Proceedings of the Fábos Conference on Landscape and Greenway Planning

Volume 4
Issue 1 *Pathways to Sustainability*

Article 61

2013

An Evaluation of Open Space Quality in Suburban Residential Communities: A Comparison of Neotraditional, Cluster, and Conventional Developments

Elizabeth Brabec
University of Massachusetts Amherst, Department of Landscape Architecture and Regional Planning, ebrabec@larp.umass.edu

An Evaluation of Open Space Quality in Suburban Residential Communities: A Comparison of Neotraditional, Cluster, and Conventional Developments

Cover Page Footnote
Many people have been instrumental in the completion of this project: Craig Johnson, Professor Emeritus, Department of Landscape Architecture and Environmental Planning, Utah State University for input into the initial conception of the project, and Graduate Student Researchers Sarah Rigard, Utah State University for native plants and site inventory and analysis; Vratislava Janovska, Czech University of Life Sciences, Prague, Ailea Omotosho, Stella Lensing, Tara Germond, Zach Silverman, University of Massachusetts Amherst, for GIS analysis; and codes analysis, Pedro Miguel Soto, Paul Gagnon, Jonathan Hymer, University of Massachusetts Amherst. This paper was supported in part through a grant from the US Forest Service Urban and Community Forestry Program on the recommendation of the National Urban and Community Forestry Advisory Council.

An Evaluation of Open Space Quality in Suburban Residential Communities: A Comparison of Neotraditional, Cluster, and Conventional Developments

Elizabeth Brabec
University of Massachusetts Amherst, Department of Landscape Architecture and Regional Planning

Introduction

In the past 35 years, planning theory for open space in both urban and suburban developments has begun to focus not only on recreation, but on the creation of multifunctional landscapes. The flight of homeowners out of cities to relatively inexpensive land and housing in the suburban fringe during the latter part of the last century, placed tremendous pressure on ecosystems, water quality, visual quality, agricultural land and also recreation opportunities. For these reasons, the goals for open space in many suburban developments over the past three decades have expanded to provide active and passive recreational areas, to serve as stormwater quality enhancements, wildlife habitat, act as a visual buffer to the hard surfaces of urban areas, and finally to accommodate urban agriculture. This was certainly the case with neotraditional and conservation developments of the late 1980´s and 90´s which were simultaneously seen as an antidote to the placeless sprawling suburbs and the environmental degradation that ensued.

Three major approaches for effective suburban development that promised a more sustainable outcome than conventional post-World War II subdivision design have emerged, each with its own solution for the provision of open space: conservation (cluster) development (Arendt 1996; Yaro, Arendt et al. 1988; Arendt, Dodson et al. 1994); transit oriented design (Calthorpe 1995); and neotraditional development (Duany 1995). While each approach has its strong advocates, with the exception of the literature on conservation development, the theory tends to treat open space and its provision of green infrastructure benefits as an afterthought in the design process.

Compounding the issue for the provision of green infrastructure services in the open space system is the fact that theoretical evaluations (Davis, Nelson et al. 1994; Frank 1999; Beatley 2000; Hayden 2001; Hopkins 2001) of the impact of new development and its attendant urbanization have been much more common than empirical studies. The existing empirical studies have largely focused on specific issues such as the effects of urbanization on bird populations (Geis 1974; Beissinger and Osborne 1982; Machtans, Villard et al. 1996; Odell, Theobald et al. 2003; Hostetler and Holling 2004), water quality and quantity (Carignan and Steedman 2000; Harbor 1994; Cifaldi, Allan et al. 2004; Goff and Gentry 2006) and habitat fragmentation (McDonnell and Pickett 1990; Fahrig 1997; Ehrenfeld 2000; Eppinka, Bergha et al. 2004). Comprehensive looks at the interaction of land use and broader ecosystem function have been few (Burke, Lauenroth et al. 1994; McDonnell 1997).

When case study analysis has looked at neotraditional and conservation subdivision developments, it has most often been to evaluate their overall design approach, without a comprehensive analysis of their green infrastructure systems (e.g. Francis 2003a; Francis 2003b). Alternatively, studies have focused on the other end of the spectrum, evaluating the success of one aspect of green infrastructure function (Galuzzi and Pflaum 1996), or one aspect of the impact of alternative design such as gross density (Gordon and Vipond 2005). Although there have been some post-occupancy assessments of the suburban forest and the open space system remaining after development these have focused on the social and psychological impacts of new urbanist developments (Brown and Cropper 2001; Kim and Kaplan 2004), the social importance of green spaces (Burgess, Harrison et al. 1988) and have related the existence of urban green to demographic variables (Emmanuel 1997). In addition, existing studies of specific aspects of the green infrastructure system have largely relied on remote sensing and available GIS data, focusing on area protected (and in some cases patch size) (Brabec 2001; Foresman, Pickett et al. 1997), rather than the functionality and condition of the protected area.

As a result, more than 20 years after neotraditional and conservation developments were brought into common use the question remains: How effective have they been, particularly in comparison with other more conventional development styles, in protecting functioning open space systems? This paper addresses that question with a comprehensive analysis of pre-development goals and codes, and a functional analysis of the open space system 10 to 20 years after development completion. Merging GIS data and on-site assessment of 16 sites across the United States, the project compared development outcomes with original development goals to assess the overall successes and failures. Using case studies from five regions across the country, neotraditional, conservation and conventional residential developments were analyzed and compared for their habitat, recreational, visual landscape quality and water quality goals. The insights gained can result in improvements both design and legislative best practices for community development codes.

Methods and Selection of Case Studies

The project identified and analyzed the following aspects:

1. Open space and green infrastructure protection goals through two methods: a content analysis of public documents filed in connection with development and site plan approvals, and interviews with the developer, planners and designers;
2. Evaluation of pre-development forest stand protection through the comparison of current and pre-development aerial photographs and site level inventory, resulting in a finding of the amount and quality of existing forest stands that were protected during the development process;
3. Open space protection measures and outcomes, using aerial photographs, a detailed site-level inventory of ecosystem, recreational, visual and water quality indicators, and an analysis of local regulatory and homeowners association codes; and
4. Level of compliance and achievement of green infrastructure protection goals through a comparison of current conditions and intended outcomes.

Case study sites were chosen from five regions of the continental United States, with selection of each of the three types – conventional, conservation subdivision and neotraditional or new urbanist - in each region. This allowed comparisons to be made between the cases on a regional as well as a typological level. e.g. comparing the three types of subdivision development occurring in the region, and the comparison of five cases of one type (eg. neotraditional as implemented in five different regions of the United States).

Table 1: Case studies shown by region and subdivision type.

Region	Subdivision Type		
	Neo-traditional	Conservation	Conventional
Mid-Atlantic	Kentlands City of Gaithersburg, Maryland	Wesley Chapel Woods, Baltimore County, Maryland	Dufief City of Gaithersburg, Maryland
Southeast	I'on Mt. Pleasant, South Carolina	Spring Island Beaufort County, South Carolina	Sea Pines Hilton Head Island, South Carolina
Mid-West	Prairie Crossing Lake County, Illinois	The Fields of St. Croix, Lake Elmo, MN	Cloverdale, Washington County, MN
Mountain West	Stapleton Denver, Colorado	Hidden Springs Boise, Idaho	Rosecreek, Herriman, Utah
Pacific Northwest	Northwest Landing, Pierce County, Washington	Defiance and Lincoln Green, Whatcom County, Washington	High Point, Seattle, Washington

Each case was studied according to the following methodology:

1. *Open space, forest stand and green infrastructure protection goals.* Local codes and site plan approval documents were collected for each jurisdiction, analyzed for the protection goals and placed in tabular form. Where possible, codes for the period of approval of the development were collected. This proved difficult in some cases, since several developments were permitted between the early 70's and early 90's. Jurisdictions vary in whether they keep an accessible archive of their old ordinances, so these were variably available. In some instances codes in effect at the time of approval could be interpolated from the legislative history printed within the code, but this also varied with jurisdiction. Interviews with local planners and developers (as available) were completed to expand the understanding of initial goals for green infrastructure, and why those goals were or were not implemented. Code summaries were completed for developments.

2. *Evaluation of pre-development forest stand protection.* Current and pre-development aerial photographs were collected for all sites. These were visually compared in GIS to identify the amount of pre-development forest stand protected during the development process.

3. *Inventory of current forest stand and open space management and protection measures.* Using GIS data the ownership of each protected open space parcel was identified. Using the covenants and restrictions filed with each development in concert with the homeowners' association codes, a comprehensive view of the protection and management measures for the open space in each development was collected and analyzed.

4. *Inventory of current forest stand and open space protection outcomes.* Each open space parcel was mapped with GIS data and aerial photographs at a minimum one-meter resolution. Each site was visited, photographed at ground level, and an analysis protocol completed to assess the level of success of
   i. ecosystem and habitat protection;
   ii. stormwater quantity and quality protection;
   iii. recreational opportunities; and
   iv. visual and aesthetic quality.

The protocol is a mixed methods approach, which includes an on-site rapid assessment technique to inventory each site. The methods and variables evaluated are outlined in table 2 below.

Table 2: Methods used to assess protection outcomes in the 15 sites included in the study.

Protection Outcome		***Method***		
		GIS	*Site Survey*	*Documents*
Ecological	*quality*		rapid assessment	
	patch size	acreage		
	veg. type		transect	
	connectivity	Patches, corridors and distance acreage and feet		
	management			community docs content analysis
Water Quality/ Quantity	*impervious surface*	% land area		
	BMPs		visual/photos existence	
	connectivity			engineering docs
Recreation	*type*		visual/photos existence of facilities	
	amount	Acreage calc.		
Visual	*views*		visual/photos viewshed analysis	
	access	Distance calc.		

Findings and Conclusions

The findings from this analysis are mixed. Success in open space conservation and optimal function with respect to habitat, stormwater, recreation and visual quality, depends as much on the vision and sophistication of the developer as in the development type and design paradigm chosen. In many cases, no matter which development type is chosen, the execution contained serious flaws that compromised the long-term function of the open space system.

Ecological Functions:
Ecological function of the open space system was most impacted by three aspects of the developments: the funding and implementation of maintenance schemes for common areas; the use of private easements to protect ecological function; and the encroachment of private landowners on common areas.

For all of the developments, the proliferation of exotic, invasive plants into natural areas is a critical management problem. Those developments that were the most successful in maintaining native plant species and species diversity (e.g. Prairie Crossing and Spring Island), had a separate foundation established to manage the ecological function of the open space. These entities, separate from the homeowners associations, did not have the voting and financial constraints of typical HOA management, and also were able to maintain focus on the goal of ecological diversity. They were also able to engage in long-term educational programs, to ensure that successive waves of homeowners understood the local ecosystem and the management scheme necessary to maintain it (e.g. prairie burns at Prairie Crossing).

The use of private easements (e.g. Kentlands) to protect tree stands, native vegetation and ecosystem functions was ineffective in reaching those goals. While there was some success at Prairie Crossing in maintaining prairie vegetation on private property, this was accomplished with consistent homeowner education. The City of Gaithersburg noted that they did not have the resources necessary to effectively inspect and manage the easements long term. Therefore, after the initial homeowners turned over, it was difficult to maintain the intent and quality of the easements.

In addition, the details of maintenance schemes for common open space were also key aspects of ecosystem function. Developments tended to focus on tree stands and tree canopies, neglecting the critical composition of the understory. In some cases where the goal was the maintenance of pre-development forest stands (e.g. Kentlands), the tree canopies were protected, but the understory was completely removed by HOA maintenance schemes. This affects not only ecological function, but also stormwater function.

Stormwater Functions:
Although many of the early developments studied did not initially include stormwater functions (e.g. Dufief), all of the case study sites had addressed stormwater functions with some level of retrofit. In some cases (e.g. Kentlands and Dufief), water quality goals were hampered by direct discharge of stormwater into the stream system, and an inability of protected stream buffers and other BMP´s to absorb levels of site runoff created by new development in surrounding

areas. The addition of new, instream BMPs were instituted to mitigate the increased flow. However, with the exception of HighPoint, which was a retrofit of an earlier development, and Spring Island which is isolated form adjacent land uses, each case study site has had to deal with the increase of stormwater from adjacent land uses. These are issues that the initial development design should anticipate, particularly in greenfield development areas.

The increase in stormwater runoff has also increased the need for BMP maintenance measures, an issue that the HOAs were just beginning to deal with. This promises to be in increasing trend as developments (e.g. High Point) implement more onsite infiltration BMPs which catch and hold sediments from stormwater runoff.

Recreation Functions:

All of the case study sites were successful in providing a wide range of recreation functions for the local residents. Although the neotraditional developments touted - and provided – a large range of pedestrian walkways, these were most successful (e.g. Kentlands), when they created a system of pedestrian paths that included mid-block connectors as well as sidewalks and paved trails through open spaces. In addition, the mix of jurisdictional control of protected areas and the lack of removal of invasive exotics in many instances compromised the ability of the areas to serve as native habitat, and attractive, passive recreational areas.

Visual Quality Functions:

Although this aspect of the open spaces was given a more limited, expert-based analysis, it was clear that the inclusion of open space throughout the developments had a positive effect on the visual quality of the developments. Distance to common open space was the lowest for conservation subdivisions, reflecting the design of these developments. Conventional subdivisions, although not necessarily less visually "green," had the highest average distance to open space of all the developments, followed by the neotraditional developments.

Conclusions

This project links three aspects of urban forest and open space protection within residential developments: the science of the benefits of green infrastructure, the design and planning practices intended to achieve those benefits, and the legal tools needed to protect the forests and open spaces. The project identified a number of disconnects between the best design and management practices for green infrastructure in urban and suburban residential developments, and the code requirements that created them. Further research is needed in this area, both for post-occupancy evaluations and also evaluations of developments as they transition from developer control to HOA control, and as the original residents are replaced with new homeowners who may not retain the original values that created the development.

Acknowledgements

Many people have been instrumental in the completion of this project: Craig Johnson, Professor

Emeritus, Department of Landscape Architecture and Environmental Planning, Utah State University for input into the initial conception of the project, and *Graduate Student Researchers* Sarah Rigard, Utah State University for native plants and site inventory and analysis; Vratislava Janovska, Czech University of Life Sciences, Prague, Ailea Omotosho, Stella Lensing, Tara Germond, Zach Silverman, University of Massachusetts Amherst, for GIS analysis; and codes analysis, Pedro Miguel Soto, Paul Gagnon, Jonathan Hymer, University of Massachusetts Amherst.

This paper was supported in part through a grant from the US Forest Service Urban and Community Forestry Program on the recommendation of the National Urban and Community Forestry Advisory Council.

References

Arendt, R. (1996). Conservation Design for Subdivisions. Washington, D.C., Island Press.

Arendt, R., H. Dodson, et al. (1994). Rural by Design. Chicago, American Planning Association.

Arnold, C., L., P. J. Boison, et al. (1982). "Sawmill Brook: An Example of Rapid Geomorphic Change Related to Urbanization." Journal of Geology 90: 155-166.

Arnold, C. L. J. and C. J. Gibbons (1996). "Impervious surface coverage: The emergence of a key environmental indicator." Journal of the American Planning Association 62(2): 243-258.

Beatley, T. (2000). Green Urbanism: learning from European cities. Washington, DC, Island Press.

Beissinger, S. R. and D. R. Osborne (1982). "Effects of Urbanization on Avian Community Organization." Condor 84(1): 75-83.

Brabec, Elizabeth. 2001. An Evaluation of the Effectiveness of Cluster Development in the Town of Southampton, New York. Urban Ecosystems 4: 27-47.

Brown, B. B. and V. L. Cropper (2001). "New urban and standard suburban subdivisions: Evaluating psychological and social goals." Journal of the American Planning Association 67(4): 402-420.

Burgess, J., C. M. Harrison, et al. (1988). "People, parks and the urban green: A study of popular meanings and values for open spaces in the city." Urban Studies 25(6): 455–473.

Burke, I. C., W. K. Lauenroth, et al. (1994). Interactions of Landuse and Ecosystem Structure and Function: a case study in the Central Great Plains. Integrated Regional Models: interactions between humans and their environment. P. M. Groffman, and Gene E. Likens. New York, Chapman & Hall: 154.

Calthorpe, P. (1996). The Next American Metropolis: Ecology, Community and the American Dream. Princeton, Princeton Architectural Press.

Carignan, R. and R. J. Steedman (2000). "Impacts of major watershed perturbations on aquatic ecosystems." Can. J. Fish. Aquat. Sci 57(S2): 1-4.

Cifaldi, R. L., J. D. Allan, et al. (2004). "Spatial patterns in land cover of exurbanizing watersheds in southeastern Michigan." Landscape and Urban Planning 66(2): 107-123.

Davis, J. S., A. C. Nelson, et al. (1994). "The new 'burbs: The exurbs and their implications for planning policy." Journal of the American Planning Association 60(1): 45-.

Duany, A., E. Plater-Zyberk, et al. (2005). Smart Growth: New Urbanism in American Communities.

Ehrenfeld, J. G. (2000). "Evaluating wetlands within an urban context." Urban Ecosystems 4(1): 69-85.

Emmanuel, R. (1997). "Urban vegetational changes as an indicator of demographic trends in cities: the case of Detroit." Environment and Planning B: Planning and Design 24: 415-426.

Eppinka, F. V., J. C. J. M. v. d. Bergha, et al. (2004). "Modelling biodiversity and land use: urban growth, agriculture and nature in a wetland area." Ecological Economics 51(3-4): 201-216.

Fahrig, L. (1997). "Relative effects of habitat loss and fragmentation on population extinction." Journal of Wildlife Management 61: 603-610.

Foresman, T. W., S. T. A. Pickett, et al. (1997). "Methods for spatial and temporal land use and land cover assessment for urban ecosystems and application in the greater Baltimore-Chesapeake region." Urban Ecosystems 1: 201-216.

Francis, M. (2003a). Urban Open Space: Designing for User Needs. Washington, D.C., Island Press.

Francis, M. (2003b). Village Homes: A Community by Design. Washington, D.C., Island Press.

Frank, A. I. (1999). "A theoretical, interdisciplinary framework for environmentally sensitive urban land use and development." The Journal of Regional Analysis and Policy 29(2): 5-30.

Galuzzi, M. R. and J. M. Pflaum (1996). "Integrating Drainage, Water Quality, Wetlands, and Habitat in a Planned Community Development." Journal of Urban Planning and Development 122(3): 101-108.

Geis, A. D. (1974). Effects of urbanization and type of urban development on bird populations. Wildlife in an Urbanizing Environment. J. H. Noyes and D. R. Propulske. Amherst, University of Massachusetts.

Goff, K. M. and R. W. Gentry (2006). "The Influence of Watershed and Development Characteristics on the Cumulative Impacts of Stormwater Detention Ponds." Water Resources Management 20(6): 829-860.

Gordon, D. and S. Vipond (2005). "Gross Density and New Urbanism: Comparing Conventional and New Urbanist Suburbs in Markham, Ontario." Journal of the American Planning Association 71(1): 41-55.

Hammer, T. R. (1972). "Stream channel enlargement due to urbanization." Water Resources Research 8(6): 1530-1540.

Harbor, J. M. (1994). "A practical method for estimating the impact of land-use change on surface runoff, groundwater recharge and wetland hydrology." Journal of the American Planning Association 60(1): 95-109.

Hayden, D. (2001). Redesigning the American Dream. New York, W.W. Norton & Company.

Higgins, K. F., J. L. Oldemeyer, et al. (1996). Vegetation Sampling and Measurement. Research and Management Techniques for Wildlife and habitats. T. A. Bookout. Bethesda, Maryland, The Wildlife Society.

Hopkins, M. I. W. (2001). "Exploring the links between urban morphology and urban ecology." Urban Morphology 5(1): 51-53.

Hostetler, M. and C. S. Holling (2004). "Detecting the scales at which birds respond to structure in urban landscapes." Urban Ecosystems 4(1): 25-54.

Kim, J. and R. Kaplan (2004). "Physical and Psychological Factors in Sense of Community: New Urbanist Kentlands and Nearby Orchard Village." Environment and Behavior 36(3): 313-340.

Lee, C.-M. and K.-H. Ahn (2003). "Is Kentlands better than Radburn? The American Garden City and the new urbanist paradigms." Journal of the American Planning Association 69(1): 50-72.

Machtans, C. S., M.-A. Villard, et al. (1996). "Use of Riparian Buffer Strips as Movement Corridors by Forest Birds." Conservation Biology 10(5): 1366-1379.

McDonnell, M. J., and Steward T. A. Pickett (1990). "Ecosystem Structure and Function along Urban-Rural Gradients: An unexploited opportunity for ecology." Ecology 71(4): 1232-1237.

McDonnell, M. J., Steward T. A. Pickett, Peter Groffman, Patrick Bohlen, Richard V. Pouyat, Wayne C. Zipperer, Robert W. Parmelee, Margaret M. Carreiro, and Kimberly Medley (1997). "Ecosystem processes along an urban-to-rural gradient." Urban Ecosystems 1: 21-36.

Odell, E. A., D. M. Theobald, et al. (2003). "Incorporating Ecology into Land Use Planning: The Songbird's Case for Clustered Development." Journal of the American Planning Association 69(1): 72-80.

Tu, C. C. and M. E. Eppli (1999). "Valuing New Urbanism: The Case of Kentlands." Real Estate Economics 27(3): 425-451.

Tu, C. C. and M. J. Eppli (2001). "An Empirical Examination of Traditional Neighborhood Development." Real Estate Economics 29(3): 485-.

Yaro, R., R. Arendt, et al. (1988). Dealing with Change in the Connecticut River Valley: A Design Manual for Conservation and Development. Cambridge, Massachusetts, Lincoln Land Institute.

Youngentob, K. and M. Hostetler (2005). "Is a New Urban Development Model Building Greener Communities?" Environment and Behavior 37(6): 731-759.