

# **Forestland Development Literature Review – July 2005 (VPI&SU – Irs/pd)**

## **INTRODUCTION**

Given the demand for single-family homes in scenic, rural settings that are within 30-40 minutes of growing towns, cities, and metropolitan areas, forestlands are likely to be developed or impacted in some manner. The most prominent type of residential development occurring on mountainous forestland close to urban centers is large residential lots and subdivisions.

Wear, et al. (1999) and Best & Wayburn (2001) describe how urbanization threatens forest health and integrity and the production and use of timber and non-timber resources in Virginia and the United States. These authors note the importance of private land holdings in the ongoing supply of timber and non-timber resources.

While residential forestland development near urban areas may be viewed as inevitable, the extent and type of these developments are largely determined by the knowledge, intentions, and economic interests of landowners, developers, and others who have the responsibility for obtaining legal approvals from local governments for re-zoning approvals and for approved plats, plans, designs, and engineered development scenarios. Too often, minimal attention is paid to issues concerning working forests and farmlands or to ecological functions. As a result, the loss of productive landscapes and the degradation of soils, streams, rivers, native plant and animal habitats, and other sensitive resources are common.

Planners, developers, designers, engineers, surveyors, real-estate professionals, and landowners can each play a prominent role in guiding new developments to the areas that are best suited to the infrastructural requirements of residential lots, homes, and neighborhoods - while also conserving rural landscape settings and working farms and forests.

The guidelines and model planning process presented in this document are intended to assist land development professionals as they seek to meet the needs and interests of their clients as well as the needs and interests of the larger community.

## **Goals of the project**

This document highlights the benefits of conservation-based development and sustainable forest harvesting in the mountains of western Virginia. The project is intended to help communities sustain forestlands that might otherwise be lost or degraded due to urban development. Where applicable, associated farmland should be protected, particularly farms containing prime soils and other important resources. The project also seeks to retain connections between larger tracts of forestland, intact forest habitat, retain high-quality views and water quality, and protect valued human resources.

Specific project goals are to: 1) educate stakeholders and the public about ways to protect forestland and its associated values; 2) recommend tools and techniques that will enable developers to implement conservation-based designs in or near forested areas with minimum disturbance to forests, streams, and watersheds. Our intended audience has been local officials, administrators, planners, designers, engineers, developers, landowners, real-estate professionals, investors, and interested local residents.

## Objectives of the literature review

The primary intent of the literature review is to draw upon the knowledge of those who have written about:

- 1) the ecological function and structure of forested ecosystems;
- 2) the potential hazards associated with developing mountainous terrain;
- 3) the opportunities to create highly livable and life-sustaining residential developments; and,
- 4) the potential to employ low-impact development techniques in new developments.

Secondary objectives of the literature review included the need to locate ordinance language that may help localities protect valued forestland resources as well as studies and projects which provide insights as to the economic viability and market attractiveness of sustainable forestland developments.

## LITERATURE REVIEW

Forests have been and always will be “in a constant stage of change wrought by forest succession, climatic change, fire, wind, insects, fungi, browsing animals, and [human] activity” (Spurr & Barnes 1980, 558). Each forested property thus has a legacy of change, which property owners, designers, and developers would do well to learn and account for as they plan for future use and management.

The following literature review highlights a few of the ideas that seem most relevant to those contemplating residential development, recreational use, logging and/or harvesting of non-timber resources on the property they own or manage.

### The Big Picture: Regional and Landscape Ecology

Forman (1995a) discusses 12 principles that are helpful as one considers how to use, develop, or manage a forestland property they own or are responsible for. Forman begins by discussing the interrelationships between the landscape patterns we see (landscape structure), the dynamic nature of ecosystems and landscapes (landscape functions), and the evolution of ecosystems and landscape over time (landscape change). Principle 3 states that large natural-vegetation patches (areas) “are the only structures in a landscape that protect aquifers and interconnected stream networks, sustain viable populations of most interior species, provide core habitat and escape cover for most large-home-range vertebrates, and permit near-natural disturbance regimes” (Forman 1995a, 135-136). This principle relates directly to forestland settings in southwest Virginia, to forests throughout the Appalachian Mountains, and to many other regions where there are large tracts of forest. Forman’s last two principles (1995a, 139-140) focus on the application of earlier principles to land use planning and land development.

*Principle 11. Land containing humans is best arranged ecologically by aggregating land uses, yet maintaining small patches and corridors of nature throughout developed areas, as well as outliers of human activity spatially arranged along major boundaries.*

*Principle 12. Top-priority patterns for protection, with no known substitute for their ecological benefits, are a few large natural-vegetation patches, wide vegetated corridors protecting water courses, connectivity for movement of key species among large patches, and small patches and corridors providing heterogeneous bits of nature throughout developed areas.*

Forman (1995a, 140) states that “these principles [are] applicable for any environmental or societal land-use objectives [and] should be applied intelligently, not blindly, to solving our land use problems.” Forman (ibid) indicates that these principles “are useful in growing wood, protecting species, locating houses, protecting soil, enhancing game, protecting water resources, providing recreation, locating roads, and creating sustainable environments. Each objective is accomplished more effectively, and for a longer time frame, using a healthy dose of landscape and regional ecology principles.”

### **Meeting Human Needs: Safe, Livable, Affordable Homes & Communities; Sustained Livelihoods**

In America, the right of owning private property is seen as a core value. Forested private property is thus generally viewed as an economic investment – a place to secure future income by selling timber and house lots, allowing for hunting, fishing and other recreational uses for a fee, or selling the land to developers or investors. Because more than half of the forests in the US are in private ownership (Best & Wayburn 2001) it is vital to encourage private landowners to meet their individual needs for adequate income (profitability) while simultaneously conserving important forest functions and values in the social and ecological realms (Stokes et al. 1989). Doing this requires seeing the forest as more than land or property (Wilson et al. 1998). Seeking to know the land and to act as a responsible steward is essential (Leopold 1949). Recognizing the opportunity to help create safe, livable, and affordable homes and communities (Corbett 1981), and to sustain livelihoods by conserving forest productivity (Chance 1982) provides a vision for forestland stewardship that connects the landowner to larger social and ecological values. With this vision, landowners can harness the natural capital of their forestland properties to provide vital environmental services, and do so in ways that bring substantial economic returns and that meet other important human needs. By acting in this way we can create integrated landscapes and greenways (Arendt 2004; Dramstad et al. 1996; Hellmund 1993), minimize or even eliminate waste, mimic sustainable natural processes, and maintain natural capital (Hawkins, Lovins & Lovins 1999).

### **Forest Benefits and Threats to Forest Health**

Benefits of forestland protection include multiple social, economic, and environmental functions and values. Primary functions and values include a diverse set of wood products for homebuilding, furniture, tools, etc., fiber for paper and other products, non-timber products such as berries, mushrooms, medicinal herbs, places for recreation and spiritual and aesthetic renewal, climate control, air and water quality enhancement, and habitat and biodiversity conservation (Hammett & Chamberlain 1998).

Randolph (2003, 525), Lewis (1997, 23-25), and Petit, et al. (1995, 5) note the following benefits of trees and the urban forest: increased property values, decreased energy (heating/cooling) costs, improved air quality, reduced stormwater runoff, decreased soil erosion, improved water quality, wildlife habitat, increased community pride and recreational opportunities, improved health and well-being, reduced noise levels, buffer zones for visual and aesthetic relief, and increased property values and sales.

Major concerns related to the health of forest ecosystems are summarized by Randolph (2003, 524) and Sauer, et al. (1998). Concerns include increased wildfire threats due to fuel buildup and management practices such as wildfire suppression; invasion of exotic pests; tree mortality due to disease, air pollution, and the degradation of soil fertility (caused by soil compaction, loss of soil organisms, and the lack of organic matter); degradation of habitats due to tree removal and forest fragmentation, changing plant communities, and imbalanced populations (for example, overpopulation by deer and other browsers); loss of wildlife due to hunting by cats and other pets; degraded riparian corridors due to clearing, increased stormwater runoff causing erosion and sedimentation, trash buildup, etc.

### **Forestry and Urban/Residential Development**

A central issue related to land use in the “urban/forest interface” includes the perceived incompatibility between timber production and urbanization (especially residential development) and between logging and non-commodity uses of forestland such as aesthetics, recreation, and habitat and watershed protection (Bradley 1989, ix). Although many non-industrial private forest landowners have no interest in logging, there are many tracts within 30-40 minutes of towns and cities in Virginia and many other states that could potentially be logged to help supply wood and fiber to local and/or international markets. Additionally, important non-timber values could be marketed for use by the larger public, or can simply be enjoyed by landowners and those who they invite to access and use their land.

Given the keen desire by people to live “near to nature”, particularly forests, it is possible that multiple uses of private forestlands can be effectively employed on a single property to meet the interests/needs of foresters and timber suppliers, landowners, developers and homebuilders, residential homeowners and those interested in forest-based recreation, and conservation-minded groups and individuals.

Nevertheless, successfully planning appropriate uses for urban/forest interface lands without major conflict requires understanding and accounting for “all relevant factors and perceptions” (bio-physical, social and economic), facilitating communication and negotiated decision-making among the various stakeholders, and making these factors and perceptions “an explicit part of the strategies and policies...implemented...to achieve land use and forest resource goals” (Bradley & Bare 1993, 31).

### **Sustainable Use and Management of Forestlands**

In order to build understanding, reduce conflict, and develop high quality solutions related to logging and development within forestland settings there is a need to ask and explore “problem-oriented questions”. For example (building upon questions asked by Maser in his book *Sustainable Forestry* [1994, 82]) property owners, designers, and developers could ask: How much organic material in the form of large woody debris must be left on site following logging or development to ensure the continued productivity of forest soils? How much room does a stream or drainageway need to adequately protect water quality due to increased stormwater runoff, especially from areas disturbed by road or home construction? Who owns private forestlands and what are their goals and interests? What forest harvesting activities are appropriate on this tract of forestland? And, how do we conserve forestlands and other important ecosystems while providing pleasing places for people to live?

Examples of those seeking to ask and explore such questions include ecologists, foresters, planners, horticulturalists, landscape architects, and other researchers and professionals, including: Arendt 1996, 1999, and 2004; Baker & Kusel 2003; Best & Wayburn 2001; Bosch, et al. 2003; Bradley 1984; Dramstad, et al. 1996; Forman 1995b; Forman, et al. 2003; Fujimori 2001; Hammett & Chamberlain 1998; Hawkins et al. 1999; Hobbs, et al. 2002; Kusel and Adler 2003; Lindenmayer & Franklin 2002; Lyle 1985; Marsh 1998; McHarg 1969; Miller 1997; Nixon & Hansen 1987; Randolph 2003; Sauer, et al. 1998; Shaffer 1997; Steele & Koprowski 2001; Steiner 1991; Thompson & Sorvig 2000; Wiest 1998; and Wilson, et al. 1998.

To both use and conserve forestlands in a truly sustainable manner we must first protect as much intact forest as possible (Dramstad, Olson & Forman 1996), locate and construct temporary and permanent roads with the minimum impact possible (Forman, et al. 2003; Wiest 1998), locate and manage home sites so as to minimize negative inputs to the forest ecosystem (Forman 1995) and groups of trees (Matheny & Clark 1998), protect the interrelated processes leading to soil fertility, watershed protection, and biological diversity (Fujimori 2001; Lindenmayer & Franklin 2002; Maser 1994), and manage forest use, including recreation, logging and non-timber harvests, wisely over time (Hobbs, et al. 2002; Kusler & Adler 2003; Maser 1994). According to Hobbs, et al. (2002, 244) four main ideas underlie the concepts of sustainability, sustainable development, and sustainable forestry:

- 1) Economic, social, political, and ecological factors are integral to sustaining forests and landscapes.
- 2) Human activities today should not limit options for future generations to sustain themselves.
- 3) There are limits on what forest and stream ecosystems can provide to people.
- 4) “There is a balance between what ecosystems can safely produce (without jeopardizing ecosystem integrity and resilience) and the demands humans make on them.”

### **Benefits of Cluster Development for Forestland Conservation**

Small land owners (fondly referred to as Ma & Pa Kettle) and larger developers can potentially secure the following benefits by employing cluster development techniques (Kendig 1980; Porter et al. 1988; Jarvis 1993; Petit, et al. 1995; Arendt 1996, and 2004) where they intend to develop forestland properties:

Provide highly attractive (marketable) lots and homes close to conserved forestland.

Reduce design and construction costs associated with roads and utilities.

Reduce impacts of development on watersheds by providing water infiltration into forestland soils, and using natural areas and grass swales to manage stormwater, reducing the volume and velocity of runoff (CWP 2000; Guillette 2005).

Sustain forest productivity over the long term (timber and non-timber uses), providing continuing economic returns for the managing entity (refer to Hammett & Chamberlain 1998; Shaffer 1997).

Receive tax credits through the use of conservation easements, thus easing development-related cash-flow difficulties.

Create a sense of community among residents.

Provide for larger parks/gardens/recreation areas with opportunities for extensive walking/hiking trails.

Provide opportunities to create more affordable housing.

Help maintain local rural character, thus reinforcing local comprehensive plans which call for forestland conservation (refer to Arendt 2004).

Preserve critical forestland and provides core wildlife habitat for animals such as black bear, bobcat, tree squirrels, neo-tropical songbirds, and many other species of flora and fauna. Reduce disturbance to forest flora, fauna, and soil fertility (refer to Forman 1995b; Maser 1994).

Create larger, more effective environmental corridors, especially when linked to other open space.

Create opportunities for larger community wastewater treatment, thus protecting area waters from individual failing/leaky systems that are not properly maintained.

### **Cluster Development in Forestland Settings**

A cluster development is a design technique that concentrates lots and buildings in specific areas of a site that are best suited to support infrastructure demands, while minimizing development impacts.

Conservation of environmentally sensitive areas and historic or cultural resources can be accomplished on a site in conjunction with residential housing. Clustering smaller home sites allows the remaining land to be used for alternatives to house lots, such as sustainable forestry and farming, recreation, common open space, and/or natural areas. The ecological and productive functions and values of such areas can be protected through the use of conservation easements, management plans, and covenants and restrictions.

#### **The major objectives of cluster development are to:**

Protect sensitive areas such as stream corridors and steep mountain slopes;

Conserve natural resources and productive land as working landscapes;

Support economic vitality and provide farm/forest products to local communities; and

Create highly attractive residential developments near conserved open space.

**Other potential objectives of cluster development are to:**

Provide opportunities for affordable, well designed housing, where neighbors can frequently meet;  
Encourage more active living by providing places for walking/hiking and other outdoor activities;  
Support transit or carpooling by bringing residents together in highly livable neighborhoods, villages and/or hamlets, thus reducing single automobile trips and reducing air & water pollution.

**Obstacles to conservation design/development applied to conserve productive forestland settings include** the following (Petit 1995, 67-73): **political concerns** (local zoning and subdivision development requirements may be too vague or too inflexible, and unnecessarily complex and lengthy reviews and permit approval processes may create disincentives to plan and implement cluster developments), **socio-economic concerns** (market acceptance, time for creative, integrated planning, lack of expert advice/interdisciplinary teams for most residential developments, long-term forest management typically not considered by residential developers), **and education-related needs** (planners/designers/engineers, developers, bankers, stakeholders, and the larger public may be unaware of the positive aspects of cluster developments and may mistakenly think of cluster development as less-livable, high-density development).

**Cluster Development Concerns and Responses to Concerns**

**Loss of property tax revenue.**

Property values may increase.

Surrounding land may benefit from preserved greenspace and increase in assessed value.

**Time delay to project (lack of timely plan approvals).**

If cluster development regulations are clear and well formulated there will be no time delay. Further well-written ordinances expedite approvals.

**Smaller-sized lots are less private.**

Well-designed, each house has retains a high level of privacy.

**Local officials, developers, and the community may be predisposed toward conventional development designs because they are familiar and well understood.**

Well-designed cluster developments can change this perception. Developers have found a strong market for open space / cluster development housing units. Further, if land use ordinances and subdivision regulations make compact layouts the easiest (default) option, then interest in these development types will change.

**Stormwater run-off and septic management can take additional planning and management.**

There is less total infrastructure to plan and manage.

**How does a locality give the proper incentives for a developer to design a cluster development instead of a conventional subdivision?** Regulations and/or planning process incentives can make clustering mandatory, allow density bonuses, or set maximum densities in conventional subdivisions at very low levels. Well formulated ordinances/regulations allow flexibility to address site and contextual needs.

**Integrated Comprehensive Planning/Design at the Site, Local, Regional & Watershed Scales**

According to numerous authors (including Forman 1999b; Dramstad et al. 1996; Randolph 2004; and Arendt 2004) there is a real need for integrated comprehensive planning/design at the site, local, regional, and watershed scales. At the sub-regional, county, and small watershed basin scales we need to ask: where is it appropriate to develop and what do we conserve for timber production and/or for non-timber values? At the site scale Ma and Pa Kettle, larger developers, and others considering the development of residential subdivisions in forestland settings need to **identify primary and secondary conservation areas** and compare these to the areas well-suited for and compatible with roads, driveways, houses, lawns (for fire protection and outdoor living/play), wastewater and stormwater treatment facilities (designed for individual homes, multiple residences, or an entire subdivision), and other utilities.

The following section briefly discusses ways to apply the principles gleaned from the literature during the site planning, design, development and management process.

### **Improving the Subdivision Review Process**

If more sustainable modes of residential development are to occur in the mountains of Virginia and other locations it is critical to provide mechanisms that will encourage the conservation of working-and-living farm and forest landscapes. Localities can promote sustainable development by providing a process where "doing the right thing for the land and people" is easiest in terms of re-zoning and plat approvals and by promoting and coordinating "green infrastructure" planning/design/development at regional, county, and local levels. Landowners, developers, and the professionals who plan and design new residential subdivisions can assist by letting local officials know early in the subdivision review process that they want to help conserve working farm and forest landscapes and then creatively and rigorously explore how this can best be done.

### **Four Common Flaws in Subdivision Review**

(adapted from Randall Arendt - <http://www.plannersweb.com/wfiles/w160.html>)

A) Most local ordinances fail to require applicants to submit detailed surveys or inventories of a site's features, beyond the few features which would render areas unbuildable. Similarly, most ordinances do not require maps depicting the subject parcel's surrounding context.

B) Most municipalities don't require planning board members to walk the land. Yet a group site visit, which also invites other interested parties, is essential to an understanding of any property.

C) Many local subdivision regulations require highly detailed design drawings at the "Preliminary Plan" stage. Thus, developers may spend tens of thousands of dollars in preparing a first submission. Understandably, developers are not inclined to discard such plans, even if better ways to design the development are pointed out to them by planning staff, planning board members, or others.

D) Subdivision layouts are often prepared by people trained in recording site data and in street and drainage issues (surveyors and engineers), but who have little or no expertise in the fields of landscape architecture and neighborhood design.

### **Developing a Better Subdivision Review Process**

(adapted from Randall Arendt - <http://www.plannersweb.com/wfiles/w160.html>)

Three sequential steps can be taken that will dramatically improve the subdivision review process:

1. Require the applicant to prepare a Context Map of the surrounding area and a detailed Existing Resources and Site Analysis Map of the property;
2. Conduct a site walk with the applicant, planning staff, planning board members, and adjacent landowners very early in the process;
3. Require the applicant to submit an inexpensive conceptual Sketch Plan as the first layout document, before preparing detailed layout and design drawings.

For a discussion of the **site planning and development process** and recommended **forestland development guidelines** please refer to: [http://www.lar.arch.vt.edu/forests/site\\_planning.htm](http://www.lar.arch.vt.edu/forests/site_planning.htm) and <http://www.lar.arch.vt.edu/forests/guidelines.htm>.

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For additional references refer to Resources for Developers at:

<http://www.lar.arch.vt.edu/forests/Resources%20for%20Developers.htm>

**Highlights - Best, C. & L.A. Wayburn. 2001. *America's Private Forests: Status and Stewardship*. Washington, DC: Island Press**

In 1992, private forests comprised approximately 58 percent of America's forestland (roughly 430.5 million acres). Of these forestlands, over 362.5 million acres were classified as non-industrial private forests. Almost half of America's forests were held by 9.3 million non-industrial private owners.

The majority of forestland in Virginia and Appalachia is composed of hardwoods (primarily oak-hickory). Depending on soil quality, topography, the position of trees related to landform, and micro-climate, these forests can be highly productive.

Many of these forestlands are being undermined from potential harvesting and ecological standpoints by the construction of single-family residences and subdivisions, as well as by recreational developments. Between 1978 and 1994 an average of almost 2 million acres per year were broken up into parcels smaller than 100 acres – feeding into the market for smaller residential or recreational properties.

Concerns associated with creeping urbanization is that development threatens forest health and integrity, and the production and use of timber and non-timber resources. Because smaller parcels are bought and sold as real-estate, short-term economics frequently trumps longer-term forest stewardship/management efforts. Additionally, owners of smaller, forested parcels generally view trees as visual amenities, not as vital elements of larger ecosystems or essential timber inventories. Lack of continuity in forest ownership and stewardship is likewise a significant concern because understanding how to care for forestlands takes knowledge, commitment, time, and patience.

As of 1997, non-industrial private owners held about 326.8 million acres of forestland in the U.S. Of this, 290.8 were classified as timberland. Recent trends in forest ownership include: increasing fragmentation into smaller parcels (with significant increases in the number of owners holding forestlands in the 1-99 acre range as larger parcels are subdivided); the aging of individual landowners (leading to intergenerational property transfers, the moments when tracts are generally subdivided); increasing financial ownership of forestlands (including the buying and selling of forestland as shorter-term real-estate ventures); and growing interest in sustainable forestry and forestland conservation (for example, by combining environmentally-sensitive silvicultural practices and the use of conservation easements to create working community forests).

*In Virginia there are tens of thousands of owners of non-industrial private forests. Although the most effective conservation-and-stewardship efforts will occur on large parcels not facing imminent development pressures, small and medium sized patches of forestland can also be retained intact on parcels of various sizes where development is likely to occur in the near term due to rapid or incremental urban growth.*

*Retaining intact forestland is important for future timber supply (Wear, et. al. 1999 – *The effects of population growth on timber management and inventories in Virginia*), high water quality and groundwater recharge, and for multiple ecological and quality of life functions and values.*

**Highlights - Best, C. & L.A. Wayburn. 2001. *America's Private Forests: Status and Stewardship*. Washington, DC: Island Press, continued...**

***Private forestland owners can be categorized by type/size as follows:***

**Residential Forest Owners (1-9 acres)**

Characteristics of forestland: dominated by residential uses (including roads, buildings, and lawns), and strongly influenced by domestic animals and exotic (non-native) vegetation; provide minimal ecological functionality & timber productivity (following clearing for homes, roads, lawns, and septic fields these forestlands may only allow cutting of trees for safety [hazard removal], disease control, and firewood use); prime locations for wildlife adapted to humans and their pets (for example deer, squirrels, and raccoons); depending on how much impervious surfaces are created and how stormwater is managed, these forests may have greatly reduced capacities to hold and infiltrate precipitation, a vital function of intact forests and well developed forest soils.

**Small Forest Owners (10-49 acres)**

Characteristics of forestland: may be physically isolated or well-connected to other forestlands; may provide a number of important forest functions and values (including water quality protection, carbon sequestration and tempering of local climatic conditions, habitat for native plant and animal species, supply of wood for fuel, building materials, paper, and other products; production of foods, medicinals, and decorative florals, storage of genetic wealth; provision of recreation and aesthetic enjoyment; can be managed for periodic timber or other forest-based revenue – providing small storehouses for economic capital, employment, and non-economic benefits, although economic returns may be modest, depending on forest and species types.

**Medium to Large Forest Owners (50-999 acres)**

Characteristics of forestland: may be physically isolated or well-connected to other forestlands; typically provide major forest functions and values (including water quality protection, carbon sequestration and tempering of local climatic conditions, habitat for a diversity of native plant and animal species, supply of wood for fuel, building materials, paper, and other products; production of foods, medicinals, and decorative florals, storage of genetic wealth; provision of recreation and aesthetic enjoyment; can be managed for regular timber or other forest-based revenue – providing well-functioning storehouses for economic capital, employment, and non-economic benefits.

**Very Large Forest Owners (1000+ acres)**

Characteristics of forestland: typically held for commercial (industrial) timber production; decisions regarding forest management are likely driven by financial considerations (much more than for the smaller tracts of forestland discussed above).