Mountain Ridge and Steep Slope Protection Strategies

Mountain Ridge and Steep Slope Protection Advisory Committee

April 2008

Acknowledgments

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About Land-of-Sky Regional Council

Land-of-Sky Regional Council is a multi-county, local government planning and development organization in North Carolina. It is one of 17 such organizations in the state and serves Region B, which includes the counties of Buncombe, Henderson, Madison and Transylvania. Land-of-Sky Regional Council is made up of chief elected officials - mayors and county commission chairpersons and alternates - from member governments, one private representative of economic development interests in each county and two at-large members. Members meet monthly to plan programs and set policies and goals to benefit the entire region.

Land-of-Sky Regional Council's mission is to work with local governments, the Region's leadership and state and federal agencies to foster desirable social, economic, cultural and ecological conditions in Buncombe, Henderson, Madison and Transylvania Counties. More information about the Council and its programs can be found at *www.landofsky.org*.

This report and other project materials can be found on the Land-of-Sky Regional Council website (*www.landofsky.org*).

Executive Summary

The mountainous area of western North Carolina (WNC) is experiencing rapid growth and increasingly more development is moving onto steeper slopes and mountain ridges. Community leaders and long-time residents are expressing concerns about losing the resources and viewsheds that give this region its unique sense of place. Local governments are looking for ways to encourage and/or require safer and more responsible development on steep slopes.

In response, the Land-of-Sky Regional Council secured funding from the Z. Smith Reynolds Foundation and established a diverse Mountain Ridge and Steep Slope Protection Advisory Committee to study this issue and develop strategies to promote safer and more responsible and sustainable development.

- There are a variety of issues and impacts related to these development activities, yielding various and sometimes conflicting recommendations. Specific issues we addressed in the study include:
- Public safety, including landslides and emergency response;
- Public health, including water supply and wastewater treatment;
- Water quality and quantity effects due to accelerated soil erosion and increased stormwater runoff and the resulting impacts on fish and other aquatic organisms;
- The loss of forestland, natural areas and wildlife habitat and the role of land conservation; and
- The positive and negative economic impacts of both development and protection programs.

Issues and Strategies — Major Findings and Recommendations

It is helpful to consider a couple overarching issues and recommendations before getting into the details of specific recommendations:

- ***Policies need to be based on the best available scientific data*** (e.g., geotechnical analyses, landslide hazard maps, etc.).
- ***Governments across the mountain region need to work together to ensure policy consistency.*** Without coordinated actions by governments, we will likely not see an amelioration of the problems associated with mountain ridge and steep slope development but rather a shifting of the problems across the landscape. For example, if one city/county chooses to enact relatively more strict regulations on steep slope development than other areas, then some developers may shift to other cities/counties.
- ***Decision-makers need to consider the inter-relatedness of these development-related issues and acknowledge that tradeoffs exist among policy recommendations, and tradeoffs will occur as a result of a particular recommendation*** (e.g., public safety versus environmental protection considerations regarding road design).

Following are key findings and strategies for the major issue areas covered in this study. More details may be found in each corresponding chapter of this report.

Economic Impacts of Development and Preservation — Findings:

There are benefits and costs associated with both development and preservation of steep slopes and mountain ridges.

- Examples of economic impacts of steep slope and ridge development:

  Benefit – Design and construction jobs related to development. The real estate industry is a critical component of our local and regional economy. Home building is the third largest private sector "employer" in the region and one in eight jobs are created by the real estate and home building sectors (Asheville Homebuilders Association).

  Cost – This type of development often results in higher costs to provide utilities, fire, emergency and public safety services to these areas. These costs may exceed tax revenues received, so taxes may need to be raised to cover costs of services.

- Examples of economic impacts of steep slope and ridge preservation/conservation:

  Benefit – Scenic quality is preserved. Scenic quality draws people and businesses to this area. It also a key reason why people and business stay here.

  Cost - Less land is available for development, which increases pressure to develop on less steep land and drives up the value of land that is developable.

Photo: Marc Pruett

Landslides may threaten human life and public safety. The woman inside this home was killed during a landslide in Maggie Valley in 2003.

Economic Impacts of Development and Preservation — Strategies:

- ***Identify priority parcels/areas for conservation*** based on the quality of their natural and/or cultural resources and habitats, and their location related to other conservation areas, priority viewsheds, etc. Examples include areas along the Blue Ridge Parkway, which is a significant tourism draw in western North Carolina. (EC-1)
- ***Provide a range of incentive options to reward land owners who commit to conserve their land through a conservation easement or similar measure***. (EC-2)
- ***Provide financial incentives to developers who protect viewsheds, avoid habitat fragmentation, and protect water quality***. Examples include: density bonuses; accelerated permitting process; and recognition through a certification or award program. (EC-5)
- ***Local governments should consider a variety of financing mechanisms to generate revenues for protecting mountain ridges and steep slopes.*** Ideas include: voluntary donations from land owners or visitors; impact fees; and local bond referenda to finance open space preservation.

Public Safety — Findings:

- ***Landslides are a legitimate concern in western North Carolina and they result from the cumulative effect of many interrelated factors***. A damaging landslide occurs nearly every year in the region and major landslide events occur about every nine years somewhere in the region.
- ***Landslides pose threats to human life and public safety and landslides lead to significant environmental damage*** including soil and forest loss, sedimentation of streams, rivers and lakes, increased erosion and habitat destruction.
- ***Homeowners' insurance in North Carolina does <u>not</u> cover structural damage due to landslides.*** Four homeowners in the Hunters Crossing condominiums in Haywood County have been forced from their severely damaged homes due to a slow moving landslide. The owners are still paying mortgages even though they cannot live there; they may also have to pay to have the homes demolished.
- Fires are influenced by three major factors: weather; topography; and vegetation (fuel). These factors determine the likelihood of a wildfire starting, how fast a wildfire will burn, the direction and intensity of a fire and firefighters' abilities to extinguish it. ***A wildfire can spread twice as fast on moderately steep slopes (40 percent incline) and four times as fast on very steep slopes (70 percent incline).***

Public Safety — Strategies:

- ***A program of public education that emphasizes the key aspects of landslide mitigation should be developed in order to provide information on the triggering mechanisms.*** (PS-2)
- ***Local governments should check for landslide hazard areas before approving development plans.*** However, landslide hazard maps <u>should not be a substitute</u> for a detailed, site-specific geotechnical engineering and geologic report to properly evaluate slope safety and suitability. (PS-4)

- ***Geotechnical analysis should be required for proposed developments on slopes greater than 40 percent or in landslide hazard areas as a minimum standard*. When measuring slope for a parcel, the focus should be on the area that will be disturbed, rather than the average slope across the entire parcel.** State legislation and/or local regulations should set minimum standards for safe slope development. (PS-5)

- ***Advocate for appropriations from the NC Legislature for approximately $580,000 per year to accelerate the Landslide Hazard Mapping*** (LSHM) program and to complete the mapping for all 24 WNC counties by 2016. (PS-6)

  Current funding for the LSHM Program will only fund mapping for 5 of the 19 WNC counties named in the Hurricane Recovery Act of 2005. Macon and Watauga maps are complete; Buncombe County maps are underway and will be completed in 2008; Henderson and Jackson county maps are planned for completion in fiscal year 2008-2009. The NCGS has requested additional funds to conduct additional mapping.

- ***Developers are strongly urged to design and construct interconnected and loop roads*** because they provide much better access to property, and may allow for a reduction in widths. Local governments should encourage these designs. (PS-8)

- ***Road widths should be carefully considered, weighing public safety issues with environmental issues. A variety of strategies may be employed to reduce road widths.*** The Advisory Committee had a lot of discussion and debate related to road widths. (PS-13 and PS-14)

- ***Access to a development must be carefully considered. At least two points of access should be provided to all areas of the development***. (PS-10)

A wildfire can spread twice as fast on moderately steep slopes (40 percent incline) and four times as fast on very steep slopes (70 percent incline).

- ***The Firewise program should be utilized for all steep slope developments.*** This comprehensive education and implementation program allows for proper construction and landscaping practices and selective clearing to reduce the risk of structural fire damage as the result of a wildlands fire. (PS-15)

- ***Provide information to the public about alternatives to burning and on safe burning practices.***

Public Health — Findings:

- ***Groundwater is a critically important natural resource in WNC and there is a heavy reliance on it for potable water supply in steep slope developments.***

- ***There are unique groundwater quality, usage, and sustainability issues on steep slopes, particularly in the fractured rock terrain of Western North Carolina*** – groundwater storage is limited due to thin soils, increased runoff and limited groundwater recharge, so long-term sustainability (i.e. consistent supply) may be affected, particularly in steeply sloped or ridge top terrains and in high density areas.

- ***Development can, in some instances, adversely impact a local groundwater supply by: 1) producing greater demand for water than is available for withdrawal; and 2) contaminating down- gradient wells with septic and other domestic wastes.***

- ***Development results in areas of impervious or less pervious land cover (such as rooftops, building footprints, streets, parking lots, etc.). This can result in greater rainfall runoff and therefore less water available for recharge back into the aquifer.***

- ***Groundwater recharge areas must be preserved in steep slope areas to ensure a sustainable supply of potable water.***

- ***Steep and unstable slopes present special challenges for siting and installing effective onsite wastewater (septic) systems.*** Soils on ridgetops and steep slopes tend to be thinner. The steeper the slope, the more difficult it is to install an effective conventional system. State rules require thicker soil as slope increases. State rules indicate that slopes over 65 percent are "unsuitable." Installation of systems on slopes between 30 and 65 percent are problematic and require special design considerations. A site is unsuitable if there is evidence of a past landslide.

- ***Studies are recommended to determine whether standard state setbacks between private wells and septic tank systems are adequate to prevent well contamination in steep slope developments.***

- ***While State officials believe that discharge limits and treatment requirements for state permitted package treatment systems are adequate to protect headwater streams draining steep slope watersheds, some biologists and citizens disagree.***

Public Health — Strategies:

- ***All agencies (local and state) should enforce existing rules*** and this will require additional manpower and resources provided by state and local elected officials (PH-1).

- ***Because sustainability of high quality groundwater is a local-scale issue, it is recommended that, prior to development, a site-specific evaluation be made to determine whether adequate high quality groundwater supplies are present, and if so, whether the supply can be sustained given the additional planned demand (PH-3).***

- ***More thorough monitoring of ground water quality is recommended on steep slopes due to increased risk of treatment system failures and downslope contamination.*** Currently, based on new rules, wells are only sampled for quality (one water sample for 19 water quality constituents) at the time of construction. State officials recommend voluntary or mandatory private well monitoring on steep slopes every 3 years (PH-6).

- ***State and local agencies should develop and implement a comprehensive education and training program across the mountain region to address these public health issues (PH-7) and should collaborate to develop research programs to address public health issues including the adequacy of existing state setbacks between septic systems and drinking water wells (PH-8).***

- ***Universities and technical colleges should expand their technical training programs to produce enough geotechnical engineers and environmental health specialists to handle the increasing demand for these professionals (PH-11).***

Water Quality/Quantity and Impacts — Findings:

- ***Land-disturbing activities can greatly change the overall health of a stream watershed, from removing streamside vegetation to increasing stormwater runoff, water temperature, sedimentation, and erosion.*** Given the importance of our headwater streams (e.g. trout fisheries) and the important economic and ecological roles that riparian vegetation plays in protecting those streams, we must ensure appropriate development designs and the use of best management practices to provide necessary protection.
- ***Existing state regulations for limits to built-upon areas, stream buffers, erosion and sedimentation controls, and stormwater control BMPs <u>were not developed taking steep slopes into consideration and are inadequate to protect our valuable aquatic resources</u>.***
- ***Aquatic resource conservation requires a multi-faceted approach.***

Photo: NC Wildlife Resources Commission

Native brook trout require cold, clear headwater streams to survive.

Water Quality/Quantity and Impacts — Strategies:

- ***In steep slope areas, impervious surfaces within the development tract should be limited to no more than 10 percent of the total project area and designers should avoid placing impervious areas on steep portions of the tract (WQ-1).***
- ***At least 50 percent of the entire steep slope development tract should be preserved as forestland; areas within individual parcels and streamside protection areas can be included in this percentage (WQ-2).***
- ***In steep slope areas, Streamside Protection Areas should be established on all perennial streams, intermittent streams and wetlands. Protection Area width should be based on the slope of the adjacent land (WQ-4).***
- ***Golf courses are strongly discouraged on steep slope areas (WQ-6), and Ponds and lakes should be off-line only (i.e., not built in the stream channel) (WQ-9).***
- ***No more than 20 acres should be disturbed at a time during development (WQ-7).***
- ***Stream crossings should be avoided. For necessary stream crossings, bridges are preferable to culverts.*** If culverts are used, they must be properly designed and installed to prevent erosion and allow for fish and other aquatic organism passage (WQ-8).
- ***The State should provide additional resources to the NC Land Quality Section for additional staff in the Asheville Regional Office to increase inspections of land disturbing sites under the state's jurisdiction (WQ-10).***
- ***Local governments should consider adopting their own local erosion and sedimentation control programs (WQ-11).***
- ***Clear Water Contractors Workshops should be offered to grading contractors across WNC on a regular basis.*** The State and others should explore a formal certification or licensing program for grading contractors operating on steep slopes (WQ-12).
- ***State and local governments should require geotechnical analyses of steep slope areas over 40 percent (as a minimum) to assist in avoiding highly erodable and landslide-prone areas***

and in developing comprehensive development plans that address water quality and quantity issues. (WQ-15).

- *State or local governments should require all steep slope developments to submit comprehensive stormwater management plans and to utilize mitigation and structural practices to ensure no net increase in runoff versus pre-development conditions (WQ-16).*
- *State and federal agencies should carry out additional research on the affects of steep slope development on headwater streams in WNC (WQ-17).*

The Loss of Natural Areas, Forests, Wildlife and Role of Land Conservation — Findings:

- *Conservation is the careful preservation and protection of something; especially the planned management of a natural resource to prevent exploitation, destruction, or neglect.*
- *Natural resources and attributes to be conserved include 1) Natural ecosystems and biodiversity: flora, fauna and wildlife; 2) Forestland and farmland; 3) Streams and their aquatic residents; 4) Viewsheds; and 5) Natural places for leisure and recreation.*
- *Development activities on steep slopes and along mountain ridges have increased substantially in both numbers and size during recent years in the mountains of western North Carolina.* A recently published report indicates that developed land in the mountains has increased by 44 percent over the last 20 years and estimates that the mountain region will lose an additional 22 percent of open space during the next 20 years.
- *Privately owned working forests are being converted to development in western North Carolina. This phenomenon is contributing to a reduction of the economic viability of the timber industry and the number of jobs associated with timber management and harvesting.*

Photo: North Carolina Wildlife Resources Commission

Suburbanization of remote areas will create a variety of problems for wildlife.

- ***Increasing pressure from suburbanization of remote areas will create a variety of problems for wildlife and their habitat.*** One report predicts decreased black bear habitat on private lands because of development. Human encounters with animals (especially bears) also will become more frequent as the landscape becomes less "wild."
- ***A number of local governments in western North Carolina have taken a very proactive approach in preserving sensitive environmental areas, including steep slopes, within their jurisdictions.*** Buncombe County has a Land Conservation Advisory Committee and has provided approximately $3.8 million in funding for land conservation projects in the last two years.
- ***Present use value (PUV) tax structures at the county level provide some property tax relief for working farms and forests, but not all counties utilize this approach.***

The Loss of Natural Areas, Forests, Wildlife and Role of Land Conservation — Strategies:

- ***Each county should establish a Land Conservation Advisory Committee (or use an existing board) to work with public agencies, non-profit conservation organizations, and other stakeholders to identify and protect sensitive areas within their jurisdiction (LC-2).***
- ***Each county should establish a Land Conservation Fund to create a funding source for state/federal grant match money to protect highly valued natural resources/open space and to provide recreational opportunities for their residents and visitors (LC-3).***
- ***Local governments should review and implement the North Carolina Present Use Value Tax Program. They should also develop new ways to provide property tax relief to owners of working lands and conservation easements (LC-4).***
- ***The General Assembly should appoint a study committee to conduct research and review of changes to property tax law in order to provide relief to landowners interested in conserving their land (LC-6).***
- ***Encourage adequate on-going state funding for the NC Clean Water Management Trust Fund, the NC Parks & Recreation Trust Fund, the Agricultural Development and Farmland Protection Trust Fund and the NC Natural Heritage Trust Fund (LC-7).***
- ***Local governments should adopt land use policies that incorporate environmental protections and conservation design principles while giving incentives to developers whose plans are outstanding examples of environmental sensitivity (LC-8).***
- ***Educate newcomers and existing residents about the special considerations necessary when living near wildlife***

Source: Equinox Environmental

A conservation subdivision design preserves open space, minimizes site disturbance and places roads and buildings on less sensitive parts of the site.

interface areas to minimize potential conflicts. Information is readily available (see *http://www.ncwildlife.org/index.htm*), but increased exposure of this information to developers and home owner associations would be beneficial (LC-15).

Preferred Development Processes and Best Management Practices — Findings:

- ***There is a critical need to define a preferred development review process and create best management practices for steep slope development. A Preferred Development Process needs to include due diligence, design, approval, permitting and implementation and should be utilized for all projects that are to be built in the mountain region, regardless of jurisdiction.*** This process will guide new and experienced developers to help manage risk, make informed decisions and enhance environmental and financial value. One major part of the goal of these efforts is to create a greater dialogue, sooner in the process, among local governments and designers and project specialists.

Preferred Development Processes and Best Management Practices — Strategies:

- ***Local governments should consider requiring one or both of the following mechanisms as their Preferred Development Process, to address concerns for all development on mountain ridges and steep slopes*** (as defined by each community): (PDP-2)

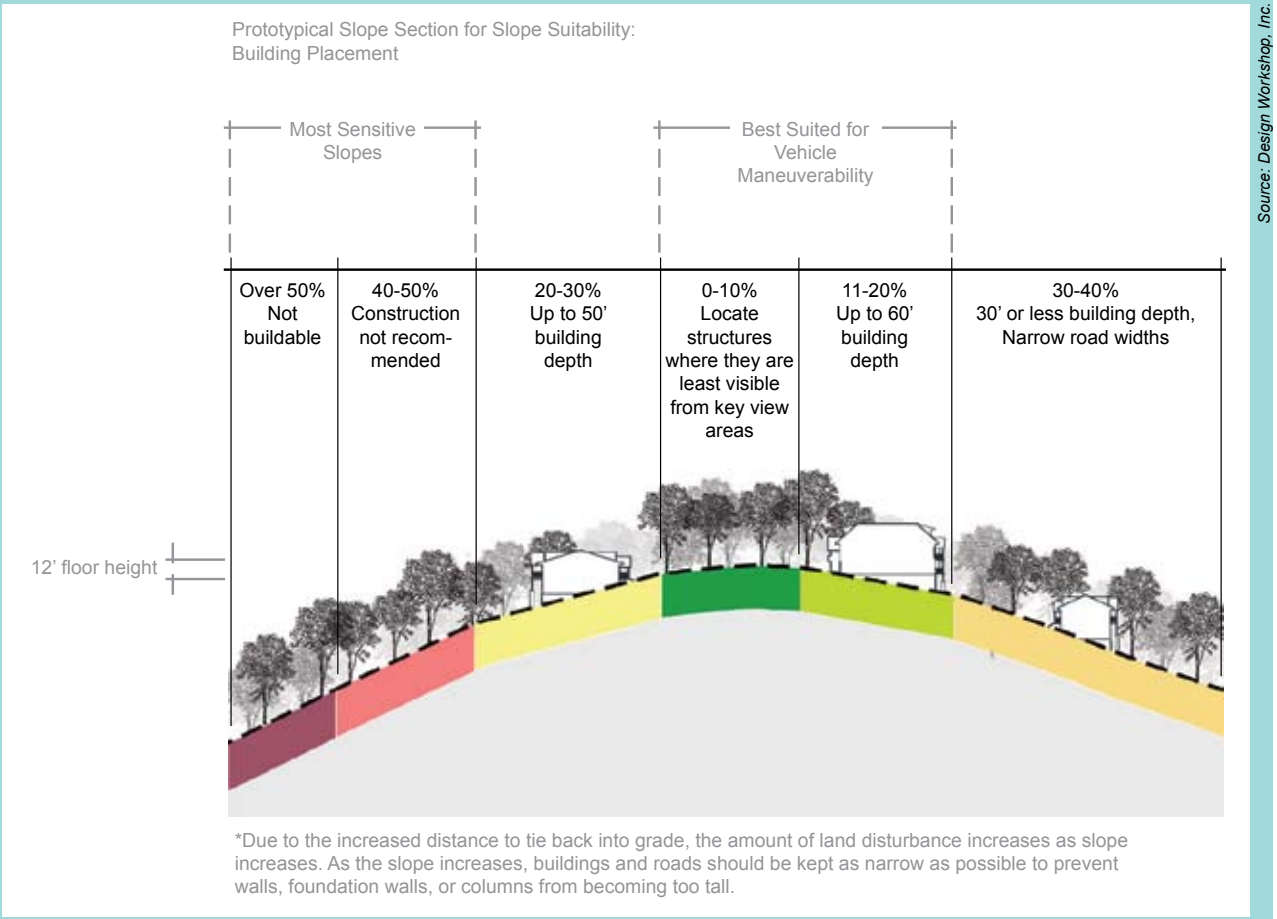
  A. Review of a Specific Regional or Local Government Website.
  A website should be developed that contains information including: specific issues/challenges regarding building on steep slopes in the mountains; existing state, federal and local rules and permitting procedures and contacts; local land planning and technical expertise available; etc.

  B. One-on-One Pre-Development Consultation Meetings with the developer and local government planning staff before development plans are drawn up.

- ***Encourage conservation-based development plans, through regulations and incentives.*** Conservation-based design practices strive to conserve/preserve a site's natural resources and features while designing the development on the site. Incentives may include a faster permitting process, allowances for increased density, reduced fees, and others. (PDP-3)

- ***Offer "Steep Slope Development 101" workshops*** for landowners, developers, design professionals, realtors, bankers, etc. (PDP-4)

- ***Develop some sort of regional Sensitive Developer Certification Program that would include having knowledge/expertise on multiple related topics pertaining to developing in the mountains (similar to the National Audubon Program).*** The Asheville Homebuilders Association and Asheville Board of Realtors are interested in partnering with Land-of-Sky Regional Council to develop and offer this type of program and offer continuing education credits and certification. (PDP-5)



An example of best management practices related to building placement on slopes.

Next Steps:

The Land-of-Sky Regional Council has secured additional funding from the Z. Smith Reynolds Foundation to take the next steps. Council staff and the Advisory Committee will convey this study's finding and strategies to key groups across the mountain region including local and state officials, the building and real estate industry, and other interested groups. The Advisory Committee has agreed to continue meeting to assist in implementing the strategies in this report. Many other organizations will need to get involved and play a role in taking positive action to ensure safer and more sustainable development on mountain ridges and steep slopes. Your assistance is welcome!

For more information, contact the Land-of-Sky Regional Council at 828-251-6622 or visit *www.landofsky.org*

I. Introduction

A. Purpose & Need

The mountainous area of western North Carolina is experiencing rapid growth and increasingly more development is moving onto steeper slopes and mountain ridges. Population growth rates vary by county, ranging from 15 percent for Transylvania and Haywood counties to almost 30 percent for Henderson and Macon counties over the past ten years. Community leaders and long-time residents are expressing concerns about losing the resources that give this region its unique sense of place. Citizens are writing letters to newspapers, speaking at public meetings, and forming new advocacy groups. Local elected officials are initiating studies, plans and regulations to understand the issues and try and address them.

The Mountain Ridge Protection Act, enacted by the North Carolina General Assembly in 1983, regulates **only** the height of buildings on "protected mountain ridges" – all ridges at or above 3000 feet elevation and whose elevation is 500 feet or more above an adjacent valley floor. The "ridge" contains the uppermost points as well as all land within 100 feet below the elevation of the crest. Buildings cannot exceed 40 feet in height and must not protrude above the ridge more than 35 feet (a few exceptions exist for towers, chimneys, steeples, etc.).

Counties had the option of adopting the State ridge law or opting out and adopting one of their own. Buncombe, Henderson, Clay, Graham, Macon, McDowell, Mitchell, Rutherford, Swain, Watauga and Yancey counties adopted the State law. The other counties and some municipalities (e.g., Waynesville, Asheville, Black Mountain) have adopted local laws.

Many other issues besides building height need to be considered when developing on mountainous terrain, such as:

- public safety issues related to landslides, wildfires and emergency response;
- public health issues around protecting drinking water sources, wastewater disposal and septic system impacts;
- erosion, sedimentation and storm water runoff;
- water quality and quantity impacts on fish and aquatic species and ecosystems;
- loss of natural areas and endangered species;
- fragmentation and loss of wildlife habitat and travel corridors;
- tree/vegetation preservation;
- aesthetics and viewshed protection;
- economic impacts of development and of preservation (positive and negative); and property rights.

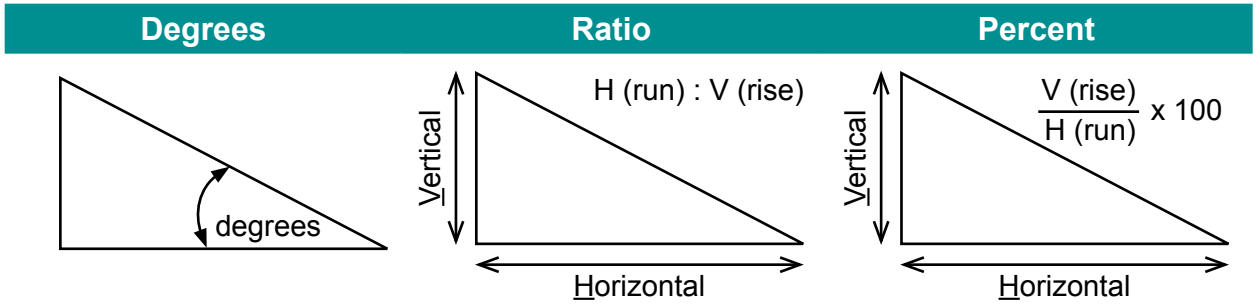
Photo: David Gantt

This condominium on Little Sugar Top Mountain led to the enactment of the Mountain Ridge Protection Act (1983).

Local governments in this region have asked for information and recommendations on these various issues and ways to address them. A few of them have drafted ordinances to regulate certain types and aspects of development on steep slopes (see Appendix B for a listing and brief comparison of the ordinances).

It is important to note that no common definition exists for "steep slopes." Policies and regulations are typically tied to the average slope of a parcel or to a range of slope amounts (e.g., greater than 15 percent slope, between 25 and 35 percent slope, etc.).

Slope is expressed in different ways in different documents and contexts: in degrees, as a ratio and as a percent. The following diagrams provide a comparison of these three expressions of slope.



45°	1 H : 1 V	100%
27°	2 H : 1 V	50%
18°	3 H : 1 V	33%
14°	4 H : 1 V	25%

This project attempts to provide a comprehensive examination of mountain ridge and steep slope development issues. Studies of individual issues have been done, but there are no previous efforts that looked at all the issues together. This is the first collaborative effort to develop effective strategies to address these issues in this region. The report contains a variety of strategies, including education, incentives, regulations, policies, funding programs and others, recognizing that a coordinated set of strategies will be most effective.

B. Advisory Committee & Process

Z. Smith Reynolds Foundation awarded grant funding to Land-of-Sky Regional Council in June, 2006 to pursue this project. LOSRC staff first consulted with western North Carolina planner and county manager associations and other key groups about the proposed project and process. Land-of-Sky Regional Council formed a diverse Mountain Ridge and Steep Slope Protection Advisory Committee in October 2006 to guide the process and the project (see Appendix A for a list of committee members). The Advisory Committee met monthly to learn from experts on issues related to development on mountain ridges and steep slopes. Issues discussed included public safety (landslides, unstable slopes, emergency response, wildfire management); public health (water supply and wastewater systems); water quality and quantity and impacts on aquatic systems (erosion and sedimentation, reduced groundwater recharge, loss of headwaters protection, stormwater runoff); loss of natural areas, working forests and wildlife habitat and the role of land conservation; and economic issues and property rights.

Ten separate community listening sessions in five counties were held in May and June 2007 to receive pubic input on the issues. LOSRC staff developed a presentation outlining the issues to provide education and background and showed this presentation at the community listening sessions. Staff also showed the presentation to the Land-of-Sky Regional Council Board in June, 2007 to provide them with information and hear their input. Seven subcommittees of the Advisory Committee were formed in July to review all input and develop findings and recommendations for consideration by the full Advisory Committee. This report is a result of the subcommittees' work and review and revision by staff and the Advisory Committee.

This project has already had a significant impact by focusing attention on the many issues related to development on steep slopes and mountain ridges. Local media covered the community listening sessions and have produced articles focused on specific issues. Several communities have already put measures in place to address the issues related to steep slope and ridge development.

II. Issues & Strategies

In each section below the main issues are discussed first, followed by specific strategies for addressing them.

A. Overarching Issues & Tradeoffs

Before getting into individual issues, it is important to recognize some overarching issues associated with mountain ridge and steep slope development. Also, many development issues are inter-related, so strategies to address them may involve trade-offs. Overarching issues include the following:

- ***Better enforcement of existing (and new) regulations is needed.*** This will require additional costs on the part of both developers, who will face higher application and compliance costs, and governments, who will face higher enforcement costs. These will lead to higher costs for housing and possibly increased taxes for residents. The precise cost burden of these actions (i.e., how much is shifted to home buyers and how much is shared by taxpayers) will depend on the specifics of the proposed enforcement actions and decisions by local governments about how to implement/enforce these rules.

Photo: NC Wildlife Resources Commission

Additional staff are needed to inspect construction sites.

- ***Additional transparency of the policy process (involving both existing and any new regulations) is needed.*** In part because some of the policy changes are happening quickly, a 'black box' is often perceived to be in operation in terms of how citizens, developers, and governments make decisions. Policy changes and actions need to be identified and communicated effectively and consistently.

- ***Policies need to be based on the best available scientific data.*** In cases where there may not yet be adequate scientific data to guide the policy process, a meaningful, community-based participatory planning process should be followed to ensure adequate opportunity for public input.

- ***Governments across the mountain region need to work together to ensure policy consistency.*** For example, if one city/county chooses to enact a relatively more strict regulation on steep slope development than other areas, then some developers may shift to other cities/counties. Without coordinated actions by governments, we will likely not see an amelioration of the problems associated with mountain ridge and steep slope development but rather a shifting/displacement of the problems across the landscape.

The **general economic issues** associated with mountain ridge and steep slope development include the following:

Photo: Linda Giltz

Wider roads may provide better access for emergency vehicles, but they require more land disturbance and grading, which can affect water quality, scenic quality and other things.

- ***There are costs and benefits associated with both steep slope and ridge development and protection.***
- In addition to itemizing these costs and benefits, communities must consider equity issues such as who pays the costs and who receives the benefits of development or protection in order to determine what is best for their community.
- The **external costs** of development are those costs that spill over onto the community. These include soil erosion, storm water run-off/re-direction, habitat fragmentation and cost of services. ***These externalities are not accounted for by markets, thus additional government intervention will be needed in order to address the social consequences of these spillover costs.*** If a landowner is creating costs for communities as a result of the externalities associated with development of a ridge or slope, the community may wish to intervene and request compensation for the costs that are being imposed on the community.
- **Similarly, there are *spillover or external benefits* associated with steep slope and ridge protection**, such as scenic beauty, protection of wildlife habitat, and protection of water quality and quantity. If a landowner is providing benefits to the community because they have chosen to not develop their land, the community may wish to compensate them for the benefits that the community is enjoying because of their conservation decision. These spillover benefits may be a rationale for government intervention in the form of payments or tax relief for conservation.
- ***There are both property rights and responsibilities.*** Markets do not protect rights that are not clearly defined, and in the presence of external benefits and costs, government intervention may be necessary in order to ensure that rights and responsibilities are defined and enforced.

Decision-makers need to consider the ***inter-relatedness*** of some of these development issues and acknowledge that **tradeoffs** exist among policy recommendations, and tradeoffs will occur as a result of a particular recommendation. A few examples:

- Because of the limited supply of land, if we restrict development on steep slopes and mountain ridges, then we will need to accept more dense development in the less-steep and more urbanized areas and/or development spreading across the landscape.
- To preserve prominent viewsheds (e.g., from the Blue Ridge Parkway and other main roads) while allowing development in these areas, local governments may place restrictions on the height of structures, color of homes and/or roofs and the amount of tree removal. Scenic mountain views are a basis for the region's popularity and its economy.
- While wider roads may provide better access for emergency access and for evacuation during a fire or other emergency, wider roads require more land disturbance and grading and result in more impervious surfaces, which can have negative impacts on water quality.
- If governments choose to enact stricter regulations for water quality/public safety/aesthetic purposes, we will have cleaner water/safer slopes/scenic beauty, but these all come at a cost. The distribution of the costs and benefits of these actions, and the tradeoffs among them, should be recognized.
- If governments choose to require disclosure of slide hazards, then there may be fewer consumers interested in living in those areas which will put owners of properties in slide areas at a disadvantage, if they intend to develop them.

B. Economic Impacts of Development and Preservation

Findings:

There are benefits and costs associated with both development and preservation of steep slopes and mountain ridges.

1. Economic impacts of steep slope and ridge development:

- Benefits:

» Increased tax value of land, resulting in increased tax revenues to local governments. Since it typically costs more to develop on this type of land, resulting development may have a higher sales price than similar development on flatter land.
A related point is that people are generally willing to pay more for property that has a scenic view and for properties that have been sensitively developed.

» Design and construction jobs related to development. The real estate industry is a critical piece of our local and regional economy. Home building is the third largest private sector "employer" in the region and one in eight jobs are created by the real estate and home building sectors (Asheville Homebuilders Association).

» Some of these benefits will be short term (construction jobs) and others will be longer lasting (increased tax revenues).

» Some of these benefits have a broad impact (tax revenues) while others are more narrowly beneficial (construction).

- Costs:

» Development often results in higher costs to provide utilities, fire, emergency and public safety services to these areas. Costs of public services may exceed tax revenues received. Taxing authorities may have to consider raising taxes in order to cover costs of services. If costs of providing fire protection increase, all homeowners in the fire district will face higher rates, not just those located on steep slopes.

» Communities and homeowners that previously enjoyed views of undeveloped slopes and ridges may experience a loss of property values when development occurs in their viewshed.

Photo: Marc Pruett

Sometimes development causes damage to down-slope properties, so costs must be reconciled between property owners.

» The loss of scenic views can lead to a loss of tourism and related income since much of our region's tourism is dependent on visitors' and residents' appreciation of our scenic beauty and distinct mountain character.

» Some of the costs will have an impact on a broad spectrum of the community (loss of scenic views) while others will be costly to narrower segments of the community (insurance rates within one particular fire district) or to individual property owners.

2. Economic impacts of steep slope and ridge preservation/conservation:

- Benefits:

» Plant and animal habitats protected and not fragmented resulting in less need for public expenditures to protect species.

» Water quality and quantity are protected in undeveloped areas.

» Scenic quality preserved – scenic quality is what retains many existing businesses and draws many people and new businesses to locate and visit this area. Scenic quality can be marketed nationally and internationally and tourism and economic development organizations in western North Carolina utilize this in their current marketing campaigns.

» Scenic quality preservation also maintains or improves property values – i.e., people are willing to pay higher prices for homes "with a scenic view" (Bolitzer & Netusil; Espey & Fakhruddin; Lake & Easter; among others). The value of properties adjacent to and/or within view of a protected property are higher than they would otherwise be, thus adding tax revenues that the community receives from those properties.

- Costs:

» Less land is available for development, which increases pressure to develop on less steep land and drives up the value of land that is developable.

» If protection is through regulations which are too onerous, owners may sue local/state government for their rights to develop, which will cost all parties in legal fees.

» If protection is through purchase (outright or purchase of conservation easement), a public or private funding mechanism must be identified to pay for the costs of protection.

Strategies:

In order to determine the economic impact of steep slope development and protection on communities, it will be necessary for each community to fully explore the costs and benefits to the community of the action (slope/ridge development or protection), including both the direct and indirect impacts in the short and long run. In addition, communities should consider who is benefiting from and who will pay for a proposed action (slope/ridge development or protection). Decisions that result in a net benefit to the community, where benefits outweigh the costs, will require each community to compare the net benefit of development with the net benefit of conservation.

1. To encourage conservation/protection that results in a net benefit to the community:

EC-1. ***Identify priority parcels/areas for conservation*** based on the quality of their natural and/or cultural resources and habitats, and their location related to other conservation areas, priority viewsheds, etc.

◊ Examples include areas along the Blue Ridge Parkway, which is a significant tourism draw in western North Carolina (Mathews, Kask & Stewart).

◊ The cost of not protecting priority viewsheds may have a negative impact on adjacent property values and a decline in tourism, which would be undesirable for communities from a financial perspective.

EC-2. ***Provide a range of incentive options to reward land owners who commit to conserve their land through a conservation easement or similar measure.***

◊ Existing or potential incentives could include:

~ direct financial compensation in exchange for voluntarily giving up the development rights on the property;

~ a tax credit with enough flexibility to make it attractive and worthwhile to property owners, when development rights are donated;

~ preferential property tax rate that reflects the conservation value;

~ paying the transaction costs associated with putting an easement on the property.

EC-3. When communities have determined that costs and benefits are not fairly distributed, ***adopt carefully crafted regulations which attempt to balance development and conservation by making as explicit as possible the costs and benefits of the regulations.***

2. To encourage development that results in a net benefit to the community:

EC-4. ***Enforce regulations and ensure that mitigation for any external costs identified is borne by the party or parties responsible for creating those costs, not the community at large.***

◊ For example, if a gravel road on a steep slope washes out into the road and/or adjacent waterways, the party responsible for creating the washout (property owner, builder, etc) should incur the costs of clean up instead of the greater community (taxpayers).

Photo: Marc Pruett

The party responsible for creating a washout or similar effect should incur the costs of repairing the damage.

◊ For another example, if a stream is polluted by sediment washing off of a development, then the party responsible for creating the erosion (property owner, builder, etc) should incur the costs of stream repair or should pay into a local land preservation fund (see EC-2 above or EC-5 below) to off-set the cost borne to the community.

EC-5. ***Provide financial incentives to developers who protect viewsheds, avoid habitat fragmentation, and protect water quality.***

◊ Examples of incentives include:

~ **Density bonuses**. Developers could be granted permission to build more densely than existing zoning regulations allow on some portions of the property in exchange for not developing on other areas of the property. The density bonuses could be calibrated to reflect the conservation value of the property that is protected, with a greater density bonus awarded for protection of priority viewsheds or habitats.

~ Henderson County offers a density bonus for conservation subdivisions. Information available on their website: *www.hcplanning.org*

~ **Accelerating the permitting process** for developments that include preservation of natural resources, viewsheds, habitats, etc.

~ **Recognition** for a good steward of the region's resources via a certification and/or award program that could be used by the developer as a marketing tool.

EC-6. ***Local governments should adopt site lighting requirements to protect property values and enhance public safety.*** Site lighting has the potential to create glare and light "trespass" onto neighboring properties and adjoining rights-of-way. These effects can result in devaluation of property through light intrusion and safety problems when drivers are distracted by glare. They also impair views of the night sky.

◊ Site lighting should be equipped with 90-degree cut-off fixtures and oriented away from any adjoining property or right-of-way. 90-degree cut-off fixtures are lighting fixtures designed to block the emission of light at angles greater than 90 degrees perpendicular to the surrounding ground level.

◊ Lights installed in canopies and under roof structures should be recessed into the canopy or structure.

The mission of the International Dark-Sky Association (IDA) is "to preserve and protect the nighttime environment and our heritage of dark skies through quality outdoor lighting." IDA's website, *www.darksky.org*, contains many resources related to outdoor lighting including studies, fact sheets and model policies and regulations.

◊ No site lighting should be mounted on a pole or a building at a height greater than 16 feet in residential districts and 30 feet in mixed-use and nonresidential districts (Note - these heights are examples from Asheville's requirements). Height shall be measured from the surrounding ground level.

Financing Mechanisms:

The protection of mountain ridges and steep slopes may require additional revenue streams for local governments to cover the additional costs associated with improving monitoring and enforcement of existing regulations, the purchase of conservation easements or transaction costs associated with them, etc.

EC-7. ***Local governments should consider a variety of financing mechanisms to generate revenues for protecting mountain ridges and steep slopes. Ideas include:***

◊ ***Voluntary donations.*** These could be solicited from:

~ Developers and/or the property owners who enjoy the beautiful views provided by the decisions of other landowners to protect their land.

~ Taxpayers interested in "rounding up" their tax bill for mountain ridge protection.

~ Visitors who come to the region to enjoy the mountains, via a voluntary donation at the Visitor's Center, or on their hotel or car rental bills. An example is the Hotel Giving Program of the High Country Conservancy in Boone, NC which adds a $2 voluntary donation on hotel bills at participating establishments (*http://www.highcountryconservancy.org/community/page.php?58*).

◊ ***Local tax revenues generated from higher property values on properties adjacent to those protected.***

~ Protected property tends to generate increased property values on adjacent lands and land opposite the protected property, due to the 'value of the view' that households are willing to pay to enjoy a beautiful view from their home. Thus when a parcel is protected, the additional tax revenues generated from other properties may more than compensate for the costs associated with the purchase of the protection. Additional research is needed to identify the magnitude of the increase in property values in western North Carolina, and to determine whether or not counties will, on net, gain or lose revenue with protection.

~ ***Impact fees*** on developers based on the cost incurred by the community of the development (amount of habitat fragmentation, the impact of soil erosion on water quality, viewshed disruption, etc.). The NC General Assembly would need to grant permission to allow local governments to use impact fees.

~ ***A local bond referendum.*** Many communities across the U.S. have passed bond referenda to finance open space preservation. (Nelson & Polasky)

~ ***A visitor impact fee collected on car rentals or hotel bills.***

Bibliography:

Bolitzer, B., and N.R. Netusil. 2000. "The impact of open spaces on property values in Portland, Oregon." *Journal of Environmental Management*. 59(2): 185-193.

Deller, S. C., T. Tsai, D.W. Marcouiller, and D. B. K. English. 2001. "The role of amenities and quality of life in rural economic growth." *American Journal of Agricultural Economics*. 83(2): 352-365.

Espey, M. and F. Fakhruddin. 2007. "Living on the Edge: Residential Property Values in the Urban-Rural Interface." *Journal of Agricultural and Applied Economics*.

Kask, S. PhD. Professor of Economics, Warren Wilson College. Presentation to project Advisory Committee, February 12, 2007.

Lake, M.B. and K. W. Easter. 2002. "Hedonic Valuation of Proximity to Natural Areas and Farmland in Dakota County, Minnesota." *University of Minnesota Department of Applied Economics Staff Paper*. P02-12.

Lutzenhier, M. and N. R. Netusil. 2001. "The Effect of Open Spaces on a Home's Sale Price." *Contemporary Economic Policy*. 19(3): 291-298.

Mathews, L. G. PhD. Associate Professor of Economics, The University of North Carolina at Asheville. Presentation to project Advisory Committee, February 12, 2007.

Mathews, L. G., S. Kask and S. Stewart. 2003. *Blue Ridge Parkway Scenic Experience Project Phase 2 Final Report*. Submitted to the Blue Ridge Parkway Foundation. Available at *http://www.nps.gov/blri/parkmgmt/upload/blriscenicexpnc2.pdf*

Nelson, E., M. Uwasu, & S. Polasky. "Voting on open space: what explains the appearance and support of municipal-level open space conservation referenda in the United States?" *Ecological Economics*. 62(3-4): 580-593.

Tyravainen, L. and A. Miettinen. 2000. "Property Prices and Urban Forest Amenities." *Journal of Environmental Economics and Management*. 39(2): 205-223.

C. Public Safety Issues

Findings:

1. Landslides

Landslides are a legitimate concern in western North Carolina. Since 1916 major storm events that triggered landslides across the region have occurred about every 22-29 years. A damaging landslide occurs nearly every year in the region and major landslide events occur about every nine years somewhere in the region.

Landslides result from the cumulative effect of many interrelated factors, including underlying geology, geomorphology (landforms and processes that create them), hydrology, weather/climate, slope modifications, and deforestation. Landslides may be "triggered" by earthquakes, blasting, freeze-thaw, slope modifications, with the most common trigger being high levels of precipitation. Slope modification is a major contributing factor to slope instability. Note also that in the past few years a number of low magnitude earthquakes have occurred in western North Carolina (e.g., one measuring 3.1 on the Richter scale had an epicenter in Polk County on December 7, 2007).

Photo: Rick Wooten

The bottom of the Peeks Creek debris flow, September 2004; five people were killed and fifteen homes were destroyed.

Landslides pose threats to human life and public safety.

For example:

- Five people were killed in the Peeks Creek debris flow during the storms from Hurricane Ivan on Sept. 16, 2004 and fifteen homes were destroyed. The Peeks Creek debris flow moved downstream at speeds of over 30 miles per hour.
- There were over 2,000 landslides and 14 landslide related fatalities in Watauga County during the August 13-14, 1940 storm event. Other landslide fatalities occurred in North Carolina in the August 28-31, 1940 and July 15-16, 1916 storm events.

Landslides lead to significant environmental damage including soil and forest loss, sedimentation of streams, rivers and lakes, increased erosion and habitat destruction.

The NC Geological Survey is undertaking a Landslide Hazard Mapping (LSHM) Program. These maps identify potential problem areas – locations that need a more detailed assessment by qualified geotechnical engineers, geologists or soil scientists. Information from the NC Slope Movement-Slope Movement Deposit Database is currently available at *www.nconemap.com*.

Landslide hazard mapping in Macon County was completed in 2006. Maps for Watauga County are complete and Buncombe County maps are planned to be complete in 2008. Henderson and Jackson county maps are planned for completion in fiscal year 2008-2009.

The three map set shows:

» where landslides have occurred, or are occurring (Map of Slope Movements and Slope Movement Deposits; see Figure 2);

» where landslides are likely to start (Stability Index Map); and

» if they start where they are likely to go (Downslope Hazard Map; see Figure 3).

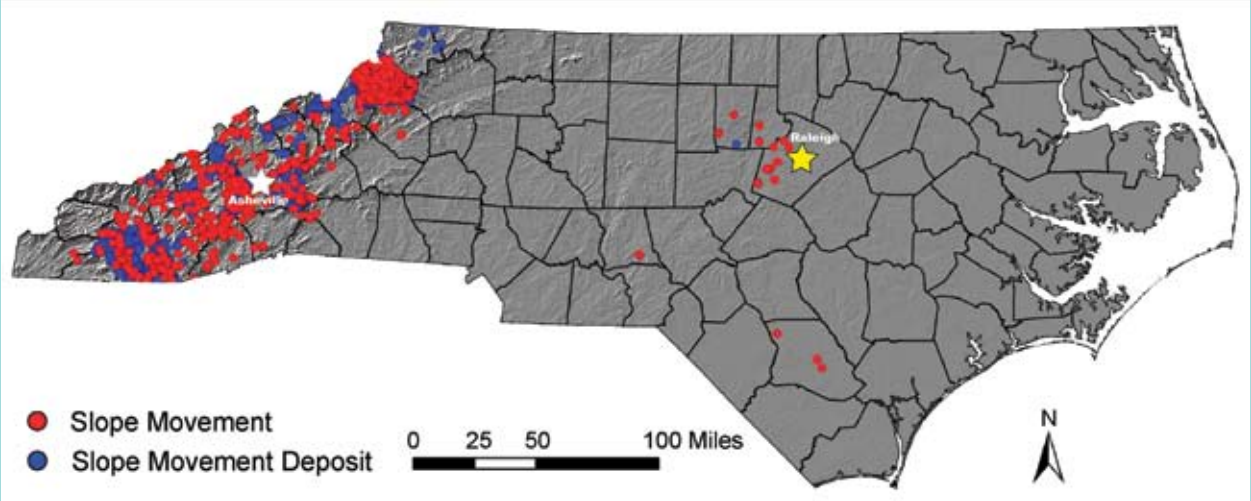


Figure 1.

Map showing the locations of 2,046 slope movement and slope movement deposit database entries as of August 2006, and the geologic provinces in North Carolina. Star shows the location of Raleigh, the State Capitol. The locations of slope movements and slope movement deposits in the NCGS database are made available on the Internet at *http://www.nconemap.org*, and statewide information on geohazards is available at *http://www.geology.enr.state.nc.us*.

Landowners, homebuilders, realtors, surveyors, bankers, etc. are not currently aware of landslide hazard zones. There is no current notification system that tells someone they are buying property, building or living in a landslide hazard zone. Developments have or are occurring in areas of past landslide activity. For example, there is one very dense housing development in Maggie Valley (Haywood Co.) that was constructed in 1985 on top of a debris fan (unconsolidated material deposited by landslides over geologic time). There is another on the steep slopes of Beaverdam Valley in Buncombe County. Since 1940 in Watauga County nearly 130 homes have been built in tracks of landslides that occurred in 1940.

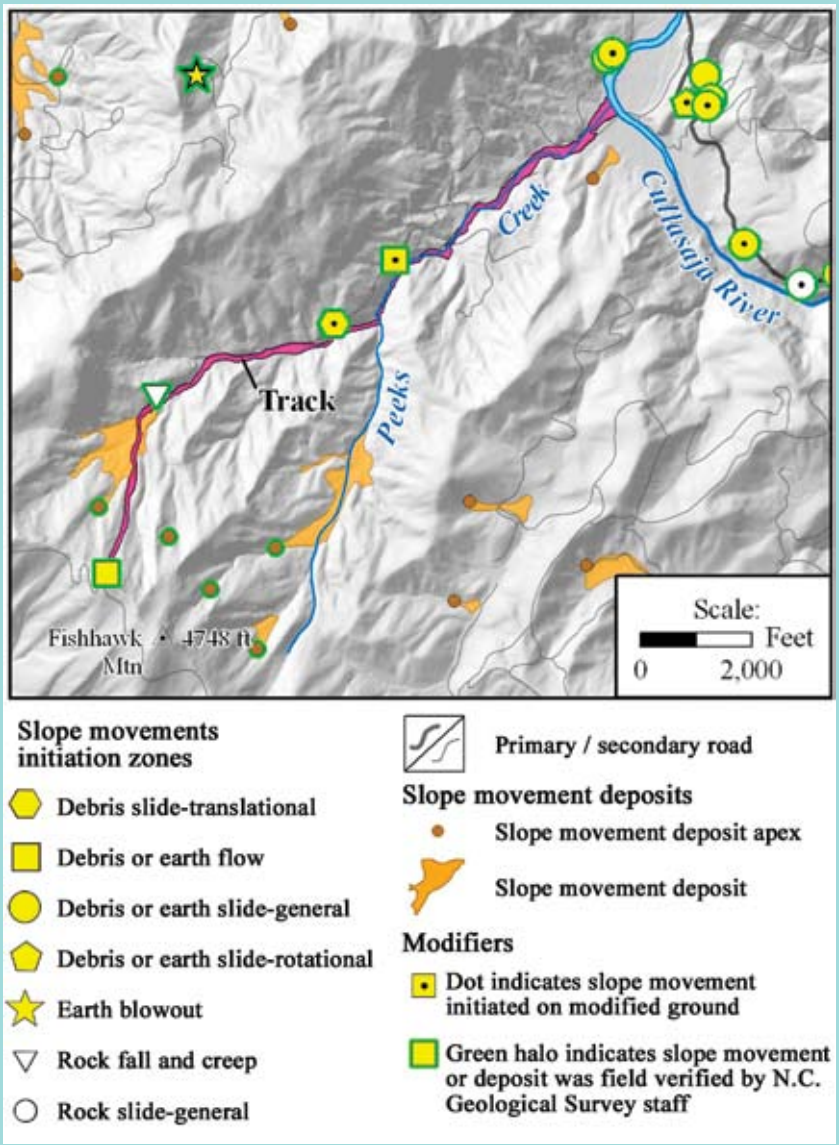


Figure 2.

Excerpt of the map of slope movements and slope movement deposits of Macon County, North Carolina (Wooten, et al., 2007) showing the area near the September 16, 2004, Peeks Creek debris flow (track shown in pink). Not shown are at least two generations of pre-existing debris flow deposits exposed along the track of the Peeks Creek debris flow. Map base is a hillshade LiDAR DEM.

Homeowners' insurance in North Carolina does not cover structural damage due to landslides. Four homeowners in the Hunters Crossing condominiums in Haywood County (constructed between 1991 and 1998) have been forced from their severely damaged homes due to slow movement of a 1.5-acre landslide. The owners are still paying the mortgages even though they cannot live there and may even have to pay to have the homes demolished. This represents a devastating economic loss for these families. Four additional homes are endangered; two of these homes have gone into foreclosure.

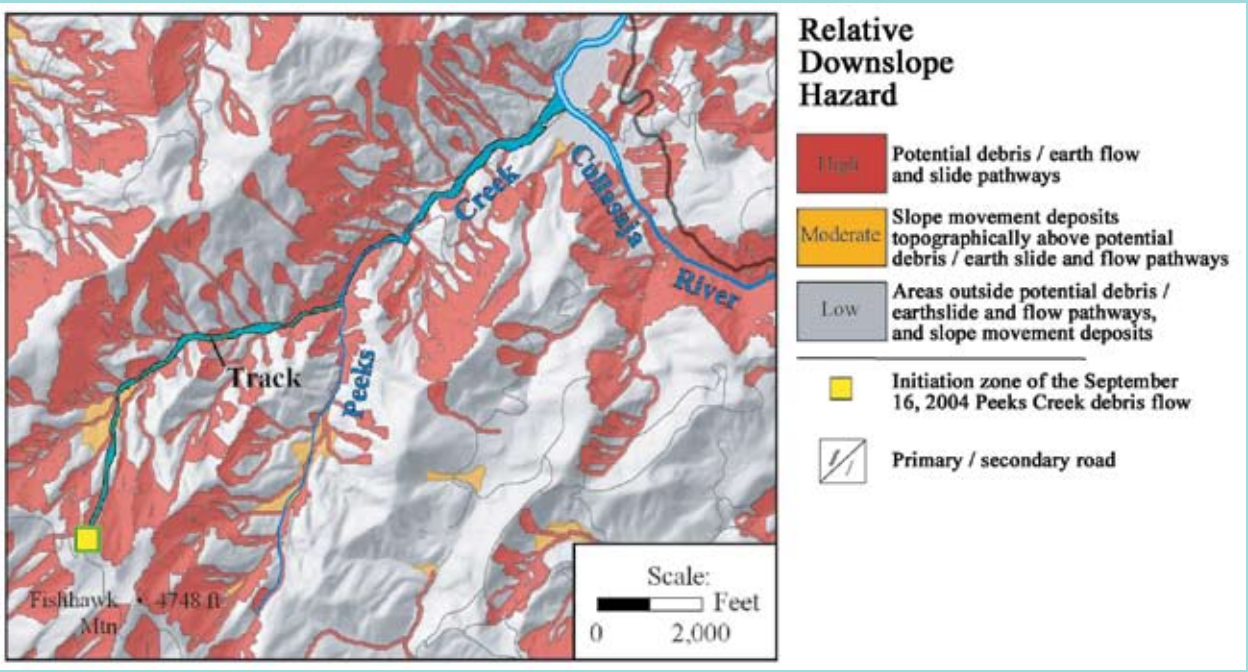


Figure 3.

Excerpt of the downslope hazard map of Macon County, North Carolina for shallow translational slope movements (Wooten, et al., 2007) showing the area in the vicinity of the September 16, 2004, Peeks Creek debris flow (track in blue). Map base is a hillshade LiDAR DEM.

Landslides are a significant issue, but they do not occur frequently. However, erosion is prevalent and more visible on a daily basis. General impacts of erosion are: downhill property damage; increased water flow to downhill properties; risk of structure destabilization from water and debris flows; and development of gullies and channels that alter natural patterns of rainfall events. Strategies to address the impacts of erosion are included in the Water Quality/Quantity and Impacts section (E.) of this report.

2. Fire and Emergency Response

Fires are influenced by three major factors: weather; topography; and vegetation (fuel). These factors determine the likelihood of a wildfire starting, how fast a wildfire will burn, the direction and intensity of a fire and firefighters' abilities to extinguish it.

The following is excerpted from "Minimizing Wildfire Risk" (Bardon and Carter, 2003):

> "**Weather –** Wind, relative humidity, temperature, rainfall and atmospheric stability affect fire behavior by drying fuel and making it more flammable. High winds that are gusty, low humidity, high temperatures, and drought conditions led to the rapid spread of a wildfire. The combination of severe weather conditions and hazardous fuel levels can generate devastating, nearly uncontrollable wildfires.

Topography – Steep slopes and forest openings affect the direction and spread of wildfires. Steep slopes can expose fuel to more solar radiation, increase winds and cause wildfires to spread faster. A wildfire can spread twice as fast on moderately steep slopes (40 percent incline) and four times as fast on very steep slopes (70 percent incline)…

Vegetation – Ground-level fuels are vegetation that accumulates on the forest floor, such as pine needles, fallen limbs and leaves, as well as low-growth plants, such as weeds, shrubs, and small trees. These fuels are the primary means by which wildfires spread. … Without periodic fire, these fuels can accumulate to dangerous levels. Wildfires that begin in forests with heavy levels of ground-level fuels spread rapidly and often move into the tops, or crowns or tall trees by climbing up shrubs, vines, and small trees. … Many opportunities to reduce the risk of wildfire lie in the proper management and manipulation of wildland vegetation.

Photo: Greg Yates

Fires are influenced by three major factors – weather, topography and vegetation – and fires spread faster, the steeper the slope.

It is difficult to meet the two goals of providing emergency service protection on developed steep slope areas and minimizing the environmental impact of the development, without compromises from both sides. Emergency response vehicles need roads that are wide enough to handle their vehicles and access and traverse developed areas in their service areas. However, as road width increases, the amount of land disturbance and related environmental impacts increase.

The *North Carolina Fire Prevention Code*, Appendix D, addresses road construction widths and slopes to allow for optimum response from fire fighters and Emergency Medical Services (EMS). The code recommends 20-foot wide roads which widen to 26 feet at fire hydrants and road grades no greater than 15 percent. Local governments may adopt Appendix D or may develop their own rules. Asheville allows road grades up to 18 percent if buildings above where this grade begins have residential interior sprinklers.

Cost factors determine many aspects of design and development on steep slopes, but the need for emergency services must also be evaluated. Developers must consider the future ramifications if emergency services cannot be provided to their development as a result of improper planning or road designs that were not approved prior to construction.

Strategies:

1. Landslide Hazard Identification, Prevention and Mitigation

PS-1. ***Establish a notification system for identified landslide hazard areas.*** Once landslide hazard areas are identified, then property owners should be notified and prospective buyers of property for sale should be advised of this risk. Notification should include disclosure statements for owners and potential buyers.

PS-2. ***A program of public education that emphasizes the key aspects of landslide mitigation should be developed in order to provide information on the triggering mechanisms.*** This should include signs that would indicate past movement or potential for future movement. Information on slope movement deposits may be found at *http://www.nconemap.org* and statewide geohazards information is available at *http://www.geology.enr.state.nc.us*.

◊ The North Carolina Geological Survey (NCGS) hopes to have a web service in place by May 2008 where property owners can see their parcel locations relative to the landslide hazard map set for each County. The maps are made available to counties in a GIS format, so that they can be viewed on county web sites. NCGS encourages counties to make the maps available on their web site. General information on landslide hazards is available at *http://www.geology.enr.state.nc.us/Landslide_Info/Landslides_main.htm*. Hard copies of the maps are available for purchase by calling 919-715-9718 or visiting the on-line store at *http://nc-maps.stores.yahoo.net/*.

PS-3. ***Landslide hazard weather advisories should be issued*** when forecasts of 5 inches of rain or more in a twenty-four hour period are expected. Fewer slope movements typically occur on unmodified/natural slopes than on slopes modified by excavations or embankments slopes in response to that amount of rainfall; however, slope movements have occurred on modified slopes when less than 5 inches of rainfall occurred in 24 hours. Landslide advisories are also appropriate when there are high antecedent moisture conditions with an approaching high-intensity storm.

PS-4. ***Local governments should check for landslide hazard areas before approving development plans.*** However, landslide hazard maps should not be a substitute for a detailed, site-specific geotechnical engineering and geologic report to properly evaluate slope safety and suitability.

PS-5. ***Geotechnical analysis should be required for proposed developments on slopes greater than 40 percent or in landslide hazard areas as a minimum standard.*** <u>When measuring slope for a parcel, the focus should be on the area that will be disturbed, rather than measuring the average slope across the entire parcel</u>**.** State legislation and/or local regulations should set minimum standards for safe slope development.

PS-6. ***Advocate for appropriations from the NC Legislature for approximately $580,000 per year to accelerate the Landslide Hazard Mapping*** (LSHM)

program and to complete the mapping for all 24 WNC counties by 2016.

◊ Current funding for the LSHM Program will only fund mapping for 5 of the 19 WNC counties named in the Hurricane Recovery Act of 2005. Macon and Watauga maps are complete; Buncombe County maps are underway and will be completed in 2008; Henderson and Jackson county maps are planned for completion in fiscal year 2008-2009. The NCGS has requested additional funds to conduct additional mapping.

PS-7. ***Require stream setbacks in high hazard areas indicated on the county's Downslope Hazard Map.*** These maps will show areas that could be affected by debris flow originating in high hazard areas up slope (as delineated on the Stability Index Map). The width of the high downslope hazard corridor along streams is based on the actual track width of mapped debris flows. If there are no known tracks below high hazards (as in most cases) an average track width from known debris flows is determined for each county. In the case of Macon County the distance is approximately 30 feet on either side of the stream channels below high hazard areas. On-site identification of past debris flow activity or deposits is recommended to verify the actual width of high downslope hazard zones for construction planned near stream channels below high hazard areas upslope.

2. Road Design, Construction and Access:

PS-8. ***Developers are strongly urged to design and construct interconnected and loop roads*** because they provide much better access to property, and may allow for a reduction in widths. Local governments should encourage these designs.

◊ Ideally, dead-end roads should not be built at all but if that is impossible then they should be as short as possible and constructed with adequate turn-around areas.

PS-9. ***During construction, roads must remain open.*** If a road in question is the only access to other structures, it must not be entirely blocked at any time. Local governments should require this in their development ordinances. During construction, the condition of the roads must be monitored by local officials and contractors to ensure safe passage for residents and emergency services.

PS-10. ***Access to a development must be carefully considered. All developments should provide at least two points of access to all areas*** in the event that one road is completely compromised.

◊ Gated communities should be required to provide gates which are approved by the "Authority Having Jurisdiction." ***Gate access should be configured to allow access by all emergency vehicles.*** It is recommended that a SOS (Siren Operated Sensors) system be installed on all gates. This system permits emergency vehicle operators to open the gate by use of the siren on the vehicle.

Photo: Marc Pruett

The need for emergency services access must be considered along with cost and other factors when designing roads and access points.

PS-11. ***Access into private driveways should be configured so emergency vehicles can safely turn into the drive without additional backing maneuvers.*** A minimum of 20 feet of the driveway should be level where it intersects with the road to provide for fire operations for the residence on that drive.

PS-12. ***Road grades should not exceed 15 percent.*** There are some instances where a steeper grade may be approved if the length of the run is restricted, usually no more that 150 feet. NOTE – North Carolina Department of Transportation specifications vary from these standards, but it is important to remember that their standards are for the flow of traffic, while the fire standards are written for performing a fire-related activity at any point on the road.

◊ Sections of roadway that are above 10 percent grade should be paved.

PS-13. ***Two-way roads should be a minimum of 20 feet wide to allow for safe passage of fire apparatus. However, a variety of strategies may be employed to reduce road widths – see PS-14 below***. The newer fire engines are constructed on chassis that are eight feet six inches wide and when mirrors are added, the truck width increases to nine feet six inches. In order to permit water shuttle operations, the 20 foot width is necessary. Roads are to be constructed of all-weather materials that will support 75,000 pounds. If shoulders are considered in the width they need to meet the weight requirements.

PS-14. ***Road widths may be reduced by utilizing various strategies.*** Each development should be examined individually to look for opportunities to reduce road widths.

a. ***Road widths may be reduced for one way loops if they are not long.*** This will lessen the environmental impact and still provide for emergency operations. The width may be reduced to between 13 and 14 feet in areas where the "Authority Having Jurisdiction" permits.

b. ***Road widths may be reduced if adequate pullouts and turn-around areas are provided.***

c. ***Road widths may be reduced if adequate water supplies are available:***

~ If the development is connected to a public water system capable of providing a water flow of 500 gallons per minute for a minimum of 30 minutes, plus a 10 percent safety factor, road widths may be adjusted because water shuttling is not needed.

~ For private systems, a storage tank with a minimum of 20,000 gallons would be required. The road widths where a private storage tank is in place will not allow for a large reduction of road width, as water shuttle operations may still be required.

~ Another alternative for water supply would be residential sprinkler systems installed to NFPA 13 R specifications. This would allow for a reduced road width in many instances. The residential sprinklers would require a storage capacity of 440 gallons per residence.

3. Fire Prevention and Minimizing Fire Damage

PS-15. ***The Firewise program should be utilized for all steep slope developments.*** This comprehensive education and implementation program allows for proper construction and landscaping practices and selective clearing to reduce the risk of structural fire damage as the result of a wildlands fire. A key is providing defensible space for all structures in the development. The North Carolina Forest Service can assist in the development of a plan for each area. For additional information see *www.dfr.state.nc.us* and *www.ncfirewise.org*.

Recommended defensible space distances			
	Steepness of slope		
Vegetation type	Gentle slope 0-20%	Moderate slope 21-40%	Steep slope +40%
Grass	30 feet	40 feet	50 feet
Shrubs	30 feet	30-60 feet	60-100 feet
Trees	30 feet	30-100 feet	100-200 feet

Figure 4. Recommended defensible space distances, from "Minimizing Wildfire Risk." (Bardon and Carter, 2003).

One of the Firewise concepts is "defensible space." Defensible space is the area extending out from a structure. The space varies by the type of vegetation growing near the house/structure and the steepness of the terrain (see Figure 4). After determining the size of the defensible space, a property owner can protect it by removal, reduction and replacement of vegetation.

PS-16. ***Provide information to the public about alternatives to burning.*** Alternatives include using grinders/chippers and donating material to local mulch yards or using onsite for mulch and erosion control.

PS-17. ***Provide information on safe burning practices to individuals requesting burning permits.*** The information should teach people that when they choose to burn and how they perform and monitor the burning is critical to successfully controlling the fire so it does not spread to adjoining structures or woods.

Bibliography:

Black Mountain Fire Department. "Wildland Fire and Your Home." Available at *www.bmfire.org* from a list of materials to "Download" on the home page.

Bardon, Robert and Robin Carter, "Minimizing Wildfire Risk," 2003. North Carolina Cooperative Extension Service. Available at *www.ncfirewise.org/pdf/MinimizingWildfireRisk.pdf.*

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Richard M. Wooten, PG, Senior Geologist, North Carolina Geological Survey. Presentation to project Advisory Committee, December 11, 2006.

Greg Yates, Assistant Regional Forester, NC Division of Forest Resources. Presentation to project Advisory Committee, April 2, 2007.

USDA, Layman's Guide to Private Access Road Construction in the Southern Appalachians, 2nd edition, 2005.

D. Public Health (water supply, wastewater, air quality)

"We never know the worth of water til the well is dry." –Thomas Fuller, 1732

Findings:

Groundwater is a critically important natural resource in WNC and there is a heavy reliance on it for potable water supply in steep slope developments. Approximately half of WNC residents rely on groundwater and this percentage is much higher in steep slope areas.

There are unique ground water quality, usage, and sustainability issues on steep slopes, particularly in the fractured rock terrain of Western North Carolina. Groundwater storage on steep slopes is limited due to thin soils, increased runoff and limited groundwater recharge, so long-term sustainability may be affected, particularly in steeply sloped or ridge top terrains and in high density areas.

Development can, in some instances, adversely impact a local groundwater supply by: 1) producing greater demand for water than is available for withdrawal; and 2) contaminating down- gradient wells with septic and other domestic wastes. In general, areas of higher elevation and steeper slopes are more likely to transport certain contaminants (e.g., viruses that can travel significant distances) down-gradient faster and farther than in areas of lower elevation and milder slopes. As a result, wells down-gradient of steep slope development may be more susceptible to contamination migrating from the upslope development.

Local-scale studies in WNC are limited, so the extent to which development may impact a given watershed is not known. However, evidence in some local areas suggests that groundwater quantities, in some cases, may not be adequate for demand. In addition, studies to evaluate the potential impact of development on ground water quality are very limited in mountain terrain, so it is unknown the extent to which increasing development is adversely affecting down- gradient wells. Studies are needed to evaluate this issue.

Development results in areas of impervious or less pervious land cover (such as rooftops, building footprints, streets, parking lots, etc.). This can cause greater rainfall runoff and therefore less water is available for recharge back into the aquifer. As a result, a developed area may have significantly less groundwater recharge available than a pristine area, depending on the methods of land development.

Groundwater recharge areas must be preserved in steep slope areas to ensure a sustainable supply of potable water. According to a USGS study in Guilford County, one dwelling unit on a well requires 2.34 acres of recharge area. This was in relatively flat terrain that maximizes infiltration of rainfall. No similar studies have been conducted in the steep slope terrain of WNC but one can assume that the required groundwater recharge area in steep slope settings might be larger due to steeper slopes and potentially less ground water infiltration during rainfall events. Wells placed too close together can also interfere with each other in some instances.

Architects and land planners that design development plans are doing so without full consideration of water availability and quality and wastewater utility issues, especially the challenges of siting utilities on steep slopes. Development planning should include adequate lot sizes capable of maximizing separation distances between wells and septic systems.

There is no State requirement for geotechnical analysis for suitability of land for utilities. Slope failures cause utility lines to break and leak and cause damages to package treatment facilities.

Photo: Marc Pruett

Slope failures cause utility lines to break.

Environmental health agencies are bogged down with the regulatory process, have limited staff and resources, and limited time for pre-application meetings with developers. However, such meetings are very important and should be sought for projects with significant slope issues related to public health infrastructure.

Agency responsibilities are fragmented and not always appropriately coordinated. Responsibility for groundwater and surface water protection, well construction and permitting, onsite wastewater system permitting, and discharging package treatment system permitting are divided between several different state agencies and county health departments making effective coordination difficult. These agencies need to improve coordination and cooperation to ensure public health is protected.

Elevated levels of radon (a human carcinogen) in groundwater (as well as in indoor air) are relatively common in Transylvania and Henderson counties, both of which are characterized by steep sloped terrains (Campbell, 2005). Other steep slope counties in NC, particularly those underlain with granitic rocks, also may contain ground water with elevated levels of radon or other naturally occurring contaminants, but in most cases data are too limited to know. Buyer and homeowner education programs are needed regarding these risks and the appropriate abatement measures.

Counties are taking over private well site approvals and construction permitting and this may help as well trained county staff are more closely involved in the process.However, counties often do not have adequate numbers of trained staff available for these technical inspections and approvals. Careful geo-hydrologic evaluations must be made based on individual site conditions. Developers should be required to provide to the approving agency enough geologic, topographic, and hydrogeologic data for adequate evaluation of the impact to the groundwater resource.

Steep and unstable slopes present special challenges for siting and installing effective onsite wastewater (septic) systems. Soils on ridgetops and steep slopes tend to be thinner. The steeper the slope, the more difficult it is to install an effective conventional system. State rules require thicker soil as slope increases. State rules indicate that slopes over 65 percent are "unsuitable", while installation of systems on slopes between 30 and 65 percent are problematic and require special design considerations. A site is unsuitable if there is evidence of a past landslide. Some systems across the mountains have failed on steep slopes due to

problematic soil and hydrologic conditions. Inspection staff have to be alert to areas where slopes are sliding (e.g., bending trees) and avoid permitting systems in these high risk areas. Soil texture – especially mica and graphitic-rich content that causes slides – is another major consideration as well as proximity to cut and fill areas. Drainfields must be on parent soil materials that are stable and away from steep slopes with failure potential. Water converging in concave areas can saturate a drainfield, causing failure. Surface runoff and flow in the unsaturated zone should be diverted around drainfields. Large diameter pipe systems (10 inch corrugated pipe) are commonly used in steep slope areas. New drip dispersal systems require almost no land disturbance and are recommended but are more costly than a conventional septic system.

Septic system failures on steep slopes, in some cases, are not as apparent as on flat slopes where sewage may percolate up into the yard. Failures on steep slopes may surface further downslope and off the parcel and potentially discharge into a spring or stream or impact the land or water source of an adjoining property owner.

Studies are recommended to determine whether standard state setbacks between private wells and septic tank systems are adequate to prevent well contamination in steep slope developments. State rules specify that if a site has a septic system the well must be at least 100 feet from the system; exceptions to this rule may be approved, but the absolute minimum distance is 50 feet and the minimum setback for a septic system from a property line is 10 feet. Rules allow the septic "repair area" to be less than 100 feet from a well. Although the setback rules are uniform across the State, the hydraulic connection between septic fields and wells is different in different geologic terrains. Current understanding of the relationship between slope, geology, and potential contaminant transport from septic systems is limited, particularly in steep sloped, fractured rock settings. Transport pathways in fractured rock may lead to contamination of wells despite standard setbacks. Current laws and ordinances do not reflect this and, instead, employ a "one size fits all" rule. That is, current setback rules do not address potential differences between contaminant transport in varying geologic settings (for example, coastal plain sediments in relatively flat topography versus fractured bedrock in steep sloped settings). Well-to-septic connectivity can increase in steep sloped settings, and care should be taken to eliminate this possibility regardless of the laws on the books.

There is tremendous pressure on county health departments to permit lots for septic systems as fast as possible. The significant increase in development and permit applications is straining county staff. Resources must be allocated to county departments to ensure that review and approval process time is sufficient to protect public health and the environment well into the future.

State officials believe that discharge limits and treatment requirements for state permitted package treatment systems are adequate to protect headwater streams draining steep slope watersheds. A developer must receive a National Pollutant Discharge Elimination System (NPDES) permit for a package treatment plant that will discharge wastewater to a stream, river, or lake. Public notice is required before permits are issued. Such permits are often hotly debated by neighbors and citizen groups. Developers seeking permits are encouraged to involve the community early to minimize the public interest hurdles. The local government(s) with jurisdiction must send a written statement to the state that the proposed development project is consistent with local land use codes. It typically takes 9-18 months to get an NPDES package plant permit causing

some developers to shy away from this alternative. The state prefers dispersal of wastewater rather than direct discharge of treated wastewater to surface waters. Therefore, an NPDES permit requires an Engineering Alternative Analysis (EAA) to make sure there is not a better alternative to a package treatment plant. Package plant permit discharge limits take receiving stream size and flow under consideration. Limits are based on low flow conditions to ensure protection of public health. While state officials (Westall) indicate permit limits are adequate, they believe geotechnical analyses are needed for treatment facility siting and for collection system layout/construction to prevent damage or failure.

Some biologists (McLarney) and citizens do not believe current state package treatment plant rules are adequate to protect the ecology of sensitive headwater streams. Some package treatment systems across WNC have had operation and maintenance problems resulting in Notices of Violation (NOVs). Permitted systems in steep slope areas discharging to sensitive headwater streams may need tighter permit limits and measures to ensure proper operation and maintenance.

Air quality is generally worse in high elevation areas and on exposed mountain ridges in WNC. Ground level ozone pollution levels (both peak and average values) are generally higher on mountains above 3,500 feet and these levels occasionally exceed values considered unhealthy for sensitive groups. Children and the elderly and anyone with respiratory disorders (e.g., asthma, bronchitis, emphysema, etc.) should avoid living in these areas. Education programs for land and home buyers need to alert citizens to this fact.

Photo: Keith Bamberger

Air quality is generally worse in high elevation areas and on exposed mountain ridges in WNC.

Strategies:

PH-1. ***All agencies (local and state) should enforce existing rules*** and this will require additional manpower and resources provided by state and local elected officials.

PH-2. ***State and local agencies should meet to identify measures to improve communication and cooperation mechanisms to ensure that both public health and the environment are protected.***

PH-3. ***Because sustainability of high quality groundwater is a local-scale issue, it is recommended that, prior to development, a site-specific evaluation be made to determine whether adequate high quality groundwater supplies are present, and if so, whether the supply can be sustained given the additional planned demand.*** This will help protect the groundwater resource and the community of well owners in the vicinity of the proposed development.

PH-4. ***Geotechnical analyses should be required to examine suitability for utilities and potential impacts to public health on the development site and those lands nearby and not simply address the issue of public safety.*** These geotechnical analyses should be required for package wastewater treatment facility siting and associated sewer collection system.

PH-5. ***Developers should ensure that all lots are buildable with suitable areas for water and onsite wastewater systems (or sewer).*** The developer should lay out all well and septic system areas and share this information with buyers. Therefore turnkey developments are preferred where the developer also designs, obtains all appropriate permits, and develops home sites and other facilities. This helps prevent "unbuildable" lots.

PH-6. ***More thorough monitoring of ground water quality is recommended on steep slopes due to increased risk of treatment system failures and downslope contamination.*** Currently, based on new rules, wells are only sampled for quality (one water sample for 19 water quality constituents) at the time of construction. State officials recommend voluntary or mandatory private well monitoring on steep slopes every 3 years. Frequency depends on the density of development, agriculture (e.g., tree farm), and industry around the well. Agencies could send automated post cards to property owners recommending sampling. The cost of analysis for the 19 constituents ranges from $150 to 300 depending on the lab used. Developers should develop a well monitoring plan and fee schedule for homeowners and homeowners associations.

PH-7. ***State and local agencies (including the Cooperative Extension Service) should develop and implement a comprehensive education and training program across the mountain region to address these public health issues. This information should be incorporated into required training for license or certification renewal. The education program should include training for:***

◊ Elected officials on these issues and the utility constraints on steep slopes.

◊ Architects and land planners about considerations related to utility issues. Education on public health issues should be done during pre-

development meetings by county planning and health departments.

◊ The general public on springs and wells and their higher risk of contamination.

◊ Home buyers and home owners regarding the public health risks of radon in indoor air and groundwater in selected counties and the appropriate abatement measures.

◊ Realtors, attorneys and bankers on the issues.

◊ Home buyers and home owners regarding air quality conditions (ground level ozone pollution) on ridgetops and in high elevation areas. Raise citizen awareness about government-issued air quality forecasts for high elevation areas.

◊ "Before You Buy" workshops to convey important information to land and home buyers. Develop and place "Before You Buy" brochures in free paper racks, real estate offices, permitting offices, etc. This information should be provided as part of the disclosure requirements of a real estate transaction.

PH-8. ***State and local agencies should collaborate to develop research programs to address public health issues including:***

◊ The impact of development on groundwater quality and sustainability in steep slope areas. These studies should determine the necessary groundwater recharge areas for wells based on slope and soil conditions found on ridgetops and in steep slope areas. Development density guidelines could then be developed to help ensure sustainable, long-term high quality water supplies.

◊ The connectivity of wells, springs, surface waters and septic systems in steep slope areas and the potential resulting contamination of wells and springs. New septic-to-well setback guidelines based on slope and other factors should be considered, based on this research.

◊ The impact of package treatment system discharges on public health and the ecology of headwater streams.

◊ The health impacts of higher ozone pollution levels in high elevation areas should be documented.

PH-9. ***State and local agencies should require more frequent septic system maintenance on slopes greater than 25 percent.*** For example, septic systems should be inspected and cleaned at least every 5 years on these steeper slopes, and/or on less ideal soils associated with slopes.

PH-10. ***State and local agencies should share or seek to secure additional resources.*** Many State and local agencies are understaffed and cannot keep up with the demand on their services.

PH-11. ***Universities and technical colleges should expand and promote their technical training programs to produce enough geotechnical engineers and environmental health specialists to handle the increasing demand for these professionals.***

Bibliography:

Adams, Jim, NC DENR - Division of Environmental Health - Public Water Supply Section. Personal Communications.

Campbell, Ted, Hydrogeologist, NC DENR - Division of Water Quality - Aquifer Protection Section. Personal Communications.

Campbell, T.R., 2005, Elevated Radon and Other Naturally-Occurring Radionuclides in Private Drinking Water Wells in Buncombe, Henderson and Transylvania Counties, North Carolina, Ground Water Circular Number 20, NC Department of Environment and Natural Resources, Division of Water Quality, Aquifer Protection Section, 81 pages.

Haynes, Keith, NC DENR - Division of Water Quality. Personal Communications.

McLarney, Dr. William, Biologist. Presentation to Mountain Ridge and Steep Slope Protection Advisory Committee, May 14, 2007.

McElduff, Jim, Altamont Environmental. Presentation to the Mountain Ridge and Steep Slope Protection Advisory Committee, January 8, 2007.

Westall, Forrest , Senior. PE, McGill Associates and Member, NC Environmental Management Commission. Presentation to Mountain Ridge and Steep Slope Protection Advisory Committee, January 8, 2007 and personal communications.

Lynn, Joseph, Regional Soil Specialist, NC DENR - Division of Environmental Health – Onsite Wastewater Section. Presentation to Mountain Ridge and Steep Slope Protection Advisory Committee, January 8, 2007 and personal communications.

E. Water Quality/Quantity and Impacts (fish and aquatic species)

Findings:

Headwater streams, primarily located in steep slope areas in western North Carolina, are important to all downstream creeks, rivers, and lakes. Headwater streams are vitally important to the health of all stream and river networks. They account for about 80 percent of the stream network and provide valuable services, including: mitigate flooding further downstream; provide habitat for diverse plants and animals; recharge groundwater; trap sediments and pollutants; recycle nutrients; and support the biological productivity of rivers and lakes further downstream (Meyer et al. 2007, Meyer et al. 2003). Unfortunately, these small headwater streams in western North Carolina are often impacted by land-disturbing activities on steep slopes, as this is where our western streams originate.

Caler Fork Case Study

Recent investigations using the Index of Biotic Integity (IBI), a measure of stream ecoystem health based on fish sample data, on Caler Fork (tributary to Cowee Creek in the Little Tennessee River Basin), indicated that residential development can cause severe short-term changes in biotic integrity, with significant long term implications. Caler Fork drains the center of the tourist gem mining industry in the Cowee Valley, and has historically been affected by sedimentation from that source. In the last decade the intensity of gem mining has declined, concurrent with improvement of associated management practices. IBI monitoring on lower Caler Fork in 1997, 2001 and 2005 showed a positive trend – from a score of 41 (Fair) in 1997 to 50 (Good) in 2005.

However, in 2006 the IBI score dropped to 33 (Poor), the largest one year decline ever recorded in the upper Little Tennessee watershed (McLarney, 2007). The change was apparently due to greatly increased sedimentation, accompanied by constant high turbidity. The sources of new sediment were two tributaries, Tippett and Dalton Creeks, which drain a large housing development which was under construction during 2005-2006. While pre-impact data are not available for Tippett and Dalton Creeks, in 2006 the two streams were seen to be heavily impacted by new sediment. Tippett Creek was fully sedimented, with heavy sediment deposition in the flood plain. The natural diversity of fish in streams as small as Tippett Creek prevents application of IBI, but fish numbers were extremely low with no evidence of reproduction of either of the two species found (rainbow trout and mottled sculpin) in 2005-2006.

When Caler Fork was monitored again in 2007, the IBI had recovered to 47 (Fair-Good), but the sediment load was still well in excess of earlier levels, and fish abundance in riffle habitat was well below normal expectations. It can be expected that the later stages of recovery, to 2005 conditions, will take much longer, even absent new sediment inputs. To the degree that Caler Fork continues to recover, it will do so through flushing of accumulated sediments, which will subsequently be passed downstream to Cowee Creek, the Little Tennessee River and Fontana Reservoir, where cumulative negative effects may be expected on the upper portion of the watershed (McLarney, 2007).

Soil erosion and sedimentation increase significantly as slope increases requiring stronger erosion control measures within steep slope developments. Sediment is the number one water pollutant by volume in NC. The size of new homes constructed in steep slope developments has increased over the years resulting in greater land disturbance and risk of erosion and sedimentation. Land disturbance on steep slopes has many of the same inherent problems as land disturbance on relatively flat land, except that the problems are exacerbated due to the gradient differential. One soil loss model (Water Erosion Prediction Project) indicates soil erosion rates triple on an acre of land as bare soil when the slope increases from 10 percent to 30 percent (assuming all other factors including climate, land use, etc. remain the same) (Price 2007). Commonly-used silt fences have very limited effectiveness in controlling sediment especially on steep slopes. It must be recognized that even current best engineering practices largely have been shown to be inadequate (erosion, storm water, etc) for development on steep slope terrains. More effective measures must be used to prevent off-site impacts. NC Division of Land Resources' Erosion and Sediment Control Planning and Design Manual has several recommendations for controlling erosion and sedimentation on steep slopes, including: spacing slope breaks based on percent slope to limit sheet and rill erosion and prevent gullying; alter vegetation type and seed mixtures on cut-and-fill slopes based on percent slope to stabilize soils after disturbance (see *http://www.dlr.enr.state.nc.us/pages/publications.html*). NC Division of Water Quality also recommends using a Site Grading Plan and/or Site Fingerprinting to help manage clearing and grading activities on steep slopes (see *http://h2o.enr.state.nc.us/basinwide/documents/Chapter8_007.pdf*).

Photo: Marc Pruett

Sediment is the number one water pollutant by volume in North Carolina.

Streamside vegetation, or the riparian area, is vitally important to the health of stream ecosystems and its effectiveness in protecting stream ecosystems is affected by slope. The vegetated area, particularly if it is forested, filters pollutants and sediment from runoff entering the stream; slows runoff before entering the stream to prevent scour, erosion, and flooding further downstream; recharges groundwater; provides nutrient input to support the aquatic food web; stabilizes stream banks; contributes large woody debris; maintains appropriate temperatures for sensitive aquatic species, such as trout; among many other functions. The ability of a riparian area to filter sediment may be based on many factors, although one of particular importance is slope. Dillaha et al. (1988, 1989 *in* Wenger 1999) showed that the efficiency of the riparian area at removing sediment declined by 7 to 38 percent when riparian slope increased from 11 percent to 16 percent. Slopes in the mountains of western North Carolina often are far greater than these.

Trout are a valuable component – biologically, recreationally, and economically - to our small, headwater streams. Trout are of value due to their contribution to the biological diversity of our stream ecosystems, but also due to their recreational value. Trout fishing provides a service from a purely recreational value, but it also provides a large economic value to surrounding communities. Trout fishing is part of North Carolina's billion dollar tourism industry and many tourist activities in western NC, like trout fishing and whitewater rafting, are dependent upon clean water. In North Carolina alone, more than $1 billion a year is spent on fishing activities (Dept. of Int. NC Report, 2001). Trout rely on cold, clear mountain streams for survival. Increased sediment, pollutants, and temperatures resulting from land clearing activity can decimate a healthy trout population. In fact, very little native brook trout habitat remains in western North Carolina; special measures must be taken to preserve remaining habitat.

Trout fishing is part of North Carolina's billion dollar tourism industry.

In 2001, the State Legislature of Georgia reduced riparian area requirements on designated trout streams from 30m (100ft) to 15m (50ft) and requested a study by researchers to determine the effects this legislative decision might have on trout populations. Jones et al. (2006) found that when comparing trout streams with these differing widths, streams with 15m riparian areas had higher peak temperatures and more fine sediments than those streams with a 30m riparian area. Models based on young trout biomass documented an expected 87 percent reduction in biomass with the change in riparian area width. Researchers concluded that "as young trout are indicative of trout reproductive success, our results portent substantial reductions or elimination of trout populations in northern Georgia streams where vegetated riparian buffer widths are reduced to 15m."

Impervious surfaces within a watershed are linked to declining stream health. As land development takes place, the amount of impervious surface in that watershed increases. Numerous studies have shown the effects of varying impervious surface percentages on physical and biological variables within a stream (Paul and Meyer 2001 provide a good literature review, Booth et al. 2002, May et al. 1997, Miltner et al. 2004). In general, watersheds with 10 percent imperviousness or greater show declined biological health and that decline worsens as the imperviousness approaches around 23 percent, at which point the rate of decline in biological health is less because most of the damage to the stream ecosystem has already occurred. Few, if any, studies have examined impervious surfaces as related to steep slopes, but one can speculate that the increased stormwater runoff problems

associated with impervious surfaces will only increase as the gradient increases. There is great need for scientific research that relates impervious surfaces to steep slope areas.

Stormwater management plans and controls are necessary to mitigate increased stormwater flows associated with development and land disturbance. Increased impervious surfaces means increased runoff carrying non-point source pollutants and warmer temperatures into nearby bodies of water. Increased flows due to stormwater runoff to streams can cause accelerated stream bank erosion due to the high water velocity. Increased flows cause increases in the nutrients and sediment carried and therefore deposited into streams. Based on work conducted in Coweeta Creek in Macon County, North Carolina, Swank and Bolstad (1994) determined that water quality cumulative impacts due to land conversion are much greater during stormflow (flows during runoff events) than baseflow (normal flow) conditions. This emphasizes the importance of stringent stormwater management practices.

Aquatic resource conservation requires a multi-faceted approach. King County, Washington, has been engaged in developing strategies to protect aquatic resources and declining salmon populations for the past 20 years. Based on those experiences, Booth et al. (2002) state that ***"preservation of aquatic resources in developing areas will require integrated mitigation, which must [include] impervious-surface limits, forest-retention policies, stormwater detention, riparian-buffer maintenance, and protection of wetlands and unstable slopes."*** This same type of integrated strategy must be used in western North Carolina to help protect the natural resources so important to and integrated with our mountainsides.

Land-disturbing activities can greatly change the overall health of a stream watershed, from removing streamside vegetation to increasing stormwater runoff, water temperature, sedimentation, and erosion. Given the importance of our headwater streams and the important role that riparian vegetation plays in protecting those streams, we must ensure the use of appropriate development designs and best management practices to provide necessary protection.

Existing state regulations for limits to built-upon area, stream buffers, erosion and sedimentation controls, and BMPs **were not developed taking steep slopes into consideration** (*http://h2o.enr.state.nc.us/csu/freshwater.pdf*). Stream buffer requirements, for example, range from 25 feet for Trout waters to 100 feet for high-density development in Water Supply Watersheds. Yet the steepness of the surrounding land does not factor into determining buffer width. Research specifically related to stormwater management, sediment and erosion control, and riparian buffers on steep slopes is limited. Therefore, strategies below are based on the best available science and on best professional judgment.

Strategies:

WQ-1. ***In steep slope areas, impervious surfaces within the development tract should be limited to no more than 10 percent of the total project area and designers should avoid placing impervious areas on steep portions of the tract.*** Numerous research studies have shown increased aquatic habitat degradation as the percentage of impervious area increases (Paul and Meyer 2001 provide a good literature review, Booth et al. 2002, May et al. 1997, Miltner et al. 2004). Impervious surfaces are mainly constructed surfaces that are covered by impenetrable materials. They include, but are not limited to rooftops, buildings, parking lots, driveways, sidewalks, and roads (paved and graveled). Impervious surfaces can be minimized through low impact development (LID) techniques including the clustering of built upon areas resulting in few road miles and more open space.

WQ-2. ***At least 50 percent of the entire steep slope development tract should be preserved as forestland. Forested area within individual parcels and within the streamside protection areas can be included in this percentage.*** Because aquatic conservation needs a multi-faceted approach (Booth et al. 2002), forest protection is one of the tools that should be implemented to ensure the continuation of our valuable resources. Additionally, forest protection provides soil stabilization which can be vitally important on steep slopes. From an economic perspective, studies have shown that homeowners are willing to pay more money for wooded lots or for homes in forested developments. Reforestation is not required but reforestation on lands that cannot be preserved as forestland because they were previously cleared for farming should be encouraged and should use native plant materials.

Photo: Gabriel Cummings

Loss of forest cover and increased impervious surfaces create water quantity and quality problems.

WQ-3. ***Stream delineations should be conducted by field verification using a combination of USGS topographic maps, soil survey maps, and National Hydrography Database (NHD) information (when available – see*** *nhd.usgs.gov****).*** There has not been a comprehensive survey of streams in the United States, and therefore many available maps grossly underestimate the presence of headwater streams. One on-the-ground study in the Chattooga River watershed in the Southern Appalachians estimated that approximately one-fifth or less of the actual stream network was visible on the USGS topographic maps. There have been other noted problems, such as misclassification of streams, i.e. a perennial stream is shown as an intermittent stream on a topographic map (Meyer et al. 2003).

WQ-4. ***In steep slope areas, Streamside Protection Areas should be established on all perennial streams, intermittent streams and wetlands.***

Intermittent Streams flow only during wet periods (30-90% of the time) and flow in a continuous well-defined channel. Perennial Streams flow more than 90% of the time.

The following recommendations are based on Wenger (1999) and all references therein.

Researchers at the University of Missouri determined that homeowners are willing to pay over $6,000 to live adjacent to riparian buffers and are willing to pay over $1,500 to live in a subdivision with riparian buffers, but not immediately adjacent to these buffers (EPA 2005).

Option 1:

◊ **Base width of 100 ft.** + 2ft. per 1 percent of slope on each side of the water body, **up to a maximum of 150 feet** on each side (additional footage is based on the slope of the 100 ft. base width). The slope percent is that slope, perpendicular to the stream, naturally occurring within the streamside protection area. The average slope should be calculated for every 100 foot segment of parallel stream frontage. This average should be used to determine the appropriate width of the zone of undisturbed vegetation across any given 100 foot segment (i.e., the appropriate width of the zone of undisturbed vegetation may vary with each 100 foot segment depending upon the topography of the site).

Example:

Slope (percent)	Streamside Protection AreaWidth (On each side of water body)
0	100 ft.
10	120 ft. (100 ft. base + 20 ft. [2 X 10])
25+	150 ft. (100 ft. base + 50 ft. [2 X 25])

Option 2:

◊ Base **width of 50 ft.** + 2ft. per 1 percent of slope on each side of the water body, **up to a maximum of 150 feet** on each side (additional footage is based on the slope of the 50 ft. base width). The slope percent is that slope, perpendicular to the stream, naturally occurring within the streamside protection area. The average slope should be calculated for every 100 foot segment of parallel stream frontage. This average should be used to determine the appropriate width of the zone of undisturbed vegetation across any given 100 foot segment (i.e., the appropriate width of the zone of undisturbed vegetation may vary with each 100 foot segment depending upon the topography of the site). (from Practice Standards and Specifications, Chapter 6.74, *Erosion and Sediment Control Design Manual*)

Example:

Slope (percent)	Streamside Protection Area Width (On each side of water body)
0	50 ft.
10	70 ft. (50 ft. base + 20 ft. [2 X 10])
25	100 ft. (50 ft. base + 50 ft. [2 X 25])
50+	150 ft. (50 ft. base + 100 ft. [2 X 50])

◊ Notes:

~ Streamside Protection Area measurement starts at top of bank.

~ Impervious surfaces within the streamside area do not count toward buffer width (i.e., additional width to compensate for the impervious area must be added to the overall width of the streamside protection area).

~ Vegetation within the streamside area should consist of native woody vegetation.

~ A waiver process should exist for specific petitioned and approved cases, such as allowing a road in a streamside protection area to prevent large cut and fill on steep slopes for a road. The streamside area width would need to be extended to compensate for the road within the streamside area. The reasoning behind this allowance is that a road located within a streamside area may cause less damage to the stream habitat than one located on a very steep slope outside of the streamside protection area. The erosion and sedimentation associated with cut and fill on steep slopes may cause more stream damage than the streamside area disturbance, particularly since there would need to be streamside area width compensation.

WQ-5. ***Pesticides, herbicides, and other similar chemicals should be used in accordance with existing state and federal pesticide management rules and manufacturers' literature within the Stream Protection Areas.***

WQ-6. ***Golf courses are strongly discouraged on steep slope areas.*** Due to the sensitivity of these steep slope areas, golf courses are strongly discouraged. Stream protection zones should never be disturbed or infringed upon by any activities related to golf courses. Golf course greenways do not count towards area in the Stream Protection Zone.

WQ-7. ***No more than 20 acres should be disturbed at a time during project development. This recommendation is based on NC Division of Water Quality's High Quality Water designation rules, but can be applied to other sensitive areas such as trout waters, water supplies, etc.*** The area should be stabilized using vegetative cover or ground cover sufficient to restrain erosion. Adequate cover of grass or other ground cover (such as properly applied and secured, mulched seeding or appropriate rip-rap) sufficient to restrain accelerated or man-made erosion must be established on the 20 acres before moving onto any other area for disturbance.

WQ-8. ***Stream crossings should be avoided. For necessary stream crossings, bridges are preferable to culverts. If culverts are used, they must be properly designed***

and installed to prevent erosion and allow for fish and other aquatic organism passage. Culvert placement should follow Condition 3.6 of the U.S. Army Corps of Engineers Final Regional Conditions for Nationwide Permits (see *http://www.saw.usace.army.mil/wetlands/NWP2007/SAW-NWP-regional-conditions-6-2007.pdf*).

WQ-9. Ponds and lakes should be off-line only. In-line ponds and lakes (built within the stream channel) should be avoided due to the many negative impacts to natural stream systems. Ponds and lakes disrupt the natural flow of streams which in turn changes the population dynamics of aquatic organisms within these systems. Streamside vegetation is often disturbed or removed when these water bodies are created, which can be detrimental to stream health. These water bodies, due to their standing water and loss of streamside vegetation, accumulate heat and have much higher temperatures than the stream itself. This can have a negative impact on trout and other aquatic species that rely on cold, flowing water for sustainability.

WQ-10. ***The State should provide additional resources to the NC Land Quality Section for additional staff in the Asheville Regional Office (ARO) to increase inspections of land-disturbing sites under the state's jurisdiction.*** NC has a Sedimentation Pollution Control Act that provides a good framework for a state-local partnership to address erosion and sedimentation control in the state. The NC Land Quality Section has been historically understaffed. A geotechnical or soils engineer position is needed in the ARO to assist with review of erosion control plans and to suggest measures to prevent landslides within developments.

WQ-11. ***Local governments should consider adopting their own local erosion and sedimentation control programs.*** There are about 50 local programs in NC including programs in Avery, Buncombe, Haywood, Henderson, Jackson, Macon, Swain and Watauga counties and Asheville, Beech Mountain, Boone, Grandfather Village, Highlands and Lake Lure. The State provides a model ordinance for local governments to use as a starting point. Local programs can be more stringent than the state rules to help address local conditions including steep slopes. The State requires erosion and sedimentation control plans for land disturbing activities of one acre and above but many local communities require plans for smaller disturbances and some communities, such as Henderson County, base plan size requirements on steepness of the disturbed area (see *http://www.hendersoncountync.org/planning/projects/ldc/09.19.07_articles/art8sube.pdf*

WQ-12. ***Clear Water Contractor Workshops provided by the Mayberry Group, LLC should be acknowledged by the State of North Carolina as a viable training program for grading contractors.*** Some grading contractors are not familiar with state and local rules and proper erosion and sedimentation procedures and practices. The Mayberry Group has institutionalized The Clear Water Contractor© Training Program and continued to implement with partners such as the NC Division of Water Quality, US Army Corps of Engineers and

Credit: The Mayberry Group, LLC

The Clear Water Contractor© program is an eight-hour training program on erosion and sedimentation control.

local sediment and erosion control programs. A registry of participating contractors is available on a maintained website (*www.themayberrygroup.org*). The Mayberry Group is also developing, in consultation with the State of NC, a formal certification program for grading contractors especially those operating on steep slopes (Georgia has a certification program - See *http://gaswcc.georgia.gov/00/channel_modifieddate/0,2096,28110777_29155166,00.html*

WQ-13. ***Local governments should encourage or require conservation subdivision designs for all steep slope developments.*** These designs preserve natural forests and stream corridors and minimize disturbed areas and impervious surfaces.

WQ-14. ***State and local government organizations need stronger enforcement of existing development regulations.*** Runoff from construction sites and land clearing not utilizing best management practices or using best management practices that do not work on steep slopes contributes significant sediment loads to nearby streams, which causes an unfair public expense.

WQ-15. ***State and local governments should require geotechnical analyses of steep slope areas over 40 percent slope (as a minimum) to assist in avoiding highly erodable and landslide- prone areas and in developing comprehensive development plans that address water quality and quantity issues.*** When measuring slope for a parcel, the focus should be on the area that will be disturbed, rather than measuring the average slope across the entire parcel.

WQ-16. ***State or local governments should require all steep slope developments to submit comprehensive stormwater management plans and to utilize appropriate mitigation (non-structural) and structural practices to ensure no net increase in runoff versus pre-development conditions.*** Mitigation measures include maintaining undisturbed expanses of forest – specifically the establishment of setbacks from water bodies and wetlands. NC Division of Water Quality's Stormwater Best Management Practices (BMPs) Manual notes that steep slopes affect the selection process for BMPs and when an entire site has steep slopes, it may be necessary to use a variety of smaller BMPs to fit the site contours. Examples of BMPs that work with steep slopes include: rain gardens (a type of bioretention) that parallel the slope, sand filters, grassed swales, and rooftop runoff management. Collectively, these components will function to filter sediment and contaminants and cool water before entering water bodies. See *http://h2o.enr.state.nc.us/su/documents/BMPManual_WholeDocument_CoverRevisedDec2007.pdf*).

WQ-17. ***State and federal agencies should carry out additional research on the affects of steep slope development on headwater streams in WNC.*** Various development patterns and water resource and aquatics protection measures (e.g. impervious surface and grading limits, riparian buffer widths, erosion and stormwater control measures, etc.) should be tested for effectiveness. This research could be conducted in cooperation with the University of North Carolina-Asheville's Environmental Quality Institute, Western Carolina University's Institute for Watershed Research and Management, the University of Georgia, Warren Wilson College's Environmental Leadership Center and other institutions.

Bibliography

Booth, Derek B., Hartley, David, and Rhett Jackson. 2002. "Forest Cover, Impervious-Surface Area, and the Mitigation of Stormwater Impacts." *Journal of the American Water Resources Association*, Vol. 38(3): 835-845.

Brabec, Elizabeth, Stacey Schulte, and Paul L. Richards. 2002. "Impervious surfaces and water quality: A review of current literature and its implications for watershed planning." *Journal of Planning Literature*, Vol. 16, No. 4.

Environmental Protection Agency, Nonpoint Source News-Notes, May 2005, #75.

Jones, K. L., G. C. Poole, J. L. Meyer, W. Bumback, and E. A. Kramer. 2006. "Quantifying expected ecological response to natural resource legislation: a case study of riparian buffers, aquatic habitat, and trout populations." *Ecology and Society* **11**(2): 15.

May, Christopher W., Richard R. Horner, James R. karr, Brian W. Mar, and Eugene B. Welch. 1997. "Effects of Urbanization on Small Streams in the Puget Sound Lowland Ecoregion." *Watershed Protection Techniques*, Vol. 2(4): 483-494.

McLarney, Bill, presentation to Advisory Committee, 2007 and personal communications.

Meyer, Judy L., David L. Strayer, J. Bruce Wallace, Sue L. Eggert, Gene S. Helfman, and Norman E. Leonard, 2007. "The Contribution of Headwater Streams to Biodiversity in River Networks." *Journal of the American Water Resources Association* (JAWRA) 43(1):86-103.

Meyer, et al. 2003. "Where Rivers are Born: The Scientific Imperative for Defending Small Streams and Wetlands."

Meyer, J. L., L. A. Kaplan, D. Newbold, D. L. Strayer, C. J. Woltemade, J. B. Zelder, R.Beilfus, Q. Carpenter, R. Semlitsch, M. C. Watzin, and P. H. Zelder. 2003. "Where rivers are born: The scientific imperative for defending small streams and wetlands." *American Rivers and Sierra Club*. 24p.

Miltner, Robert J., Dale White, and Chris Yoder. 2004. "The Biotic Integrity of Streams in Urban and Suburbanizing Landscapes." *Landscape and Urban Planning* 69: 87-100.

North Carolina State University and N.C. Sedimentation Control Commission. 2006. "Erosion and Sedimentation Control Planning and Design Manual, Practice Standards and Specifications," Chapter 6.74.

Paul, Michael J. and Judy L. Meyer. 2001. "Streams in the Urban Landscape" Annu. Rev. Ecol. Syst. 32:333-365.

Price, Zan. 2007. Biological and Agricultural Engineering, North Carolina State University. Personal communications

Scott, Mark C. 2006. "Winners and losers among stream fishes in relation to land use legacies and urban development in the southeastern U.S." *Biological Conservation*, 127:301-309.

Swank, W.T. and P.V. Bolstad. 1994. "Cumulative effects of land use practices on water quality. Hydrological, Chemical and Biological Processes of Transformation and Transport of Contaminants in Aquatic Environments." Proceedings of the Rostov-on-Don Symposium, May 1993.

Wargo, Rebecca S. and Richard N. Weisman. 2006. "A comparison of single cell and multi-cell culverts for stream crossings." *Journal of the American Water Resources Association*, August 2006.

Wenger, Seth. 1999. "A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation." Institute of Ecology, University of Georgia.

F. Loss of Natural Areas, Forests, Wildlife and the Role of Land Conservation

Overview:

The Role of Conservation in the Management of Steep Slope & Mountain Ridge Development

Definition:

Conservation is the careful preservation and protection of something; especially the planned management of a natural resource to prevent exploitation, destruction, or neglect. (Merriam-Webster)

Natural Resources and Attributes to be Conserved

1. Natural ecosystems and biodiversity: flora, fauna and wildlife
2. Forest land and farmland
3. Streams and their aquatic residents
4. Viewsheds
5. Natural places for leisure and recreation

Conservation purposes as defined by US Internal Revenue Code for the donation of conservation easements

i) the preservation of land areas for outdoor recreation by, or the education of, the general public,

ii) the protection of a relatively natural habitat of fish, wildlife, or plants, or similar ecosystem,

iii) the preservation of open space (including farmland and forest land) where such preservation is –
   - I.) for the scenic enjoyment of the general public, or
   - II.) pursuant to a clearly delineated Federal, State, or local governmental conservation policy, and will yield a significant public benefit, or

iv) the preservation of an historically important land area or a certified historic structure.

Methods of Conservation

1. Voluntary stewardship by landowners
2. Conservation easements
3. Land use regulations
4. Purchase and management of land by federal, state, or local governments

Comments on the methods of conservation

1. The attraction of voluntary stewardship is that it allows property owners to retain all currently held rights. The problem with this method is that the natural resources are not protected against landowners making poor decisions—whatever their reasoning may be.
2. Conservation easements reduce the value of property since certain rights—most notably

the valuable right to develop—are extinguished. Landowners can be indirectly compensated in part for the loss by federal and state income tax benefits, and a reduction in local property tax assessments. Landowners can be directly compensated in part or whole for the loss through cash payments or exchange for other rights or assets. Direct compensation is usually provided by governments and philanthropists.

3. Regulations on land use as a method are limited by the political process and the frequent lack of enforcement capacity. Regulations can be an appropriate mechanism for conservation because some of the goods being protected are public (e.g. clean air and water), and because of the authority vested to units of government.

4. Public parks, forests, preserves, etc. offer most if not all the purposes defined by the IRS Code listed above. However, the financial burden to tax payers for purchase and ongoing maintenance/operations renders this option a limited solution. Some of this financial burden would be offset by the revenue resulting from increased tourism that results from preserving rather than developing the mountain landscape.

Role of conservation in the management of steep slope and mountain ridge development

Regulations are the best way to protect vital public goods such as human health and safety, and the control of storm water runoff. Regulations are the best method to ensure some level of continuity in the community landscape. Zoning and subdivision ordinances should prevent major conflicts in land use within specific geographic areas. Local regulations can also provide incentives, such as density bonuses, for landowners to develop their property in an environmentally responsible manner.

State and local governments should continue to make investments in real property in order to conserve the natural environment and provide recreation and education opportunities for the public. Increasing numbers of visitors to existing parks and forests indicate a need for more public space.

Federal, state and local governments should provide funding for the acquisition and management of land for protection and public access and should contribute to the direct and indirect compensation for conservation easements. Although the public does not have access to some conserved lands, taxpayer contributions are highly leveraged. Private conserved lands contribute to water quality and quantity, habitat protection and scenic preservation - which are all public "goods." Landowners should be regularly educated and encouraged to be responsible stewards of their land and other natural resources.

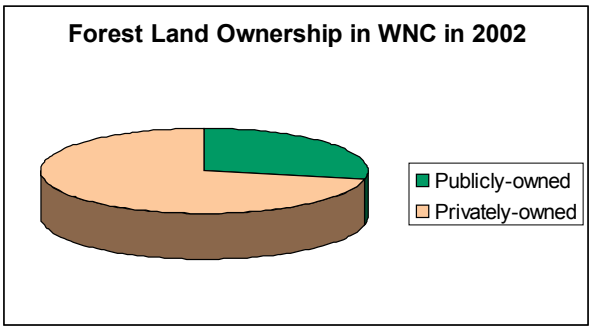
Photo: Gabriel Cummings

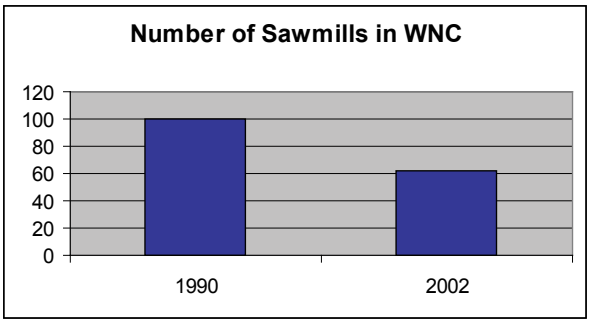
Development activities on steep slopes and along mountain ridges have increased substantially in both numbers and size in recent years.

Findings:

Development activities on steep slopes and along mountain ridges have increased substantially in both numbers and size during recent years in the mountains of western North Carolina. A recently published report by the Environment North Carolina Research and Policy Center indicates that developed land in the mountains has increased by 44 percent, from 591,000 acres to 852,000 acres, over the last 20 years. The same document estimates that the mountain region will lose an additional 22 percent of open space during the next 20 years. A separate report issued by the Conservation Trust for North Carolina entitled "From Rural to Suburban in Less Than a Century: Changes in Housing Density in North Carolina" shows that, with few exceptions, North Carolina's farms, forests, and other natural lands will be islands in a sea of development by the year 2030. Since January 2007, there are at least six new developments in the 15 westernmost counties that are in excess of 500 acres in size that have required wetland permits from the US Army Corp. of Engineers. Additionally, a growing number of existing developments are expanding and requiring additional permitting. These individual developments range in size from several hundred acres to over 3000 acres.

Privately owned working forests are being converted to development in western North Carolina. This phenomenon is contributing to a reduction of the economic viability of the timber industry and the number of jobs associated with timber management and harvesting.From US Forest Service data collected in 2002, approximately 28 percent of forestland in the mountain region of western North Carolina (21 counties) is publicly owned forest land. The balance of this important resource (72 percent) is owned by private individuals and companies. Between 1990 and 2002, the state of North Carolina has lost over 1 million acres of timberland, and nearly





one-quarter of those acres were lost here in the mountain region. During that time period, an estimated 147,000 acres of forest lost in western North Carolina is directly attributed to development and urbanization. This has resulted in significant decreases in the amount of cubic feet of timber processed here (approximately 10 percent decrease) and a dramatic reduction in the number of timber industries located here. For example, in 1990, there were over 100 sawmills operating in western North Carolina. In 2002, that number had dropped to 62. Though no statistics for associated job loss western North Carolina are available, over 22,000 timber related jobs have been lost statewide since 1990 (not totally due to conversion of working forests to developments).

Some information is available to indicate the types of natural areas that are being threatened, but much of the information is incomplete or dated. The NC Department of Environment and Natural Resources (NCDENR) includes a program called the North Carolina Natural Heritage Program (NCNHP). The NCNHP provides low-cost inventories to assist counties in identifying their natural heritage sites, including

federal and state listed threatened and endangered species and other species of concern. Included in each inventory is a description of the ecosystem/habitat types found in the county. Landowner participation is completely voluntary. The inventories provide an important tool for land use planners, developers, and conservationists to identify locations of fragile areas that should be avoided though conservation-design development plans and/or preserved through easements or acquisitions.

There are ten counties in western North Carolina that have not been inventoried (Cherokee, Clay, Graham, Swain, Macon, Madison, Mitchell, Alleghany, Wilkes, and Alexander). Transylvania, Caldwell, and Yancey counties currently have an inventory process underway that is not yet complete. Of the counties that have completed inventories, the Jackson, Buncombe, Henderson, and Polk documents are older than 10 years and are considered to have dated information. These inventories should be updated when possible. The inventories are conducted predominantly by botanists, so they are often deficient in information concerning animal/terrestrial species. This information should be added. The inventories describe a number of threatened habitat types – which may be different for each county. For example, steep rocky slopes are a valuable habitat type for a large number of threatened and endangered plants and animals. In addition, mountain bog areas have been decreasing dramatically. It is estimated that there are fewer than 500 acres remaining of this critical habitat type in North Carolina. (see the end of this paper: *http://el.erdc.usace.army.mil/emrrp/emris/EMRIS_PDF/ec.pdf*)

Increasing pressure from suburbanization of remote areas will create a variety of problems for wildlife and their habitat. Though little information is available specifically for western North Carolina, a 1996 Southern Appalachian Man and the Biosphere (SAMAB) technical report (*http://samab.org/saa/reports/terrestrial/terrestrial.html*) forecasted declines in Southern Appalachian high elevation habitat types that are found primarily in western North Carolina. The report also forecasted through 2010, decreased black bear habitat on private lands because of development and decreased ruffed grouse habitat suitability because of aging timber stands. Human encounters with animals also will become more frequent as the landscape becomes less "wild." There were 232 bear encounter complaints tracked by the North Carolina Wildlife Resources Commission's (NCWRC) district biologist for 12 southwestern North Carolina counties during 2006 alone. This constituted 62 percent of all calls in the entire state and the figure does not include numerous undocumented public contacts with other NCWRC staff. Continued pressure from development will diminish the amount and quality of various habitat types and contribute to loss of biodiversity. Aging forest stands and the inability to manage for early successional habitat and to promote understory vegetation could have implications for ruffed grouse, wild turkey, bear, as well as non-game species such as the golden-winged warbler. Because many public lands are not specifically managed for that purpose, habitat suitability for many species may decline on both public and private lands for the foreseeable future. Poorly planned development will also diminish water quality and habitat for all aquatic species due to sedimentation and increased stormwater impacts.

There are an adequate number of organizations and agencies working on conservation issues in western North Carolina, but their efforts are often hampered by a lack of funding and effective coordination. Blue Ridge Forever (*www.blueridgeforever.org*) is a coalition of 13 conservation organizations serving western North Carolina that have joined in a campaign to protect an additional 50,000 acres by 2010. To do so, they are raising $25

million in private capital to leverage another $275 million in a combination of donated land value and public grants. The Blue Ridge Forever *Conservation Vision* is a collaborative project among land trusts and some of the region's leading conservation thinkers, biological experts, agricultural specialists, and cultural researchers and will serve as a guide for connecting protected lands on a landscape scale. Attention is placed on nationally and state significant ecological quality, working lands, important wildlife habitat, high water quality, and cultural/economic significance and scenic values. Their analysis has resulted in the identification of 24 geographic focus areas for joint land protection efforts. Blue Ridge Forever continues to work on refining their data and developing funding strategies for protection activities.

The NCDENR *One NC Naturally* program (*www.onencnaturally.org*) is conducting a statewide strategic conservation planning project that is utilizing existing and developing new geospatial data to identify conservation priorities for the entire state. Landscape attributes are prioritized using a "Green Infrastructure" approach that includes wildlife habitat and plant community information, working farms and forest data, identification of existing and future recreation facilities, and surface water resources (on and off shore). The resulting maps will be a useful tool for identifying conservation priorities for future state funding and programming. The project is currently in a peer-review phase with an initial public "roll out" date of early 2008. Once established, the plan will consist of an interactive on-line map that can be accessed by the public and updated every six months with new information.

Photo: NC Wildlife Resources Commission

Suburbanization of remote areas will create a variety of problems for wildlife.

Many local and regional governments in western North Carolina are conducting conservation planning and acquisition strategies as well. The most effective of these incorporate a regional approach that includes consideration of multi-jurisdictional landscape-scale evaluations and development of cooperative partnerships to undertake conservation and protective action. Other state and federal land management agencies continue to develop and implement planning projects and other useful data as their budgets permit.

There are a number of areas where additional financial and technical assistance is needed. For example, information about working lands is scanty and money for agricultural easements is lacking. Transaction costs alone include surveys, baseline inventories, legal descriptions, title work, recording fees, title insurance and appraisals. Although the General Assembly recently approved $8 million partially for this purpose, much more is needed. Although there exists a sufficient network of land trusts across the mountain region, they lack the capacity to develop and facilitate every potential conservation project. One barrier to conservation easement projects is the land trusts' need for funds to pay the costs of monitoring and enforcing the conditions of the easement in perpetuity. Land trusts typically manage a stewardship

endowment to pay these annual expenses, and require a contribution be made to that endowment prior to accepting a new easement. Although there are occasions when this contribution is provided by a grant from one of the state's trust funds it is usually made by the landowner. The inability of the land trust to secure the stewardship endowment derails an untold, but probably significant, number of conservation easement projects across the mountain region each year.

A number of local governments in western North Carolina have taken a very proactive approach in preserving sensitive environmental areas, including steep slopes, within their jurisdictions. Several local governments in western North Carolina have developed land conservation committees, plans, or funding mechanisms. Buncombe County has a Land Conservation Advisory Committee and has provided approximately $3.8 million in funding for land conservation projects in the last two years. The City of Asheville and Buncombe County each recently committed $575,000 to help purchase land on Beaucatcher Mountain to protect it from development and provide natural areas for public use.

In addition to funding, a number of counties have enacted land use policies designed specifically to protect significant natural areas. Such strategies often contribute to both environmental protection and economic vibrancy. An example of this is in Burke County where large conservation zoning districts were established that include provisions for vegetation protection, conservation-design requirements, no-build areas including slopes in excess of 25 percent, scenic compatibility criteria, wildlife interface area standards, and water quality protection measures that have resulted in the expansion of the Lake James State Park, significant extensions of the Overmountain Victory National Historic Trail, and the protection of the drinking water source for millions of residents living downstream along the Catawba River. This planning process was a collaborative endeavor including county officials, private developers, and numerous stakeholder groups. An economic impact analysis of the project indicates the results will create almost 2500 new jobs and contribute an additional $2 million annually to the local tax base.

There is a significant amount of technical and financial assistance available for willing landowners who are interested in conserving private land, but more is needed. The university system in North Carolina sponsor a variety of aggressive landowner education outreach activities in cooperation with numerous federal agencies. The USDA Natural Resource Conservation Service and the NC Cooperative Extension Service and other related programs provide technical and funding assistance to owners of working lands. Additionally, the North Carolina Division of Forest Resources has technical resources available to assist owners of working forests. Requests are generally prioritized based on time sensitivity for forest management and harvest plans. All of these programs face limits in their ability to respond to all the requests they receive due to funding and staff constraints. Land trusts in the region report that requests from landowners for tax assistance through conservation easements has doubled in recent years, but they continue to be hampered by limited staff and budget constraints. Though North Carolina is a national leader in provision of state funding for conservation, there is still not nearly enough money to handle the amount of requests. For example, the North Carolina Clean Water Management Trust Fund is only able to provide money for one-third of the conservation requests they typically receive.

Present use value (PUV) tax structures at the county level provide some property tax relief for working farms and forests, but not all counties utilize this approach. It would be helpful if a proposed present use

tax program were legislatively established for provision of wildlife habitat areas as well as working lands. On August 1, 2007, a bill passed the NC House which would establish a new wildlife present use value category. Land would have to be at least 10 acres and could not enroll more than 100 acres. To be eligible, a landowner must have a Wildlife Resources Commission-approved wildlife management plan. Land withdrawn from the program would be subject to payment of five years of deferred taxes. The legislation also clarifies that 25% of a conservation easement's value must be donated for land to remain in the PUV program if the easement would prohibit activities (i.e. farming/forestry) necessary to comply with PUV program requirements. This legislation is eligible for consideration by the NC Senate during 2008. Additional tax relief options for landowners may be available through the NC Conservation Tax Credit Program. Ultimately, choosing a conservation approach is a landowner decision. Local land trusts report that we have more willing landowners than resources at this point.

Strategies:

LC-1. ***Public agencies and universities need to collaborate to collect better data on development activity in the mountains and the loss of natural areas, working forests and wildlife habitat.***

LC-2. ***Each county should establish a Land Conservation Advisory Committee (or use an existing board) to work with public agencies, non-profit conservation organizations, and other stakeholders to identify and protect sensitive areas within their jurisdiction.*** Such organizations would be even more effective if they had a regional forum, such as their Council of Government, to develop strategies to promote conservation and identify local priorities.

LC-3. ***Each county should establish a Land Conservation Fund to create a funding source for state/federal grant match money to protect highly valued natural resources/open space and to provide recreational opportunities for their residents and visitors.*** Such a Fund could be established by contributions from the local government general fund and through the implementation of a real estate transfer tax such as the option recently given legislative approval by the North Carolina General Assembly.

LC-4. ***Local governments should review and implement the North Carolina Present Use Value Tax Program. They should also develop new ways to provide property tax relief to owners of working lands and conservation easements.***

LC-5. ***Local governments should provide funding support to local land trusts that are serving the conservation needs of western North Carolina.*** Buncombe County has partnered particularly well with local land trusts to conserve valued mountain ridges and steep slope areas.

LC-6. ***Recommend that the General Assembly appoint a study committee to conduct research and review of changes to property tax law in order to provide relief to landowners interested in conserving their land. This research should also examine the economy of conserving open space versus the cost of providing public services to developments.***

LC-7. ***Encourage adequate on-going state funding for the NC Clean Water Management Trust Fund, the NC Parks & Recreation Trust Fund, the Agricultural Development and Farmland Protection Trust Fund and the NC Natural Heritage Trust Fund.*** Insist on increased funding that specifically focuses on easements for working lands.

LC-8. ***Local governments should adopt land use policies that incorporate environmental protections and conservation design principles while giving incentives to developers whose plans are outstanding examples of environmental sensitivity.*** Such policies should include limiting or prohibiting development on steep slopes as well as other sensitive areas. In exchange for avoiding disturbance on these areas, developers should be rewarded with density bonuses in non-sensitive areas and a streamlined permitting process. Local governments could publicize these developers by highlighting them on their web sites and creating links to the developers' sites. In all cases, initial development /concept plan review should be conducted PRIOR to conducting expensive engineering studies and physically modifying the site.

LC-9. ***Development design professionals should put riparian areas and other environmentally sensitive areas within common areas to facilitate protection by one conservation easement.*** These areas are often included within the boundaries of individual lots making it practically impossible to protect them through conservation easements.

LC-10. ***Identify new sources of revenue for conservation work such as a state income tax "check off" option or other mechanisms.***

LC-11. ***Engage local, state, and federal elected officials in the discussion of conservation priorities and funding options. Enlist their support on this critical issue.*** Hold meetings and workshops to stimulate these discussions.

LC-12. ***Implement existing conservation plans, such as the NCDENR statewide strategic conservation plan and the Blue Ridge Forever Conservation Vision through local actions and political support.***

LC-13. ***Encourage counties without Natural Heritage Inventories or with dated inventories to contact the NC Natural Heritage Program.*** There are many ways that an inventory can be funded and the local contribution is typically quite minimal. The information gained through an inventory is a very valuable tool for planning and awareness in each county. It also assists in making funding decisions utilizing state and federal dollars.

LC-14. ***Educate lending institutions regarding development issues and sustainability.*** They should also be made aware of the slope stability issues that can severely damage (and devalue) the homes they are financing. Encourage the North Carolina Bankers Association or similar organization to provide education for banking professionals and develop programs that would offer favorable terms to customers implementing a conservation approach to development.

LC-15. ***Educate newcomers and existing residents about the special considerations necessary when living near wildlife interface areas to minimize potential conflicts.*** Information is readily available (see *http://www.ncwildlife.org/index.htm*), but increased exposure of this information to developers and home owner associations would be beneficial. Such education should also include information concerning the negative impacts of exotic species on native landscapes and recommendations about compatible landscape plants that will complement the natural features of their home site.

LC-16. ***Conduct a comprehensive "awareness campaign" (brochures, workshops, short informational film, etc) to educate land owners, would be developers, and the general public about the numerous incentive programs available for land conservation.***

Bibliography:

Army Corps of Engineers. Permit Data provided by David McHenry, Habitat Conservation Biologist, NC Wildlife Resources Commission, 2007.

Conservation Trust for North Carolina. *From Rural to Suburban in Less Than a Century: Changes in Housing Density in North Carolina. (www.ctnc.org)*

Environment North Carolina Research and Policy Center. April 2007. *Losing Our Natural Heritage: Development and Open Space Loss in North Carolina (www.environmentNorthCarolina.org)*

McDow, Will, Kris Coracini and Dan Whittle. 2006. *Standing Tall,* Environmental Defense.

NC Natural Heritage Program. Inventory status as of August, 2007. Personal Communication with Harry LeGrand, August 2007. Natural Heritage Inventory Information can be found at *www.ncnhp.org*.

Schafale, M.P. NC DENR, Division of Parks and Recreation, Natural Heritage Program. Personal Communication regarding data on Mountain Bog Loss.

Southern Appalachian Man and the Biosphere (SAMAB). 1996. *The Southern Appalachian Assessment Terrestrial Report: Report 5 of 5.* Atlanta, GA, US Department of Agriculture, Forest Service, Southern Region.

USDA Forest Service data. 2002 – Resource Bulletin SRS-113 (*North Carolina's Forests, 2002*)

USDA Forest Service, *Forest Statistics for North Carolina, 2002.* Resource Bulletin SRS-88

USDA Forest Service. Resource Bulletin SE-132 and SRS-112 (Sawmill Data)

G. Preferred Development Processes and Best Management Practices

Findings:

Some developers and design professionals are frequently developing plans and bringing them to planning offices without any initial consultation with the planning staff. As a result, these plans are not responsive to the unique mountain environment, steep topography and sensitive site issues that are inherent to many properties in this region. Lack of initial consultation can potentially result in unnecessary costs and time loss for developers.

Photo: Marc Pruett

Realtors, developers and designers need training/guidance on best practices for steep slope development.

There is a critical need to define a preferred development review process and to create best management practices for steep slope development. It is essential that land owners, developers and design professionals review these before beginning the development design process and then follow the best management practices throughout the design and implementation processes. ***A Preferred Development Process needs to include due diligence, design, approval, permitting and implementation and should be utilized for all projects that are to be built in the mountain region, regardless of jurisdiction.*** This process will guide new and experienced developers to help manage risk, make informed decisions and enhance environmental and financial value. One major part of the goal of these efforts is to create a greater dialogue, sooner in the process, among local governments and designers and project specialists.

Best Management Practices (BMPs) are needed to address specific issues/challenges regarding developing on steep slopes in the mountains and be a resource for obtaining information regarding existing local, county, state and federal regulations and permitting procedures. These BMPs will also provide a vehicle to communicate design and development issues to the public.

It is recognized that in some cases even current "best management practices" are not effective in preventing negative environmental impacts that extend beyond a proposed development boundary. As such, it follows that some land simply may not be suitable for development at all. Local officials, in consultation with the community and developer, must weigh these considerations when determining whether or not to proceed with a given project.

Strategies:

PDP-1. ***Local governments should establish a preferred land development review process and adopt best management practices for design and design standards and guidelines.*** A model process and best management practices should be developed by state or regional planning organizations. Project Advisory Committee members have contributed materials for a Best Management Practices (BMP) document and it should be available shortly after this project report is published.

PDP-2. ***Local governments should consider requiring one or both of the following mechanisms as their Preferred Development Process, to address concerns for all development on mountain ridges and steep slopes*** (as defined by each community):

A. Review of a Specific Regional or Local Government Website
A website should be developed that contains information including: specific issues/challenges regarding building on steep slopes in the mountains; existing state, federal and local rules and permitting procedures and contacts; local land planning and technical expertise available; etc. The website could also include links to GIS maps and other tools including county and NCDOT slope and elevation maps, soils information, DENR Landslide Hazard Maps, County parcel maps and links to gain additional digital base mapping data.

A few useful sites are listed below:

The NC DOT has very useful slope and elevation maps now online at *http://www.ncdot.org/it/gis/DataDistribution/default.html* - by county; elevation, slope is found under topographic by county.

NC One map GIS mapping download page:
http://www.nconemap.com/default.aspx?tabid=286

The developer or responsible party would have to certify electronically through the website that he/she reviewed the information and understands the special challenges related to building on steep slopes in the mountains. This registration/certification process would become the first step in the steep slope development review process and no plans or permits would be considered until this certification is made. This registration could be sent to the local jurisdiction for follow-up and it would be a *pre-requisite for a Pre-Development Consultation*.

B. One-on-One Pre-Development Consultation Meetings with the developer and local government planning staff before development plans are drawn up. The developer should bring to the meeting the following:

~ Due Diligence (at a minimum)

· Base map showing property boundaries, adjacent property owners, 5' topography, USGS blue-line streams, wetlands, aerial photo. All data listed above are available from public sources free of charge.

- Slope Analysis – performed by a professional or obtained free from NCDOT's website.
- Preliminary soils study to determine septic feasibility

~ Concept plan showing:

- Land uses
- Access roads alignments and statement of maximum road grades, grading limits
- Location of suitable building areas, including proposed "building envelopes"
- Summary of infrastructure construction, density and minimum lot size

~ Preliminary water supply assumptions

~ Identification of historic, cultural and environmental resources

~ Preliminary statement regarding proposed road standards and how they will meet or exceed state/local standards

~ Preliminary statement regarding proposed water quality protection standards and how they will meet or exceed state/local standards.

The development process after this point would follow the local jurisdiction's process for development, platting or subdivision.

PDP-3. ***Encourage conservation-based development plans, through regulations and incentives.*** Conservation-based design practices strive to conserve/preserve a site's natural resources and features while designing the development on the site. Incentives may include a faster permitting process, allowances for increased density, reduced fees, and others.

PDP-4. ***Offer "Steep Slope Development 101" workshops*** for landowners, developers, design professionals, realtors, bankers, etc. These can be held by local design firms as a way to connect to potential clients, appropriate regulatory agencies, regional Councils of Governments, or other organizations. They can be advertised and promoted through the registration website described in A. above. These workshops can provide information about the overall process, best practices, or specific topics presented in a series or conference. Completion of this series of workshops can be incentive-driven or part of the developer/designer certification program.

PDP-5. ***Develop some sort of regional <u>Sensitive Developer Certification Program</u> that would include having knowledge/expertise on multiple related topics pertaining to developing in the mountains (similar to the National Audubon Program).*** The Asheville Homebuilders Association and Asheville Board of Realtors are interested in partnering with Land-of-Sky Regional Council to develop and offer this type of program and offer continuing education credits and certification.

Source: Design Workshop, Inc.

Conventional Yield Plan

This development pattern creates a neighborhood plan that does not respond to a site-specific framework. A higher yield can be achieved through this approach, but the value of each lot may be reduced.

This development pattern:

- Requires a larger amount of grading and site disturbance;
- Sacrifices a higher amount of vegetation and habitat;
- Creates a higher watershed impact due to the increased amount of disturbance, impervious surface area, and stream crossings;
- Requires a larger investment in infrastructure.

Source: Design Workshop, Inc.

Conservation-Oriented Cluster Development Plan

This plan represents a combination of multi-family, duplex, and single-family housing. If a cluster development produces a lower numerical yield, statistics indicate that lots adjacent to open space garner a 10-15% premium over comparable lots.

This development pattern:

- Requires less grading, thus less site disturbance;
- Maintains greater connectivity of existing vegetation and habitat;
- Reduces total impervious surface area;
- Reduces the number of stream crossings.

PDP-6. ***Provide more comprehensive, accessible, technical assistance on the Preferred Development Process, principles, practices and available resources.***

◊ County Soil and Water Conservation Districts and Cooperative Extension Service offices could possibly provide such services in the future.

◊ The "Resource Assessment for Mountainside Development Project" coordinated by the Haywood Soil and Water Conservation District, Haywood Waterways Association and Haywood Community College is a good example of such an assistance program. Highlight and advertise this on other outlets free of charge.

◊ Consider establishing a regional Architectural Review Board (ARB) that reviews plans or supplements local jurisdictions' review processes.

◊ Organizations that offer design and consultation services could help land owners work through the process and offer design services.

PDP-7. ***Provide the staff and/or consulting services needed to assist local governments and jurisdictions.***

◊ Local government planning offices need more staff and resources (e.g., funds for consultants) to implement these strategies. Elected officials need to provide more resources and possibly create new revenue streams for this work. Revenues could come from additional general fund appropriations, increased plan review fees, impact fees, land transfer fees and/or permit fees.

◊ Fees could fund a third-party group or non-profit organization of professionals that lend their technical expertise to projects that are in the process.

PDP-8. ***Develop incentives to implement the above strategies.*** Some examples:

◊ Special certification and/or advertising (similar to LEEDS certification or a green-built home);

◊ Fast-track approval process for completing the certification program;

◊ Reduced-fees for developers who complete the Steep Slope Development 101 classes;

◊ Tax incentives for certified developments or for developers who donate conservation easements;

◊ Increased density allowances for conservation-based developments, as appropriate.

Appendices

A. Advisory Committee Members and Resource People/Organizations

Mountain Ridge and Steep Slope Advisory Committee

Name	Organization	Interest(s) represented
Andy Brown / Darlene Kucken	Equinox Environmental	Experience with environmental issues and conservation-based design; work with developers and land owners
Anthony Starr, AICP	Henderson County Planning	County planning director
Bill Gibson	Southwestern Commission	Local governments in Region A
Bob Carr	Madison County Economic Development Board	Economic development, local government
Bret Frk	The Land Form Partnership	Landscape Architect; experience with best practices, site layout issues, ordinance writing, development feasibility, land analysis
Carlton Murrey	WNC Sportsman's Federation	Hunting, fishing, and recreational land use
Carol Peterson	Buncombe Co.	County elected official
David West	Asheville Board of Realtors	Real Estate Industry
Forrest R. Westall, Sr., PE	McGill Associates	Engineer; NC EMC member; Water Resource Expert
Greg Yates	NC Division of Forest Resources	Wildfire management, Forestry
Jack Lingerfelter	Former Polk County Commissioner	Very proactive in ridgeline protection; interested in state initiative
Jim McElduff	Altamont Engineering	Environmental engineer, groundwater, sedimentation, land use economics
Jody Flemming	WNC Alliance	Grass-roots, advocacy on environmental issues
John Bonham	Carolina Mountain Lands Conservancy	Land conservation, land trust, exp. working with land owners
Josh Freeman	City of Brevard	Municipal government; planning and regulatory issues
Judy Francis, AICP	NC DENR, Office of Conservation and Community Affairs	Planning and environmental issues, state, economic development, legislative activities, establishing conservation partnerships
Leah Greden Mathews	UNCA – Economics Dept.	Environmental and land economics – issues/impacts
Mack Salley	Buncombe County Deputy Fire Marshall	Emergency/fire access and prevention issues
Marc Pruett	Haywood Erosion Control	Erosion control issues
Mike Butrum	Mountain Council for Accountable Development (MCAD)	Asheville Board of Realtors & Home Builders Assoc.
Pat Smathers	Canton – Mayor	Local municipal elected official

Mountain Ridge and Steep Slope Advisory Committee

Name	Organization	Interest(s) represented
Phillip Gibson	Warren Wilson College	Environmental issues, WNC Tomorrow experience, academic community
Phyllis Stiles	Blue Ridge Forever	Land trusts in western North Carolina
Ray Rapp	State House of Representatives	State legislature; WNC legislative delegation
Reese Lasher	Crest Mountain Communities, LLC	Developer, Goodson Cove, LLC
Robert Hawk	NCSU Cooperative Extension	Rural communities across WNC; area agent for Coop Ext.
Russell Blevins	NRCS - Madison	Erosion and sedimentation issues
Steve Metcalf	The Policy Group, Inc.	Former county manager and state senator; government affairs/relations
Steve Sloan	Buncombe Environmental Advisory Board	Ridge & steep slope development issues, Buncombe Co EAB
Susan Ervin	Macon Co. Planning Board, Macon Co. Tomorrow	Experience in Macon County with growth and steep slope development issues
Tom Massie	NC Clean Water Management Trust Fund	Interests in far WNC; water quality issues
Virginia Faust, AICP	NC Division of Community Assistance (DCA)	State and local government planning

Project Resources and Technical Experts

Who	Organization	Topics
(group)	WNC Managers	Issues most interested in and challenged with
(group)	WNC Sanitarians	Septic and related issues
Angie Rodgers	NC Natural Heritage Program	Freshwater Ecology
Ben Brown	Macon Tomorrow (Chair); writer	Macon County Voices, community charettes, growth issues
Dave McHenry	NC Wildlife Commission	Habitat Conservation Biologist; impacts on fish and wildlife species/habitats
Dave Penrose	NCSU Water Quality Group	Development impacts on water quality
Diedra Case	Design Workshop	Landscape Architect; sustainable site design; water quality/quantity impacts
Glen Locascio	DCA	Mountain Ridge Protection Act areas, mapping, GIS
Glenn Stach	Design Workshop	Landscape Architect; sustainable development for steep, sensitive environments; conservation development
Gordon Small	Haywood Waterways	GIS mapping, water quality impacts, best practices
Janet Boyer	NC DENR, Land Quality Section	Erosion control and dam safety
Jason Gilliland	LandDesign	Development and design guidelines/standards
Jesse Jacobson	S&ME	Engineering standards and recommendations
Jim Adams	DENR - Public Water Supply	Wells and water supply
Joe Lynn	DENR – Div. of Environmental Health	On-Site Wastewater Systems
John Myers	Hickory Nut Forest	Developer perspective
John Spear	Boone Planning Director	Steep slope and viewshed protection ordinances
Jon Calabria	NCSU– French Broad Watershed Training Center	Erosion and Sedimentation and Stormwater Control
Jon Creighton	Buncombe County	Experience with steep slope regs; recommendations
Kent Smith	Global Development Resources	Developer perspective
Kirk Bowden	Crescent Resources	Development design professional, Lake James
Laurie Moorhead	NC DENR – Div. of Water Quality	Water Quality Issues
Loren Raymond	Boone / Watauga; ASU Geology Dept.	City/county planning – headed task force that developed slope hazard map & ordinance
Luther Smith, ASLA	Luther Smith and Associates	Landscape design and development perspective

Project Resources and Technical Experts

Who	Organization	Topics
Neil Thomas	WWC, Resource Data Inc.	GIS, watershed analysis, impervious surface analysis
Paul Muller	NC Div. of Air Quality	Air Quality on Ridges
Paul Szurek	Biltmore Farms	Development perspective
Rick Wooten / Rebecca Latham	NC Geological Survey	Expert on landslide data and related info
Roger Edwards / Keith Haynes	NC DENR, Division of Water Quality	Water quality expertise
Scott Shuford	City of Asheville, Planning Director	Experience with steep slope regs; recommendations
Stacy Guffey	Macon County Planner	Experience with planning issues in far WNC; Macon County Voices
Ted Campbell	DENR - Aquifer Protection Section	Hydrogeologist with groundwater expertise
Ted Prosser	Landmark Asset Management	Developer (Bear Lake Reserve, others?)
Tim Hauser	Ambient Design Group	Stormwater Management
Tom Tribble	NC Center for Geographic Information Assistance	Tools, data layers, state assistance
Tom Williamson	Biltmore Farms	Development perspective
Vann Stancil	NC Wildlife Resources Commission	Impacts on Streams/Fisheries
Will McDow	Environmental Defense	Forest lands and Impacts on Timber Industry
William McLarney	Biologist	Impacts on Streams

Land-of-Sky Regional Council Staff:

Bill Eaker, Environmental Services Manager, and Linda Giltz, AICP, Regional Planner, provided project management, meeting facilitation and technical support and services for this project.

B. Local Government Regulations Related to Development on Steep Slopes and Mountain Ridges

Background:

Most local governments enforce state rules on mountain ridges according to the Mountain Ridge Protection Act, enacted in 1983. This state legislation regulates **only** the height of buildings on "protected mountain ridges" – all ridges at or above 3000 feet elevation and whose elevation is 500 feet or more above an adjacent valley floor. The "ridge" contains the uppermost points as well as all land within 100 feet below the elevation of the crest. Buildings cannot exceed 40 feet in height and must not protrude above the ridge more than 35 feet (a few exceptions exist for towers, chimneys, steeples, etc.).

In addition, several local governments in western North Carolina have adopted regulations related to steep slope development. The level of regulations and guidelines is inconsistent across jurisdictions – some have no regulations and others have extensive regulations. Some local governments offer incentives in exchange for less development on steeper areas and less disturbance of the landscape. The types of things which are regulated include:

- Amount of land disturbance and/or grading;
- Amount of impervious surface allowed;
- Building height;
- Road width and slope;
- Maximum cut and fill ratios for lot development and road development;
- Tree removal and replacement;
- Density (number of dwelling units per acre or square footage of non-residential buildings)

Most ordinances become effective for properties above a certain elevation or on slopes greater than a certain amount (usually around 15-25% slope). Most local ordinances use a formula that calculates the average slope over the entire parcel, and the regulations are based on this average slope. This report recommends that slope measurement should focus on the <u>area that will be disturbed</u>, rather than the average slope across the entire parcel (recommended strategies PS-5, WQ-15). A detailed site analysis, a slope map and a map of septic feasibility, if applicable, should also be required.

Following is a list of local governments in western North Carolina that have local regulations covering aspects of steep slope and/or ridge development (in addition to the Mountain Ridge Protection Act rules). The list may not be complete and note that regulations change over time. Also note that some local governments have stricter soil erosion and sedimentation control rules for development on steep slope areas (e.g., Henderson County).

Local Government	Phone*	Website and Ordinance	Notes
Asheville	259-5830	*www.ashevillenc.gov* Unified Development Ordinance (Sec. 7-12-4 Steep Slope and Ridgetop Development)	Applies to areas above 2220' in elevation and existing grade >= 15% and designated ridges. Regulates amount of disturbance, road design, building height, density, vegetation removal. Incentives for building on less steep/sensitive areas.
Black Mountain	669-9784	*www.townofblackmountain.org* Subdivision Regulations Land Disturbance and Slope Protection Ordinance	Subdivision and Land Disturbance and Slope Protection ordinances regulate disturbance, road design, vegetation, public safety and require low-impact design (LID) and conservation subdivision design in some cases.
Boone	268-6200	*www.townofboone.net* Steep Slope Protection Ordinance; Viewshed Protection Ordinance	Regulations focus on public safety and viewshed protection. Land disturbance is limited in viewshed areas. Developers are encouraged to minimize visual impact on ridges and steep slopes.
Brevard	883-8580	*www.cityofbrevard.com* Unified Development Ordinance (Chapter 6. Environmental Protection)	Regulations focus on minimizing land disturbance and ensuring safe construction. Creative designs are encouraged and development potential may be transferred from steep areas to less-steep areas of parcel.
Buncombe County	250-4830	*www.buncombecounty.org* Subdivision Regulations and Zoning Ordinance	Regulates amount of land disturbance, impervious surfaces, density, road design and building height for subdivisions and multifamily dwellings. Emphasis is on limiting disturbance and impervious surfaces on steep slopes; encourages clustering development in less-steep areas of parcel in return for a density bonus.
Haywood County	452-6632	*www.haywoodnc.net* Slope Ordinance	Regulates slope height, cut and fill slopes, compaction and placement of utilities with a focus on safe construction.Established an Engineering Review Board for policy recommendations and enforcement.
Henderson County	697-4819	*www.hcplanning.org* Land Development Code	County follows state ridge law, but allows for conservation subdivisions which encourage conserving steep slopes as open space through a density bonus.
Jackson County	631-2261	*http://planning.jacksonnc.org* Mountain and Hillside Development Ordinance	Regulates all types of development and land disturbing activity in the Mountain and Hillside Development District. Limits grading, height, density, vegetation removal. Requires compliance with BMPs in ordinance.
Waynesville	456-2004	*www.townofwaynesville.org* Hillside Protection Ordinance	Regulates amount of grading and density based on slope. Construction on mountain ridges governed by Haywood County and State regulations.
Transylvania County	884-3205	*www.transylvaniacounty.org* Mountain Ridge Protection Ordinance Subdivision Ordinance	Ridges covered include all ridges that are at least 500 feet above the elevation of an adjacent valley floor, regardless of elevation. Project approval dependent upon adequate water supply, safe waste water disposal, adequate fire protection and preservation of natural beauty.

* All phone numbers are in area code 828.

Organizations that can provide assistance:

North Carolina Division of Community Assistance (DCA), Asheville Regional Office – *http://www.nccommerce.com/en/CommunityServices/CommunityPlanningAssistance/*; 828-251-6914

Regional Councils of Government:

- Southwestern Commission – *www.regiona.org*; 828-586-1962
  Serving Cherokee, Clay, Graham, Haywood, Jackson, Macon and Swain Counties
- Land-of-Sky Regional Council – *www.landofsky.org*; 828-251-6622
  Serving Buncombe, Henderson, Madison and Transylvania Counties
- Isothermal Planning and Development Commission – *www.regionc.org*; 828-287-2281
  Serving Cleveland, McDowell, Polk and Rutherford Counties
- High Country Council of Governments – *www.regiond.org*; 828-265-5434
  Serving Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes and Yancey Counties

Additional Resources:

Planning for Hillside Development, by Robert B. Olshansky, AICP. Published by the American Planning Association (APA) in November 1996 (also referred to as Planning Advisory Service Report Number 466). Available from APA (*www.planning.org/apastore/*)

Georgia Department of Community Affairs *2007 Model Code: Alternatives to Conventional Zoning.*

The model code is available on Georgia DCA's website at:
http://www.dca.state.ga.us/development/PlanningQualityGrowth/programs/modelcode.asp

All types of development-related regulations are included in the model code. Hillside development model regulations are in Section 3-4. The purpose of the "Alternatives" project "was to provide Georgia's local governments a set of relatively simple tools, both old and new, they could use to address land use and development issues in their communities. The final product provides a one-stop shop for a variety of regulations designed for communities with limited capacity to prepare and administer these types of tools."

Land-of-Sky Regional Council
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