CHAPTER 14

Social Mosaics and Urban Community Forestry in Baltimore, Maryland

Morgan Grove, William R. Burch, Jr.,
and S. T. A. Pickett

Introduction: Rationale for Urban Community Forestry

Urbanization is a dominant demographic trend and an important component of global land transformation. By 2005, slightly more than half the world's population will reside in cities, and by 2025 this figure is projected to rise to more than 60 percent of the world's population (Gottdiener and Hutchinson 2000). The developed nations have more urbanized populations; for example, close to 80 percent of the U.S. population is urban. Urbanization has also resulted in a dramatic rise in the size of cities: over three hundred cities have more than ten million inhabitants and fourteen megacities exceed one hundred million. The increasing population and spatial prominence of urban areas are significant reasons for turning our attention to the environmental management of cities and to ensure they are reasonable places to live in the future (Pickett et al. 2001).

In addition to its global dimensions, urbanization has important relationships to regional landscapes. For example, in industrialized nations the conversion of land from wild and agricultural uses to urban and suburban settlement is growing at a faster rate than the population in urban areas. Cities are no longer compact; rather, they sprawl in fractal or spider-like configurations (Makse, Havlin, and Stanley 1995). Consequently, urban areas increasingly intermingle with wild lands. Indeed, even for many rapidly growing metropolitan areas, the suburban zones are growing faster than other zones (Katz and Bradley 1999). The resulting new forms of urban development include edge cities (Garreau 1991) and housing interspersed in forest, shrubland, and desert habitats. While these habitats were formerly controlled by agriculturists, foresters, and conservationists, they are now increasingly

dominated by people possessing resources from urban systems, expressing urban habitats, and drawing upon urban experiences.

Urban ecosystems are the dominant global human habitat of this century in terms of constituency, geography, and influence. This reality has important consequences for social and ecological systems at global, regional, and local scales, as well as for natural resource organizations attempting to integrate ecological function with human desires and behavior. Urban community forestry has a significant role to play in this effort. This chapter paints a broad-brush picture of some of the linkages between communities and forests.

Continuities From Rural to Urban Community Forestry

Community forestry projects typically address local needs and benefit local residents, and they work with people in a community to develop tree-based systems that meet their needs and interests. Historically, community foresters have worked mostly in developing nations to design projects in rural areas that increase access to firewood and fodder, prevent soil erosion, improve soils, and provide other benefits associated with trees. In addition to growing trees, some of the social goals of community forestry include group formation and collective action, institutional development, and the establishment of sustainable social structures and value systems to mobilize and organize groups and individuals (Cernea 1991). In practice, community foresters focus on assisting local people to plan and execute their own projects by providing advice, skills, and inputs to derive the desired goods, benefits, and services the community desires.

The application of community forestry principles in the United States, particularly in urban settings, is more often the exception than the rule for two reasons. First, many people in the U.S. believe that forestry primarily involves the growing and harvesting of trees for commercial wood utilization. Many foresters have perpetuated this relatively narrow definition. Yet forestry includes a much broader set of activities, and "the forestry community—including practicing foresters, forestry educators, and researchers—must expand its concern to understand and articulate the multiple functions of forests" (Lee et al. 1990), and this expanded view of the functions, values, and challenges of forestry is extremely relevant to urban areas. Second,

when people accept the idea of forestry in urban areas, most people confuse urban forestry with arboriculture: the planting and maintenance of individual trees. But, as Smith (1984, 101) indicates, forestry in urban areas provides foresters with a number of challenges and opportunities that extend beyond either the production of pulpwood and sawlogs or the maintenance and care of trees:

> The urban forester seldom knows which problem is going to hit next and works in an environment that is full of them. . . . This means that urban forestry ought to be one of the best fields for foresters, who are, in the long run, esteemed most for the problems they solve and not for how well the trees grow. Physicians do not necessarily thrive in healthy communities, and it is worth noting that the urban forest is full of patients needing cures. The urban forest has opportunities as well as maddening problems. Foresters should not be put off by those who know only what cannot be done.

Urban community forestry activities can occur at several scales and include a variety of environmental, economic, and social goods, benefits, and services (see Box 1; Grove et al. 1994). The continuity from rural to urban community forestry is strikingly highlighted by the fact that the list in Box 1 could be applied equally well to either rural or urban areas. Indeed, our initial inspiration for this list is based upon rural community forestry publications such as Chambers 1985, Cernea 1991, and numerous publications from the U.N. Food and Agriculture Organization (FAO).

Organization of this Chapter

The goal of this chapter is to broaden the continuities of sociological study of communities and forests to include community forestry in urban areas. To achieve this goal, we use experiences gained since 1989 in Baltimore, Maryland, through:

• The Urban Resources Initiative, a partnership among the City of Baltimore's Department of Recreation and Parks, The Parks and People Foundation, and Yale University's School of Forestry and Environmental Studies to initiate research and development projects

for the department based upon international lessons in natural resource management and community development;

• Revitalizing Baltimore, a U.S. Forest Service-leveraged collaboration among federal, state, and local government agencies, community groups, and nonprofit organizations to link urban revitalization with environmental restoration; and

• The Baltimore Ecosystem Study, one of two urban Long Term Ecological Research Projects funded by the National Science Foundation in order to understand the long-term relationships among social and ecological patterns and process in urban areas.

We do not provide in-depth case studies. Rather, we give an overall view of the diverse types of forestry in the Baltimore metropolitan region. Second, we discuss community forestry strategies that have emerged through The Urban Resources Initiative and Revitalizing Baltimore. Finally, we describe four modes of social ecology thinking from the Baltimore Ecosystem Study that are important perspectives for a sociological understanding of communities and forests in urban areas.

A Typology of Forestry in an Urban Ecosystem

Forestland cover in the Baltimore metropolitan region ranges from 2.8 percent in Baltimore City to 35.4 percent in Baltimore County, with forestland cover defined asareas greater than 0.4 hectares, 10 percent stocked, and at least 40 meters wide (Jenkins and Riemann, 2001; Figure 1). There are five primary types of forestry in the Baltimore metropolitan area: (1) regional forestry; (2) stream valleys; (3) large, protected areas; (4) abandoned, industrial areas; and (5) neighborhood areas.

Regional forestry activities focus on management for drinking-water supply, streamwater quality and quantity, biodiversity, recreation, wildlife habitat, and timber and non-timber forest products. For instance, the city has recently completed a comprehensive forest management plan for 6,880 hectares of city-owned watershed properties that addresses community issues associated with water supply, biodiversity, wildlife, recreation, and forest harvesting.

Forestry focusing on the city's 140 km of stream valleys addresses issues of streamwater quality and quantity and recreation, particularly

Box 1. Environmental, Economic, and Social Goods, Benefits, and Services from Community Forestry

Goods

Forest Products
Fruits
Nuts
Craft materials
Poles
Timber
Christmas trees
Firewood

Materials for Community Projects
Tree seedlings
Saplings and small diameter trees
Mulch
Woodchips

Infrastructure

Community land
Irrigation systems
Fencing
Vacant lots and vacant homes (reduce)

Benefits

Social
Improved community organization
Empowerment for collective action
Social bonding within and across generations and cultures, etc.
Improved community identity and pride
Immigration vs. emigration from urban areas
Safety (reduced crime)
Improved continuity and neighborhood stability
Development of microbusinesses based upon community gardens, greenhouses, agroforestry, and recycling

Environmental
Improved air quality
Reduced air temperatures
Improved water quality
Neighborhood beautification
Increased wildlife habitat
Identification of environmental hazards in the community

Services
Educational
Technical support and training
Tree planting and maintenance skills
Expansion of traditional educational skills (improvement in reading, writing, math, science, and history skills)
Identification of long-term job and career paths in environmentally related professions for local residents
Greater awareness and understanding of local links to regional resources such as the Chesapeake Bay (e.g. through the dumping of motor oil in storm sewers)
Organizational
Leadership skills
Community organization
Community cohesion
Collective action

greenway projects in the city's three primary watersheds: Gwynns Falls, Jones Falls, and Herring Run. Regional and streamvalley forestry are frequently assessed in the context of the Chesapeake Bay watershed.

Forestry in large protected areas, or parks greater than 15 hectares, deals extensively with reforestation and forest succession in order to promote aesthetics, particularly scenic qualities, water and air quality, and wildlife habitat. In these areas, forests are balanced with grass and picnic areas.

As manufacturing in Baltimore continues to decline, the extent of abandoned, industrial areas has grown. Many of these areas are along the city's harbor or adjacent to decommissioned rail lines and numerous sites are classified as brownfields, sites identified by the U.S. Environmental Protection Agency as having low-level toxic contamination. Forestry in these areas centers on site remediation, greenway recreation along the harbor or rail-to-trail lines, and wildlife habitat.

Finally, forestry in neighborhood areas attempts to address the city's 276 neighborhoods and a range of activities, including local parks, 6,500 abandoned lots, community gardens and tree nurseries, and approximately three hundred thousand street trees.

Community Forestry Strategies for Urban Revitalization and Environmental Restoration

Drawing lessons initially from rural community forestry activities in tropical countries, community forestry in Baltimore has emphasized the importance of three goals: sustainable productivity of the goods, benefits, and services associated with the five types of forestry listed above and included in Table 1; equity in the distribution of benefits and burdens of such productivity; and a sense of cultural and ecological continuity. Consequently, a significant aspect of urban community forestry must be tied to real gains in productivity, learning, leadership, health, security, housing, and employment. Also, various types of social units exist that might be predisposed to participate in urban forestry activities (Grove et al. 1994). These include:

- Natural (existing) social units, such as individuals, families, or tightly knit ethnic or kinship groups or subgroups;
- Groups organized specifically to plant, protect, or cultivate trees, such as local or national environmental organizations, participants in community gardens, and stream restoration groups; and
- Groups established for purposes other than forestry, but willing to undertake forestry-related activities as well. These might include religious organizations, block clubs, neighborhood associations, and parent/teacher associations.

Community forestry programs in Baltimore have responded to the five primary types of forestry discussed above by adopting and relating five dominant strategies for their programs: regional analysis, organizational networks, organizational change, community development, and information networks, education, and training.

Regional Analysis

Regional analysis has involved all three types of groups listed above in identifying forestry issues, collecting and analyzing data, and proposing policies, plans, and management strategies. Results from these efforts include the Gwynns Falls Human Ecosystem Atlas (http://www.parksandpeople.org/gfatlas.pdf), hydrologic field measurements and modeling projects that incorporate social and ecological patterns and processes, and forest landscape analyses to address drinking-water supply, biodiversity, wildlife habitat, recreation, and forest products. For instance, Brun and Band (2000) have modeled the progressive

effects of land use change on streamflow in the Gwynns Falls watershed over a twenty-year time frame. Band et al. (2002) have been measuring and modeling the effects of urban development and infrastructure on soil moisture patterns, and runoff and water quality in forested and suburban catchments, while Law et al. (forthcoming) have compared lawn extent and management practices in different neighborhoods as they affect catchment nitrogen budgets. In addition, Costanza et al. (2002) have developed integrated ecological economic models that examine the effects of historic and future scenarios of land use and policies—human settlements and land management practice—on hydrology, plant productivity, and nutrient cycling in the landscape (http://www.uvm.edu/giee/giee_projects.html).

Organizational Networks

Like community forestry activities in nonindustrialized nations, Revitalizing Baltimore has played an important role as a facilitator, connecting a variety of individuals and institutions that have common interests but little coordination in their efforts. In order to forge

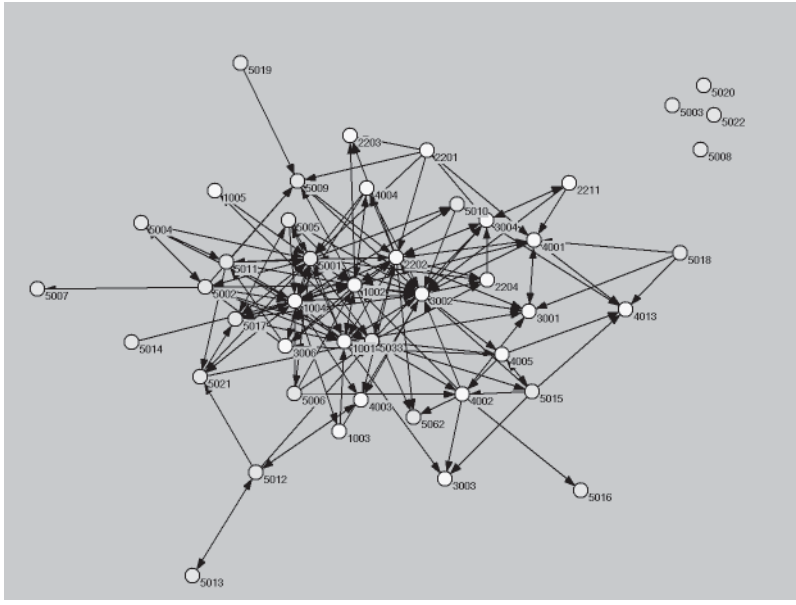

Figure 1. Organizational network structure of the natural resource management regime in the Gwynns Falls watershed, Baltimore, Maryland (Dalton 2001).

linkages, Revitalizing Baltimore works to build networks between formal social structures, within and between local, state, and federal public agencies, and to integrate formal structures with informal social structures, neighborhoods, nonprofit and civic organizations, and community associations (Figure 1). As these networks are knit together, projects become more sustainable and forestry activities become more linked to participants' needs. This enables participants to act upon the connections between themselves, their communities, and their environment (Dalton 2001).

Organizational Change

In many forestry projects, governmental and non-governmental agencies have tried to change or reform communities to conform to the goals of the planning organization. This strategy of community development has begun to change, and in many cases community forestry projects have recognized the importance of working to change the goals of governmental agencies to be more responsive to the needs and interests of the communities themselves (Whyte 1991; Dalton 2001). Community participation in urban forestry depends on the level of community organization. In some cases, the community already has a strong neighborhood association, church leadership, or informal neighborhood leaders. In other cases, the community forestry program works with selected individuals to help develop community leadership, training and education programs, and other community development activities.

Community Development

Revitalizing Baltimore works in partnership with community residents to determine the type of project most appropriate for each individual community. This is necessary since a number of diverse communities exist within an urban area, including geographically based communities and affiliation-based communities. Further, none of these communities are homogeneous and many might contain discrete interest groups.

Different types of property regimes—state, private, community, and open access—play a significant role in community forestry activities, since access to land and local rights enable the community to regulate local resources (Grove 1995; McManus and Steer 1998; Parker et al.

1999). Community members have used forestry projects such as tree nurseries, pocket parks, and sliver parcels to reclaim derelict properties from absentee landowners. Many neighborhood associations believe that these projects increase local control of the neighborhood, attract potential residents from outside the community, and decrease rates of vacancy. At the same time, local residents who are renters are more inclined to purchase a house in the neighborhood and to make a commitment to the area because they feel that the community is stable and a desirable place to live. This investment in the community has financial as well as social rewards, since property values will increase as more people choose to live in the area.

In one neighborhood, the community has received official permission to develop tree nurseries and community gardens on city-owned properties. After the neighborhood has developed a credible record and a sustainable organization for community management, the city will transfer the title to the community organization. In a similar example, a community has taken on the responsibility for the management of an entire stream valley park that runs through their neighborhood. The community's management of the area ensures that the park is maintained at a level higher than the city could afford (Burch and Grove 1993).

Information Networks, Education, and Training

A critical component to regional analysis, organizational networks, organizational change, and community development is information networks, education, and training. Revitalizing Baltimore has become a central node, helping to link consumers and suppliers of data, knowledge, education, and training in order to help the community forestry strategies listed above to be more effective, efficient, and equitable. Although it has not been broadly addressed, an underlying question from the rural sociology literature is the relationship between characteristics of public agencies, nonprofit organizations, and neighborhoods; different types of information networks and education and training programs; and the adoption of community forestry innovations (Burch and DeLuca 1984).

Framing Community Forestry in a Social and Ecological Context: Patches and Mosaics

The preceding sections focused on practical applications and experiences from our urban community forestry work since 1989 in Baltimore and our previous experiences in international rural community forestry. These strategies enhance existing approaches to community forestry by promoting a complex social-ecological approach. The following section further describes this social-ecological approach in terms of four modes of thinking from the Baltimore Ecosystem Study: spatial, temporal, scalar, and systems thinking. We propose that these four ways of thinking provide a structure and generalizable complement to the practical and particular aspects we have described for linking communities and forests in urban areas. These modes of thinking are necessary for a truly social-ecological approach to urban community forestry because they are the foundation for integrating the physical, biological, and social dimensions in which urban communities and forests exist.

Spatial Thinking

Understanding communities and forests in urban areas requires many forms of spatial thinking. We intuitively know that all human behavior occurs in space and is spatially dependent at many scales. For instance, the path an individual walks down a street may depend upon and respond to the path of an approaching person. Changes in one community may depend upon changes in a neighboring community, or the competitive advantage of one port versus another may depend upon their differential access to maritime and land routes for transporting goods.

While behaviors occur in space and are spatially dependent, it is also important to appreciate that the spatial characteristics of cities are strikingly heterogeneous (Pickett et al. 2001). For instance, sharp contrasts between neighborhoods are a familiar characteristic of cities (Clay 1973). Within the span of a city block, which is on the order of two hundred or fewer meters, an observer may cross several obvious boundaries. Different kinds of commercial use, shifts between owner-occupied and rental properties, and shifts in socioeconomic resources available to residents are but some of the many contrasts. Such

heterogeneity is not unique to dense, central urban districts (Gottdiener and Hutchinson 2000). In fact, the contemporary suburb is frequently zoned for even more discrete transitions than the traditional mixed use of older cities: residential streets, feeder streets, commercial streets, strip malls, regional malls, and industrial parks are notable patches in the suburban landscape. Of course, the scale of transition in post-World War II suburbs tends to be coarser than that of older neighborhoods and districts due to the shift in dependence on the automobile. However, spatial patchiness in the social, economic, and infrastructural fabric of metropolitan areas remains one of their most obvious features.

Understanding the significance of spatial heterogeneity to the allocation of critical natural, socioeconomic, and cultural resources is crucial for understanding communities and forests in urban areas (Grove and Burch 1997; Pickett et al. 1997). For instance, the spatial characteristics of the Gwynns Falls watershed in Baltimore (Figure 2)—the adjacency, connectivity, and configuration of land uses—can have important implications for the economic structure, interactions among neighborhoods, and hydrology of the watershed. Different communities within an urban watershed, due to their level of organization, access to civic decision making, and perceived desirability, are able to attract varying levels of public and private green investments. Some of these green investments are parks, trees, stormwater systems and their maintenance. However, the character of adjacent communities can also affect whether or not investments are made in a community. For instance, communities whose desirability might be characterized as "medium" and bordered by "low" communities are less likely to receive green investments than "medium" communities bordered by

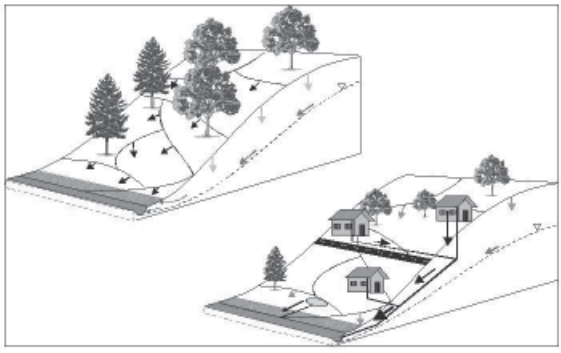

Figure 2. Changes in watershed connectivity: before and after urbanization.

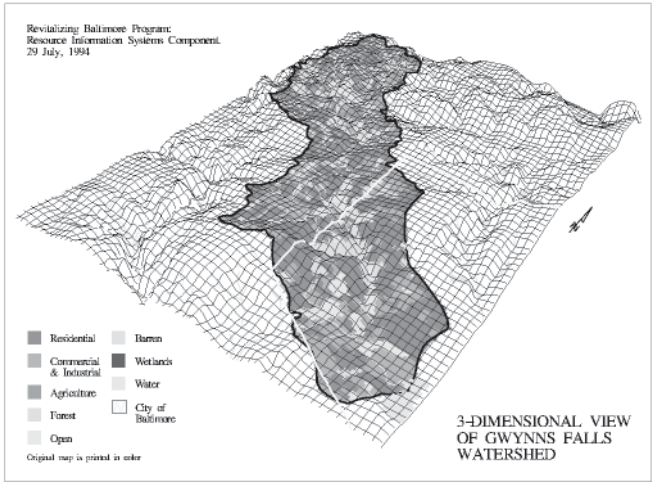

Figure 3. A three-dimensional view of the Gwynns Falls watershed.

"high" communities. Therefore, the spatial "neighborhood" of communities can affect the investment of public and private resources. The presence of green infrastructure, in turn, affects the hydrologic quantity, quality, timing, and rate that each community makes to the streams in the watershed, which represent each community's hydrologic profile. Further, the hydrologic adjacency, connectivity, and configuration of the community mosaic can affect the overall hydrologic dynamics of the watershed (Band et al. 2002; Figure 3). Thus, spatial characteristics can be critical for understanding complex physical, biological, and social interactions in urban watersheds.

Temporal Thinking

Temporal thinking is crucial to understanding urban communities and forests, particularly because the temporal dynamics of urban areas are probably more elusive a reality than spatial heterogeneity. We often have to reconcile remembrances of the "good old days" with our determined belief in perpetual progress and growth. And to explain many changes over time, we search for linear, cause-and-effect relationships. However, urban communities and forests are frequently characterized by social and ecological legacies. For instance, the historical relationships among soils, floodplains, and waterborne diseases (Hinman 2002) might be the best explanation for the location of low-income housing today. Relationships might be nonlinear, sudden rather than gradual switches in state. . A neighborhood might

progressively change until a critical threshold is reached, and then a neighborhood with predominantly elderly residents might shift to one with a majority of parents with young children (Johnson 2001). There might also be time lags between changes in neighborhood status and changes in environmental conditions (Grove 1996). Related processes might also be in effect at different time scales. For instance, stream measurements of nitrogen along one stream in the Gwynns Falls watershed are inordinately high. The areas adjacent to the stream are residential land uses and some individuals have claimed that the high levels of nitrogen are associated with the residential urbanization of the stream. Because of the amounts and timing of the nitrogen, however, the Baltimore Ecosystem Study (BES) scientists have determined that the source of the nitrogen is groundwater from agricultural application of fertilizers thirty years ago. This legacy is the result of the fact that groundwater transport in this area is approximately thirty years. Thus, the causal explanation of an urban watershed's dynamics can be quite different with knowledge of different rates of ecological processes—surface runoff versus groundwater transport—and knowledge of the social history of an area. It is important, therefore, to recognize that various social and ecological processes operate over different time spans, can be nonlinear, and have persistent legacies (Lee et al. 1990; Allen and Hoekstra 1992; Grove and Burch 1997).

Scalar Thinking

The preceding sections help to appreciate the fact that different social and ecological processes associated with urban communities and forests occur at different spatial and temporal scales. Scalar thinking, hierarchy theory, and panarchy theory (Berkes and Folke 1998; Holling 2001) extend this appreciation by compelling us to think about how strong and weak linkages within and between scales are related to one another; in particular, how lower levels of organization interact to generate higher-level behaviors and how higher-level units control those at lower levels (Johnson 2001; Figure 4).

The BES has worked to articulate and understand the dynamics of urban communities and forests at different social scales (Pickett et al. 1999; Grimm et al. 2000). Some examples of issues studied include: (1) regional variations: urban-rural dynamics (Morrill 1974; Cronon 1991; Rusk 1993); (2) municipal variations: distribution and dynamics

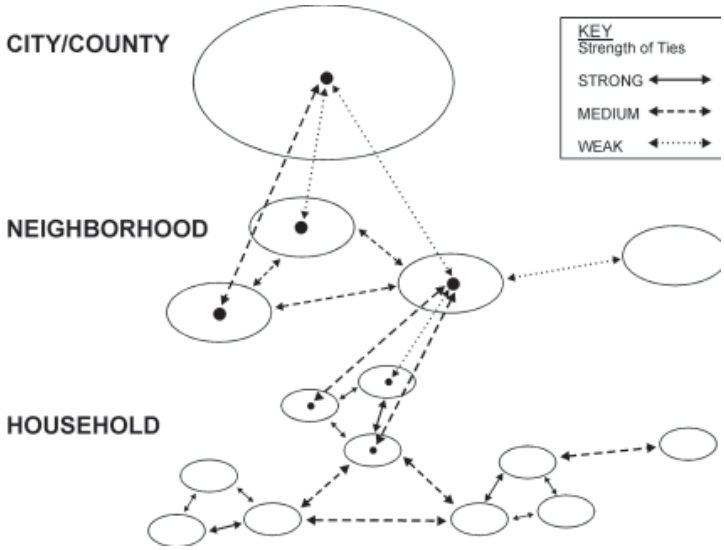

Figure 4. Example of an urban hierarchical system (adapted from Urban et al. 1987)

of land use change (Burgess 1925; Hoyt 1939; Harris and Ullman 1945; Guest 1977); (3) neighborhood variations: power relationships between neighborhoods (Shevky and Bell 1955; Timms 1971; Johnston 1976; Agnew 1987; Logan and Molotch 1987; Harvey 1989); and (4) household variations: household behavior within communities (Fortmann and Bruce 1988; Fox 1992; Grove and Hohmann 1992; Burch and Grove 1993; Grove 1995).

The following summary of a study of social stratification and vegetation in Baltimore's Gwynns Falls watershed illustrates how spatial, temporal, and scalar thinking can converge in our understanding of urban communities and forests. This study focused on how the social stratification of groups (i.e., power structures) affects green investments made by private firms and public agencies in neighborhoods within the watershed (Grove 1996). The theoretical foundation for this question comes from Logan and Molotch's (1987) political economy of place theory. Logan and Molotch argued that patterns and processes of social stratification between people and place have significant environmental implications. According to their theoretical framework, the key social variables affecting access to power, the allocation of private and public resources, and subsequently the biophysical characteristics of wealthy residential areas include: (1) the presence of homeowners and the absence of renters or absentee landowners; (2)

residents who are able to migrate to more desirable and healthy areas, effective at community organizing, or willing to become involved in local politics; (3) elites who have differential access to government control over public investment, pollution control, and land use decision making. Conversely, low-income and heavily populated minority areas are disproportionately in or next to polluted areas and their residents are unable to migrate to more desirable and healthy areas and have fewer human resources in terms of leadership, knowledge, tactical and legal skills, and communication networks to manipulate existing power structures.

Logan and Molotch (1987) and Choldin (1984) described these socio-cultural and biophysical interactions as a dynamic process. In this process, residents act individually and collectively to control and maximize the exchange and use values of their neighborhood by restoring, maintaining, or improving their current place or migrating to a more desirable place. Some of these acts of restoring, maintaining, or improving include changing the biophysical characteristics of residential areas (e.g., planting trees, parks, lawns, and community gardens, and clean streets). These restoration activities produce an environment that is both socially and biophysically heterogeneous.

Logan and Molotch's theory was applied to one of the watersheds of the BES study area. The selection of variables and indices of social stratification for the classification of social areas or neighborhoods used the theoretical parameters identified by Logan and Molotch (1987), Choldin (1984) and Bullard (1990). These variables and indices were also further adjusted to incorporate recent adjustments recommended by Johnston (1976), Murdie (1976) and Hamm (1982). These indices of residential social stratification included a socioeconomic index (income and education), a household index (homeownership), and an ethnicity index (race and ethnicity).

A classification of vegetation structure was developed using Bormann and Likens' (1979) theory of vegetation regulation of watershed hydrology and the data requirements of various hydrologic ecosystem models. At the ground surface, areas were classified as impervious or pervious. At the canopy level, areas were classified as having or not having a vegetation canopy layer. Statistical analyses of data were conducted for residential land uses only. In addition, the research included a temporal component (1970 to 1990) to explore possible time lag or nonlinear relationships.

The results indicated a significant relationship between two of the three indices of social stratification—socioeconomic and ethnicity—and vegetation structure. Further, a time lag was found between independent variables and dependent variables (1970 social data and 1990 biological data). In retrospect, the temporal results indicating a time lag were realistic considering that the primary response variable being measured—tree canopies—takes time to grow and die. This highlighted the importance of considering the rate at which response variables may change and the time frames necessary to measure that change, thus demonstrating the significance of temporal thinking.

The absence of a relationship between indices of homeownership and vegetation structure was puzzling since the literature suggested such a relationship should exist. Extensive literature from rural forestry has indicated the importance of ownership and property regimes to land cover (Coase 1960; Hardin 1968; Ciriacy-Wantrup and Bishop 1975; Fortmann and Bruce 1988; MacPherson 1989; Raintree 1987; Ostrom 1990; Bromley 1991). Further, community foresters and community organizers in Baltimore City reported the significance of ownership to their activities. Thus, alternative explanations needed to be explored.

The spatial structure of the three social-stratification indices was re-examined to try to tease apart the lack of a relationship between ownership and land cover on a watershed or city/county scale (Figure 4: neighborhood variations), which suggested the need to examine these data at a different scale. Perhaps the relationship between home ownership and vegetation structure was effective at an alternative scale. Based on an initial exploratory data collection, scale dependence for this relationship was verified (McManus and Steer 1998); the relationship between ownership and vegetation structure occurred at a neighborhood level (Figure 4: household variations).

Systems Thinking: A Human Ecosystem Approach

Systems thinking using a human ecosystem approach (Machlis et al. 1997) provides the means for linking space, time, and scale in our understanding of urban communities and forests. The explicit incorporation of an ecosystem approach within the social sciences dates to Duncan (1961; 1964). Recently, the social sciences have focused increasingly on the ecosystem concept because it has been proposed

and used as an organizing approach for natural resource policy and management (Machlis et al. 1997; Cortner and Moote 1998.

The ecosystem concept and its application to *Homo sapiens* is particularly important because of its utility as an analytical framework for integrating the physical, biological, and social sciences. The concept owes its origin to Tansley (1935), in one of modern ecology's clearest yet most subtle founding documents. Tansley noted that ecosystems could be of any size, as long as one's concern was with the interaction of organisms and their environment in a specified area. He noted further that the boundaries of an ecosystem are drawn to answer a particular question. Thus, there is no set scale or way to bound an ecosystem. Rather, the choice of scale and boundary for defining any ecosystem depends upon the question asked and is the choice of the investigator. Further, each investigator may place more or less emphasis on the chemical transformations and pools of materials drawn on or created by organisms; or on the flow, assimilation, and dissipation of biologically metabolizable energy; or on the role of individual species or groups of species on flows and stocks of energy and matter. The fact that there is so much choice in the scales and boundaries of ecosystems, and how to study and relate the processes within them, indicates the profound degree to which the ecosystem represents a research approach rather than a fixed scale or type of analysis.

The application of an ecosystem approach to urban communities and forests requires an analytical framework. The analytical framework or parts diagram (Figure 5) shown here and presented elsewhere (Machlis et al. 1997; Pickett et al. 1997) is not a theory in and of itself. As Machlis et al. (1997) noted: "This human ecosystem model is neither an oversimplification nor caricature of the complexity underlying all types of human ecosystems in the world. Parts of the model are orthodox to specific disciplines and not new. Other portions of the model are less commonplace—myths as a cultural resource, justice as a critical institution. Yet we believe that this model is a reasonably coherent whole and a useful organizing concept for the study of human ecosystems as a life science."

Several elements are critical to the successful application of this framework to urban community forestry. First, it is important to recognize that the primary drivers of urban communities and forests are both biophysical and social—there is no single, determining driver—and the relative significance of drivers may vary over time (Burch and

DeLuca 1984). Second, components of this framework need to be examined in the context of each other simultaneously (Machlis 1997) with particular concern for how ecological components influence social patterns and processes; how social patterns and process influence the use and management of urban forests; and how these interactions are changing over time. Finally, it is necessary to examine how dynamic biological and social allocation mechanisms—ecological, exchange, authority, tradition, and knowledge—affect the distribution of critical resources—energy, materials, nutrients, population, genetic and non-genetic information, population, labor, capital, organizations, beliefs, and myths—in the context of urban communities and forests (Parker and Burch 1992).

A patch dynamics approach represents both a theoretical and practical means for unifying an awareness of spatial heterogeneity, temporal dynamics, hierarchical nesting, and an ecosystem approach in urban community forestry (Burch and Grove 1997; Pickett et al. 1997; Grimm et al., 2000; Pickett et al. 2001). For instance, a patch dynamics approach focuses explicitly, not only on the spatial pattern of heterogeneity at a given time, but also on how and why the pattern

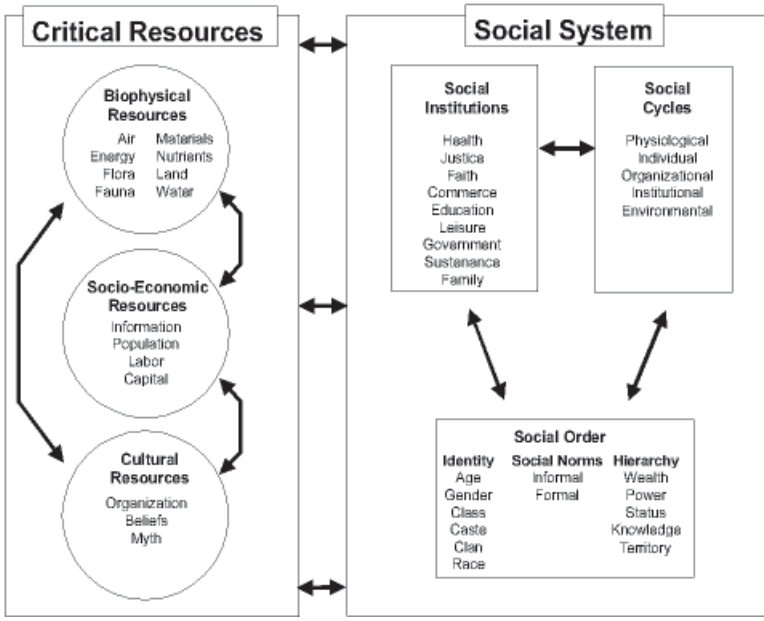

Figure 5. A framework for human ecological systems (from Machlis, Force, and Burch 1997)

changes through time, and how that pattern affects ecological and social processes. Because cities are both expanding and changing within their boundaries, the dynamic aspect of this approach is crucial to a complete understanding of urban communities and forests. Change occurs over time in the resources available for the management of urban forests and in the requirements and interests of specific communities. In Baltimore, patch dynamics are conspicuous both at the suburban fringe and in the large collection of vacant buildings and empty lots within the dense older urban areas. In both the fringe and core patches, ecological processing of water and nutrients, and the provision of goods and services are not constant in time. The dynamics of patches in and around the city have implications for the ecological processes and status of areas well beyond the city, and even beyond the present suburban and exurban areas. The search for open land, development opportunities, and changes in the economics of farming and production forestry all influence and are influenced by urban patch dynamics.

Conclusion

Like farmers clearing the land in order to see the fields they plan to furrow, we have purposefully painted a broad perspective in this chapter because urban community forestry as a whole is still an emerging area of activity. We believe these fields are fertile for exploring a sociological understanding of communities and forests in urban areas, particularly by weaving theories and approaches from both rural and urban sociology. Already, theories of social stratification, property regimes, collective action, and adoption of innovation from rural sociology have appeared in our work.

What is clear already from our work in Baltimore, both from research and practice, is that there is no single type of urban community forestry approach, theory, or way of thinking. There are multiple types of community forestry in urban areas, requiring crosscutting strategies, theories, and modes of thinking. A patch dynamics approach is both a theoretical and practical means for addressing such complexity. Our efforts in Baltimore illustrate that any approach to community forestry in urban areas will need to draw upon and synthesize knowledge from the social and ecological sciences; both people and forests need to be embraced. The need for such knowledge has never been more pressing,

as the constituency, geography, and influence of urban areas come to dominate this century.

Acknowledgments

We would like to gratefully thank the U.S. Forest Service's Northeastern Research Station and the Baltimore Ecosystem Study (NSF Grant DEB-9714835 and EPA Grant R-825792-01-0). This paper has benefited from insights gained through interactions with generous collaborators, students, and community partners from Baltimore since 1989.

References

Agnew, J. A. 1987. *Place and Politics: The Ggeographical Mediation of State and Society.* Boston, MS: Allen & Unwin.

Allen, T. F. H., and T. W. Hoekstra. 1992. *Toward a United Ecology.* New York: Columbia University Press.

Band, L. E., C. L. Tague, P. Groffman, and K. Belt, 2001. "Forest Ecosystem Processes at the Watershed scale: Hydrological and Ecological Controls of Nitrogen Export." *Hydrological Processes*, v.15, 2013-28.

Band, L. E, C. Tague, S. Kenworthy, and N. Law. 2002. Coupling water, carbon and nitrogen cycling with variable source area dynamics in forested and urban catchments. Paper given at the Spring Meetings of the American Geophysical Union, Washington, May 2002.

Berkes, F., and C. Folke. 1998 *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.* New York: Cambridge University Press (paperback edition 2000).

Bromley, D. W. 1991. *Environment and Economy: Property Rights and Public Policy.* Cambridge, MA: Basil Blackwell, Inc.

Bormann, F. H., and G.E. Likens. 1979. *Pattern and Process in a Forested Ecosystem. Disturbance, Development and the Steady State Based on the Hubbard Brook Ecosystem Study.* New York: Springer-Verlag.

Brun, S. E., and L. E. Band 2000. "Simulating Runoff Behavior in an Urbanizing Watershed." *Computers, Environment and Urban Systems,* v.24, 5-22.

Bullard, R.D. 1990. *Dumping in Dixie: Race, Class and Environmental Quality.* Boulder, Colorado: Westview Press.

Burch, W. R., Jr., and D. R. DeLuca. 1984. *Measuring the Social Impact of Natural Resource Policies.* Albuquerque: New Mexico University Press.

Burch, W. R., Jr., and J. M. Grove. 1993. "People, Trees and Participation on the Urban Frontier." *Unasylva* 44(173):19-27.

Burgess, E. W. 1925. "The Growth of the City: An Introduction to a Research Project." Pp. 47-62 in *The City*, R. E. Park, E. W. Burgess, and R. D. McKenzie (eds.). Chicago, IL: University of Chicago Press.

Cernea, M. 1991. "The Social Actors of Participatory Afforestation Strategies." Pp. 340-93 in *Putting People First: Sociological Variables in Rural Development* (2nd ed.), M. Cernea (ed.).New York: Oxford University Press.

Chambers, R. 1985. *Rural Development: Putting the Last First*. Essex, England: Longman Publishing Group.

Choldin, H. M. 1984. "Subcommunities: Neighborhoods and Suburbs in Ecological Perspective." Pp. 237-76 in *Sociological Human Ecology: Contemporary Issues and Applications*, M. Micklin and H. M. Choldin (eds.). Boulder, CO: Westview Press.

Ciriacy-Wantrup, S. V., and R. C. Bishop. 1975. "Common Property as a Concept in Natural Resource Policy." *Natural Resources Journal*, 15: 713-27.

Clay, G. 1973. *Close-Up: How to Read the American City*. Chicago, IL: University of Chicago Press (paperback 1980.

Coase, R. H. 1960. "The Problem of Social Cost." *Journal of Law and Economics*, 3: 1-44.

Cortner, H. J., and M. A. Moote. 1998. *The Politics of Ecosystem Management*. Washington, DC: Island Press.

Costanza, R., A. Voinov, R. Boumans, T. Maxwell, F. Villa, L. Wainger, and H. Voinov. 2002. "Integrated Ecological Economic Modeling of the Patuxent River Watershed, Maryland." *Ecological Monographs* 72(2):203-31.

Cronon, W. 1991. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton & Co.

Dalton, S. E. 2001. The Gwynns Falls watershed: a case study of public and non-profit sector behavior in natural resource management. Published Doctoral dissertation, Johns Hopkins University, Baltimore MD.

Duncan, O. D. 1961. "From Social System to Ecosystem." *Sociological Inquiry* 31:140-49.

Duncan, O. D. 1964. "Social Organization and the Ecosystem." Pp. 37-82 in Handbook of Modern Sociology, R. E. L. Faris (ed.). Chicago, IL: Rand McNally & Co.

Fortmann, L., and J. W. Bruce, editors. 1988. *Whose Trees?: Proprietary Dimensions of Forestry*. Boulder, CO: Westview Press.

Fox, J. 1992. "The Problem of Scale in Community Resource Management." *Environmental Management* 16(3):289-97.

Garreau, J. 1991. *Edge City: Life on the New Frontier*. New York: Doubleday.

Gottdiener, M., and R. Hutchinson. 2000. *The New Urban Sociology* (2nd Edition). New York: McGraw Higher Education.

Grimm, N. B., J. M. Grove, C. L. Redman, and S. T. A. Pickett. 2000. "Integrated Approaches to Long-term Studies of Urban Ecological Systems. *BioScience* 70:571-84.

Grove, J. M. 1995. "Excuse Me, Could I Speak to the Property Owner, Please?" *The Common Property Resources Digest* 35(September): 7-8.

Grove, J. M. 1996. The relationship between processes of social stratification and vegetation of an urban-rural watershed. Published dissertation. School of Forestry & Environmental Studies. Yale University, New Haven, CT.

Grove, J. M., and W. R. Burch, Jr. 1997. "A Social Ecology Approach to Urban Ecosystem and Landscape Analyses." *Journal of Urban Ecosystems* 1(4):259-75.

Grove, J. M., and M. Hohmann. 1992. "GIS and Social Forestry." *Journal of Forestry* 90(12):10-15.

Grove, J. M., K. Vachta, M. McDonough, and W. R. Burch, Jr. 1994. "The Urban Resources Initiative: Community Benefits from Forestry." Pp. 24-30 in *Urban and High Recreation Settings,* P. H. Gobster (ed.). USDA Forest Service, St. Paul, MN. Gen. Tech. Rep. NC-163.

Grove, J.M. and W.R. Burch 1997. "A Social Ecology Approach to Urban Ecosystems and Landscape Analysis." *Urban Ecosystems* 1(4):185-199.

Guest, A. M. 1977. "Residential Segregation in Urban Areas." Pp. 269-336 in *Contemporary Topics in Urban Sociology*, K. P. Schwirian (ed.). Morristown, NJ: General Learning Press.

Hamm, B. 1982. "Social Area Analysis and Factorial Ecology: A Review of Substantive Findings." Pp. 316-37 in *Urban Patterns: Studies in Human Ecology.* A. Theodorson (ed.). University Park, Pennsylvania: The Pennsylvania State University Press.

Hardin, G. 1968. "The Tragedy of the Commons." *Science* 162: 1243-48.

Harris, C. D., and E. L. Ullman. 1945. "The Nature of Cities." *Annals of the American Academy of Political and Social Science* 242:7-17.

Harvey, D. 1989. *The Urban Experience.* Baltimore, MD: Johns Hopkins University Press.

Hinman, Sarah E. 2002. Urbanization and Public Health: A Study of the Spatial Distribution of Infant Mortality in Baltimore, Maryland, 1880. Unpublished M.A. thesis, Department of Geography, Ohio University.

Holling, C. S. 2001. "Understanding the Complexity of Economic, Ecological, and Social Systems." *Ecosystems* 4:390-405.

Hoyt, H. 1939. The Structure and Growth of Residential Neighborhoods in American Cities. Washington: Federal Housing Administration.

Jenkins, J. C., and R. Riemann. 2001. "What Does Nonforest Land Contribute to the Global C Balance?" In Proceedings, Third Annual FIA Science Symposium, Ron McRoberts and John Moser (eds.). Traverse City, MI, Oct. 18-20, 2001. . St. Paul MN: USDA Forest Service General Technical Report NC-GTR-xx. In press.

Johnson. S. 2001. *Emergence: The Connected Lives of Ants, Brains, Cities, and Software.* New York: Scribner.

Johnston, R. J. 1976. "Residential Area Characteristics: Research Methods for Identifying Urban Sub-areas—Social Area Analysis and Factorial Ecology." Pp. 193-235 in *Spatial Perspectives on Problems and Policies.* Volume 2, D.T. Herbert and R.J. Johnston (eds.). New York: John Wiley & Sons.

Katz, B., and J. Bradley. 1999. "Divided We Sprawl." *Atlantic Monthly* 284:26-42.

Law, N. L., and L.E. Band 2002. Lawns: One piece of the nutrient puzzle in urban watersheds. Paper given at the Spring Meetings of the American Geophysical Union, Washington, May 2002.

Lee, R. G., W. R. Burch, Jr., and D. R. Field. 1990. "Conclusions: Past Accomplishments and Future Directions." Pp. 277-89 in Community & Forestry: Continuities in the Sociology of Natural Resources, R. G. Lee, D. R. Field, and W. R. Burch, Jr. (eds.). Boulder, CO: Westview Press.

Logan, J. R., and H L. Molotch. 1987. Urban Fortunes: The Political Economy of Place. :os Angeles: University of California Press.

Machlis. G. E., J. E. Force, and W. R Burch, Jr. 1997. "The Human Ecosystem as an Organizing Concept in Ecosystem Management." *Society and Natural Resources* 10:347-67.

MacPherson, C. B., editor. 1989. *Property: Mainstream and Critical Positions.* Toronto, Canada: University of Toronto Press.

Makse, H. A., S. Havlin, and H. E. Stanley. 1995. "Modelling Urban Growth Patterns." *Nature* 377:608-12.

McManus, C. R., and K. N. Stee. 1998. Towards a Unified Strategy for Open Space Management in Baltimore: Community-Managed Open Spaces. A Report to the Parks and People Foundation, Baltimore, Maryland.

Morrill, R. L. 1974. *The Spatial Organization of Society.* 2nd edition. Duxbury, MA: Duxbury Press.

Murdie, R.A. 1976. "Spatial Form in the Residential Mosaic." Pp. 237-72 in *Spatial Perspectives on Problems and Policies*, D. T. Herbert and R. J. Johnson (eds.). New York: John Wiley and Sons. [possibly 2nd Edition]

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action.* New York: Cambridge University Press.

Parker, J. K. 1994. Improving the Contribution of Forests to Food Security: A Proposed Conceptual Framework for Designing Research Studies and Practical Field Interventions. U.N. Food and Agriculture Organization, Forestry Department/FOND, Rome.

Parker, J. K., and W. R. Burch, Jr. 1992. "Toward a Social Ecology for Agroforestry in Asia." Pp. 60-84 in *Social Science Applications in Asian Agroforestry*, W. R. Burch, Jr., and J. K. Parker (eds.). New Delhi, India: IBH Publishing Co.

Parker, J. K., V. Sturtevant, M. Shannon, J. M. Grove, and W. R. Burch, Jr. 1999. "Partnerships for Adaptive Management, Communication and Adoption of Innovation, Property Regimes, and Community Deliberation: the contributions of mid-range social science theory to forest ecosystem management." Pp. 245-77 inEcological Stewardship: A Common Reference for Ecosystem Management, Volume 3, N. C. Johnson, A. J. Malk, W. T. Sexton, and R. Szaro (eds.). 3 Volumes. Oxford, England: Elsevier Science Ltd.

Pickett, S. T. A., W. R. Burch, Jr., S. Dalton,T. Foresman, J. M. Grove, and R. Rowntree. 1997. "A Conceptual Framework for the Study of Human Ecosystems in Urban Areas." *Journal of Urban Ecosystems* 1(4):185-99.

Pickett, S.T.A., J. William R. Burch and J.M. Grove. 1999. "Interdisciplinary Research: Maintaining the Constructive Impulse in a Culture of Criticism." *Ecosystems* (2):302-307.

Pickett, S. T. A., M. L. Cadenasso, J. M. Grove, C. H. Nilon, R. V. Pouyat, W. C. Zipperer, and R. Costanza. 2001. "Urban Ecological Systems: Linking Terrestrial Ecology, Physical, and Socioeconomic Components of Metropolitan Areas." *Annual Review of Ecology and Systematics* 32:127-57.

Raintree, J. B. (editor)1987. *Land, Trees and Tenure.* Proceedings of an International Workshop on Tenure Issues in Agroforestry, Nairobi, May 27-31. Land Tenure Center, University of Wisconsin, Madison.

Rusk, D. 1993. *Cities without Suburbs*. Washington, DC: Woodrow Wilson Center Press.

Shevky, E., and W. Bell. 1955. *Social Area Analysis: Theory, Illustrative Application and Computational Procedure*. Stanford, CA: Stanford University Press.

Smith, D. M. 1984. "Silviculture at the Urban/Forest Interface." Pp.101-8 in *Land Use and Forest Resources in a Changing Environment: The Urban/Forest Interface*, G. A. Bradley (ed.). Seattle: University of Washington Press.

Tansley, A. G. 1935. "The Use and Abuse of Vegetational Concepts and Terms." *Ecology* 16:284-307.

Timms, D. 1971. *The Urban Mosaic: Towards a Theory of Residential Differentiation*. Volume 2. Cambridge, England: Cambridge University Press.

Urban, D. L., R. V. O'Neill, and H. H. Shugart, Jr. 1987. "Landscape Ecology: A Hierarchical Perspective Can Help Scientists Understand Spatial Patterns." *Bioscience* 37:119-27.

Whyte, W. F. 1991. *Social Theory for Action: How Individuals and Organizations Learn to Change*. Newbury Park, CA: Sage Press.