

Conservation Subdivision: Construction Phase – Dark-sky Lighting ¹

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Introduction



Figure 1. Full cutoff street lights installed along transportation routes in Harmony, FL. Credits: Photo: Jennifer Van Walford

As urban communities grow, design and management strategies for new developments become critical factors that determine impacts on natural resources. How can we accommodate growth and yet conserve natural resources, such as biodiversity, water, and energy? In this document, we focus on conserving biodiversity when land is subdivided. The term biological diversity or *biodiversity* refers to the variety of life and its processes. Biodiversity includes species diversity, habitat diversity, and genetic diversity. For the purposes of this article, we focus on biodiversity of *native* species. Native species are plants and animals that were present within a specific region before Europeans made first contact. Non-native (or exotic) plants or animals are defined as those species that were not present in the region before European contact.

Recently, a popular concept called *clustered development* or *conservation subdivision* has been advanced by the landscape architecture community. Conservation subdivision is intended to integrate growth with biodiversity conservation. Conservation subdivisions typically are developments where

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homes are clustered on small lots with the remaining land areas conserved as open space.

The concept of conservation subdivision has gained traction in many planning and design fields. The goals for conservation subdivisions are twofold: 1) to improve biodiversity within a designated subdivision; and 2) to minimize development-related impacts on surrounding habitats. Often, though, most of the effort is on the design of the entire site. To conserve and improve biodiversity within urban environments effectively, one must consider the following three phases of development: design, construction, and post-construction. Overall, these three phases must be addressed in order to create and maintain biodiversity within residential subdivisions. The "Conservation Subdivision" series of EDIS documents discusses biodiversity conservation pertaining to all three phases of development. This fact sheet focuses on decisions made in the construction phase.

The design phase is typically where, among other aspects, lot size and open space are designated and roads are distributed throughout the site. Goals for the development project are discussed and prioritized. In this phase, homes and lots are placed across the site and the remaining area designated as natural open space. Basically, everything is laid out on paper and vertical structures (buildings) and horizontal structures (roads, lots, conserved areas, and shared spaces) are given specific spaces within the development.

Next, during the construction phase, a whole host of built environment professionals including architects, contractors, and subcontractors take whatever is on paper and implement it on the ground, constructing homes, streets, waste treatment systems, and landscaped areas such as lots and parks. In the absence of fully trained or engaged contractors or landscapers, many things can happen during this phase that could decrease the viability of onsite and nearby natural 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 topsoil and routes used by heavy construction vehicles could impair the survival of these trees. If heavy construction vehicles continually

run over the root zones of trees or if topsoil is placed against their trunks, the roots may not be able to acquire nutrients, water, and oxygen and the trees may die.

In the final phase, post-construction, buyers purchase the homes, move into the community, and manage their own homes and sections, neighborhoods, and common areas. It is now the responsibility of residents to manage their homes, yards, and neighborhoods in ways that do not compromise the original intent of the community. Additional problems can arise if residents are not fully engaged—imagine residents moving in and planting invasive exotic plants in each of their yards. Residents could also improperly apply fertilizers and pesticides. The spread of invasive plants and stormwater runoff could then destroy or at least severely reduce the diversity of animals and plants found in the conserved areas.

Again, all three phases, design, construction, and post-construction, must be addressed in order to create and maintain biodiversity within residential subdivisions. This fact sheet discusses how to manage lighting during the construction phase and explains the importance of good lighting to biodiversity in a conservation subdivision.

Lighting Considerations

How does light affect biodiversity? Artificial lights at night affect a variety of animal species. Depending on the species and location of the property, light pollution can affect both resident animals and those migrating through the area. Light pollution threatens wildlife by disrupting biological rhythms and otherwise interfering with the behavior of nocturnal animals. For example, sea turtles lay eggs on Florida beaches, and when they hatch, baby sea turtles enter the ocean because it usually is the lightest land area at night (reflecting moon and star light). However, artificial lights behind beaches can lure hatchling sea turtles away from the sea. After they become disoriented, baby turtles wander across roads or along beaches until they die of exhaustion or are crushed by cars or killed by predators. Artificial lights also alter amphibian foraging and calling behaviors. For example, some salamanders do not

like to forage around bright lights and certain tree frogs do not call in bright light conditions. Artificial lighting seems to be taking the largest toll on bird populations. Nocturnal birds use the moon and stars for navigation during their bi-annual migrations, but lights are an artificial attractor. Birds often crash into brilliantly lit broadcast towers or buildings, or circle them until they drop from exhaustion. Even ecological corridors are affected by lights because wildlife tend not to use corridors that are inundated with light (Rich and Loncore 2005).

To prevent lighting from harming animals, reduce it as much as possible and direct it towards the ground. Shield lights along roads so that the light pools on the ground instead of shining into the sky where it may confuse birds (Figure 1). Dark-sky standards (<http://www.darksky.org>) use full cut-off illumination that shields light from being emitted upwards toward the night sky or surrounding natural areas. To be fully cut off, a light bulb should not extend below its lamp shade. Following dark-sky standards also benefits humans because full cut-off illumination reduces light pollution so that people can view the night sky. For more information on international dark-sky efforts, see DarkSky (<http://www.darksky.org/>).

There is a perception that bright lights help fend off crime and criminals. However, one study found no conclusive evidence of a link between lack of lighting and crime (Sherman, 1997). Safety lighting, directed at the ground, can illuminate sidewalks and doorways without being directed into the sky. Further, using energy-efficient bulbs (such as compact fluorescent bulbs - CFLs) can save you money. CFLs require less wattage to illuminate an area when compared to incandescent bulbs. Switching from a 75-watt incandescent bulb to a 20-watt CFL, which is left on 12 hours each day, can save a homeowner over \$100.00 over five years (American Council for an Energy-Efficient Economy).

Additional Resources

For additional information on conservation subdivisions and conserving urban biodiversity, a variety of online guides, books and other publications exist.

Books and Scientific Publications

Arendt, R.G., 1996. Conservation Design for Subdivisions: A Practical Guide to Creating Open Space Networks. Island Press, Washington, DC.

Duerksen, C. and C. Snyder. 2005. Nature-friendly Communities: Habitat Protection and Land use Planning. Island Press, Washington, DC.

Hostetler, M and D. Drake. 2008. Conservation subdivisions: A wildlife perspective. Landscape Urban Plann., doi:10.1016/j.landurbplan.2008.10.018

Hostetler, M.E. and C.S. Holling. 2000. Detecting the scales at which birds respond to structure in urban landscapes. Urban Ecosyst. 4, 25–54.

Hostetler, M.E. and K. Knowles-Yanez. 2003. Land use, scale, and bird distributions in the Phoenix metropolitan area. Landscape Urban Plan. 62 (2), 55–68.

McIntyre, N. and M.E. Hostetler. 2001. Effects of urban land use on pollinator (Hymenoptera: Apodidea) communities in a desert metropolis. J. Appl. Theor. Biol. 2, 209–218.

Marzluff, J. M., E. Shulenberger, W. Endlicher, M. Alberti, G. Bradley, C. Ryan, U. Simon, and C. Zumbrunnen (editors). 2008. Urban Ecology: An International Perspective on the Interaction Between Humans and Nature. (editors:). Springer, New York.

Rich, C. and T. Longcore (editors). 2005. Ecological Consequences of Artificial Night Lighting. Island Press, Washington D.C.

Online

American Council for an Energy-Efficient Economy (ACEEE): <http://www.aceee.org/consumerguide/lighting.htm>

Hostetler, M.E., G. Klowlon, S. Webb, S.W. Miller, and K.N. Youngentob. 2003. Landscaping backyards for wildlife: top ten tips for success. <http://edis.ifas.ufl.edu/UW175>

Department of Wildlife Ecology and
Conservation Extension
<http://www.wec.ufl.edu/extension/>

Florida Fish and Wildlife Conservation
Commission – Planting a Refuge for Wildlife
[http://myfwc.com/RECREATION/
View_ibrefuge.htm](http://myfwc.com/RECREATION/View_ibrefuge.htm)

Florida Wildlife Lighting Certified
[http://myfwc.com/CONSERVATION/
Conservation_LivingWith_WildlifeLighting_fixtures.
htm](http://myfwc.com/CONSERVATION/Conservation_LivingWith_WildlifeLighting_fixtures.htm)

Florida Marine Turtle Program
[http://myfwc.com/WILDLIFEHABITATS/
SeaTurtle_index.htm](http://myfwc.com/WILDLIFEHABITATS/SeaTurtle_index.htm)

Living Green <http://www.livinggreen.ifas.ufl.edu>

Program for Resource Efficient Communities
<http://www.buildgreen.ufl.edu>

Sustainable Site Initiative
<http://www.sustainablesites.org/>

Sherman, Lawrence W., *et al.* "Preventing Crime:
What Works, What Doesn't, What's Promising" A
Report to the United States Congress Chapter 7.
1997—<http://www.ncjrs.gov/works/chapter7.htm>