Part 4

Concluding Comments

The Holmes Run/Cameron Run watershed was selected as a pilot study area to inform the Urban Biodiversity Information Node (UrBIN) project about the nature of urban biodiversity; assess the land, water, and biological data and information available to stakeholders; and provide lessons about the use of information in land use decisions to enhance urban biodiversity. These results will be used to develop an approach for the study, planning, and management of urban biodiversity in other watersheds in the Washington region and in other metropolitan areas.

This report contains a Landscape Inventory and Assessment of the watershed to address these objectives and also to provide input to other components of the pilot study. These concluding comments use the findings of this inventory to discuss the nature of urban biodiversity, direction for other studies in this pilot, and lessons for subsequent urban biodiversity projects.

This Inventory and Assessment identified some key components of biodiversity protection in Holmes/Cameron Run watershed.

1. The watershed is densely developed with little remaining vacant land.
2. Riparian areas and stream corridors associated with floodplains, parks, and Chesapeake Bay Resource Preservation Areas (RPAs) serve as the main habitats and corridors.
3. Upland habitats are very limited and, as a result, what remains is important.
4. Local jurisdictions have sophisticated planning staffs with a strong interest in environmental protection.
5. Local stakeholders (members of nonprofit organizations and residents) also have a strong interest in environmental protection and apply this interest in advocacy and volunteer activities.
6. A unique set of integrated tools and programs exist that have helped protect what habitats and corridors remain. These include Chesapeake Bay programs, flood plain management, environmental quality corridors, parks and recreation, the Lake Barcroft Watershed Improvement District, land conservation by land trusts and local governments, and citizen volunteer programs.
7. In this highly urbanized watershed, most opportunities for biodiversity enhancement must come from ecological restoration and redevelopment. These activities should focus on remaining habitats and corridors, mainly stream channels, stream banks, riparian areas, and BMP retrofits. De-armoring selected stream sections and connecting fragmented riparian corridors should be considered.

Several of these issues are discussed below.

4.1 The Nature of Urban Biodiversity in Holmes Run/Cameron Run Watershed

4.1.1 The Highly-Urbanized Case

The Inventory revealed that the Holmes Run/Cameron Run watershed is built out and densely developed. Thus it represents one important type of watershed, the highly urbanized case. Biodiversity in this context is far different from that in wildlands, rural areas, even urbanizing environments, all of which contain functional habitat patches, connecting corridors, and native species. The highly urbanized case is dominated by impervious surfaces in the watershed that not only consume and isolate upland habitat patches, but also exacerbate runoff flow rate and pollution that impact stream and riparian habitats.

Whatever upland patches that remain in highly urbanized watersheds are isolated and provide limited ecological functions. Private yards and the urban forest canopy serve as the main upland habitat elements. These can serve birds and some adapted mammals, but their small area and poor ground connectivity limit their ability to support biodiversity. Upland public parks provide larger patches, but they are used intensively for human recreation, which diminishes their ecological value. Parkland also follows riparian areas and generally larger parks provide the only connection of upland to riparian habitats.

It is these riparian areas that provide the greatest opportunity for biodiversity in highly urbanized watersheds. Often these lands are not developed for a variety of reasons other than biodiversity protection, such as flood damage mitigation, water quality, parks and recreation. These provide remnant patches and corridors, although the continuity of the corridors is often compromised by land development and roads. Still, these riparian lands are the "de facto" biodiversity network in highly urbanized areas and should serve as the foundation on which to build further habitat hubs and links.

4.1.2 Invasive and Native Species

Bradshaw (1999) notes that, while the original ecosystems of city centers have largely been destroyed, cities still harbor a great diversity of ecosystems due to nature's ability to exploit every possible opportunity. These ecological niches are often subject to physical conditions that are more harsh than those found outside the city (hotter, subject to drought or flood, alkaline soils, high levels of nitrogen, and so forth). The result is that generalist species are favored, and invasive exotic species often have a competitive advantage. The Holmes Run/Cameron Run watershed certainly follows this pattern. Based on field reconnaissance and review of applicable site surveys, invasive species dominate the flora, especially the herbaceous vegetation.

Wildland biodiversity protection aims to prevent and eradicate non-native invasive species. In urban areas where non-native species are pervasive, a different approach is warranted. Elimination of exotic species from urban parks is a financial and practical impossibility in most cases. Therefore, efforts to manage urban biodiversity will likely mean control, rather than elimination, of most exotic and invasive species. Research into the degree of threat posed by various invasive species would help landscape managers prioritize their efforts at control and develop realistic management schemes.

4.2 Data for Assessment of Urban Biodiversity

The mission of the NBII program is to collect and aid in the retrieval and use of *existing* biological resources information. An important objective of this pilot study concerns the availability, access, and analysis of biological, geospatial, and other data for use in assessing and managing urban biodiversity. This pilot watershed demonstrates both opportunities and limitations for this objective.

Advances in the quantity and quality of satellite imagery, aerial photography, U.S. Census, and environmental data have created significant opportunities for spatial analysis of ecological resources. For example, higher resolution and frequency satellite data, digital orthophotoquads and quarterquads (DOQQs), digital soils data, in conjunction with GPS-guided field data monitoring, improved GIS software (e.g., ArcGIS, Landscape Analyst, CITYgreen), and affordable plotting hardware, have all made complex spatial analysis increasingly straightforward. As a result, local governments and even community groups in urban areas have become increasingly sophisticated in data management and GIS.

The three jurisdictions have extensive data coverage and sophisticated geospatial information systems. They all made their data layers readily available for this study. While these data can be labeled sophisticated, they are not state-of-the-art/science. More advanced geospatial data that are being developed and used for urban and environmental analysis, including work by the Mid-Atlantic Regional Earth Science Applications Center (RESAC) at the University of Maryland (http://www.geog.umd.edu/resac) has been applied in the Washington, D.C. metropolitan area. Other portions of northern Virginia, such as the Occoquan watershed and its sub-watersheds have more detailed geospatial data than Holmes/Cameron Run. Coordination with RESAC and other such research initiatives will be an important component for the overall UrBIN project.

4.2.1 Limitations in Timing and Availability of Data

This watershed posed some limits for the use of geospatial data to monitor land use change over time. One objective of the pilot is to document recent land use change through geospatial analysis and relate it to both biodiversity indicators and land use management programs. However, high resolution geospatial data necessary for detailed analysis on the scale of this pilot have only been available in the past twenty years. Because this watershed has been largely developed for twenty years, these more recent data cannot be used to document land use change. Unlike urban fringe areas where satellite imagery often reveals dramatic land use changes in the last two decades, the Holmes Run/Cameron Run watershed has experienced small, incremental changes that are not captured easily with 30-m resolution data.

The limited land use change over the past two decades in this watershed also constrains our ability to assess the relationship between land use planning and biodiversity protection. There has generally been limited opportunity to employ recently developed land use and environmental management strategies in this watershed because it has been long built-out. For example, Fairfax County has had the unique environmental quality corridor system since 1990, but it has had limited impact in this already built-out watershed.

Another important consideration was the information that was *not* available. Specific studies of biological communities, flora and fauna surveys, comprehensive water quality assessments, and other such detailed accounts of ecological systems have not been conducted for the Holmes

Run/Cameron Run watershed. It simply has not been studied to the extent that some other watersheds in the Washington D.C. area (Difficult Run, Four Mile Run) have been studied. The lack of detailed biological information was a limiting factor in the pilot study – but a common one for local communities seeking to create conservation plans. Field studies are essential for helping local communities target their resources to the most significant areas in the watershed. However, financial resources are always in short supply for such studies. Inevitably, when studies are done, they are performed incrementally by various parties (academic researchers, local government agencies, and private sector firms). This suggests that the vision of a digital library coordinated by NBII is critical for facilitating urban biodiversity planning by local communities.

4.2.2 Scale of Analysis

Local actions are critical for effective design, restoration, and monitoring of biodiversity. However, regional scale planning is important to provide larger scale landscape networks. The challenge of biodiversity conservation analysis and planning is bridging these scales.

Identifying biodiversity information needs at the community scale in the pilot UrBIN study involved analysis of landscape conditions in a 45-square mile watershed. Many studies of natural resources in metropolitan areas have been based on 30-meter Landsat Thematic Mapper (TM) satellite imagery. Examples include case studies of forest cover conducted by American Forests, the national Gap Analysis program (http://www.gap.uidaho.edu), and urban landscape change research conducted by the Mid-Atlantic RESAC. Landsat TM data proved to be too course for most of the Holmes Run/Cameron Run analyses.

The Holmes Run/Cameron Run watershed is spatially heterogeneous with a fine grain size. Since the planning agencies in the study area (Alexandria, Falls Church, and Fairfax County) have fairly sophisticated GIS departments, many data layers with a resolution of 1”=500’ (original source) were available for the study area. The detailed planimetric data from the local governments allowed for highly accurate measurements of impervious surfaces and patch size/connectivity calculations. While such detail would be essential for applications like restoration planning (in essence, the design scale), it is less useful for obtaining the broad overview of biodiversity needed for regional planning. The challenge, therefore, is to move between the two scales, with regional analysis conducted using 30-meter resolution data and detailed, watershed-scale analysis using the higher resolution data. Eventually, local governments and other interested parties will need detailed information to design physical interventions that protect, enhance, or restore natural areas in the watershed.

4.3 Planning and Managing Urban Biodiversity

Fairfax, Falls Church, and Alexandria, like many communities across the U.S., have been engaged in urban biodiversity conservation, whether they call it that or not. Few communities have the resources or political support for a single purpose program for biodiversity. However, the core objectives of urban biodiversity are advanced by local, federal, and state programs many of which provide significant financial support. They include programs for water quality and watershed protection, stormwater and floodplain management, urban forestry, parks and recreation, redevelopment and conservation design standards, habitat conservation planning, and

other programs. The regulatory and non-regulatory tools used by these programs are also appropriate for urban biodiversity protection. They include overlay zoning, stormwater ordinances, land acquisition, conservation easements, education programs, and others. By partnering with these programs, urban biodiversity can be advanced with little or no additional financial investment.

A number of these compatible environmental programs are discussed below.

4.3.1 Watershed Education and Protection

There are an estimated 3500 local watershed groups and associations in the U.S. The objectives of these groups vary, but most aim to improve natural water quality and preserve and restore stream corridors. These riparian areas are critical corridors for urban wildlife and are essential components of landscape ecology. In addition, watershed protection programs often incorporate upland land use conservation which protects downstream water quality and also provides patch habitats.

The Lake Barcroft Watershed Improvement District demonstrated the effectiveness of a watershed group in planning and implementing watershed protection measures. The WID has the advantage of taxing authority that provides a resource base. Other groups are active in education and stream monitoring. The UrBIN pilot's "Watershed Days" events helped demonstrated educational programs for both school children and adults.

4.3.2 Floodplain Management and Riparian Restoration

All flood-prone communities must implement floodplain management practices to qualify for federally subsidized flood insurance. Floodplain zoning provides a base of protection for stream corridors. However, it only restricts new development within the floodway, and does not address existing development limiting its effectiveness in a built-out watershed such as Holmes Run/Cameron Run. Because it does not protect riparian lands beyond the floodway, floodplain management should be complemented with additional protection.

In the Holmes Run/Cameron Run watershed, this additional protection is provided by Virginia's Chesapeake Bay Preservation Act (CBPA) requirements and Fairfax County's Environmental Quality Corridor (EQC) System. The Resource Preservation Areas (RPAs) designated under CBPA provides the primary riparian corridor protection in the watershed (Figures 3 and 20). The EQC system is an excellent example of a riparian protection program which combines regulations and incentives to keep new development out of sensitive riparian zones. The program's effectiveness in the pilot watershed has been limited because the area was largely developed when the program began.

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4.3.3 Urban Forestry

Forest cover provides critical habitat patches, and forested riparian and other buffers provide critical corridors for urban wildlife. Enhancing forest cover and managing the urban forest are

key elements of protecting urban biodiversity. Hundreds of communities in the U.S. have established Urban Forestry programs and ordinances to protect and enhance forest cover for the wide-ranging economic and environmental benefits it provides.

The landscape assessment revealed that there are few remaining intact forest patches in the Holmes/Cameron Run watershed (Figures 20 and 22), indicating the need for protection and management. All three jurisdictions have tree protection ordinances, and Falls Church has a well-recognized urban forestry program.

4.3.4 Park and Open Space Acquisition and Management

In urban watersheds, if stream corridors provide the principal corridors for urban wildlife, parkland provides the principal core habitats. This is evident in our landscape assessment of the Holmes Run/Cameron Run watershed (Figures 18 and 20). Parks and recreation planning has been evolving in urban areas since the 1970s. Largely viewed as a means for active recreation and scenic amenity, park planning has broadened its objectives to include passive recreation and ecological protection. Greenways, blueways, green prints, and green infrastructure have been added to the vocabulary of park planners.

Green infrastructure is defined as an interconnected network of green space core habitat "hubs" and corridor "links" that conserve natural ecosystem values and functions and provide associated benefits to human populations. The network design and development is intended to be part of the land development process rather than an afterthought. Therefore, it works best in an urbanizing, rather than a built-out, landscape. Still, the concept has relevance as urban areas assess their biodiversity infrastructure (Figures 3, 18, and 20).

The three jurisdictions in the Holmes Run/Cameron Run Watershed have active park programs that now provide the main protected core habitats in the watershed. In addition, land trusts and other non-profit organizations can play an important role in land conservation to protect open space, habitats, and historic resources.

4.3.5 Redevelopment and Conservation Design

Biodiversity planning must also influence new developments to incorporate conservation designs. These designs can protect sensitive areas through clustering with open space provisions, low impact design for stormwater management, and other environmental designs. Localities can implement these designs through regulation and incentives.

Although this approach is most effective in urbanizing areas, it also has applicability in the highly urbanized case through redevelopment. Most of the development opportunities in the Holmes Run/Cameron Run watershed will be redevelopment. Redevelopment projects must comply with stormwater management and other requirements that can reduce impacts.

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4.3.6 Habitat Conservation, Wildlife, and Exotic Species Management

None of the localities in the Holmes Run/Cameron Run watershed have specific urban wildlife programs. However, other communities have developed urban wildlife programs to manage desirable, nuisance, or invasive species, and a few have been required to prepare habitat conservation plans under the Endangered Species Act to protect habitats of listed species while accommodating development. Although these programs are limited in number, they provide useful models and demonstrations of efforts to manage urban biodiversity.

4.3.7 Stakeholder Involvement

Efforts to manage urban biodiversity, as well as ecosystem management and watershed management, require the involvement of key stakeholders. Stakeholders are those effecting change and those affected by it. All of the programs described above engage a wide array of public agencies, private firms, community groups, and citizens to provide mutual education, build support, and develop creative solutions.

In the context of NBII, stakeholders are considered the community of scholars or researchers who are generating and consuming data and research results. When approaching urban biodiversity, however, the range of stakeholders broadens to the community of residents, civic organizations, and local government agencies. Enhancing urban biodiversity requires engagement of not only researchers, but property owners, citizen groups, educational organizations, and local agencies.

As a result, our pilot UrBIN project has sought to engage a local constituency to help in setting priorities, gathering data through volunteer monitoring, and educating the community, with the goal of ultimately acting on the information through land conservation and stewardship. Enhancing urban biodiversity requires a commitment, and it is this constituency who can communicate the community value of biodiversity treasures in the political process.

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REFERENCES

American Forests, “Regional Ecosystem Analysis of the Chesapeake Bay”, 1999.

Bracken, A. and Finley, S. 2001. Lake Barcroft History. Falls Church, VA: Lake Barcroft Watershed Improvement District.

Bennett, Kathleen. State Department of Environmental Quality, Phone discussion, July 1, 2002.

Bolton, Todd. Fairfax County Park Authority, Meeting, July 1, 2002 and July 11, 2002.

Bradshaw, Anthony D. 1999. Natural ecosystems in cities – a model for cities as ecosystems. Plenary Session II, Cary Conference VIII, Institute for Ecosystem Studies. [09/21/02] http://www.ecostudies.org/cary8/plenary2.pdf.

Bromberg, Francine. City of Alexandria Archeologist, Meeting, July 5, 2002.

Bulova, David. Director, Environmental Services, Northern Virginia Regional Commission, Phone conversation, July 8, 2002.

Chesapeake Bay Agreement, 2000. http://www.chesapeakebay.net/agreement.htm

Chesapeake Bay Local Assistance Board, 9VAC 10-20-10 et seq. Chesapeake Bay Preservation Area Designation and Management Regulations, December, 2001.

City of Alexandria Master Plan, Water Quality Management Supplement, January 13, 2001.

City of Alexandria Holmes Run Maintenance Alternatives, December 2001.

City of Falls Church Comprehensive Plan, 1997.

Environmental Quality Advisory Council, 2001 Annual Report on the Environment, Fairfax County, VA.

Fairfax County Stream Protection Strategy, Stormwater Planning Division, DPWES, 2001.

Finley, Stuart. Lake Barcroft Water Improvement District, Meeting, July 15, 2002.

Godefroid, S. 2001. Temporal analysis of the Brussels flora as indicator for changing environmental quality. *Landscape and Urban Planning* 52 (4): 203-224.

Hicks, Bill. Watershed Program Manager, City of Alexandria, Phone discussion ,July 1, 2002.

Kaplan, Noel. Fairfax County Planning and Zoning Department, Meeting, July 1, 2002 and July 11, 2002.

Keenan, Becky. City of Falls Church Animal Warden, Phone discussion, July 18, 2002.

Kelly, Mark. City of Alexandria naturalist. Personal communication, April 2002.

Keystone Center. 1991. Biological Diversity on Federal Lands. Report of a Keystone Policy Dialogue.

Knapp, Michael. Fairfax County Urban Forestry Division. Persoanl communication, April 2002.

Lake Barcroft Watershed Improvement District. 1996. *Watershed and Lake BMPs: Best Management Practices Appropriate for Established Urban Communities*.

Lee, Alex. Assistant Project Coordinator, and Jennifer Sunley, Environmental Specialist, Woodrow Wilson Bridge Project, Meeting, July 5, 2002.

Myers, Matt. Stormwater Planning Division, Department of Public Works and Environmental Services, Phone discussion, July 1, 2002.

Moncrief, Nancy. Ph.D., Curator of Mammalogy, Virginia Museum of Natural History, Phone conversation, July 11, 2002.

Niemela, J. 1999. Ecology and urban planning. *Biodiversity and Conservation* 8(1): 119-131.

Parsons Brinckerhoff Quade & Douglas, Inc. 1974. *Cameron Run Environmental Baseline*, Task Order 10.2. Fairfax County, Virginia.

Reinecke-Wilt, Helen. City of Falls Church Planning Division, Meeting, July 15, 2002.

Savard, J.P.L., P. Clergeau, and G. Mennechez. 2000. Biodiversity concepts and urban ecosystems. *Landscape and Urban Planning* 48(3-4): 131-142.

Schueler, T. 2000. Basic Concepts in Watershed Planning. The Rapid Watershed Planning Handbook

Simmons, Roderick, H., Tice, Meghan D., Strong, Mark T. "Cameron Run Flora and Habitat Survey", City of Alexandria Department of Transportation and Environmental Services, Environmental Quality Division, November 2001.

Small Area Plan, Landmark/Van Dorn, Adopted 1992 Master Plan, Alexandria, VA, Amended 12/12/98.

Small Area Plan, Seminary Hill/Strawberry Hill, Adopted 1992 Master Plan, Alexandria, VA, Amended 6/12/99.

Small Area Plan, King Street/Eisenhower Avenue Metro Station, Alexandria, VA Adopted 1992 Master Plan, Amended 4/15/2000.

Small Area Plan for Historic Preservation, Landmark/Van Dorn, Alexandria, VA, October 1990.

Small Area Plan for Historic Preservation, Seminary Hill/Strawberry Hill, Alexandria, VA, October 1990.

Small Area Plan for Historic Preservation, King Street/Eisenhower Avenue Metro Station, Alexandria, VA, October 1990.

Westbrooks, R.G. 1998. Invasive plants: Changing the landscape of America. Washington, D.C.: Federal Interagency Committee for the Management of Noxious and Exotic Weeds.

Whitford, V., A.R. Ennos, and J.F. Handley. 2001. "City form and natural process" – Indicators for the ecological performance of urban areas and their application to Merseyside, UK. *Landscape and Urban Planning* 57(2): 91-103.

Woodrow Wilson Bridge Project, Final Supplemental Environmental Impact Statement/Section 2(f) Evaluation.

Woodrow Wilson Bridge Project, Water Quality Report, May 2002 and November 2001.

Woodrow Wilson Bridge Project Overview, Fast Facts, June 2002.

www.cblad.state.va.us/bayact.htm, Chesapeake Bay Preservation Act, 10.1-2100, Code of Virginia.

www.dcr.state.va.us/dnh/environ.htm, Virginia's Natural Environments.

www.deq.state.va.us, Virginias' Impaired Water Report, Department of Environmental Quality.

www.geog.umd.edu/resac/northernva.htm, Mid-Atlantic Regional Earth Science Applications Center at the University of Maryland.