

Factor of significance to biodiversity protection	Explanation	Sample municipal ordinance	Selected language excerpted from ordinance
Does the ordinance include an objective related to wildlife, habitat, species, or connectivity conservation?	The ordinance is more likely to effectively protect biodiversity if biodiversity protection is explicitly included as a rationale for the ordinance.	Harrisville, NH Conservation Subdivision Ordinance	Objectives: <ul style="list-style-type: none"> To maintain rural character, preserving farmland, forests and maintaining rural views. To preserve those areas of the site that have the highest ecological value, including, for example, wildlife habitat, e.g., large unfragmented blocks of undeveloped land, areas of highest condition identified based on NH Fish and Game's Wildlife Action Plan, and water resources, e.g. drinking water supply areas and watersheds, wetlands, streams and rivers. (etc.)
Does the ordinance require more than half of the site area to be protected open space?	Ecological research affirms the value of conserving sizable patches of habitat to protect habitat for species including birds,	Waitsfield, VT Planned Unit/Planned Residential	In the Agricultural-Residential, Commercial-Lodging and Forest Reserve Districts, a minimum of 60% of the total project site shall be set aside as open space. Where a PRD/PUD involves land currently in agricultural or forestry use, or has the potential for agricultural or forestry use due to the presence of primary agricultural or forestry soils, the development should make provisions for the use of such land for agricultural or forestry

	mammals, and amphibians. Although the habitat opportunities may vary from site to site, specifying a quantitative minimum size for the protected open space provides important guidance for the CD implementation process.	Development	purposes.
Does the ordinance require an ecological site analysis to identify and map important ecological features prior to the development of the site plan?	Nationally, many CD ordinances profess to conserve natural resources without requiring these resources to be explicitly identified. An ecological site analysis, completed before the site plan is developed, allows for the identification of locally significant resources and provides an opportunity to plan for their protection.	Barnstead, NH Open Space Preservation Development	Environmental Impact Assessment The applicant shall perform an environmental assessment survey and submit a report, which evaluates the impact on social, economic and physical environments. The report must address techniques to mitigate harm to the environment and caused by the proposal. If the Board determines that the proposal will cause significant harm to the social, economic and physical environments, and it is impossible to mitigate that harm, the Board may reject the proposal in its entirety or a portion thereof. The impact statement shall include, but not be limited to the following:6-5.09 Statement of effect on the area wildlife; 6-5.10 Statement on effect of the area's ground and surface water systems.
Which environmental resources does the ordinance emphasize in describing where development will be concentrated and what will comprise the protected area?	Early CD ordinances often focused on scenic values and consequently prioritized fields for protected areas. However, if protecting habitat connectivity is a priority, this needs to be	Brunswick, ME Open Space Development	Locating Building Envelopes: The sketch plan shall then identify possible locations of building envelopes which consider the following, to the greatest extent feasible: <ol style="list-style-type: none"> 1. Minimization of fragmentation of higher value habitat 2. Minimization of wetland impact 3. Minimization of impact to scenic resources (i.e., large open fields, ridgelines) 4. Minimization of conflicts with existing recreational resources, such

	incorporated into the CD ordinance process.		as trail corridors. 5. Orientation of commercial developments toward public roadways, with windows and doors facing public streets.
Does the ordinance require consultation with a biological expert in the ecological site analysis and design of the protected area?	Availability of biodiversity information is highly variable, and seldom available at a scale that captures nuanced site-specific details. To effectively conserve a site's biodiversity, the involvement of an expert is invaluable.	New Hampton, NH* Subdivision Regulations	<i>*Note that we were unable to find an example that truly illustrated the idea of consulting with an expert in the site analysis and design of the protected area. This example demonstrates a requirement for the engagement of a consultant during the drafting of the management plan.</i> The Town may require the review of any proposed wildlife management plan by an independent consultant of the Town's choice and at the applicant's expense.
Does the ordinance require a management plan for the protected open space?	The biodiversity value of protected open space can be compromised by future human activities unless an adequate management plan is in place. This plan can address and mitigate potential future threats to ecological protection. These might include recreational developments and uses, forestry activities, and encroachment into the open space for residentially-associated land uses by adjacent property owners.	Lincoln, VT Planned Unit Development	Open/Conserved Space Management Plan. In addition to demonstrating that an organization exists to operate and maintain common areas or areas set aside for open space, recreation or the preservation of natural resources, the planning commission may require that the applicant provide a management plan describing how the resources preserved will be maintained.
Does the ordinance	If protected lands are	Milan, NH	Open Space Evaluation. The Planning Board shall evaluate the layout of any

include provisions to ensure that protected open space is contiguous within the site?	divided on a site, their ecological values may be compromised. Smaller patches of protected land experience greater edge effects and provide adequate habitat for fewer species. The biodiversity value of protected open space will be maximized if protected lands are contiguous within the site and connected to protected lands adjacent to the site.	Open Space Cluster Development	<p>proposed open space development, in light of the natural features of the tract and its environment, to assure that the designated open space parcel provides a public benefit. The Board shall not approve the layout if there exists a clearly feasible alternative which would yield a significantly improved open space public benefit, yet still meet the applicant's permitted development objectives. A "public benefit" means that the open space meets one or more of the following:</p> <ol style="list-style-type: none"> 1. Is larger and more contiguous, rather than smaller and more fragmented. 2. Conserves outstanding or sensitive natural features located on the tract. 3. Is realistically capable of management for economically-viable agriculture or forestry activities. 4. Conserves natural habitat for animals, fish or plants, especially those which are locally rare or unusual. 5. Contributes to the ecological viability of the natural systems, or of nearby parks or natural areas. 6. Provides opportunities for public outdoor recreation. 7. Provides scenic enjoyment by the public from the vantage point of public lands, highways or public waters, or: 8. Provides some other open space public benefit explicitly identified by the Planning Board in its decision.
Does the ordinance include guidance for protected lands to be located in a way that will maximize ecological connectivity with adjacent protected lands or open space networks?	In order to maintain ecological connectivity at a regional scale, it is important to integrate land use planning at one site with a larger regional perspective. Town- or regional- scale mapping of protected habitat or open space priorities provides a platform for CD developments to	Essex, NY Conservation Subdivisions	Open space areas shall be integrated wherever possible into a connected open space system within the development as well as outside the development. Open space areas should form a contiguous system with other open space areas in the vicinity of the subdivision development to the maximum extent practicable.

	connect to and roll up to larger-scale regional connections.		
Does the ordinance specify that land protection must be perpetual and enforceable via an appropriate land protection instrument (e.g. conservation easement or restrictive covenant)?	Though this would appear to be an obvious provision, it is essential to achieving long-term habitat protection. Without ensuring permanent protection, biodiversity values of open space are likely to degrade over time, especially as ownerships change hands.	Skowhegan, ME	All common land facilities and property shall be owned jointly or in common by the owners of the dwelling units by means of a Homeowners Association, or by an association which has its principal purpose the conservation or preservation of land in essentially its natural conditions. Further subdivision of the common land for its use for other than non-commercial recreation or conservation purposes, except for easements for underground utilities, shall be prohibited.
If the ordinance offers incentives to encourage conservation development, are they density bonuses that will dramatically increase development intensity, or are they alternative incentives such as streamlined review, reduced fees, or tax credits?	Nationally, in some cases density bonuses are so high that they cause a significant increase in the intensity of development, compromising the ecological value of a CD development. Modest density bonuses or alternative incentives are more appropriate to ensure that the ecological objectives of CD ordinances are realized.	Vienna, NY Cluster Development	Density Transfer: In each zone allowing cluster development, the lot size may be reduced from the lot size established in Article 4 of this law to a lesser lot size acceptable to the Planning Board. All such lot reductions shall be compensated for by an equivalent amount of land in cluster open space to be preserved and maintained for its scenic value, recreation or conservation purposes. In the approval of a cluster subdivision, in no case shall the maximum density specified for the applicable zone be increased, nor shall the other applicable regulations or use limitations for the zone be changed or modified.

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Chapter 3

Best management practices for ecologically-sensitive land use planning and the protection of wildlife connectivity

Michale Glennon

Introduction

Chapter Three of this report focuses on documenting the best management practices for land use planning that will minimize the impacts to wildlife from exurban residential development, one of the primary factors contributing to fragmentation and loss of ecological connectivity throughout the northeastern United States. WCS has focused on this topic for the past decade. As components of that work, we produced a literature review on the impacts to wildlife from low density, exurban development (Glennon and Kretser 2005), and a brochure (Make Room for Wildlife: A Resource for Local Planners and Communities in the Adirondacks; WCS 2009) outlining best management practices for planners and local communities. Those documents provide a foundation for informing best practices and land use planning tools for conservation practitioners working in rural areas in the northeastern United States. Importantly, a review of the current literature provides invaluable information from modeled and empirical work that can inform proposed language for regulations and ordinances related specifically to conservation development as well as broader comprehensive plans being developed at the town and county level throughout the region.

The objectives of this phase were threefold: (1) review recent publications from exurban development studies to determine if new guidelines and suggestions for best management practices in land use planning have resulted from this work, (2) review recent publications from the literature specific to ecological connectivity to determine if new or additional recommendations can be made since our last review which are specific to maintaining wildlife connectivity in the context of land use planning, and (3) review recent literature to identify examples where land use management practices have been measured or empirically evaluated in terms of their ability to maintain biotic integrity and/or wildlife connectivity.

Methods

We used 4 primary avenues to obtain information toward meeting the objectives outlined above. First, we consulted with Dr. Sarah Reed, a WCS scientist who assisted extensively with Chapters One and Two, and now is one of the Principle Investigators of the Conservation Development Global Challenges Research Team at the Colorado State School of Global and Environmental Sustainability. Working with this team of researchers, she is synthesizing information on conservation development practices, to develop rigorous indicators for evaluating the conservation effectiveness of these projects, and to advance an agenda for future research and monitoring of conservation development projects around the world. Their work includes an extensive literature review of the biological, social, and economic effects of residential land development. Dr. Reed shared with us some key sources from their own literature review and provided direction and suggestions for specific gaps unlikely to be covered by their work and to which our work might contribute.

Second, we conducted a Web of Science search with the key words “exurban”, “ecological connectivity”, and “best management practices” in various combinations, and limited the results to papers published between 2003 and today. We documented the resulting papers (n=141) in an excel spreadsheet and categorized them by topic and relevance to specific aspects of this project. Third, we consulted our own database of exurban development literature, which has accumulated since our original technical review and now contains more than 500 papers on a variety of topics relating to residential development and its impacts. Papers were reviewed in order to determine if recent work has resulted in suggestions for best management practices, especially with respect to ecological connectivity, and whether particular methodologies have been tested for their ability to successfully maintain ecological integrity and/or connectivity.

Fourth, we consulted internet sources, primarily by Google and Google Scholar search, to locate new sources of land use planning information that are not commonly captured in the peer-reviewed literature. This is often the most reliable way of locating information on best management practices and guiding principles of the type in which we were interested for the purpose of this review. We downloaded documents relevant to our search, and also revisited websites from which we had gained valuable information in previous work (e.g., the Beginning with Habitat program in Maine and similar efforts).

We compiled information from all of the above sources into a master database of principles for land use planning and management relevant to maintaining biodiversity and ecological connectivity. We analyzed the degree to which identified principles overlapped with those we had identified as part of our prior work and organized a core set of 14 principles. For each of the 14 principles, we identified specific recommendations and guidelines, as well as suggested thresholds or benchmarks provided by the literature (Table 1). Because ecological connectivity is the core focus of the Staying Connected Initiative, for whom this report was developed, we chose to include it as one of our primary principles, but to also produce a second set of best management practices specific to the creation, restoration, and maintenance of ecological connectivity (Table 2).

Results and Discussion

Objective 1: identify best management practices for ecologically-sensitive land use planning

Our literature review resulted in a number of new products and outreach documents that have appeared in recent years and which contain information on best management practices for land use planning and residential development. The scientific literature with respect to exurban development alone is extremely large, and – in combination with topics such as roads and habitat fragmentation – results in a wealth of information on issues pertaining to protecting and maintaining ecological connectivity. Relatedly, the “gray literature” is similarly filled with numerous sources, guidelines, and toolboxes to assist a variety of stakeholders in protecting biological diversity in the face of residential development and land use change. Both the scientific literature and the more mainstream sources are catalogued under a very wide variety of topics and located in a variety of places. It is difficult to comprehensively survey all of them, but we have attempted to draw from these sources, the scientific literature, and WCS’ prior field research, a set of suggestions that are most relevant to the northeast and the ways in which these practices might be employed to maintain ecological connectivity across the region (Table 1).

Our review resulted in a number of primary conclusions: (1) recent work – both peer-reviewed and gray literature – serves entirely to substantiate and elucidate principles identified previously as best management practices for maintaining wildlife and ecological integrity in the face of residential development; we did not find any literature to suggest that prior BMPs or suggested guidelines were wrong or misguided; (2) most suggested BMPs and scientific findings are most useful at the scale of an individual project or subdivision, although many of them are easily translatable to town or county level planning exercises; (3) the breadth of taxa for which we now have documented impacts from residential development has expanded significantly, though these findings serve primarily to reinforce prior suggestions; (4) human disturbance has arisen as a major focus area of research (e.g., impacts of noise, lights), though specific BMPs relating to these impacts remain somewhat scarce; (5) the largest change in the existing literature since our prior review is a much more implicit understanding of the importance of the construction and post-construction phases of residential development and their contribution to maintaining and enhancing biodiversity and ecological connectivity.

Objective 2: identify best management practices for maintaining ecological connectivity in land use planning

Our literature review resulted in numerous papers in both peer-reviewed and gray literature that were focused on connectivity and corridors, some of which overlapped with urbanization and land use planning literature, and much of which did not. Ecological connectivity exists as an extensive literature of its own with much of the work focused on landscape-level modeling and planning exercises rather than suggestions for maintaining connectivity in the context of individual residential development projects. However, the majority of existing BMPs associated with maintaining biodiversity in residential development were created directly in response to habitat fragmentation – the opposite of connectivity – and therefore most are focused on retaining or creating ecological connectivity even if not directly described as so. The suggestions in Table 1 can all be considered components of maintaining ecological connectivity in the context of residential development. We have also endeavored, however, to create a separate and more detailed set of suggestions relevant to the topic (Table 2). Our suggestions draw heavily on the work of Paul Beier and others who have worked to promote the design and use of corridors for many years (Beier and Loe 1992, Beier et al. 2008, [www.corridordesign.org](http://corridordesign.org)). Though the Staying Connected project has already done the difficult work of modeling and identifying key linkage zones across the northeastern United States and eastern Canada, it is worth noting that many tools exist for assistance with this process including Corridor Designer and Linkage Mapper, both of which are available for download from <http://corridordesign.org> (Majka et al. 2007).

For the purpose of this review, we adopt the definitions previously put forth by the Staying Connected Initiative. Specifically, we define *landscape connectivity* as the degree to which similar landscape elements, such as habitat patches or natural vegetation, are connected to each other so as to facilitate the movements of target organisms and ecological processes between them, and we define *habitat corridors* as components of the landscape that provide a continuous or near continuous pathway that may facilitate the movement of target organisms or ecological processes between areas of suitable habitat (SCI 2012). We also strongly encourage the recognition that maintaining ecological connectivity *per se* is somewhat misleading because a landscape's connectivity is defined relative to the requirements of the organisms that live within and move through it. As such, connectivity is species and context dependent (Rudnick et al. 2012). It is with those notions in mind that we offer the BMPs in Tables 1 and 2, which are very much related and should be used in concert.

The following sources were used in developing Table 1 and Table 2: Arendt 1996, Arendt 1999, Arnold et al. 1999, Austin et al. 2004, Beier and Loe 1992, Beier et al. 2008, Calhoun and Klemens 2002, Clevenger et al. 2003, Cohn and Lerner 2003, Collinge 1996, Dale et al. 2000, Duerkson and Snyder 2005, ELI 2003, ELI 2008, Glennon and Kretser 2005, Glennon and Kretser 2013, Harper et al. 2008, Hostetler 2012, Johnson and Smith 2006, Lenth et al. 2008, Maine Audubon 2000, Maine Audubon 2012, McHarg 1969, Milder 2007, Miller and Klemens 2004, Monahan et al. 1999, NEPARC year unknown, NHDES 2004 a and b, Ontario Extension Notes 2000, Ontario Extension Notes year unknown, Perlman and Milder 2004, Prince George's County, MD 1999, Rodewald 2001, Rosenberg et al. 1999, Rudnick et al. 2012, Sinclair et al. 2005, Sneddon et al. 2012, Strong 2008, Taylor 2006, TNC and Chicago Wilderness year unknown, USFWS 2000, Venno et al. 1991, WCS Adirondack Program 2009, WCS et al. 2006.

Table 1. Best Management Practices for ecologically-sensitive land use planning and residential development

Principles and Best Practices		Phase
Consider regional context, plan ahead, set goals		Planning
	Define biodiversity protection goals • identify important features on the site • conduct a vegetation and tree survey • conduct a topographical and soil survey • conduct a hydrologic survey • conduct a wildlife survey • conduct a wetland survey	
Utilize principles of conservation design		Design
	Maintain at least 50% of the site in open space • cluster homes and overlap ecological impacts • focus development on previously disturbed sites • ensure that the locations and functions of conserved areas as designed first, not last • maintain connections to regional-scale greenways	
Protect large blocks of unfragmented habitat		Design
	Maintain forest blocks of 55 ha or larger (138 acres) • minimize forest edges and edge effects • prioritize forest blocks that are large, circular, or broadly shaped • prioritize blocks that are connected to adjacent open land • avoid large lot zoning • regulate density <i>and</i> configuration of homes	
Preserve rare landscape elements, critical habitats, special features and/or species		Design
	Retain snags (as many as possible, early decay stage, large diameter) • retain geologic features (e.g., cliff faces, talus slopes) • protect unique or critical habitats (e.g., old growth, grassland, early-successional) • protect unfragmented areas • protect wetlands, riparian areas, and shorelines • protect agricultural or other open lands • maintain structurally complex, heterogeneous native vegetation • preserve farmland potential • prioritize protection of existing natural connectivity zones (e.g., stream valleys, ridgetops) • maintain corridors at least 100m wide	
Protect/preserve natural processes		Design
	Restore degraded habitats • map and maintain natural habitat patterns • protect undeveloped blocks in tracts large enough for natural disturbance to occur • maintain natural hydrologic processes	
Maintain, enhance, and restore ecological connectivity → see also Table 2		Design

	Link site-level designs to one another via a regional connectivity plan, which identifies priority corridors and linkages • mitigate impacts of roads that cross corridors • maintain aquatic connectivity in corridors • maintain ecological integrity in corridors	
Use buffers to protect important features		Design
	Buffer edges between human uses and open space areas • buffer water features (e.g., wetlands, riparian areas, vernal pools, shorelines) • buffer wetlands by 10-30m for sediment removal • buffer wetlands by 30-50m for nitrogen removal • buffer wetlands by 30-90m for wildlife protection • buffer wetlands by a minimum of 100-165m for amphibian habitat protection	
Use Low Impact Development principles for stormwater management		Design
	Install a low impact stormwater treatment train throughout the site • capture and infiltrate rainwater on site to maintain the	
Minimize negative impacts of roads		Design
	Minimize new road construction and impervious surface • use wildlife-friendly road design • install below-road passages (culverts) at frequent intervals (150-300m) • provide cover close to passages to enhance animal use • widen verges at curves in roads to discourage crossings • maintain vegetation as close to the road as permitted by construction standards in straight road sections • employ traffic calming methods such as narrow roads, curved streets, neck downs, speed bumps, and speed limits	
Minimize negative impacts of construction activities		Construction
	Use construction site access and routes that coincide with eventual streets and roads • designate parking and stockpiling sites for vehicles and building materials • minimize staging areas for the construction of buildings • mix chemicals and materials only in designated, properly managed areas • install significant fencing to protect significant areas • avoid lowering or raising the grade around trees in natural areas • do not bury utilities in protected areas (place in shared trenches near or under pavement) • carefully select equipment used on site • develop covenants and contracts for site construction, signed by contractors and subcontractors • reduce, reuse, and recycle materials on site • protect individual trees • protect riparian areas • limit construction activities during times of significant wildlife activity • limit footprint around houses • use contractors and subcontractors trained in sustainable practices	
Minimize the introduction/spread of non-native and invasive species		Post-construction
	Utilize natural landscaping and native plants • minimize lawn/turfgrass as much as possible • minimize fertilizer/weed	

Minimize disturbance to wildlife		Post-construction
	Be cognizant of the potential impacts of noise and light on wildlife • utilize wildlife-friendly lighting • strive for developments to meet Dark Sky Standards • turn off lights at night • light only pathways and areas near homes • consider ordinances to regulate timing/types of noise disturbance • keep pets indoors or restrained • regulate activities of dogs in natural areas • confine recreational activities to designated trails • enjoy wildlife where you find it • do not keep herptiles or other wildlife as pets • do not move wildlife • do not release plants and animals from your home to the outdoors • utilize wildlife-friendly fencing	
Minimize the potential for negative human-wildlife interactions		Post-construction
	Do not feed wildlife, intentionally or unintentionally • do not provide food for wild mammals • keep trash, compost, and grills in a secure location • encourage landowners to keep domestic animals inside or accept depredation on domestic animals as part of the price of a rural lifestyle	
Maintain what you've worked so hard to create		Post-construction
	Track/monitor/avoid depletion of natural resources • require covenants for biodiversity conservation • understand and help teach neighbors about proper management of conserved natural areas and trees, yards, trails, and common areas • create a conservation club to help maintain or restore natural areas • understand how to properly maintain rain gardens, swales, and permeable pavements • implement an environmental education program for residents for maintaining conserved natural areas and biodiversity in yards • create a management plan for natural areas and a funding source to support best management practices	

Table 2. Best Management Practices for maintaining ecological connectivity in land use planning and residential development

Principles and Best Practices		Phase
Use connectivity planning and modeling to identify priority corridors and linkages		Planning
	<p>Pay special attention to the correct characterization of the biology of focal species in the ecosystem under analysis • understand the strengths and limitations of connectivity models • consider the effects of spatial and temporal extent in analytical approaches • be aware of uncertainties when trying to extrapolate outside of originally observed conditions • be aware that relationships among ecological and landscape variables may not be linear • try to account for anthropogenic landscape change and the processes that drive it • address the random variation that is inherent in many biological processes • regularly refer back to the stated goals of the analysis so that inputs, assumptions, and methods remain consistent with goals • plan for increased connectivity and conserve existing corridors to account for changing landscape conditions and threats • in the context of greenways, design forested greenways with wide forest corridors and narrow trails, preferentially narrow dirt footpaths • view corridors as one of a suite of strategies for habitat conservation</p>	
Design and map corridors on the landscape		Planning
	<p>Identify the habitat areas the corridor is designed to connect • select several species of interest from the species present in the area • evaluate the relevant needs of each selected species • for each potential corridor, evaluate how well the area will accommodate movement by each species of interest • draw corridor(s) on a map or utilize GIS modeling tools for mapping corridors • design a monitoring program</p>	
Maintain ecological connectivity in areas of residential development through careful planning		Planning
	<p>Integrate linkage/connectivity maps into local land use plans • where development is permitted within the linkage, encourage small building footprints on large (>40 acre) parcels with a minimal road network • integrate the linkage design into county general plans and conservation plans of governments and NGOs • encourage conservation easements or acquisition of conservation land from willing landowners in the linkage design • combine habitat conservation with compatible public goals such as recreation and protection of water quality • ensure that each strand of the linkage design is broad (1-2km for most of its length) to allow a designated trail system without compromising the usefulness of the linkage for wildlife • where human residences or other low density development occurs within the linkage or adjacent, encourage landowners to be proud stewards of the linkage • stipulate conditions as part of the code of covenants and restrictions for individual landowners (e.g., native landscaping, restraining domestic pets) • develop a public education campaign to inform those living and working within the linkage area about living with wildlife and the importance of connectivity • do not install artificial night lighting on rural roads that pass through the linkage • reduce vehicle speeds in sensitive locations by speed bumps, curves, constrictions, and other traffic calming devices</p>	

Maintain aquatic connectivity in riparian corridors		Implementation
	Retain natural fluvial processes • promote base flows and maintain groundwater levels within the natural tolerance ranges of native plants • maintain or improve native riparian vegetation • maintain biotic interactions within evolved tolerance ranges • eradicate non-native invasive plants and animals • where possible, protect or restore a continuous strip of native vegetation at least 200m wide along each side of the channel • enforce existing regulations • utilize best management practices for stream crossing/culvert design (span the stream, set elevation right, slope matches stream, substrate in the crossing)	
Maintain connectivity where roads cross corridors		Implementation
	Construct multiple crossing structures at crossing points to provide connectivity for all species likely to use a given area • locate at least one crossing structure within an individual's home range • ensure that suitable habitat for species occurs on both sides of the crossing structure • whenever possible, ensure that suitable habitat occurs within the crossing structure • monitor structures and clear them of obstructions that block movement • ensure that fencing never blocks entrances to crossing structures and should direct animals toward them • use raised sections of roads to discourage animals from crossing and to encourage them to use crossing structures • manage human activity near each crossing structure • design crossing structures specifically to provide for animal movement	
Maintain ecological connectivity in areas of residential development through improved landowner stewardship		Implementation
	Encourage landowners to landscape with native vegetation • encourage landowners to minimize water runoff into streams • encourage landowners to manage fire risk with minimal alteration of natural vegetation • encourage landowners to keep pets indoors or in enclosures (especially at night) • encourage landowners to accept depredation on domestic animals as part of the price of a rural lifestyle • encourage landowners to maximize personal safety with respect to large carnivores by appropriate behaviors • encourage landowners to direct outdoor lighting toward houses and walkways and away from the linkage area • discourage residents and visitors from feeding or providing water for wild mammals • install wildlife-proof trash and recycling receptacles and encourage securement of garbage • encourage the use of wildlife-friendly fencing on boundaries and wildlife-proof fencing around gardens and other attractants • discourage the killing of "threat" species (e.g., coyotes) • reduce or restrict the use of pesticides, insecticides, herbicides, and rodenticides • pursue specific management protections for threatened, endangered, and sensitive species and their habitats	

Objective 3: empirical evaluations of best management and land use planning practices

Our third objective was to review recent literature to identify examples where land use management practices have been measured or empirically evaluated in terms of their ability to maintain biotic integrity and/or wildlife connectivity. This literature is scarce (Göçmen and Gao 2011) and can be categorized in 3 primary ways: (1) papers that have actually collected ecological data in areas of different land use management types, (2) papers that have used modeling to evaluate the impacts of various land use and residential development patterns, and (3) papers that have evaluated land use planning policies themselves rather than specific spatial patterns of development.

Papers which have collected actual ecological data are rare amongst the literature that has evaluated impacts of various land use planning policies and patterns. Nilon et al. (1995) examined the effects of wildland development on avian communities, investigating abundance patterns of forest birds in wild areas compared to areas with dispersed and clustered housing. These authors found that single home development had fewer impacts on bird abundance than did clustered development, but also stress that dispersed single-home development may have a greater effect on non-avian wildlife than cluster development because of exposure to human disturbance and activities around dispersed homes and high road density which may negatively impact large mammals and other species (Nilon et al. 1995). Lenth et al. (2006), one of the most often cited papers, examined clustered and dispersed housing patterns within subdivisions in Colorado and found few differences in a number of biological indicators including songbird abundance and nest success, presence of mammals, and proportion of native and non-native plant species. These results are potentially explained by the fact that the clustered subdivisions in which the study occurred were not designed as conservation developments for the purpose of protecting native habitats and biodiversity and were defined as clustered solely by the location of houses; their small size and past land use history likely overrode the effects of the spatial arrangements in comparison to dispersed and unbuilt areas. Some of the most significant work in evaluating consequences of development patterns has been done by Lenore Fahrig and her students at Carleton University in Ottawa. Gagné and Fahrig (2010a and b) examined the tradeoff between housing density and sprawl area in two studies including birds and carabid beetles. They collected data on both taxa across a range of housing densities in Ottawa, Ontario and Gatineau, Quebec, and then used the resulting empirical data to estimate richness and abundance for birds and beetles in four hypothetical development scenarios. In both cases, they found that compact housing development minimized the impacts to bird and beetle fauna in comparison to dispersed housing. Odell et al. (2003), in a study which similarly paired empirical data with projected or modeled land development scenarios, found strong support for clustering over dispersed development for minimizing impacts to songbirds in Pitkin County, Colorado. Last, Hale et al. (2005) investigated whether regulations designed to protect aesthetic character of a river corridor mitigated the negative impacts of development on birds, despite the absence of explicit conservation objectives in the regulation. Using data from the US Census and the Audubon Christmas Bird Count, these authors found evidence that aesthetic landscape planning may be a viable approach to protecting ecological resources.

Additional studies have focused primarily on modeling of various development scenarios or explicit spatial arrangements of development to evaluate the impacts of potential land development choices. Freeman and Bell (2011) compared various buildout scenarios for a focal town under cluster and conservation subdivision regulations with varying levels of open space requirements and their implications for habitat connectivity for wood frogs. They found that connectivity was enhanced by higher levels of open space, but that careful subdivision design may substitute for either policy if done

well. Most scenarios resulted in higher connectivity under conservation zoning than clustering, suggesting also that the design of open space may be at least as important as the quantity. In a somewhat older study, Forman and Collinge (1997) used spatial modeling to simulate a sequence of landscape change, evaluating patterns of vegetation removal expected under direct spatial planning versus random patterns. Though not evaluating any particular planning methodology, they conclude that intentional spatial planning is most significant to ecological outcomes when 10-40% of the natural vegetation has been removed from a landscape, and that understanding of a few simple patterns and principles can go far in protecting ecological integrity in the context of land use planning, especially where detailed ecological data are limited or lacking. Jeff Milder, a leader in ecology and land use planning, has made great contributions to the understanding of the effectiveness and utility of various conservation development principles. Milder et al. (2008) evaluated the conservation outcomes of one specific type of conservation development – conservation and limited development projects (CLDPs). These authors found that CLPD's outperformed both conventional development and conservation subdivisions in terms of conservation benefits, and may offer a low-impact alternative to conventional development and a low-cost method for protecting land when conventional conservation techniques are prohibitively expensive.

Outside of more ecologically-oriented papers that either conducted on-the-ground data collection or modeled biological indicators, there also exist a significant number of valuable papers that have evaluated policies themselves, rather than specific spatial arrangements of houses or subdivision designs. Kaufman et al. (2002) evaluated the fit between environmental ordinances and the physical or environmental conditions to which they were applied, utilizing an environmental response index that incorporated information on water, soil, slope, development density, roads, vegetation, and ecology. They found generally poor performance across all indicators and identified the lack of scientific specificity in state-level ordinances and lack of local expertise and/or resources for monitoring as two critical problems with the ability of state-level environmental ordinances to address local-scale (subdivisions within communities) environmental conditions. Robinson and Brown (2009) evaluated the effects of land use development policies on exurban forest cover, using spatial data in hypothetical scenarios to evaluate the individual and interacting effects of lot size zoning and municipal land acquisition strategies on possible forest cover outcomes in southeastern Michigan. They found that large lot size zoning policies led to greater sprawl and that the location strategy of forest conservation land acquisition was more effective at increasing aggregate forest cover than independent zoning policy.

Robinson et al. (2005), in a study evaluating the effects of Seattle's urban growth management policies, highlighted the potential unintended consequences of such policies which may result in sprawling low-density development in rural and wildland areas by attempts to reduce settlement density outside of urban centers. Taylor et al. (2007) investigated the influence of a local land use policy on the preservation of natural features in Fenton Township, MI. They specifically examined the effectiveness of a zoning ordinance encouraging the preservation of open space within the developable portion of a site in exchange for increased residential densities elsewhere on the site (i.e. conservation development) and compared the changes in landscape composition and configurations caused by developments created before and after policy implementation. Results of their analysis showed that the policy produced only a small number of observable and significant changes in the land cover effects of development and suggested specific changes to the Fenton town policy including: the ordinance should (1) define natural features, (2) explicitly state that the defined natural features shall be preserved (i.e., not developed within or directly adjacent to), and (3) provide a spatial context for design decisions; that is, define a configuration (pattern) of land covers and land uses appropriate for each site to be developed.

Moos et al. (2006) use modeling to conduct an empirical test of 3 different subdivision designs in Ithaca, NY: one built (ecovillage), one proposed (up-scale estate homes), and one hypothetical (new urbanist) for the same site. This paper employs the notion of an ecological footprint, and its primary purpose was to investigate the degree to which site design, or built form, can influence an individual's environmental impact. The ecological footprint described here relates to consumptive behaviors of individuals and is different from the notion of ecological footprints or impact zones often found in conservation biology literature. Nonetheless, the authors find that denser designs resulted in reduced ecological footprints, and illustrated that consumption, not built form, contributes most to the overall footprint. They highlight, therefore, that the link between design and behavior is of critical importance.

A number of synthesis and overview papers relevant to land use planning policy have also been written and are tremendously valuable. Bengston et al. (2004) provide a systematic review of policy instruments for managing urban growth and put forth a very useful set of key lessons learned about the effectiveness of growth management policies and programs. The authors conclude that: (1) there is a lack of empirical evaluations of effectiveness of growth management policies, (2) administrative efficiency and other details of policy implementation – rather than the general type of policy – are critical in determining their effectiveness, (3) the use of multiple policy instruments that reinforce and complement each other is needed to increase effectiveness and avoid unintended consequences, (4) vertical and horizontal coordination are critical for successful growth management but are often inadequate or lacking, and (5) meaningful stakeholder participation throughout the planning process and implementation is a cornerstone of effective growth management. Though limited to the Research Triangle area of North Carolina, Steelman and Hess (2009) also provide an evaluation of lessons learned in an assessment of the relationship between open space plan quality and implementation and attainment of open space protection goals, finding that planning is necessary but not sufficient for protecting open space and a technically excellent plan does not guarantee the long term relationships among local landowners, political and appointed officials, and other organizations that are crucial to meeting land protection goals. They suggest that building these relationships should become an explicit – and perhaps paramount – focus of the open space planning process. This is in line with our findings in Chapter Two of this report.

Last, Stokes et al. (2010) investigated the perspectives of planners on the factors that facilitate and impede biodiversity conservation in local planning and their results are worth elaborating for their value to conservation practitioners in the northeast. These researchers interviewed directors of 17 municipal planning departments in the greater Seattle area and compared responses of planners from similar-sized jurisdictions that were “high” and “low performing” with respect to incorporation of biodiversity conservation in local planning. Planners from low performing jurisdictions regarded mandates from higher governmental levels as the primary drivers of biodiversity conservation, whereas those from high performing jurisdictions regarded community values as the main drivers, although mandates were also important. Biodiversity conservation was associated with the presence of local conservation flagship elements and human-centered benefits of biodiversity conservation (e.g., quality of life). Planners from high and low performing jurisdictions favored different planning mechanisms for biodiversity conservation, which perhaps reflects differences in funding and staffing. High performers reported more collaborations with other entities on biodiversity issues. Planners’ comments indicated that the term biodiversity may be problematic in the context of local planning and the action most planners recommended to increase biodiversity conservation in local planning was public education. The authors suggest that to advance biodiversity conservation in local land use planning, conservation biologists should: (1) investigate and educate the public about local conservation flagships and human benefits of local biodiversity, (2) work to raise ecological literacy and explain biodiversity more effectively to the

public, and (3) promote collaboration on biodiversity conservation among jurisdictions and inclusion of biodiversity specialists in planning departments (Stokes et al. 2010). This approach is directly in line with that of what the Staying Connected Initiative has undertaken and underscores the importance of conducting land use planning at the community level.

Summary:

Taken together, these results suggest a number of conclusions. We can concur that empirical tests of the effectiveness of various land use planning methodologies at conserving biodiversity and ecological connectivity are still somewhat rare. The bulk of those that exist are modeling exercises rather than studies where ecological data have been collected on the ground, reflecting the complexities of access, timing, and funding that must be successfully navigated for such a study to occur. Those studies that have been conducted suggest mixed results and span a variety of different land use planning methodologies and policy instruments, making them somewhat difficult to compare. In cases where the question of clustered versus dispersed subdivision development has been asked specifically, the majority of studies using modeling approaches have found support for clustered rather than dispersed housing at being more protective of biodiversity and ecological connectivity. Most all of them suggest stronger conservation outcomes from various types of conservation development when compared to conventional development.

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Conclusions

A critical element of protecting wildlife connectivity through land use planning requires that planners incorporate biodiversity values into the design and management of residential landscapes. This includes: understanding the local relationships among wildlife, habitats, and human benefits; explaining biodiversity more effectively to the public; and promoting collaboration on biodiversity conservation. Existing requirements for conservation design and ecological site analysis in the northeastern United States are relatively weak with respect to habitat and connectivity values, but minor adjustments to existing regulations and how they are implemented may have a large positive benefit for wildlife and habitat connectivity.

Conservation practitioners have the opportunity to offer resources, information, and capacity to improve this process and provide input on CD ordinances in the northeastern states. These opportunities include:

- translating science into appropriate language for integrating conservation practices into local ordinances,
- engaging directly with town governments on drafting new and updated local regulations,
- engaging in partnerships with municipalities and landowners to provide biological expertise and capacity for implementation of conservation designs, and
- coordinating at a regional or state level to improve model language.

Incorporating current science into land use planning documents will more effectively link open space planning with protections for wildlife and habitat. Our research demonstrates that there is both a need and an opportunity to effect these changes. Achieving these conservation benefits will involve a multi-phased process and require partners from the conservation, planning, NGO, consulting, and municipal sectors. To maximize the conservation impacts of this work we will need to work together to improve existing regulations, put new ones in place, and mobilize a network of practitioners who can serve as resources and bring capacity to local planning processes. The conservation community may wish to proceed with prioritizing this work in high-value habitat areas, and by building a larger community of practitioners we hope to be able to expand this effort for the benefit of habitat and wildlife across the northeast.

Appendix A

County and Town level Regulations for Conservation Development – Review Criteria

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Final: 3/1/10

Conservation development is broadly defined as an alternative approach to residential development which protects or restores the ecological resources of a property and restricts compatible housing development to the remainder of the site. ‘Conservation development’ is an umbrella term referring to several site design strategies, including cluster development, open space development, and conservation subdivision design.

Regulatory documents including Zoning Ordinances, Subdivision Ordinances, Unified Development Codes, and special regulations were searched for any reference to conservation development. We included documents for review only when they provided substantive standards to guide design choices for conservation developments. Although Planned Unit Development (PUD) ordinances can also provide the regulatory flexibility necessary for approval of conservation development projects, they were included only when they contained specific objectives or design guidelines for conservation development.

All of the questions in this review should be completed for each county or town level regulation or ordinance pertaining to conservation development. When a county or town has more than one conservation development regulation, the review should be completed independently for each regulation. Each regulation or ordinance reviewed will be assigned a unique record number, which can be used to index the documents for future analyses.

The review questions should only be completed for information contained within the specific conservation development regulation. For example, detailed building setbacks should only be recorded when they are specified as a conservation design guideline, and not when they are specified elsewhere in the county or town’s development regulations.

Basic Information:

- 1) Location
 - a) State
 - b) County
- 2) Does the county have a planning department (i.e., building and planning, zoning, growth management, community development, land services, development services, etc.)?

If yes:

 - a) Website address
 - b) Staff contact
 - c) Phone or email address
 - d) Has the county adopted a general land use or zoning plan?
- 3) Does the county have multiple regulations or ordinances pertaining to conservation development?

If yes:

 - a) How many?
 - b) Specify record numbers of other ordinances or regulations reviewed
- 4) Does the county have regulations or ordinances for Planned Unit Developments (PUDs)?

If yes:

 - a) Is the conservation development regulation separate from the PUD regulation?
- 5) Specific term used to describe conservation development in regulatory documents
- 6) Where does the regulation or ordinance appear in the county's land use or development regulations? *(Select all that apply.)*
 - *Subdivision regulations, ordinance, or code*
 - *Exemptions from subdivision regulations*
 - *Zoning regulations, ordinance, or code*
 - *Unified land use or development code*
 - *Special regulation or ordinance (Specify ordinance number and title)*
 - *Other?*
- 7) Is the regulation or ordinance voluntary?
 - *Compulsory*
 - *Voluntary*
 - *Not stated*
- 8) Are incentives provided to encourage participation in, or compliance with, the regulation or ordinance?

If yes:

a) Which types of incentives are used? *(Select all that apply.)*

- *Density bonus*
- *Streamlined permit or review process*
- *Reduced permit or review fees*
- *Exemption from other development regulations*
- *Tax break or credit*
- *Other?*

9) Is a variance required for deviation from the standards in the regulation or ordinance?

10) Does the state have enabling legislation or a model ordinance for conservation development?

If yes:

a) How similar is the county regulation or ordinance to the state legislation or model ordinance?

- *Exact*
- *Similar, but modified*
- *Unrelated*

11) What year was the regulation or ordinance enacted?

a) Has the regulation or ordinance been amended or updated?

If yes:

i) What year did the most recent amendment or update occur?

Objectives and Applicability of Regulation or Ordinance:

12) Is there an objective, purpose, or goal stated for the regulation or ordinance?

If yes:

a) Which of the following elements are included among the regulation's objectives? *(Select all that apply.)*

- *Protect wildlife habitat*
- *Protect aquatic habitat*
- *Protect imperiled or sensitive species*
- *Improve water quality*
- *Reduce erosion and sedimentation*
- *Conserve agricultural lands*
- *Conserve historically or culturally significant sites*
- *Preserve local open space within developments*

- *Contribute to a network of open space or protected lands*
- *Buffer nearby protected lands*
- *Minimize the visual impacts of development*
- *Allow flexibility or creativity in site design*
- *Protect or enhance property values*
- *Reduce development infrastructure (e.g., roads, utilities, etc.)*
- *Increase street and community connectivity*
- *Increase pedestrian or bike transportation, or decrease dependence on automobiles*
- *Other?*

13) Is the applicability of the regulation or ordinance limited to particular zoning districts or area(s) of the county?

If yes:

- a) Does the regulation apply to an overlay zone?
- b) List the zoning districts or area(s) in which the regulation or ordinance applies.
(Calculate acreage.)

14) Is the applicability regulation or ordinance limited to particular size(s) of subdivisions?

If yes:

- a) What is the minimum number of lots, or minimum acreage?
- b) What is the maximum number of lots, or maximum acreage?

15) Is the regulation or ordinance primary to, or does it override, other land use or development regulations?

- *Primary*
- *Secondary*
- *Not stated*

Site Analysis Requirements:

16) Is site analysis for conservation features required?

If yes:

- a) Must conservation site analysis be completed prior to site design for the developed area(s)?
- b) Which features must be identified or delineated as part of the conservation site analysis? *(Select all that apply.)*
 - *Existing protected lands (on-site)*
 - *Adjacent or nearby protected lands*
 - *Agricultural lands*

- *Cultural or historic sites*
- *Streams, rivers, lakes, wetlands, and other hydrologic features*
- *Topography*
- *Soil types*
- *Vegetation characteristics*
- *Wildlife habitats*
- *Locations of sensitive or imperiled species*
- *Existing roads or structures*
- *Other?*

Design and Configuration of Conservation Area(s):

17) Do specific standards or guidelines apply to the design or configuration of conservation area(s)?

If yes:

a) What is the minimum size of the total conservation area?

- *Proportion of site area (%)*
- *Minimum area (ac)*
- *Not stated*

b) Can areas that are otherwise restricted from development (i.e., by county, state, or federal land use regulations) be included in the area calculation for the total conservation area?

If yes:

i) Which restricted lands are permitted to be included in the area calculation?

(Select all that apply.)

- *Steep slopes*
- *Flood plains*
- *Wetlands*
- *Water bodies*
- *Lands under permanent easement (e.g., for roads, drainage, or utilities)*
- *Cultural sites (e.g., historical or archaeological)*
- *Other?*

If no:

ii) Which restricted lands are prohibited from being included in the area calculation?

(Select all that apply.)

- *Steep slopes*
- *Flood plains*

- *Wetlands*
 - *Water bodies*
 - *Lands under permanent easement (e.g., for roads, drainage, or utilities)*
 - *Cultural sites (e.g., historical or archaeological)*
 - *Other?*
- c) Can the protected lands be allocated into multiple conservation areas?
- If yes:*
- i) What is the minimum size of a single conservation area?
- *Proportion of site area (%)*
 - *Minimum area (ac)*
 - *Not stated*
- d) Do specific standards or guidelines apply to the shape or contiguity of conservation area(s)?
- If yes:*
- i) How are the conservation area(s)' shape or contiguity regulated? *(Select all that apply.)*
- *Minimum width of conservation area*
 - *Shape index of conservation area*
 - *Measure of connectivity or contiguity among conservation areas*
 - *Other?*
- e) Does design of the conservation area require consultation with a conservation expert or plan?
- If yes:*
- i) At which stage in the development application process is consultation required?
- *Pre-Application*
 - *Site Analysis Plan*
 - *Concept Plan*
 - *Other?*
- ii) Which type(s) of consultation are required? *(Select all that apply.)*
- *Biologist on staff at the county planning agency*
 - *Public lands manager(s)*
 - *Wildlife manager(s)*
 - *Conservation organization(s)*
 - *Biological consultant*

- *Compliance with state conservation plan (e.g., SWAP)*
 - *Compliance with regional conservation plan (e.g., HCP)*
 - *Compliance with a locally-adopted (e.g., county or municipal) conservation plan*
 - *Other?*
- f) Are conservation area(s) required to be contiguous with protected lands or open space networks outside of the development property?
- If yes:*
- i) What proportion of the total conservation area must be contiguous with outside protected lands or open space networks?
 - *Proportion of conservation area (%)*
 - *Proportion of development property edge (%)*
 - *Not stated*
- g) Are conservation area(s) required to be buffered from the developed area?
- If yes:*
- i) How large of a buffer is required?
 - *Distance (ft)*
 - *Not stated*
- h) Are conservation area(s) required to be directly accessible to the residences?
- If yes:*
- i) What proportion of lots or residences are required to be adjacent to the conservation area(s)?
 - *Proportion of residences (%)*
 - *Not stated*

Ownership and Management of Conservation Area(s):

18) Do specific standards or guidelines apply to the ownership of conservation area(s)?

If yes:

- a) Which types of owners are permitted for the conservation area(s)? *(Select all that apply.)*
 - *Developer*
 - *Individual owner*
 - *Homeowners Association (HOA)*
 - *Condominium association*
 - *Non-profit conservation organization*

- *Local government or land management agency*
 - *Other?*
- b) Which instruments of land protection are permitted? *(Select all that apply.)*
- *Fee-title ownership*
 - *Conservation easement*
 - *Restrictive covenant*
 - *Other?*
- c) Is the land protection instrument recorded using a specialty code?
- d) What duration of protection is required for the conservation area(s)?
- *Perpetual*
 - *Limited (specify the number of years)*
 - *Not stated*
- 19) Do specific standards or guidelines apply the management of conservation area(s)?
- If yes:*
- a) Is a plan required for management of the conservation area(s)?
- If yes:*
- i) Which of the following elements are required to be included in the management plan? *(Select all that apply.)*
- *Establishment of funding source*
 - *Staffing needs*
 - *Monitoring of conservation targets*
 - *Management of conservation targets*
 - *External approval or review of management plan*
 - *External enforcement of management plan*
 - *Other?*
- b) Which land uses or activities are permitted in the conservation area(s)? *(Select all that apply.)*
- *Access by residents*
 - *Public access*
 - *Pets*
 - *Non-motorized recreation*
 - *Motorized recreation*
 - *Golf courses*
 - *Hunting*

- *Agriculture*
- *Grazing*
- *Timber harvest*
- *Roads*
- *Parking lots*
- *Other?*
- *Not stated*

c) Are there seasonal restrictions on any of the permitted land uses or activities?

If yes:

i) Specify seasonal restrictions

d) Which land uses or activities are prohibited in the conservation area(s)? (*Select all that apply.*)

- *Access by residents*
- *Public access*
- *Pets*
- *Non-motorized recreation*
- *Motorized recreation*
- *Golf courses*
- *Hunting*
- *Agriculture*
- *Grazing*
- *Timber harvest*
- *Roads*
- *Parking lots*
- *Other?*
- *Not stated*
-

Density and Configuration of Developed Area(s):

20) Do specific standards or guidelines apply to the size or density of the developed area(s)?

If yes:

a) What is the minimum size of the total developed area?

- *Proportion of site area (%)*
- *Maximum area (ac)*

- *Not stated*
 - b) What is the maximum size of the total developed area?
 - *Proportion of site area (%)*
 - *Maximum area (ac)*
 - *Not stated*
 - c) What is the minimum density of development?
 - *Minimum density (houses/ac)*
 - *Maximum lot size (ac)*
 - *Not stated*
 - d) What is the maximum density of development?
 - *Maximum density (houses/ac)*
 - *Minimum lot size (ac)*
 - *Not stated*
 - e) How much of a density bonus is permitted?
 - *None*
 - *Proportion of development yield (%)*
 - *Additional lots per acre of development (lots/ac)*
 - *Other?*
- 21) Do specific guidelines apply to the site design of the developed area(s)?
- a) Are any location(s) in addition to those specified by state, federal, or local regulation (see question 16-b-i) restricted from development?
 - *Hilltops or ridgelines*
 - *Peripheral public roads*
 - *Riparian areas (specify buffer width)*
 - *Other?*
 - *None*
 - b) What are the principal building setbacks?
 - *Front lot line (ft)*
 - *Side lot line (ft)*
 - *Rear lot line (ft)*
 - *Not specified*
 - c) What are the accessory building setbacks?
 - *Front lot line (ft)*

- *Side lot line (ft)*
 - *Rear lot line (ft)*
 - *Not specified*
- d) What is the maximum building height?
- *Maximum height (ft)*
 - *Not specified*
- e) Are residential lots required to be grouped into clusters?
- If yes:*
- i) What is the minimum size of a residential cluster?
- *Minimum number of lots*
 - *Minimum proportion of total lots (%)*
 - *Not specified*
- ii) What is the maximum size of a residential cluster?
- *Maximum number of lots*
 - *Maximum proportion of total lots (%)*
 - *Not specified*
- f) What is the maximum coverage by impervious surfaces on one residential lot?
- *Maximum proportion (%)*
 - *Maximum area (ac)*
 - *Not specified*
- g) What is the maximum coverage by impervious surfaces on the entire development property?
- *Maximum proportion (%)*
 - *Maximum area (ac)*
 - *Not specified*