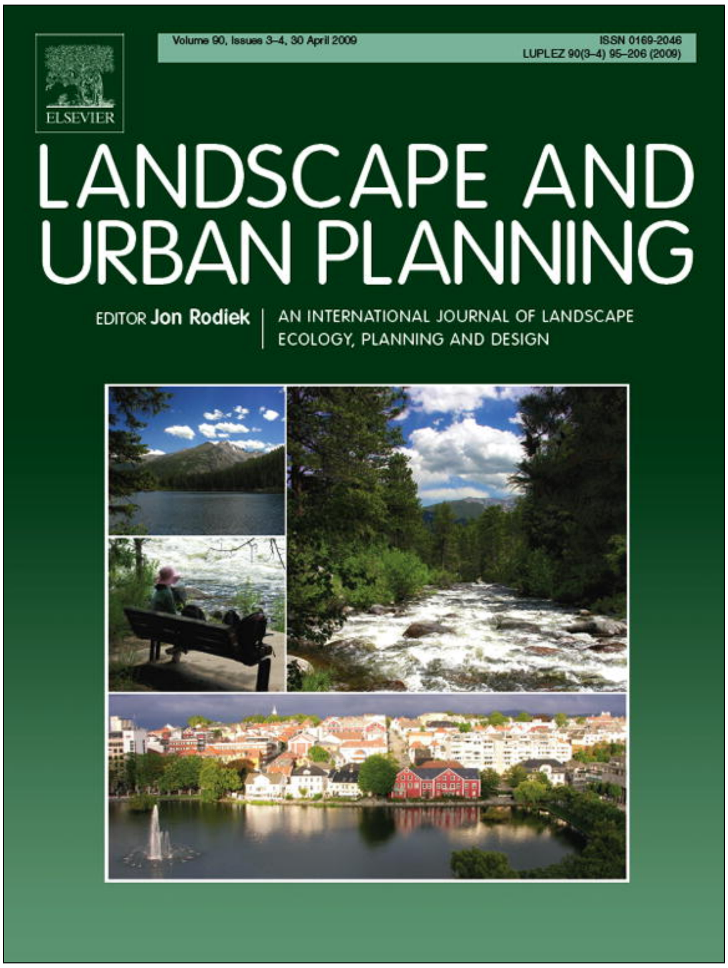
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Review

Conservation subdivisions: A wildlife perspective

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ABSTRACT

Conservation subdivision is a design concept used by landscape architects and other built environment professionals to conserve wildlife habitat within growing communities. The idea is by clustering homes together to maximize open space, one can conserve urban biodiversity. It is a popular concept used by many planners and landscape architects and is used in many municipalities as an alternative to conventional urban development. In this review paper, we systematically review Randall Arendt's book, *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks*, which has championed the conservation design concept. Through this review and our experiences with how the conservation design concept has been applied, we provide suggestions that will (1) maximize the potential of conservation subdivisions to conserve wildlife and their habitats, and (2) promote positive wildlife experiences for residents of conservation subdivisions. We found several recommended design elements that could negatively impact wildlife but of significance, we found that most guidelines and effort in conservation subdivisions are placed on the design phase: construction and post-construction phases are neglected. We discuss the social and ecological elements that warrant consideration during the construction and post-construction phases and how they are necessary in order to conserve functional wildlife habitat within a conservation subdivision.

Contents

1. Introduction

The American population is projected to reach nearly 420 million by 2050 (United States Census Bureau, 2004). In order to meet the demand for America's growth, the American landscape has undergone drastic changes. For example, from 1992 to 1997, approximately 1.2 million acres (roughly the size of Delaware) of farmland were converted annually for human development (American Farmland Trust, 2002). Additional habitats like forest and grasslands have been equally impacted. As suburbia encroaches on rural areas and open space is developed to support our burgeoning human population, there are growing concerns about how wildlife and wildlife habitats are affected (Geis, 1974; Hostetler, 1999; Grimm et al., 2000; DeStefano and DeGraaf, 2003).

In recent years, attempts have been made to simultaneously satisfy habitat needs for both human residential purposes and wildlife.

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In the landscape architecture community, perhaps the dominant concept of integrating human needs with natural resource conservation is a concept known as clustered development or conservation subdivisions (Arendt, 1996; Odell et al., 2003). The idea of a conservation subdivision is to group houses together on smaller lots, more so than a conventional design that disperses the homes throughout the development. Typically, conservation subdivisions have homes clustered within a smaller area with each lot encompassing less than 1 acre (e.g., 0.25–0.5 acres), and the remaining area is left as open space (Arendt, 1996; Lenth et al., 2006). Seen as an alternative to sprawl, conservation subdivisions have been promoted as a benefit to wildlife (Arendt, 1996; Theobald et al., 1997; Till, 2001; Odell et al., 2003). Clustered development has found traction in planning and design fields and is viewed as a design methodology to create more natural communities, especially in the New Urbanist literature (Till, 2001; Zimmerman, 2001; Congress for the New Urbanism, 2007). However, while clustering homes is a step in the right direction to conserve wildlife habitat in growing communities, many other design and management considerations are important in order to create functional wildlife habitat that supports a diversity of species. Simply conserving open space through clustering may not be enough to promote biodiversity as many other ecological, environmental, and management issues come into play (Hansen et al., 2005; Hostetler et al., 2005; Lenth et al., 2006).

Brush (1976) suggested that the success of a designed environment depends as much on the functioning of natural processes as it does upon human convenience and pleasing appearance. Brush (1976) and Longrie (1976) proposed that improved communication between wildlife biologists and landscape architects and planners is needed to ensure that informed land-use decisions are made relative to wildlife and wildlife habitat as open space is developed. With that in mind, the purpose of our paper is to offer constructive criticism of conservation subdivisions relative to wildlife and provide suggestions that will (1) maximize the potential of conservation subdivisions to conserve wildlife and their habitats, and (2) promote positive wildlife experiences for residents of conservation subdivisions. Our intended audiences are land planners, developers, and architects, but especially those professionals in academic settings teaching the next generation of leaders who will influence and shape important land use decisions that simultaneously satisfy human and wildlife habitats. In preparing this review paper, we focused on Arendt's (1996) book, *Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks,* and isolated the wildlife-related subject matter, with an analytical eye toward our stated objectives based on our training as wildlife biologists and the wildlife literature. In addition, our comments are based on our experiences of how practitioners have utilized the conservation subdivision ideal in construction projects.

2. The three phases of development

All developers must consider three phases of development when creating a residential neighborhood: design, construction, and post-construction. It is imperative that wildlife biologists and planners and developers work cooperatively, especially during the first 2 phases of development (Thillmann and Monasch, 1976). The design phase is typically where, among other aspects, lot size is designated, lots and roads are distributed throughout the site, and the landscaping palette (e.g., natives or exotic plants) is selected for lots and shared spaces. During this phase of a typical conservation subdivision, homes are clustered in a defined space and the remaining area is designated as open space. Next, during construction, an array of contractors and sub-contractors take what is on paper and implement it on the ground, constructing homes, streets, and landscaped areas. Post-construction is the last phase where buyers purchase the homes, move into the community, and manage their own homes, yards, neighborhoods, and common areas. We highlight problems and solutions to guidelines written in Arendt's (1996) book in terms of conserving or enhancing wildlife diversity as it relates to the three phases of development.

3. Design phase

Nearly every area, including the most urban, will support wildlife of some sort even if the area is not managed for wildlife. Species that frequent urban and suburban areas do so because they are typically habitat generalists and are able to capitalize on the available resources in a human-dominated landscape (Erz, 1966; Marzluff et al., 2001; DeStefano and DeGraaf, 2003). In order to increase the diversity of urban wildlife, many international studies demonstrate the importance of conserving individual native plants within small and large natural remnants (e.g., Kadlec et al., 2008; Meurk and Hall, 2006; Ruiz-Jaen and Aide, 2006). As an example, Meurk and Hall (2006) developed a design framework of indigenous vegetation patches in order to benefit birds and other wildlife in New Zealand. Chapter 5 of Arendt's (1996) book has good suggestions about the appropriate area(s) to conserve, based on an inventory of habitats and of plant and animal species found within a proposed development site. What is not mentioned, though, is that wildlife surveys should be conducted during spring, summer, fall, and winter because detection of some species is season dependent. For example, neotropical migrating birds (e.g., American Redstart, *Setophaga ruticilla*) may use only a portion of the developable area as a stop-over site during spring and fall. The flora and fauna surveys, wildlife management objectives, habitat implementation and management strategies, and plan evaluation should all be encapsulated in a written wildlife management plan that is kept on file at the site for future reference once the neighborhood is built. Arendt (1996), in Chapter 9, does mention that a good management plan and permanent funding source to implement and periodically update the plan is needed, but in practice, these management plans are minimal and usually are not associated with a permanent funding source (see Section 5).

In addition, Arendt's (1996) book places little emphasis on how the design of built areas can severely impact (or benefit) conservation areas. In practice, most planners, architects, and developers neglect the surrounding influence of built areas; this perception comes from a review of municipalities in Florida that have attempted to encourage conservation of green open space through policy initiatives (Romero and Hostetler, 2007). However, the design of individual yards and common areas is critical. First of all, backyards can provide invaluable habitat for wildlife and are essential in connecting open spaces in the surrounding area (Rudd et al., 2002). Native plants in built areas have been shown to attract a wider variety of wildlife species in urban areas than non-native plantings (e.g., Mills et al., 1989) and bolster the types of species not normally found in urban areas, particularly when the lots are located near remnant natural areas (Hostetler and Knowles-Yanez, 2003). Select wildlife species are adaptable and do quite well in neighborhood environments, albeit the composition of wildlife species pre- and post-construction may change (Geis, 1974; Blair, 1996; Hostetler et al., 2005). Additionally, species richness and abundance has been documented to increase with age of suburban neighborhood, conventional or otherwise (Clergeau et al., 1998; Chapman and Reich, 2007). However, the built areas (e.g., yards, common areas, storm water retention ponds) can have a major negative impact on wildlife diversity in the conserved open spaces. For example, if the landscaping palette contained plants that invade nearby natural areas (e.g., invasive exotics), then these exotics could transform the natural habitat into something quite different (Pimentel et al., 2001).

Not only the quality of plantings, but the quantity, can affect wildlife. The amount of turf or ornamentals allocated to each lot or public space within a development can attract exotic wildlife species (e.g., European Starling, *Sturnus vulgaris*) and/or increase the abundance of common commensal species (e.g., Groundhogs, *Marmota monax*). An abundance of exotic or commensal native species, in turn, outcompete other native species for resources such as nesting sites and food (McKinney, 2002). For example, a neighborhood dominated by turf can increase the abundance of species like starlings; starlings evict woodpeckers and other native cavity-nesting birds from the limited number of urban tree cavities (Ingold, 1994). In addition, a decision by the landscape architect to preserve dead trees (e.g., snags) throughout the site would enhance bird diversity within the neighborhood as over 30 species of North American birds forage or nest in dead trees (Ehrlich et al., 1988). Of course safety for people and buildings is an issue but once the vision is there to preserve snags, there are ways to conserve snags and mitigate safety concerns (Hostetler et al., 2003).

The geometry of the conserved open space has implications for wildlife diversity. In Chapters 5 and 6, Arendt's (1996) discussions appropriately focus on the percentage of quality open space conserved and connectivity. This could take the form of several small patches that add up to a large percentage of conserved open space, or could be one contiguous block of open space. Not discussed, though, is that the number and shape of patches have consequences for wildlife because of the amount of edge created. Edge is where two or more vegetation types or age classes meet. The more fragmented the habitat patch, the more edge habitat that is available. Generalist species like white-tailed deer (*Odocoileus viriginianus*) prefer edge habitat and are commonly found in developed areas (Bolger et al., 1997; McKinney, 2002; Stralberg and Williams, 2002). Other species, like interior forest birds, tend to avoid fragmented forests with a large amount of edge and are not common in urban areas (Bock et al., 1999; Maestas et al., 2003).

An increased amount of edge habitat can result in overabundant populations of certain problematic wildlife species creating unwanted human–wildlife conflicts (Conover, 2002). Furthermore, the "edge effect" (e.g., different vegetation structure, noise disturbance, impact of predators along the edge, or competition with generalists found within the edge) can extend up to 200 m into a remnant patch and impact breeding or foraging birds (Bock et al., 1999; Lenth et al., 2006). Thus, having the built areas clustered in one corner of a site instead of placing the built lots in the middle would create larger and more circular core habitat that may be used by less common species (Odell and Knight, 2001).

However, we note that many of these edge effect or small remnant studies refer to impacts on breeding birds and very few address small urban patches concerning insect, reptile, or amphibian diversity (Dawson and Hostetler, 2008). McIntyre and Hostetler (2001) demonstrated that even small urban patches of native vegetation contained a wide array of native bee species and other invertebrates. With birds, small urban patches and even tree canopy cover within the built matrix can serve as stopover, dispersal, or overwinter habitat for migrating birds (Hostetler and Holling, 2000; Hostetler et al., 2005). Thus, depending on site limitations and community goals, small patches containing edge habitat can benefit wildlife in certain situations.

3.1. Wildlife corridors

Chapter 6 of Arendt's (1996) book references wildlife corridors and speaks to the positives of conservation subdivisions relative to corridors. Corridors can benefit wildlife, especially in a fragmented environment where connecting travel ways may be necessary to allow wildlife to move between larger patches of habitat (Rudd et al., 2002; Hilty and Merenlender, 2004). Corridors can also provide other habitat requirements like cover, food, and even water (Fleury and Brown, 1997; Tigas et al., 2002). However, corridors should be a well thought out exercise prior to implementing them on the landscape to ensure that they are the best use of the land and will accomplish their intended objective (Noss, 1987; Simberloff et al., 1992; Hess, 1994). Many wildlife species like raccoons, white-tailed deer, and Canada geese (*Branta canadensis*) that inhabit residential areas may not need corridors to move across the landscape (Mann and Plummer, 1995; Tigas et al., 2002). Additionally, even though corridors may be present and some wildlife may use them, one size does not fit all and a generic corridor may not satisfy the needs of wildlife species present at a site (Mann and Plummer, 1995; Schiller and Horn, 1997; Beier and Noss, 1998). Fleury and Brown (1997) examined a host of corridor attributes and concluded that many attributes are species specific and that species with a high dependence on corridors should be considered first in the design process. For example, the speed with which a species moves will be affected by corridor length. The slower moving species like reptiles may face greater predation traversing a long corridor connecting habitat patches than a fast moving species like a bird (Fleury and Brown, 1997; Mason et al., 2007). Furthermore, a narrow corridor may prove less suitable for an interior forest species than an edge species (Fleury and Brown, 1997). Beier and Loe (1992) suggested thinking of corridors in terms of "passage species" (e.g., large herbivores and medium to large carnivores) and "corridor dwellers" (e.g., plants, amphibians, small mammals, and birds with limited dispersal ability). "Passage species" use corridors for brief time spans as they pass between two larger habitat patches, whereas "corridor dwellers" spend several days to their entire life span within the corridor and use the corridor to satisfy habitat requirements. Beier and Loe (1992) provided a 6-step guide to designing and evaluating wildlife corridors that would be useful for residential developers and planners to review prior to designating corridors on the landscape.

4. Construction phase

Even the best conservation subdivision design on paper is dependent on contractors, landscapers, and sub-contractors to properly implement the plan. Arendt's (1996) book does not mention this important construction phase. From our experiences, even the best designs can be compromised by improper implementation. Often, contractors are not brought in during the design phase and are not fully engaged or understand the conservation priorities of the project (Hostetler et al., 2008). Without *fully engaged* contractors or landscapers, many things can happen during the construction phase that could impact the viability of nearby wildlife habitat. For example, even if the most important large trees are preserved across the subdivision and built areas are designed around them, the placement of fill dirt and routes of heavy construction vehicles can cause the demise of these trees. The roots underneath the drip line (the outer edge of the leafy canopy) should be protected by a sturdy fence (Coder, 1995; Ruppert et al., 2005). If heavy vehicles continually compact the root zone of a tree or fill dirt is placed right up to the tree trunk, the roots may not be able to acquire nutrients, water, and oxygen and the tree may die. In addition, designated zones for disposal of debris and chemicals should be away from any trees meant to be preserved. Debris can be toxic or can change soil pH due to leeching of chemicals into the ground which could affect certain trees (Johnson, 2005).

On-site management during construction of conservation subdivisions is important and a well-informed construction site manager is critical. Wetlands and waterbodies are typically protected by silt fences; these silt fences should be *well-maintained* around any wetlands or water bodies to prevent silt from entering these areas during construction. Run-off can carry large amounts of silt into a wetland and essentially choke this system to death and destroy nearby wildlife habitat (Lee et al., 2006). Even the casual feeding of wildlife present on the construction site can lead to wildlife/human conflict in the future. In one example of a development in central Florida, many of the retention ponds were populated with alligators. Apparently, contractors were feeding these alligators lunch scraps and they lost their natural fear of humans. Once people moved into their homes, a few of the alligators became quite aggressive as they came out of the water "begging" for food as people walked by these ponds (Greg Golgowski, personal communication). These alligators had to be removed.

From our experiences, very few contractors and landscape architects have the training to implement the appropriate construction practices as to minimize future impacts on wildlife populations. Continuing education courses are one way to educate built environment professionals and several University Extension programs are taking the lead on developing such courses (e.g., Program for Resource Efficient Communities, http://www.buildgreen.ufl.edu). In addition, hiring an informed and motivated site construction manager(s) can help manage the multitude of contractors that come on site each day and identify any natural resource issues that appear during the construction phase (e.g., the appearance of invasive exotics and implementation of control measures).

5. Post-construction phase

5.1. Homeowner education and management of open space

In Chapter 10, Arendt (1996) suggests that conservation subdivisions can reconnect people to the land and help people develop a land ethic. Studies, though, have indicated that homeowners living in conservation subdivisions do not understand the concept of conserved open space and are not aware of appropriate management practices to maintain wildlife habitat (Youngentob and Hostetler, 2005; Noiseux and Hostetler, in press). Youngentob and Hostetler (2005) found that residents of a conservation subdivision did not differ or scored lower on several questions about environmental knowledge, attitudes, and behaviors than residents of "conventional" communities. Thus, conservation subdivision communities may not be attracting or encouraging environmentally sensitive residents and in the absence of engaged residents, a community may resort to environmentally insensitive behaviors (Zimmerman, 2001; Youngentob and Hostetler, 2005) and not retain the long-term ability to manage open space habitat of good quality.

Although it is the developer who implemented the conservation subdivision design, decisions made by homeowners in maintaining their own homes and yards can have drastic consequences for nearby conserved open spaces. Consider the effect of a homeowner adding new plants to a garden and her/his choice included some invasive exotics: that decision would have an impact on nearby conserved natural areas as the invasive plants' seeds can be carried into the open space by wind, water, or wildlife. Invasive plants that spread into natural areas outcompete existing indigenous vegetation and create vast stands of exotic vegetation that negatively impact wildlife. Property owners need to know which plants are considered invasive exotics, remove them, and avoid planting them in their yards.

Other impacts include pets (particularly cats) that are off leash and roaming in conserved areas. They can be significant predators on a wide variety of mammal, amphibian/reptile, and bird species (Baker et al., 2005; Beckerman et al., 2007). Feral cat colonies can become established near suburban areas depending on the desires of local residents. Such cat colonies can have significant impacts on local wildlife species; in some cases, cats from these colonies are known to prey on federally endangered species such as the Florida Anastasia beach mouse (*Peromyscus polionotus phasma*) (Bird et al., 2002). Even how homeowners irrigate their own yards can impact conserved areas. For example, if water comes from local groundwater, a neighborhood consuming too much water can dry up nearby wetlands and affect the habitat for many wildlife species (e.g., nesting and/or roosting waterbirds). Runoff, fertilizers, and pesticides can enter local streams, waterbodies and wetlands. Influxes of additional nutrients and toxins can change vegetation in conserved open spaces to a point where it is not conducive to wildlife diversity.

Even with protected natural areas, local residents need to understand the importance of staying on designated trails and not walking through or using bikes and ATVs to traverse conserved areas. In Arendt's (1996) book, many of the site design examples in Chapter 7 suggest that walking trails be located within the conserved open spaces. The presence of humans walking near or through conserved areas can negatively affect wildlife. The frequent presence of humans within an area has been shown to diminish the number of breeding bird territories and nests (Gutzwiller et al., 1997; Miller and Hobbs, 2000; Lenth et al., 2006) and decrease daily activities of large mammals (Shalene and Crooks, 2006).

In Chapter 9, Arendt (1996) does mention that good management plans, effective homeowner associations, and permanent funding sources are necessary to manage conservation areas. However, in practice, management plans for wildlife are not well-defined in a conservation subdivision and funding mechanisms for the long term management of conserved areas are not established or rewarded in policy initiatives (Romero and Hostetler, 2007). This is important, as many natural areas will need at least some perpetual management to retain the biological integrity of the area. For example, in the southern United States, prescribed burning is an important management tool that promotes healthy pine/upland ecosystems (Myers and Ewel, 1990). Without fire, these systems revert to thick shrub/hardwood ecosystems, negatively affecting such species as the gopher tortoise (*Gopherus polyphemus*) and a host of other animals and plants dependent upon fire to maintain the open aspect of pine/upland ecosystems (Myers and Ewel, 1990).

Developers should set up a funding mechanism to support open space management over the lifetime of a community, and Arendt (1996) recommends such things as homeowner dues and lot sales as a source of funding. Developers should also implement an on-site, robust education program that would address wildlife issues and conservation and would describe best management practices (and the importance thereof) for maintaining the biological integrity of the conserved areas. Education about the concepts of land stewardship should not only be implemented through their sales office, but it should be visible within the neighborhood long after the sales office is closed. A study of several conservation subdivisions indicated that very few environmental principles were retained by homebuyers that went through the sales office (Noiseux and Hostetler, in press). Educating residents through signage and community Web sites are strategies meant to engage local residents (see examples at http://www.wec.ufl.edu/extension/gc). Furthermore, funds should be used to evaluate the success of wildlife management objectives identified at the outset; such evaluation will help identify new solutions for unforeseen problems that arise.

Lastly, most new residential communities have Community Codes and Restrictions (CCRs) which act as guidelines for managing individual lots and common areas. A developer should place environmental guidelines and regulations in these CCRs to help maintain wildlife habitat across the community in both individual yards and conserved areas. Usually a homeowner association (HOA), set up by the developer, has the power to enforce the CCRs. Arendt (1996) mentions (Appendix H—p. 174–175) that HOAs eventually would own the conservation areas and manage them but we emphasize that the CCR document needs to contain language for both the management of individual lots and conservation areas.

5.2. Wildlife/human conflict

The general concept of conservation subdivisions can certainly attract and benefit wildlife, but sometimes conflicts do arise between homeowners and wildlife. Wildlife can cause significant economic, health-related, and natural resource damage (Conover, 2002). It is estimated that residents spend more than $8 billion annually to manage wildlife damage in suburban and urban environments (Conover, 1997; Waller and Alverson, 1997; Conover and Chasko, 1985). Arendt (1996) makes no mention of the very real and increasingly common issue of human–wildlife conflicts as a result of human residential development.

Wildlife managers are struggling to manage overabundant populations of particular wildlife species in many suburban and urban environments (Wildlife Society Bulletin, vol. 25, 1997; DeStefano and DeGraaf, 2003). Common examples, among others, include white-tailed deer, beaver (*Castor canadensis*), raccoons, groundhogs, Canada geese, wild turkey (*Meleagris gallopavo*), and American crows (*Corvus brachyrhynchos*) (Witmer and deCalesta, 1992; Conover, 1997, 2002). In many instances, either inadvertent or purposeful feeding of these more problematic species can lead to conflicts like artificially inflated wildlife populations, intra- and inter-species disease transmission, and increased wildlife-vehicle collisions as wildlife travel to and from human-provided food (Dunkley and Cattet, 2003). Behaviors of overabundant wildlife can negatively alter natural habitats relied upon by a host of other wildlife species (Waller and Alverson, 1997), which can negatively affect conservation areas in subdivisions.

As mentioned previously, wildlife inhabiting suburban and urban areas tend to be edge species and habitat generalists (Marzluff et al., 2001; DeStefano and DeGraaf, 2003). Typically these species are involved in a majority of the wildlife/human conflicts (Conover, 2002). Increased edge habitat within the conservation subdivision can occur with efforts to integrate built areas with open space. Non-linear lot lines (e.g., use of Z-lots as mentioned by Arendt (1996, p. 47), hedgerows (Arendt, 1996, p. 58 and 59), and interspersing open areas throughout woody vegetation and creating a patchwork of varying habitats are three examples that increase the amount of edge habitat for edge-loving wildlife. We cite these examples not to discourage the use of hedgerows or other designs that increase edge habitat but to make people aware that potential wildlife–human conflicts could arise and contingency plans (e.g., management and educational strategies) should be implemented from the very beginning. A homeowner education campaign should be conducted to inform homeowners about potential conflicts and ways to change (in many cases) human behaviors to lessen nuisance wildlife instances. The earlier a problem is solved, the cheaper and easier it will be to solve. For example, raccoons are common inhabitants of chimneys (O'Donnell and DeNicola, 2006). The installation of a $25 chimney cap at the time of home construction guarantees that no raccoons will take up residence in that chimney. If no cap is installed, it may cost the homeowner upwards of $150 to have the raccoon(s) removed, plus the installation of the $25 chimney cap after the fact to ensure no further raccoon problems.

6. Synthesis

Nearly $40 billion was spent on non-consumptive activities like observing, feeding, and photographing wildlife in 2002 (United States Fish Wildlife Service, 2002). A great fascination exists amongst the general public with wildlife, and conservation subdivisions are the perfect tool to satisfy the demands of residential development while simultaneously conserving biodiversity and providing wildlife viewing opportunities. Arendt's (1996) book is a good start to conserve urban wildlife habitat because the framework is there to conserve natural remnants and other critical habitats. However as outlined in this paper, land developers must consider many other design and management issues in order to create *functional* habitat for wildlife and to promote healthy human-wildlife interactions. In Arendt's (1996) book and in typical conservation subdivisions, most of the emphasis is placed on the design phase and less on the construction and post-construction phases. Considerable effort is needed to address construction and post-construction issues. Conserving only a target percentage of open space in the design phase is woefully inadequate to improve urban wildlife diversity. For example, built lots need specific design and management considerations as not to impact conservation areas. Also, many recent policies are attempting to encourage conservation subdivisions (e.g., Romero and Hostetler, 2007), but these policy initiatives tend to focus on the design phase in terms of conserving *X percentage* of open space. Most conservation subdivision policy initiatives do not address construction and post-construction phases and this is critical in order to create functioning urban wildlife habitat. To help with this, we have developed a working model that highlights some of the important issues during the three phases of construction (Fig. 1).

A mixture of social, economic, environmental, and political factors influences the construction of any subdivision, and it is no simple matter to produce a policy or site design that satisfies all of these influences. The big question is how to create a "culture" within planning and built environment professional circles so that they place just as much emphasis on construction and post-construction phases as they do with the design phase. LaNier (1976) asked a similar question over 30 years ago from the perspective of a planner! We strongly believe the answer needs to be found in Academia, where faculty are currently teaching students – the next generation of planners, developers, and landscape architects – the principles of conservation subdivisions. Addressing all three phases of development is a more holistic method, but it is no easy task because implementing best management practices, securing long-term funding sources, engaging contractors, and involving homeowners is just as difficult as or more difficult than placing the appropriate conservation subdivision design on paper. We developed this paper to shed light on the importance of all three phases of a development, and we hope that some of the issues raised and solutions offered will not only help to cultivate awareness among academic units, but it will aid planners, policymakers, built environment professionals, and communities to create urban wildlife habitat.

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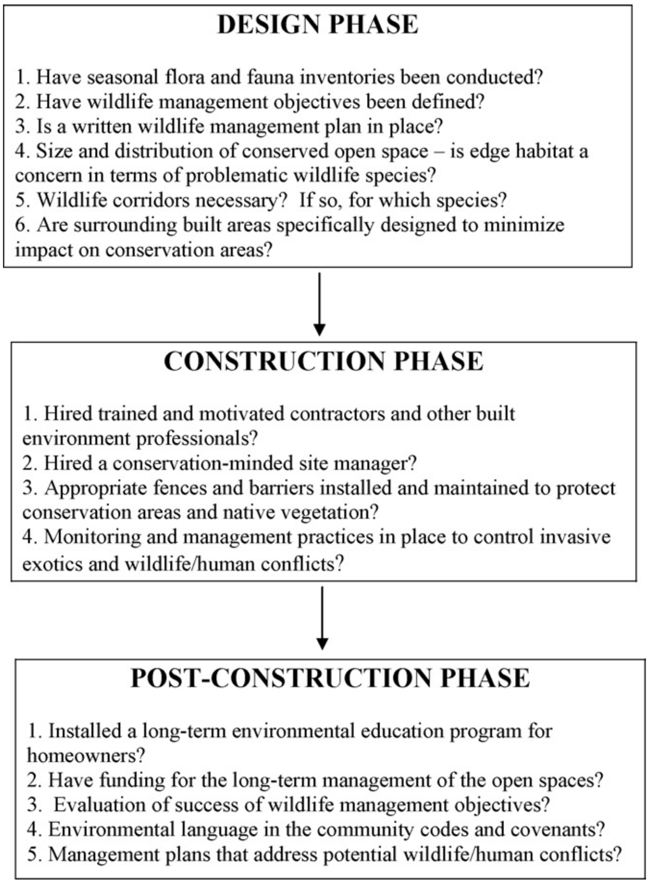

Figure 1. A schematic of important design, construction, and post-construction issues to be addressed when creating functional wildlife habitat in conservation subdivisions.

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