SUSTAINABLE DEVELOPMENT of FORESTLANDS:
Subdivision Planning/Design to Protect Forest Ecosystems and
Water Quality in the Mountains of Virginia

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http://www.uap.vt.edu/forests/

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USDA-Forest Service & Virginia Department of Forestry,
Urban and Community Forestry Grant Program

Building for Greener Communities National Conference - September 20, 2005
Sustainable Development of Forestlands Project

project team:

Virginia Tech

New River Planning District Commission

New River Land Trust

Giles & Montgomery counties

Confluence Services (land planners)

Foresters Incorporated

other local partners

project sponsor:

Virginia Department of Forestry,
Urban and Community Forestry Grant Program
Presentation Outline

Project Context
forestland development in southwest Virginia

Project Findings
planning process & development guidelines

Model Development Plans

Benefits & Concerns
of compact/cluster development

Need for integrated regional & local planning
and high-quality site planning/design

...Issues for additional consideration...
Southwest Virginia – Ridge & Valley Province

Context for Forestland Development in the NRV-PDC area
NRV-PDC Reference Area: Tom’s Creek Watershed

Steep Forested Slopes and Riparian (Stream) Buffers

Tom’s Creek near Sunnyside and Old Creek Road

Poverty Creek and Brush Mountain area
Tom’s Creek Headwaters – off Coal Bank Hollow Rd. Brush Mountain Forestland (Preston Forest area) in background.
Tom’s Creek Watershed – typical forestland types…
Intact & Fragmented Valley Woodlands and/or Mountainous Slopes
Tom’s Creek Watershed – residential development
Virginia has 15.8 million acres (62%) of forestland. This is a decline of 180,600 acres since 1992.

Urbanization is the biggest factor in the loss of forestland. Since 1992, over 615,000 acres of forested land have been lost to land use change; 62% of these forests were cleared for urban development; 37% for agricultural uses; and 1% was converted to water impoundments.

Private individuals own 10.1 million acres (66%) of Virginia's timberland.

Between 1990-2000 Montgomery Co. (VA) grew by 13.1%
As of 2000, Montgomery Co. had 12,639 Owner-Occupied Single-Family Housing Units

Montgomery County, Virginia Housing Counts

Laurel Ridge, Preston Forest, Brush Mtn. Estates

In 2004, 131 single-family building permits were issued, many of these on forested sites.

Issues to Consider
Habitat Fragmentation
Impacts to Watersheds
Increased Wildfire Risk
Loss of Productive Land
Tom’s Creek Watershed – major land development impacts:
Water pollution; Loss of productive farm and forestland…
Tom’s Creek Watershed – early examples of large-lot residential subdivisions on forestland in the New River Valley
Tom’s Creek Watershed – high demand for single-family homes on large to medium-sized lots with access to “greenspace”

Why the demand for larger lots on “greenfield” sites?

Familiarity & Well-Marketed Aesthetics?
Tom’s Creek Watershed – Preston Forest

1,130-acre forest subdivision
172 lots; 6.6 acre/lot avg.
~400 acres of intact forestland on private lots

172 septic systems
~55 acres in roads, homes, and asphalt & gravel driveways

Concerns: septic systems, fire & other hazards,
poor water quality, total dependence on cars…
Sinking Creek Watershed / Giles County – Clover Springs

224-acre forest subdivision
23 lots; 8.6 acre/lot avg.

~175 acres of fragmented forestland on private lots

~50 acres in roads, homes, septic systems, and gravel driveways
Montgomery County / Lick Run – Mountain Homeplace

67-acre forest subdivision
7 lots; 7.6 acre/lot avg.

~40 acres of fragmented forestland on private lots
~14 ac. intact forestland in creek-side easement

~13 acres in roads, homes, septic systems, and gravel driveways
Montgomery County – Coal Bank Ridge

227-acre forest subdivision
55 lots; 2.4 acre/lot avg.

~106 acres of intact forestland (in conservation easements)
~30-40 acres of fragmented forestland

~80-90 acres in roads, homes, septic systems, and driveways
Town of Blacksburg – The Village at Tom’s Creek

99-acre subdivision
200 lots; 0.25 acre/lot avg.
~3.5 acre woodland
~43 acres of open space with community trails

~60 acres in roads, homes, driveways and trails

connected to town water & sewer
Town of Blacksburg– Shadowlake Village (SLV)

www.shadowlakevillage.org

connected to town water & sewer

Shadowlake Village Woodland

33-acre subdivision with community bldg.
33 lots; 0.10 acre/lot avg.
~17 acres of intact forestland with trails
~10 acres of open space
Montgomery County / Catawba Valley – Willow Springs

360-acre parcel
5 lots on 51.5 ac.; 12.8 ac/lot
~305 acres of forestland in conservation easement (with timber/hunting management)
~1.5 ac. access road
Eggleston / Giles County – Nanny Catch Commons

60-acre parcel
5 lots, plus a community bldg. on 1.5 acres.
0.25 acre/lot avg.
~45 ac. forestland in conservation easement
with timber/hunting management & trails
~0.33 ac. as two-track gravel access road

“NannyCatch Common Forest Resources are to be managed and maintained in an estate format specifically designed to accent landscape and aesthetic forestry objectives, emphasizing diverse mature and old growth forest stands and the wildlife species dependent on such forest types. General guidance is to be derived from the NannyCatch Natural Resources Plan...”

NC Covenants
D. Chance / 2003
Case Studies outside Virginia

McKenna Forest Reserve - Pierce County Washington
Source: Weyerhaeuser Real Estate Development Company & Forestpark

20-acre home site (approx. 3 acres cleared). Forest cover primarily 20 year old Douglas fir.

Lake Hills PUD - Lane County, Oregon (community of 20 homeowners)

Selective harvests (on 120 acres of common area) occur every few years for view enhancement, fire protection, forest health, and cleanup after wind storms. Revenues from harvests go to Homeowners Association to replace or offset dues used to fund a tractor to maintain trails, pay for insurance, taxes, and support the organization. 120 acres net an average annual revenue of about $6,000.

Source: Steve Strain - President, Lakehills Homeowners Association
Project Findings - Suggested Planning Process

Identify Development Goals & Objectives w/Interdisciplinary Team

Select a Site that helps Minimize Impacts to Productive Forestland & Other Sensitive Resources. Use Clustering on Greenfield Sites.

Delineate Productive and Sensitive Areas on the-Selected Property by Evaluating the Bio-Physical and Socio-Cultural Aspects of the Site by Identifying Primary (Critical) and Secondary (Important) Resources to be Protected or Conserved on the Site.

Maximize Energy Efficiency & Minimize Secondary Impacts caused by Wastewater Treatment Failures, Concentrated Stormwater Runoff, Soil Loss & Compaction, Invasions by Exotic or Other Undesirable Species, and Tree Stressors.

Develop Management Plan to Effectively Conserve Productive and Sensitive Areas on the Selected Property

Implement Plans with an Understanding of Sustainable Materials, Tools, and Techniques
Conventional Lot Layout for Single-Family Home Subdivisions

Precludes community open space and viable timber harvesting

**Single-Family Detached**

This is the housing type to which most Americans aspire. Its principal feature is that the house is roughly centered on the lot and has large front and rear yards and narrow side yards. The large yards make it especially attractive to families with children.

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<tr>
<td>IMPERVIOUS SURFACE RATIO</td>
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</table>

Source: *Performance Zoning*, Urban Land Institute
Cluster Development

Allows for both conservation and low-impact timber harvesting

Village House

There are numerous old single-family detached houses built on very small lots in the historic towns and villages New England and areas such as Bucks County, Pennsylvania. The village house is a modern descendant of these units. It is placed close to the street to maximize the rear yard; alleys are encouraged to reduce the visual impact of the auto on streets. The result is a lot which is smaller than that of the lot-line house. Specific architectural or landscape standards are required for the street yard(s) of the house. Research on historical houses of this type indicates that landscape features provide the charm, scale, and privacy that permits their location close to the street.

<table>
<thead>
<tr>
<th>DENSITY</th>
<th>1.55</th>
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<tbody>
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<td>IMPERVIOUS SURFACE RATIO</td>
<td>.13</td>
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Source: *Performance Zoning*, Urban Land Institute
Key Guidelines:
*Forest Vegetation, Hydrology & Soils*
- Minimize fragmentation of large tracts of forest, particularly those connected to surrounding conservation areas.
- Minimize number of large trees lost due to development.
- Minimize disturbance to soils, vegetation (including roots), and other elements.
- Prohibit use of invasive species.
- Strictly limit clearing, construction, and vehicle parking near or within riparian and wetland areas and other surface water features.
- Minimize number of stream crossings.
- Retain natural hydrologic patterns; collect, filter and retain stormwater using forest vegetation and soils.
- Protect slopes adjacent to streams (ideally by providing buffers of at least 100 feet, with greater buffers on slopes steeper than 20%).
- Minimize erosion and sedimentation; use appropriate erosion controls.
- Minimize impervious surface areas by minimizing roads, roofs, etc.
- Minimize removal/compaction of soils to protect structure/biology/fertility.
- Retain dead woody material (4-5 snags/acre & approx. 20% downed wood).
Plan to Conserve & Manage Timber and Non Timber Resources

Require development and use of a forest management plan.

Encourage sustainable use of wood products (timber, firewood and other specialty wood products).

Encourage sustainable use of non timber products (including fruits, vines, herbs, mushrooms and other plants as well as deer, game birds, fish and other animals).

During forestry (logging/hauling operations) avoid or minimize visual, auditory, and transportation related impacts on nearby residents.

Use low impact timber access routes that also enhance recreation access/opportunities; construct and manage as multi-use roads/trails.
Utilize the Economic Values of Timber and Non-Timber Resources

Conserve timber and non-timber forestland resources for their combined economic, ecological, and socio-cultural values.

Encourage long-term natural capital improvements;
Discourage short-term economic high-grading in forestry.

Allow for the annual removal and use of wood (timber and firewood) and non-timber products (including plants and animals) in a manner that preserves the integrity of the forest, ecologically and economically.

Employ “Firewise” (fire prevention) practices during planning, design, development, and management to protect people and conserve resources.

Resources - http://www.uap.vt.edu/forests/Resources%20for%20Developers.htm
Context Map
Toms Creek Watershed
Montgomery County, Virginia
Understand Landscape Context – Where should we conserve & build?

It can be concluded that parcels in need of the most work towards water quality and biodiversity improvements exist beyond the forested cover.

Besides GIS data – often readily available – there are many local & regional sources of information to help communities and planners/designers/developers and decision-makers determine where to build and what to conserve.
Sustainable Development of Mountainous Forestlands
VPI&SU-LAR (2003-2005)

Local developments and the literature were reviewed to prepare guidelines for more sustainable forestland development.

Two properties selected to highlight a model planning, design, and development approach...

Goals: retain/build soil fertility and protect/improve water quality.

Key ideas: conserve productive, intact forest and riparian corridors by reducing roads and clustering development.
Two model subdivision designs for sites near Blacksburg in Montgomery County. These “models” represent types of residential development that could take place without degrading the inherent natural ecosystems associated with these two properties.

The first step in the conceptual planning/design process was to obtain a good sense of topography (slope), landform (geology & aspect), soil types, vegetation, and hydrology (streams & drainageways).

Early in the process we sought to delineate “potentially productive forestland” and “quality farmland”. Sensitive areas (including wetlands, floodplains, stream corridors, steep slopes, and sinkholes) were also identified. Because soil moisture and soil depth are generally the limiting factors for tree growth, areas having both deep soils (fairly level foot-slopes, floodplains, and ridgelines) and north/north-east aspects were viewed as the most productive forestland settings. If at all possible, productive forestland and quality farmland were to be conserved – particularly large, intact areas of forest, pasture, and hayfields.

After ag-forestal resources were delineated, existing and potential roadway access and home sites were carefully considered.
Sustainable Development of Mountainous Forestlands
Site Analysis & Synthesis Mapping
Preliminary plans provide an excellent way to create dialogue with local planners, engineers, ecologists, neighbors, and other stakeholders, before more expensive site plans are prepared.

Questions that arise may indicate the need to revisit inventory & analysis work or re-think initial design ideas.
Concept plans for a 600-acre forested parcel on Brush Mountain and a 420-acre site with a mix of forest and ag. land along the Tom’s Creek corridor.

**Sustainable Development of Mountainous Forestlands**

18-Lot Family Subdivision Sketch Plan

- **Existing road recommended for use in Family Subdivision.**
- **Existing clearings recommended for use as home sites.**
- **Proposed location for 20-lot clustered neighborhood.**
- **Existing fencerows create rooms & walls for several lots.**
Model Development Plans
Lot Layouts for Neighborliness, Low Impact Development, Walkable Connections to Conserved Open Space, Potential for Community Wastewater Treatment & Energy Efficiency
Implementing Model Development Plans
Need for Rural PUD Cluster District or Overlay Zone

Goals of Rural PUD Cluster Districts & Overlay Zones:

Conserve forestlands in large enough tracts to make them highly useful for protecting watersheds, providing regionally and locally appropriate habitat, offering marketable timber and non-timber products, and affording appropriate recreational uses.

Enable landowners to make a reasonable economic return from the use and/or future sale of their land – and for localities to offer homeowners a diversity of housing types.

Arrange housing in compact villages, hamlets, clusters, or farmsted-like groupings to:

a) limit impacts to environmentally sensitive and other highly valued farm/forestland,
b) reduce infrastructure demands and costs, and

c) encourage neighborliness and active living (i.e., walking, running, biking, hiking, community gardening, and other outdoor activities).

Retain large, visually attractive and physically accessible areas of open space – farms, forestlands, and protected areas to serve as working-and-living landscapes.
Implementing Model Development Plans
Primary Land Use Planning & Policy Recommendations

Establish districts or floating zones where “Rural Planned-Unit-Development/PUD Clusters” are the by-right development type (the default option), and where each new development will be evaluated by local administrators/code officials based upon the development’s ability to conserve intact forestland for its ecological, social, and economic values – and for its ability to effectively address health, safety, and welfare needs and concerns.
Employ “conditional rezoning” or the use of voluntary proffers (conditions, limitations, or specific conservation design features) by developers/owners (*per state/local codes*).

Implement, incentive zoning or “the use of bonuses in the form of increased project density or other benefits to a developer in return for the developer providing certain features or amenities desired by the locality within the development.

Allow rezoning approvals with no relapse date to increase feasibility and reduce uncertainty. Create process incentives – for example, providing technical assistance to those who choose to prepare a conservation-based development, and requiring neighborhood meetings and requesting written comments from neighbors and the public.

Waive standard subdivision requirements if owners/developers/designers conclusively show that a property will be developed in a manner that conserves resources and addresses health, safety, and quality-of-life issues.

Encourage the use of legally-binding conservation easements and create subdivision covenants & conditions to establish reliable mechanisms for long-term monitoring and appropriate use/management.
Performance Standards (examples):

*Many performance standards can be drawn by referring to the Guidelines.*
Refer to: [http://www.uap.vt.edu/forests/guidelines.htm](http://www.uap.vt.edu/forests/guidelines.htm)

*Examples of standards that could be adapted to meet local conditions, then used in local comprehensive plans, and zoning and subdivision ordinances.*

1) Demonstrate the viability of development plans by preparing a report in collaboration with a forester and/or other qualified professionals. Show how monitoring, maintenance, and management activities will be funded and explain who will be responsible for these activities.

On properties with larger tracts of forestland, retain at least half of the forest as “intact” (forest un-fragmented by new residential lots and roads). Previously cleared areas, excepting important farmland or other high-value areas/resources, should be considered for clustering residences & related infrastructure.

Conserve as forestland and non-invasive vegetation for watershed protection. Retain natural hydrologic patterns by protecting existing forest vegetation, minimizing concentrated surface water flows, and infiltrating stormwater runoff into forest soils, rain gardens, dry wells, or other appropriately located and designed bio-retention areas.
Economic Benefits of Compact/Cluster Development

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

Reduces design/construction costs for roads and utilities.

Uses natural areas and grass swales to manage stormwater, reducing the volume and velocity of runoff.

Sustains forest productivity over the long term (timber and non-timber uses).

Provides continuing economic returns.

Offers tax credits through the use of conservation easements, thus easing development-related cash-flow difficulties.
Social Benefits of Compact/Cluster Development

Creates a sense of community among residents.

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

Provides opportunities to create more affordable housing.

Helps maintain local rural character, thus reinforcing local comprehensive plans.
Compact/Cluster Development in Forestland Settings

Ecological Benefits of Compact/Cluster Development

Preserves critical forestland; provides core wildlife habitat.

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

Reduces impacts of development on watersheds by providing water infiltration into forestland soils.

Reduces disturbance to forest flora, fauna, and soil fertility.

Creates opportunities for innovative wastewater treatment, thus protecting area waters from failing/leaky systems.
Potential Concerns Related to Compact/Cluster Development

Perceived value/marketability
Smaller-sized lots seen as providing less privacy.
Reduced lot values; lower return on investment; loss of property tax revenues.

Time delay to project
Exemptions/variances may require more time for plan/design approvals.
Stormwater run-off and wastewater treatment can take additional planning and management coordination for cluster developments.

Local officials, developers, and the community may be predisposed to conventional development designs because they are familiar and well understood.
We like what we know and larger lots are typical in forestland settings.

Key point:
Need incentives for cluster developments instead of conventional subdivisions!
Major Objectives of Cluster Development

Protect sensitive areas; Conserve natural resources & productive land;
Support economic vitality; Provide affordable, well designed housing;
Encourage more active living; Support transit; Reduce air & water pollution.

Patio House

The patio house is a single-family detached or semi-detached unit. It is built on a small lot enclosed by walls which provide privacy. If the walls are ignored, its layout may be similar to either the lot-line or twin house; thus, it may be built either as a detached or semi-detached dwelling. The patio house appeals to those who want privacy without the maintenance of a larger yard.

| DENSITY | 1.55 |
| OPEN SPACE RATIO | .75 |
| IMPERVIOUS SURFACE RATIO | .11 |

Source: Performance Zoning, Urban Land Institute
Comparing Housing Alternatives

Cluster housing allows for conservation and high property values.
Cluster housing also reduces infrastructure costs.

Source of Images:
Performance Zoning
Urban Land Institute
Cluster development can be done in highly attractive ways. These six images show compact development in England and Blacksburg, Virginia.

Aesthetics and privacy are retained, recreation opportunities created, and a productive land base maintained.
Need for integrated regional, county, and local planning as well as high-quality site planning/design

“Fauquier County, [Virginia] which prides itself on land conservation policies, applies most of the traditional land conservation strategies. [From] 1993 to 2004, the average new urban house consumed nearly seven acres of land. At that rate, in 10 years the County urbanized more land than had been set aside for all urban land uses for the indefinite future in the service districts.”

(E M Risse - http://www.baconsrebellion.com/Issues05/03-28/Risse.htm)

What is wrong with this picture?
Homes are not near jobs and services & eat up more and more productive land.

We know integrated planning is important.

Let’s help create excellent examples of how this happens, encouraging re-development of underutilized urban land so we can really protect trees, forests & farmland.
Improving the Subdivision Review Process

Four Common Flaws in Subdivision Review (adapted from Randall Arendt)

A) Most local ordinances fail to require applicants to submit detailed surveys or inventories of a site’s features, beyond features which 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, open to all interested parties, is essential to an understanding of a property.

C) Many local subdivision regulations require highly detailed design drawings at the “Preliminary Plan” stage. Developers may spend tens of thousands of dollars in preparing a first submission and are generally not inclined to discard such plans, even if there are better ways to design the development.

D) Subdivision layouts are often prepared by people trained in recording site data and street/drainage issues (surveyors & engineers), but who have little or no expertise in the fields of neighborhood design (landscape architects). Project teams need to include all relevant disciplines.

Adapted from - http://www.plannersweb.com/wfiles/w160.html
Improving the Subdivision Review Process

Developing a Better Subdivision Review Process
Three sequential steps can be taken to dramatically improve the subdivision review process:

1. Require applicants 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 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.

Adapted from - http://www.plannersweb.com/wfiles/w160.html
Key Questions asked at June 2005 Stakeholders Workshop:

Q1: What are the key issues, obstacles, and challenges related to clustering residential development to retain intact forestland?

Q2: How do we change development patterns; what is it going to take to make clustering happen – and to redevelop underutilized urban areas that already contain needed infrastructure?

Q3: How do we overcome the barriers during the planning/design and development process?

Q4: What are the critical longer-term management issues to be addressed to retain intact forestland for timber, non-timber, and ecological values? What must be done to successfully conserve productive and healthy forests over the long term?

Key Finding: More local models & incentives are needed!!!
Manassas, Virginia

**Water-Sensitive Site Planning Project**

An Example of Integrating Innovative Planning, Design and Development Techniques

Here we sought to protect the stream corridor and remnant woodland, while also employing low impact development practices on and in-between every lot.

At the same time total lots/units were increased and urban infrastructure would be readily tapped into.
Synthesis: Define Areas Suitable for Development; Primary & Secondary Conservation Areas; & Implement compact, mixed residential development with water-sensitive design techniques

Critical Areas:

**Primary Conservation Areas**
Stream Corridor & Riparian Buffer; Wetlands & Floodplain; Important Habitats; Steep Slopes; Historic Areas...

**Secondary Conservation Areas**
Existing Drainage Network; Established Woodlands; Biologically Intact & Water-Holding Ecosystems; Cultural Resources; Other Visually Important Areas...

Water-Sensitive Site Design - Manassas

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**SUMMARY STATISTICS**

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**SUMMARY STATISTICS**

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**Legend**

- OPEN SPACE
- STREAM CORRIDOR
- WETLAND & ECOLOGY CORRIDOR
- TOWNHOME/ROW HOUSE WITH FLOODWAY
- TOWNHOME/ROW HOUSE WITH FLOODWAY
- TOWNHOME/ROW HOUSE WITH FLOODWAY
- SURROUNDING LOT

---

**Street Right of Ways**

- LOCAL
- COLLECTOR
- MINI-MAJORS
- MAJOR"
NAHB’s Model Green Home Building Guidelines

Guiding Principles

Lot Preparation and Design - Careful planning & design can dramatically reduce the home’s impact on vegetation, soil, water, plus a home’s long-term performance can be enhanced. Such preparation can provide significant value to the developer, homeowner, environment, and community.

Resource Efficiency & Construction Waste Management
Energy and Water Efficiency & Conservation
Occupancy Comfort & Indoor Environmental Quality
Homeowner Education

These last five principles require context-based planning/design.

Source of Guidelines: National Association of Home Builders
Rules of Thumb

1) Don’t put your thumb in the blender.
   *In other words...*
   Don’t limit your future options from the outset.
   *In other words...*
   Conserve as much intact forest as possible
   (by clustering new development in areas best suited for homes/roads).

2) Make sure you have someone to tend the blender
   so as to protect viable thumbs in year to come.
   *In other words...*
   Manage the forest wisely over the long term.
   *In other words...*
   Establish the mechanisms to conserve
   timber and non-timber forest resources in perpetuity
   (by employing a forest manager; using conservation easements; etc.).
Project Team

Lee R. Skabelund, Senior Research Associate, Landscape Architecture
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Dean Stauffer, Associate Professor (Habitat Evaluation & Wildlife Management)
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Tom Hammett, Associate Professor (Niche Markets for Non-Timber Forest Products)
John Seiler, Professor (Water, Pollution & Environmental Stressors on Woody Plants/Forests)
John Randolph, Professor (Energy Conservation, Engineering & Environmental Planning)
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Joyce Graham, Co-developer of The Village at Toms Creek

Michael Gay & Blaine Keesee, Co-designers of The Village at Tom's Creek
Chris Kaknis & Tommy DiGiulian, Co-developers of Willow Springs

Thomas W. Reisinger, Forester with Reisinger & Associates, Inc.
Randy Gardner, Co-developer of Preston Forest
Wolt Fabrycky, Developer of Mountain Homeplace
Randi Lemmon, Lucas Appraisal, Inc.
Jerry Moles, Global Renaissance LLC

James & Elaine Gaines

Workshop participants are noted in the Workshop Summary:
http://www.uap.vt.edu/forests/Stakeholder%20Workshop.htm