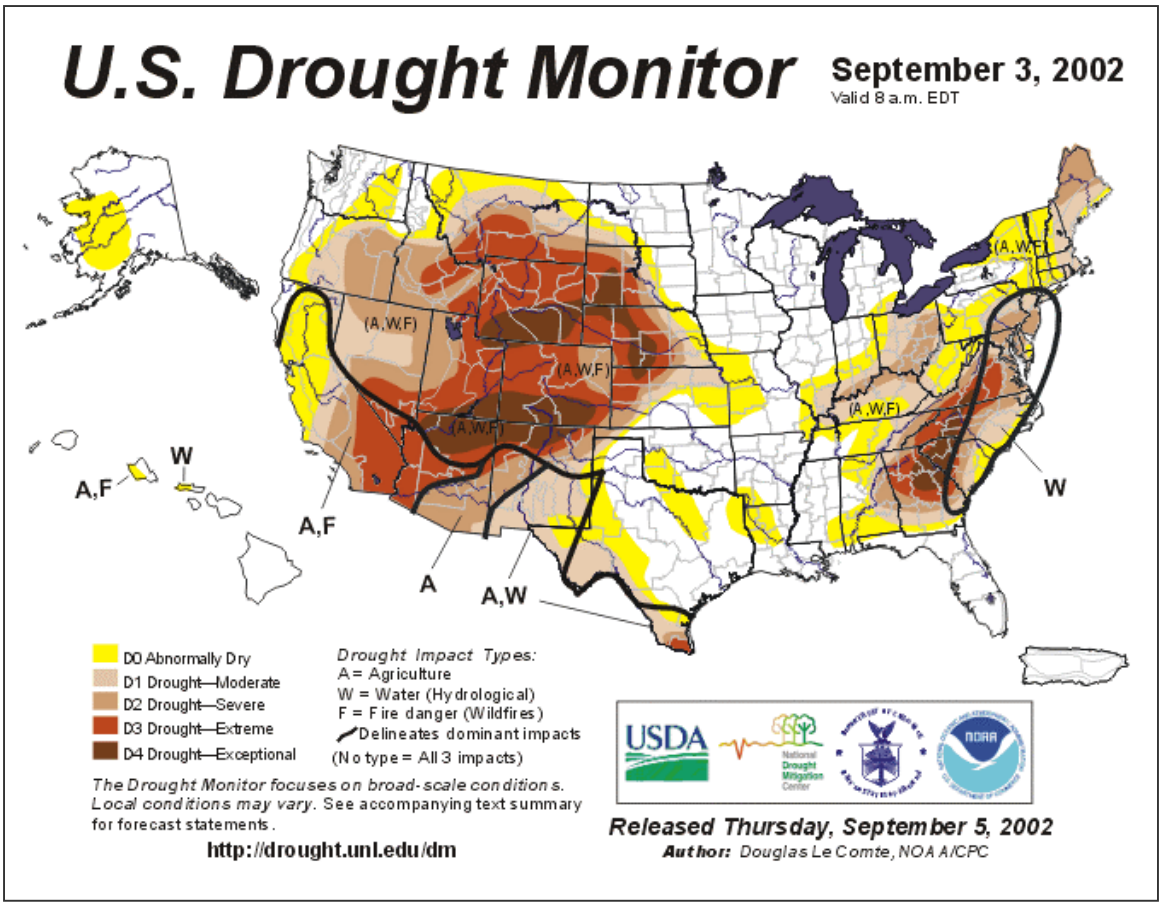
DROUGHT

History

The New River Valley has just come out of an extended severe drought. The drought that began in 1998 and continued through the early Fall of 2002 impacted public water supplies, agriculture and fire dangers (as revealed in Figure 38 below.) The accumulated rainfall deficit was at least 20 inches before rain finally resumed. The effect was more dramatic because most of the limited rainfall was in the summertime, when vegetation used it up, versus the more typical heavy precipitation in the winter when groundwater recharges.

Figure 38



Risk Assessment and Vulnerability

No place in the world is immune to drought. Rainfall fluctuates year to year and a moisture year "below average" is not uncommon. What is not yet well understood, however, is the likelihood of multi-year, severe droughts. A research team from Columbia University is currently researching drought for the past 1,000 years or so in the eastern U.S. to get a sense of frequency and severity of impact.

It is understood from the recent drought, though, that it poses a serious threat to public water supplies, agriculture and wildfire dangers.

Water Supplies

About 70% of NRV residents receive their water from a public water system, and therefore about 50,000 people are dependent on private springs and wells (see Table 20). The public water systems across the NRV are not generally interconnected, leaving systems vulnerable to inadequate supplies. For example the Giles County Public Service Authority system, which supplies five towns and much of the unincorporated area, has only one primary source (well).

Table 20

Locality	Population (2000)*	% on Private Well or Spring, 1990**
Floyd County	13,874	92.0%
Town of Floyd	432	
Giles County	16,657	44.7%
Glen Lyn Town	151	
Narrows Town	2,111	
Pearisburg Town	2,729	
Pembroke Town	1,134	
Rich Creek Town	665	
Montgomery Co. (Unincorporated areas only)	27,109	25.3%
Elliston-Lafayette CDP	1,241	
Merrimac CDP	1,751	
Shawsville CDP	1,029	
Pulaski County	35,127	29.5%
Dublin	2,288	
Fairlawn CDP	2,211	
Pulaski	9,473	

* Source - US Census 2000

**Last time collected in US Census

In areas without public water systems, there were more than 700 dried-up springs and private wells during the recent drought (see replacement wells in Table 19). At $2,000 to $10,000 per replacement well, this cost alone totaled $1,400,000 to $7,000,000.

Table 21

New River Drought Report and Surveillance Summary: 8/1/99 to 11/30/02*

	New River Valley
Total well applications	2,957
Replacement wells	726
Floyd County	463
Other NRV Localities	263
NRV Percentage replacement wells	**24.6%**
Floyd County percentage replacement wells	**43.90%**
Other NRV Localities % replacement wells	13.90%

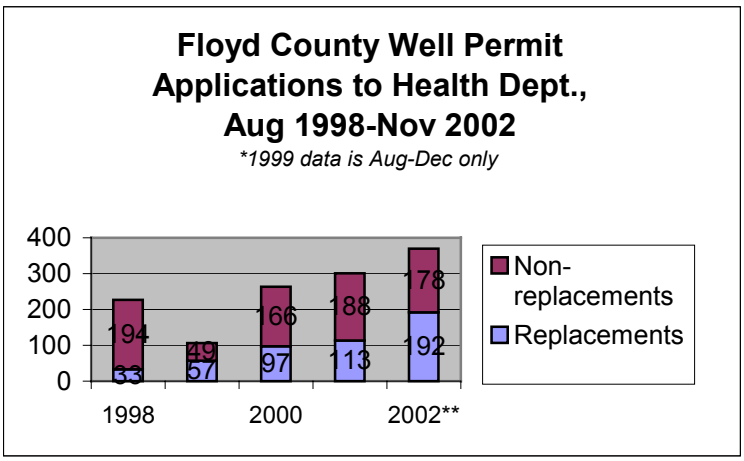
Source: Virginia Department of Health, New River Valley District

*Does not include January to July, 2000; data unavailable.

Special Hazard Area

About 63% of the replacement wells in the NRV from August 1999 to November 2002 were in Floyd County, which is the only NRV jurisdiction in the Blue Ridge Physiographic region. Throughout the period more than 43% of well permits in Floyd County were for replacement wells. By the worst part of the drought in 2002, this percentage increased to more than half (Figure 39). Spatial analysis of the well permits revealed that the replacement wells in Floyd County were not clustered around any particular area, but were geographically dispersed. Moreover, 29% of the wells had to go deeper than 400 feet, and 45% of the new wells yielded 5 gallons per minute or less (see maps of each analysis in the Large Map Supplement.) Based on this and the number of households dependent on private water supplies, it is estimated that 5,000 households are still vulnerable to water loss in droughts.

Figure 39



Agricultural Losses

Beyond threats to public water supplies, the economic losses due to the drought were significant in the region. As Table 22 demonstrates, the agricultural losses alone were dramatic $10,000,000. Fortunately, the US Department of Agriculture (USDA) finally classified all four NRV counties as federal drought disaster areas, qualifying local farmers for assistance programs. Again, the estimates of losses from USDA showed Floyd County to be most vulnerable to the recent drought.

Table 22

Estimate of Agricultural Losses, Drought 2002				
	Floyd County	Montgomery County	Giles County	Pulaski County
# Farm Facilities (developed springs, wells)	560	370	100	200
Value of Farm Facilities Lost	$300,000	$200,000	$100,000	$200,000
$ Livestock, Loss of Weight gain	$3,700,000	$2,500,000	$1,000,000	$2,000,000
Total $ Loss	$4,000,000	$2,700,000	$1,100,000	$2,200,000

Other Economic Losses

Other economic losses included reduced tourism at water-based locations, such as Mountain Lake. The location of Mountain Lake on a fault-line and the severe drought left the lake virtually empty by September 2002. Chateau Morrisette, a winery and fine dining establishment in Floyd County, suffered loss of its principal spring as well.

Mountain Lake, September 2002

Drought also exacerbates wildfire dangers and losses. Wildfires will be discussed in greater detail in a later section.

Past Drought Mitigation

The existing public water systems themselves, especially those with multiple sources, are one measure of mitigation, adding versatility and reliability to local public water supplies.

Other mitigation efforts include conservation and rainwater catchment systems. Conservation efforts were largely voluntary until the State Emergency Declaration in September 2002. Rainwater catchment systems have traditionally been personal efforts to provide additional water supply during “normal” years. During extended periods without rain, many of the systems can serve as cisterns, with water being delivered by truck from other sources.

New sophistication in rainwater systems is also resulting in use in larger scale projects. Carilion New River Valley Medical Center in Montgomery County is developing a rainwater catchment system which will simultaneously reduce stormwater run-off and supply re-use needs. These large systems are based on the same principals as the traditional "rainbarrels."

Photo Courtesy of Rainwater Harvesting, Inc.

To address the nearly-dry pond at Mountain Lake, the private owners attempted to pump water back into the lake. They found this to be ineffective, however. Fortunately, the heavy rains of 2003 have re-charged the lake.

Additional Drought Mitigation Opportunities

There is a relative short-list of drought mitigation opportunities. This list includes:

- ✓ Having a long-term water supply plan, and short-term drought contingency plan
- ✓ Seeking additional public water supply sources and/or the interconnecting of additional sources/systems.
- ✓ Encouraging water conservation, especially in times of drought.
- ✓ Protecting critical recharge areas to insure maximum recharge.
- ✓ Encourage good forest stewardship, recognizing that trees aid recharge and minimize run-off.
- ✓ Encourage alternative water sources for agriculture.
- ✓ Encouraging more rainwater catchment systems, which supplement other water supplies and reduce stormwater run-off.

Specific drought mitigation projects are included in the NRV Hazard Mitigation Project List.

WILDFIRE

History

The New River Valley has not suffered any devastating fires of the scale that now seem frequent in the western U.S. Yet, as Table 23 demonstrates, small fires are relatively frequent in the New River Valley.

Table 23

Forest Fire--5-year Average

	Total fires	Total AC	Avg AC
Floyd County	47	71	1.5
Giles County	9	44	4.9
Montgomery Co.	68	147.9	2.1
Pulaski Co.	55	229	4.1

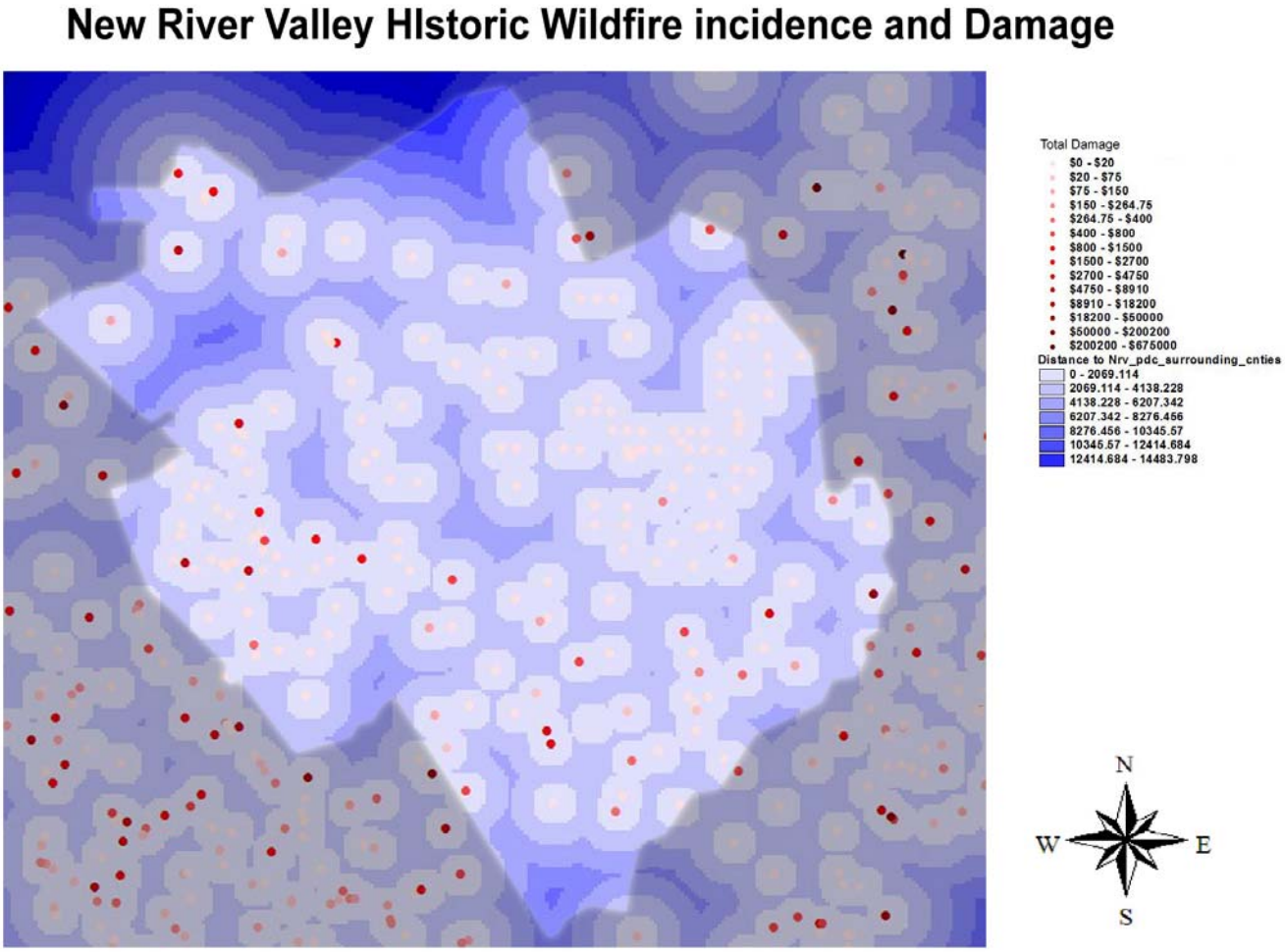
Source: VA Dept. of Forestry

Helicopter fights Poor Mountain Fire, 2003

Two significant wildfires did occur simultaneously this year in the New River Valley, despite the heavy moisture in the winter and spring. From April 16-19, 2003, 142 acres burned on Draper Mountain in Pulaski County and about 100 acres on Poor Mountain in Montgomery County.

Wildfires sometimes damage homes and structures, as well as destroying wildlife habitat, merchantable timber and critical watersheds. While the NRV has been spared devastating fires, numerous fires have caused thousands of dollars of damage (see Figure 40). As evidenced in Figure 40, Floyd and Pulaski Counties appear to have had the greatest number of damaging fires. Unfortunately, no detail is available regarding the type of damage incurred.

Figure 40



Source: Virginia Department of Forestry, July 2003
Time period covered is undefined.

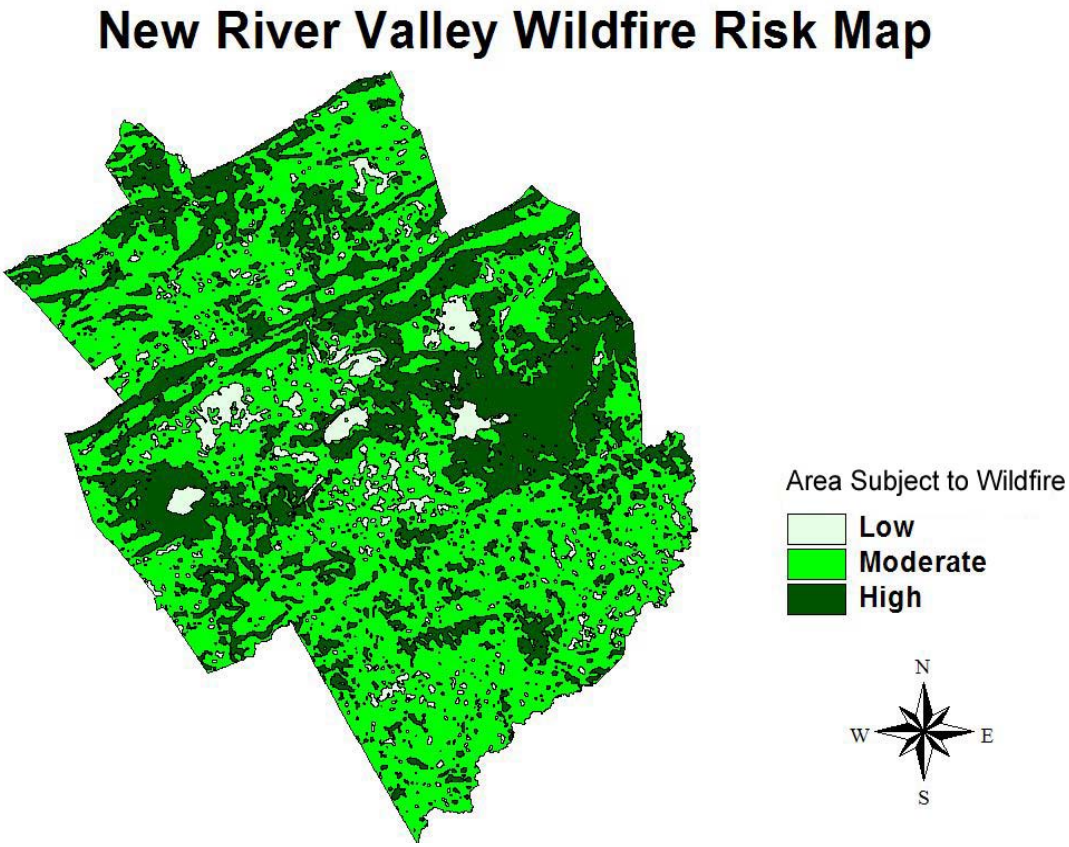
Risk Assessment and Vulnerability

The risk factors for wildfire include drought, other weather factors (such as wind, temperature, atmospheric stability), slope, fuel and fire-fighting capabilities (including water supply). Risks are also increased by the Southern pine beetle outbreak and hemlock wooly adelgid, as well as past ice and wind storms leaving behind dry debris.

With its many public and private forests, portions of the New River Valley are at high risk of wildfires (Figure 41). Indeed, 76% of Giles County is classified as woodland, and slopes sometimes exceed 20%. Moreover, Giles County and the New River Valley are experiencing an increase in wildland-urban interface area, where residential development is pushing into sloped, forested areas. These woodland homes are at high-risk,

particularly during spring and fall "wildfire seasons." During the drought in 2002, a fire ecologist from the University of Tennessee stated, "It's not a matter of if but when wildfires of the [massive] magnitude experienced in the West. . . will occur in the Southern Appalachians where our forests are less open and the fuels are greater." Interestingly, the risk map from VDOF (Figure 41) does not seem correlated with past incidents and damage map from VDOF (Figure 40).

Figure 41



Source: Virginia Department of Forestry, July 2003

Special Hazard Areas

Several special hazard areas have been identified locally as well. The wildland-urban interface along the southern portion of the Jefferson National Forest is believed to be especially vulnerable to wildfire risks. It is likely that 30-50 homes are at high risk; likely total value is $6 to 15 million. Also, steep-slope, woodland recreational homes, such as in southern Floyd County are also believed to be especially vulnerable (up to 40 homes, total value $ 2 million+). Lastly, Camp Powhatan, a multi-thousand-acre Boy Scout reserve in Pulaski County, is believed to be especially vulnerable given the steep woodlands and lack of internal roads for fire-fighting equipment.

Past or Existing Mitigation

The NRV benefits from many national and state forestry initiatives. These include the Virginia Forestry Smokey the Bear program, the Fire Risk Index, outdoor burn laws, dry-hydrant programs, and geographic information system development (such as the past two maps). Additionally, the US Forest Service's Federal Wildland Fire Policy emphasizes community initiatives including cross-training among structural and wildland (local, state and federal) firefighters. The U.S. Fire Administration and USDA's Rural Development program administer a grant programs to help equip fire departments. Also, abundant information is available from these sources as well as the non-profit organization, Firewise, regarding wildfire mitigation techniques for home-builders, home-owners and government officials. Similarly the New River-Highlands Resource Conservation and Development agency is offering to help set up wildfire mitigation demonstration sites.

Mitigation Opportunities

There are many mitigation opportunities related to wildfires:

- Homebuilders and homeowners can be educated on building techniques, such as avoiding steep slopes; limiting wildfire fuel through building design, materials, maintenance and landscaping; and creating fire breaks or defensible space.
- Local foresters could be called on to help review subdivision plat for wildland areas.
- Local governments can utilize zoning and subdivision ordinances to restrict high risk development and insure adequate structure setbacks and road access.
- Lastly, all high-risk areas should have either public water or adequate dry hydrants.

Specific wildfire mitigation projects are listed in the NRV Hazard Mitigation Project List.

GEOLOGIC HAZARDS: LANDSLIDES, SINKHOLES, AND EARTHQUAKES

The New River Valley has had multiple geologic hazard events, from much localized landslides and sinkholes to a sizable earthquake in 1897.

LANDSLIDES

History

Western Virginia was the site of one of the most devastating landslides in US history. Nelson County and its vicinity had 150 deaths and $133 million in damage from Hurricane Camille remnants in 1969. The catastrophic debris flows occurred following 20+ inches of rain.

While no devastating landslides have occurred in the NRV, significant landslides have occurred. The 1897 earthquake triggered significant rockslides in Giles County, though little information is available on damage. Major flooding in 1940 resulted in landslides that temporarily closed rail lines and roads. The most significant slide on recent record was in the Draper community of Pulaski County in June 1994, when 6" of rain in 3 hours produced landslides that knocked at least one home from its foundation and blocked 5 miles of roads. Narrows in Giles County has periodic landslides that affect Route 460.

Minor landslide in Elliston, February 2003

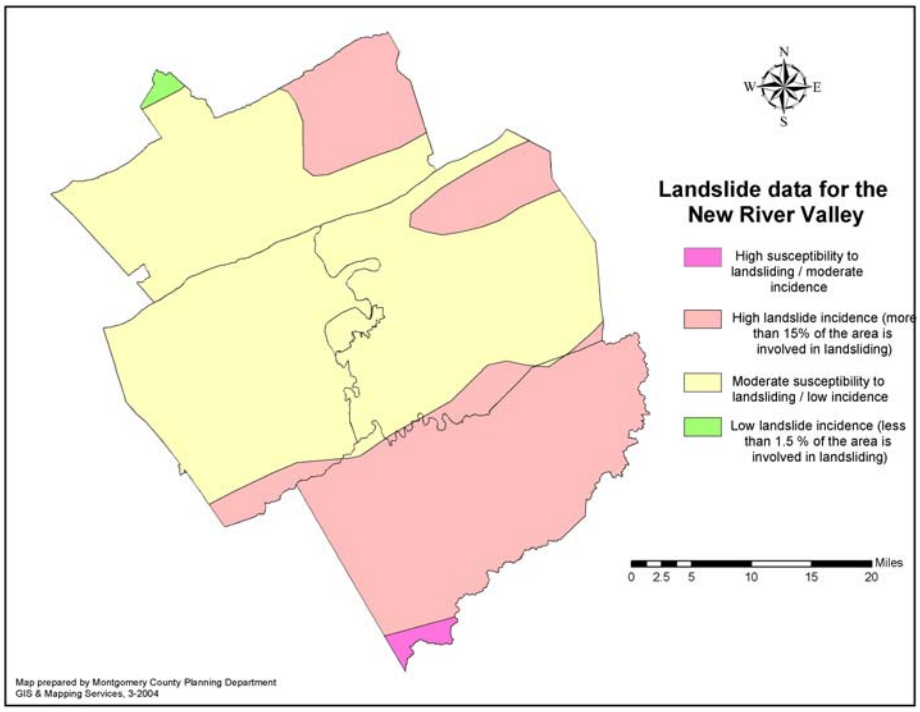
Risk Assessment and Vulnerability

All of the Appalachian Mountain range has some elevated risk of landslide due to clay-rich soils, steep slopes and weak or fractured geology. Along that range, a narrow band of western Virginia—which includes only Floyd County in the NRV--has particularly high incidence and high susceptibility to landslides (Figure 42).

Any steep slope is inherently dangerous, representing a precarious equilibrium that either upward geologic forces or downward rain or wind could upset. Consequently, landslides are most often associated with significant rain events or earthquakes.

Since no past damage information is available, it is impossible to project any likely damage from devastating landslides. The dramatic experience during Hurricane Camille is the only indication of level of destruction that may be brought. That is to say, in a worst case scenario, hundreds of lives and homes might be destroyed.

Figure 42
Landslide Incidence and Susceptibility in Virginia



Past or Existing Mitigation

Safety Fence along Interstate 81 near Christiansburg Mountain.

Most zoning and subdivision ordinances in the NRV have only weak language stating that "size, location, shape, slope and condition of land shall be suitable" for development. Generally, no specific parameters are set. So, development on steep or unstable slopes is largely unrestricted in the NRV. The one exception is the Town of Blacksburg which requires that "primary conservation areas" such as floodplains, wetlands, and steep slopes "shall be dedicated as open space" (where slopes are 25% or greater.) Also, the Virginia Department of Transportation (VDOT) does utilize safety fences to help protect against minor rockfalls into traffic along primary roads.

Mitigation Opportunities

Ideally, all high-risk areas should be mapped. Hillside development could be minimized. Also, earth-stabilizing vegetation should be planted or retained wherever possible. This will require "common sense," site-specific decisions to balance landslide and wildfire threats. Caution should be used along road cuts, as well to avoid "root wedging," which can push out rocks over time.

SINKHOLES

History

Much of the NRV rests on karst topography, and therefore the landscape is dotted with sinkholes. While there are no records of major structural damage caused by sinkholes in the NRV, such incidents have occurred in other karst regions. Major highway collapses are a recurring event for example. On the contrary, sinkholes opened up in Pearisburg during the 2002 flooding which provided sufficient temporary drainage to avoid significant flood damage to structures. Sinkholes are always challenging, however, as there is potential for direct groundwater contamination.

Sinkhole in Castle Rock Recreation Area of Giles Co.

Figure 43

Risk Assessment and Vulnerability

The Counties of Giles, Montgomery and Pulaski as well as the City of Radford consist of limestone, dolomite or other soluble rocks where karst may develop (Figure 43). Floyd County does not have karst topography. Karst is characterized by subsurface drainage systems, sinking or losing streams, sinkholes, springs and caves (Figure 44).

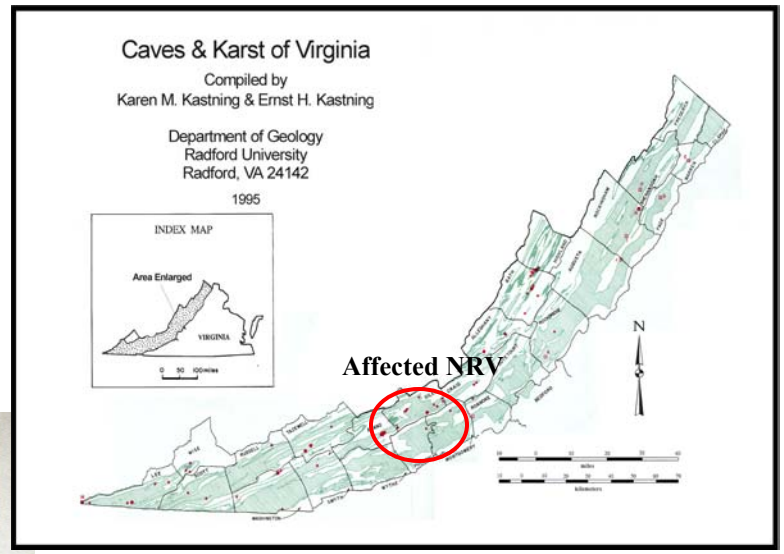
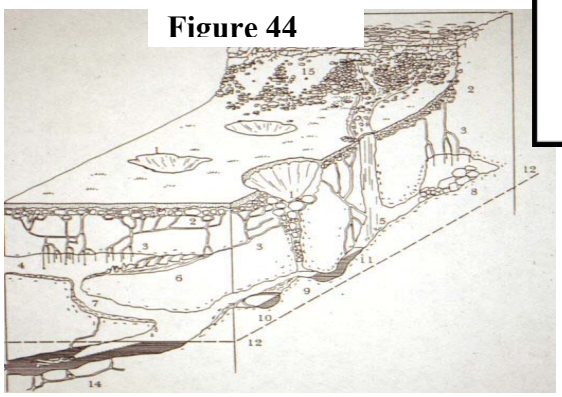


Figure 44



Source: Virginia Department of Conservationa and Recreation

The principal event associated with karst is subsidence, or sinkholes, which may open up under structures such as a home. Sinkholes also literally open up a direct avenue for potential groundwater contamination, which can occur naturally through run-off or when people dump waste or dead animals into them. While fecal coliform has been found in 25-30% of wells in some areas, expensive dye tracing is necessary to trace paths from sinkholes, so no precise cases are known.

A Virginia Department of Conservation and Recreation karst expert stands near a sinkhole with a dead calf in it

The risk of new sinkholes developing is highest during times of flooding or drought. In terms of structural damage, a new sinkhole would likely impact only one property.

Past or Existing Mitigation

Most land use ordinances in the NRV, including zoning and subdivision ordinances, have only weak language regarding karst, such as "land deemed to be topographically unsuitable shall not be platted for residential use."

Most karst mitigation efforts to date have been made by the Virginia Department of Conservation and Recreation (DCR), which has a karst office in the NRV, or the Senior Environmental Corp, or the Cave Conservancy. DCR has sponsored local workshops for planners and local officials. They also offer a cost-share program for sinkhole clean-outs, to try to prevent groundwater contamination.

Also, the Virginia Department of Transportation (VDOT) requires the locality and developer to make additional stormwater management provisions in areas with karst topography prior to the acceptance of subdivision streets.

Mitigation Opportunities

Additional mitigation opportunities are problematic in predominantly-karst jurisdictions. A good GIS database would be useful. Stormwater management ordinances may also be needed in some areas. Karst overlay zones with special studies and buffer requirements may be possible, as well as special warnings and/or education for landowners.

Shrink-swell Soils

On a related note, the new International Building Code in effect in Virginia indicates shrink-swell soil in this region. New development in certain areas must do soil tests (see Appendix E). While shrink-swell soils could cause structural damage, this is not analyzed here since there is no existing data on past damage or risk. It is assumed, therefore, that this is a low-impact risk. As more data becomes available, this should be analyzed more closely.

EARTHQUAKE

As the name implies, an earthquake is the trembling at the Earth's surface or below, resulting from the release of energy or strain on the Earth's tetonic plates. The shaking and movement can cause serious damage to buildings and structures. There are four hazards associated with earthquakes (from *Planning for Post-Disaster Recovery*):

- Ground motion: waves of vibration
- Seismic activity: energy transferred, measured by magnitude (total energy) and intensity (subjective description at a particular place)
- Surface faulting: visible, lasting ground changes
- Ground failure: weak or unstable soils can liquefy and move

The most familiar terminology associated with earthquakes are magnitude and intensity. Table 24 below provides explanation of the Modified Mercalli Intensity Scale and relates it to likely magnitude at the epicenter.

Table 24 Earthquake Intensity and Magnitude Scales

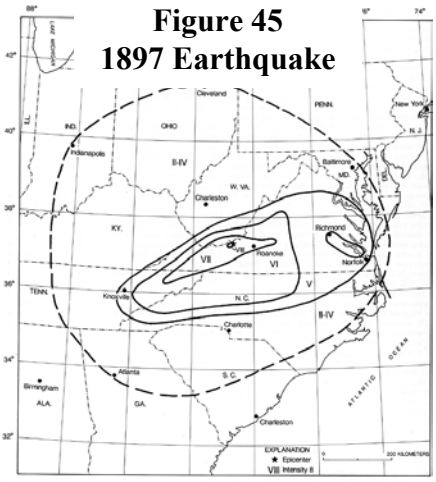
Modified Mercalli Intensity	Magnitude (at epicenter)	Witness Observations
I	1 to 1.5	Felt by very few people; barely noticeable.
II	2	Felt by a few people, especially on upper floors.
III	2.5	Noticeable indoors, especially on upperfloors, but may not be recognized as an earthquake.
IV	3	Felt by many indoors, few outdoors. May feel like heavy truck passing by.
V	3.5	Felt by almost everyone, some people awakened. Small objects moved. Trees and poles may shake.
VI	4.5	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.
VII	5	Slight to moderate damage in well built, ordinary structures. Considerable damage to poorly built structures. Some walls may fall.
VIII	5.5	Little damage in specially built structures. Considerable damage to ordinary buildings, severe damage to poorly built structures. Some walls collapse.
IX	6.5	Considerable damage to specially built structures, buildings shifted off foundations. Ground cracked noticeably. Wholesale destruction. Landslides.
X	7	Most masonry and frame structures and their foundations destroyed. Ground badly cracked. Landslides. Wholesale destruction.
XI	7.5	Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground.
XII	8 or greater	Total damage. Waves seen on ground. Objects thrown up into air.

Source: Martin Chapman, Virginia Tech Seismologist, hand-out, 2003.

History

On May 31, 1897 an earthquake estimated at 5.8 on the Richtor scale occurred in the NRV. The epicenter was in Pearisburg, but it was felt as far north as Cleveland, Ohio and as far south as Atlanta, Georgia (Figure 45 identifies various levels of intensity, based on the Modified Mercalli Scale). In the Giles County area, chimneys fell, brick homes were damaged, streams changed course, and rockslides and landslides covered railroad tracks.

Figure 45
1897 Earthquake



Smaller earthquakes have also occurred in the Pulaski County area. These were generally no more than 3.5 in magnitude (on the Richter Scale).

Risk Assessment and Vulnerability

According to Martin Chapman, Ph.D, a seismologist at Virginia Tech, a 6 to 6.5 magnitude earthquake is estimated to be a 1-in-2,500-year event in the New River Valley (Figure 46, NRV circled in red). Specifically, he suggests that the region within 30 kilometers of the epicenter of the 1897 Earthquake is most likely to see the next significant event (depicted by the red circle in Figure 47).

Figure 46
Seismic Hazard Map

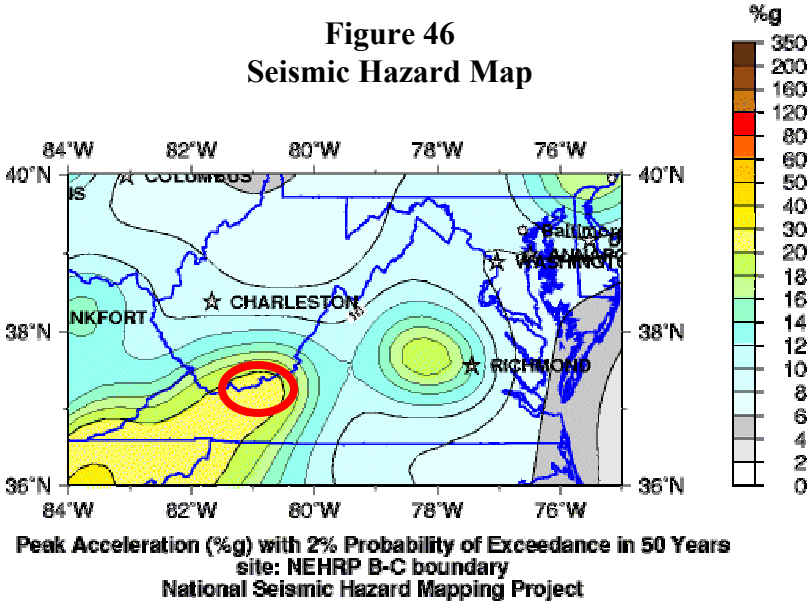
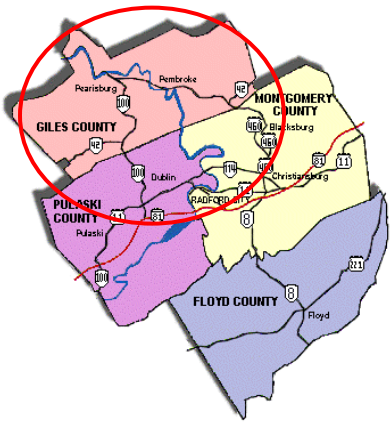


Figure 47
NRV Earthquake
Elevated Hazard Area



Also according to Dr. Chapman, old brick and block construction results in the most death and injuries during this level of earthquake. Specifically, he mentioned that firehouse doors and hospital equipment not restrained may be rendered inoperable. There are four hospitals in this high hazard area, and there are approximately 15 firehouses. A major earthquake could damage medical and rescue equipment, as well as major bridges—causing millions of dollars in damage.

There is also one major natural gas transmission line (through Pulaski and Montgomery Counties) and a major hydroelectric dam (Claytor Dam in Pulaski County) that could be affected by a major quake. Given the very low probability of this type event, however, no additional assessment was deemed necessary at this time.

Past or Existing Mitigation

The only earthquake mitigation currently in effect is the statewide building code. The building standards in earthquake hazard areas will be further increased with the new International Building Code.

Earthquake Mitigation Opportunities

The reasonable mitigation opportunities include:

- Recognizing high danger areas such as gas pipelines near dense population bases.
- Ensuring that new hospitals and firehouses are properly designed, including consideration of seismic strengthening.
- Recognize that deep soils, such as old floodplains, suffer the greatest damage during shaking.

Specific geologic hazard mitigation projects are listed in the NRV Hazard Mitigation Project List.

SEVERE WEATHER: HAIL, LIGHTNING, COLD, ICE, AND WIND

The New River Valley experiences a variety of severe weather events. Most of these do not cause catastrophic damages, however. Rather, most threats to life can generally be minimized through attention to personal safety. Threats to property may be minimized in a variety of ways. Most of these hazard events are not associated with particular places, except for lightning, which tends to strike the highest place, including a person standing in an open field. The histories, risk assessments and mitigation options are summarized in the table below.

Table 25

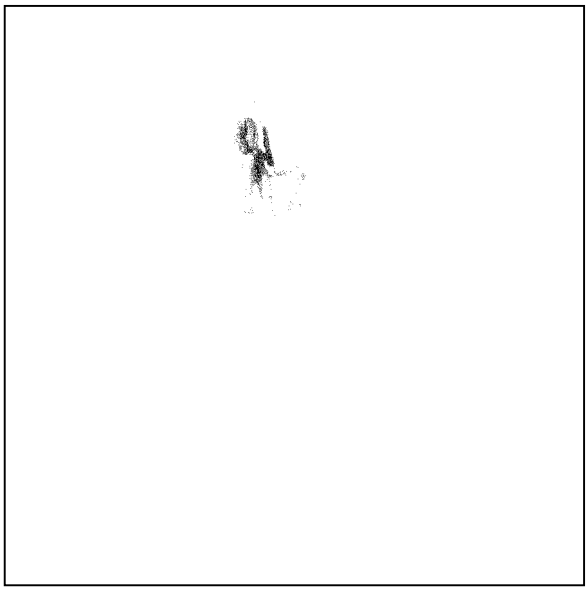
Other Severe Weather Histories, Risk Assessments, and Mitigation Options

	History	Risk Assessment		
	Worst Recent	**Damages**	**Frequency**	**Mitigation**
HAIL	Baseball Size, May, 2002, in Dublin	Large hail can damage people, vehicles and homes	Greater than 1" hail 11 times since 1995	Insurance, well-built homes, personal safety precautions
COLD	-30 degree F, Mountain Lake, January 21, 1985	Hypothermia for people and animals, frozen and bursting pipes	Sub-zero temperatures are almost annual in NRV, special risk if power outage	Education and outreach to avoid high-risk activities and shelter in the case of power outage; alternative heat sources.
SNOW	March 13&14, 1993 and January 6&7, 1996 brought 2' to 3' of snow with 10' drifts to NRV	$12 million in statewide clean-up, 12 deaths, thousands stranded, power outages, collapsed roof (RU & Lowes)	At least once/decade	Heed NWS warnings, VDOT snow fencing and road clearing, avoid flat roofs. Alternative heat sources.
ICE	February 4, 5&6, 1998, 3 to 5 inches of ice accumulated on Poor Mountain	Brought down huge power lines and towers	Heavy icing once every 2 to 10 years	Bury utility lines, existing utility line clearance, heed NWS warnings, VDOT road clearing; alternative heat sources.
WIND	Hurricane Hugo, September, 1989 and 3 small tornadoes 1987, 1998 and 1999	80 mph winds with Hugo brought down many trees and power lines; 1987 tornado cause $3 million damage in Montgomery Co	Once every 5 to 10 years	Manufactured home tie-downs, good roofing, wind-secured critical facilities, and securing property that can become "missiles"
LIGHTNING	Severe Thunderstorm at VT on August 27, 2000 with 55,000 people in Lane Stadium	$191,000 in damage to structures & equipment reported in NRV since 1995	Very frequent	Recognize May-August as high hazard season
	Lightning struck Floyd County farm on May 22, 2001, killing 28 cows.	Lightning is #2 weather killer in US, causes 30% of power outages and 20 wildfires in VA annually		Avoid open space, under trees, water and equipment during storm

Severe Weather Photos

Wind damage in Pembroke
February 2003

Heavy ice in Floyd County,
December 2002



1960 Snows: around Buffalo Mountain,
Floyd County
Photo from Willadean Hylton

LESSONS LEARNED

Since the NRVPDC was the first Virginia region awarded funding notification to do a regional natural hazard mitigation plan, FEMA and the VDEM asked that this section be included for the benefit of others. This section will highlight challenges and successes.

Challenges

Newness

Hazard Mitigation is not a common term or thought among local government staff or elected officials, and this planning process labored to begin to ingrain that thought. Similarly, the newness of the federal requirements brought additional difficulty. The FEMA How-To documents or guidelines for this process were largely being produced during our process; so much of our effort was self-invented or borrowed from other agencies, including the North Carolina Department of Emergency Management. Despite the lack of formal policy, FEMA and VDEM did provide strong encouragement and participation during the process.

Timing and Coordination

If the State had been given additional time to gather and consolidate central information, this would have saved great effort and expense at the regional and local level. For example, if the Virginia Department of Forestry database of past wildfire incidents, high hazard areas and dry hydrant locations had been completed in advance of the regional effort, duplication of effort could have been avoided. Fortunately, the VDOF did complete a good portion of their work by the end of our process, and they shared it expeditiously. Similarly, if the Virginia Department of Mines, Minerals and Energy could have had the resources to complete detailed geologic hazard studies, local effort could have focused longer on solutions rather than on hazard and risk assessment.

Lack of Damage Data

The Virginia Mitigation Plan (part of emergency Operations Plan), cites the lack of available data to accurately assess risk and exposure. Instead, it suggests population density as a proxy for such information. Unfortunately, this past damage information has generally not been quantified and retained at the local level either. This lack of quantitative data on past hazards results in a significant amount of local, qualitative information in this report. Clearly, a better mechanism is needed to document and retain past damage information. Ideally this would be maintained in a geographic information system to enable broader planning uses and sharing up to the state level.

One of the only current mechanisms is the process to seek a state or federal disaster declaration. This process is not well understood locally. Our request for past disaster declaration information was promptly honored by the State, but unfortunately, they also

lacked key information such as location of damage, types of damage and damage amounts. Perhaps this system could be expanded to meet damage information needed.

At the regional level, the "on the ground" damage assessment needs to be given more attention. In the future, the formation of a damage assessment team could help insure good, timely information. This information could support both short-term and longer-term assistance requests.

Another national source for all risk information is the National Insurance Association. If the actuarial data were opened, analyzed and/or refined to reveal the highest risks areas, local efforts could focus on education and mitigation.

Lack of Infrastructure Data

At the present time, localities in the NRV have not generated lists of public infrastructure and its value. New Government Accounting Standards (#34) will require this in the near future. It is recommended that the infrastructure located in the high hazard areas also be identified at that time.

Language Barriers

One of the difficulties already cited was the newness of "hazard mitigation" in the local government lexicon. Similarly, some of the older hazard language is problematic as well. For example, the "100-year floodplain" is a misnomer, to some extent. Too many people, even when they should know better, make the mental assumption that a place will only flood once every 100 years, rather than assuming it has a 1% chance of flooding in any given year. It may be more useful to develop a risk terminology based on the life of the average mortgage for example. So the 100-year floodplain would become "25%-probability zone." It would be better to err on the side of potential overstatement, than the current language, which dramatically understates risks.

Tools Needed

While HAZUS is beginning to address geographic risk assessment needs, it is not yet to the point of being user-friendly. Furthermore, additional local data (such as the value and location of all critical facilities) is needed to make this software fully functional.

Another tool needed is standardized risk terminology for hazards such as drought, wildfire, and winter storms. Lastly, electronic versions of dam failure inundation areas are needed, especially for major dams, though security concerns may severely restrict the distribution of this information.

Variety of Input Needed

One of the challenges has been trying to bring land use planning to the table with emergency responders. Both have meaningful insights, but this process required each to participate and think beyond their normal ranges. For example, a sheriff's office has trouble imaging that people might want to be permanently relocated from the floodplain when they can't even get some to leave when they're on their doorstep and flooding is imminent. Many planners have not been trained to think in terms of natural hazard mitigation, assuming that emergency management means only preparedness and response and not land use. This planning process was at least a first step in bringing the two together.

Priorities and Opportunities

Another challenge is vying for leader's attention in the midst of horrible budget times. Fortunately, the timing of some serious natural events aided this process. The clear and marketed availability of real mitigation funding would have greatly aided this process. This was almost impossible in this round given a combination of things: the change in federal administration, the reorganization of FEMA under Homeland Security, and Virginia's limited mitigation staff. Similarly, it would have been helpful if more of FEMA's work with other Federal agencies to present a coordinated and comprehensive message could have been completed ahead of this effort. For example, Housing and Urban Development's Community Development Block Grant program is often listed as a pre-disaster mitigation funding source. Yet, in Virginia, the Community Development Block Grant program will only fund mitigation projects immediately following a Presidential disaster. Communities such as the Town of Pulaski which have had major flooding 11 times in the previous 90 years are not eligible because they haven't had flooding this year.

Successes

Though it was one of the challenges, one of the greatest successes of this planning process was the broad variety of input and participation, from local citizens groups to planners, emergency personnel, facilities managers, building officials, zoning official, and local government managers. The diversity of perspective made the process informative and hopeful, but grounded in reality.

The NRV process benefited greatly from participation by various "local" experts. These experts ranged from professionals at Virginia Tech (including a seismologist, a land use professor/attorney, and the Virginia Water Research Center staff) to local fire fighters sharing war stories of flood histories. Other local experts included public employees from the Virginia Department of Forestry, Virginia Department of Conservation and Recreation, the National Weather Service, as well as private professional such as Rainwater Harvesting, Inc.

The NRV process also alerted some agencies about some relatively simple things they could do differently that would have dramatic impact on future risk analysis and mitigation planning. For example, when the Virginia Department of Health district office realized that details collected in their environmental staffs' field could be immensely helpful to local governments for planning purposes if it was documented with latitude and longitude, they agreed to purchase GPS units and begin doing that. So, in Floyd County, for example, all future wells will be recorded along with replacement well data, depth, yield, etc.

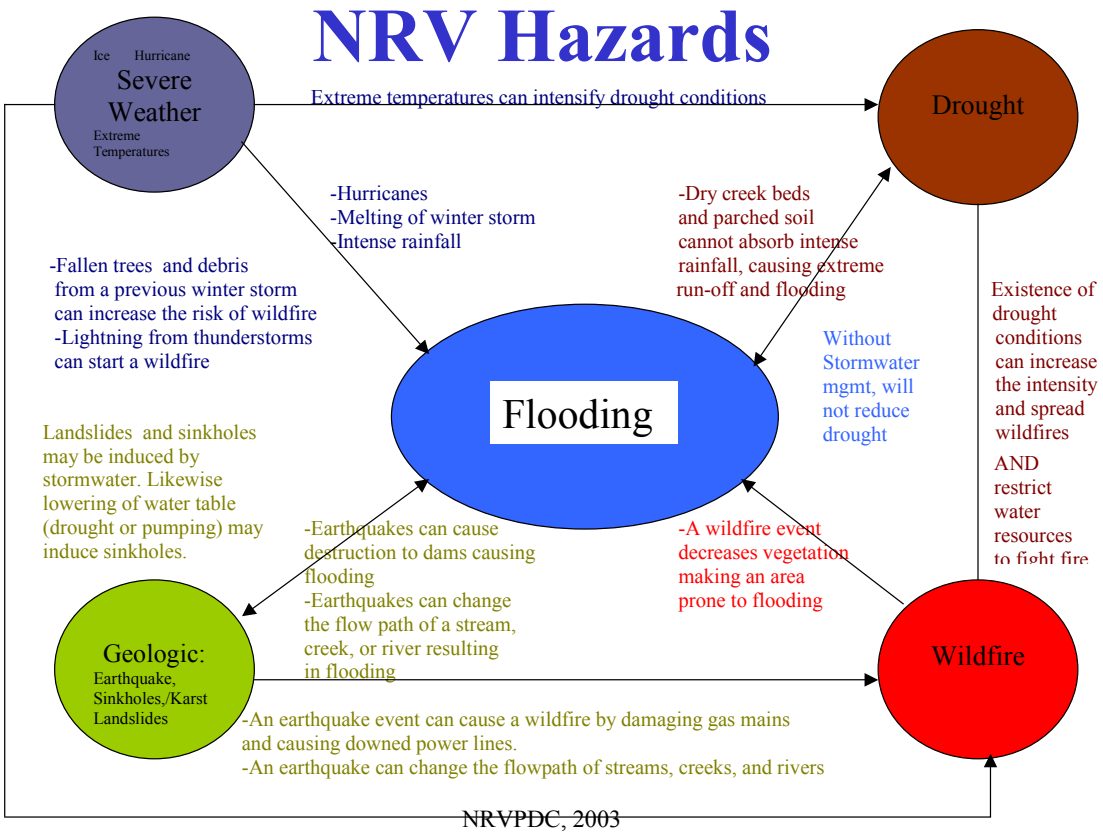
The NRV process benefited from and hopefully helped contribute to very forward thinking by some planning departments in the region. For example, the Montgomery County planning department is integrating GIS fully into their new pre-development process, which will make hazard-related information available to potential buyers and builders early on in the process.

Lastly and perhaps most importantly, though it was not technically required, a good deal of data was transformed into real and usable information by staff and several Virginia Tech interns. "Pieces of the puzzle" were gathered from a wide range of sources, including personal accounts, files in local planning and engineering departments, tax assessment data, newspaper accounts, previous studies and plans, federal and state agencies' documents, and Internet resources. This created information and the projects it supports are perhaps the greatest contribution of this Plan.

CONCLUSION AND PRIORITIES

While hazards and mitigation opportunities are numerous, this planning process has prioritized hazards, risks and mitigation projects. This section includes prioritized goals, objectives and strategies, which were developed through multiple work group and public input sessions. Most address flooding, except in Floyd County where drought is the greater concern. Some projects, such as the emergency warning and educational outreach, could be used for all hazards. These goals and projects have also taken into consideration the interaction among hazards (interaction Figure 48 below). Then, the NRV Hazard Mitigation Project list includes only projects with a positive benefit-to-cost ratio. However, these projects are only financially feasible with federal and state partnerships to assist local governments.

Figure 48
Interaction Among Hazards



NRV NATURAL HAZARD MITIGATION PLAN

SUMMARY OF GOALS, OBJECTIVES AND STRATEGIES

Mission: Minimize the loss of life and property to natural hazards by focusing on likely events, high-risks areas, and cost-effective mitigation opportunities.

Goal 1: Minimize flood-related deaths and losses of existing and future structures.

Objectives

1.1 Save lives at imminent risk.

Strategies

Seek grant funding to develop early warning systems in high-risk areas utilizing high technology.

Develop regional capacity for swift-water rescue, including training and equipment purchase.

1.2 Reduce risks to critical facilities.

Strategies

Do not build new critical facilities in high hazard areas (may be a general policy decision or more strict zoning).

Identify critical facilities in high-risk areas.

Replace critical facilities currently located in high-risk areas.

1.3 Offer mitigation assistance to owners of flood-prone properties, especially repetitive loss properties.

Strategies

Pursue mitigation grant opportunities to buy-out, elevate or water-proof flood-prone properties through FEMA, VDEM and Community Development Block Grant.

1.4 Educate citizens about the inevitability of flooding, the dangers it poses to life and property, and the opportunities for mitigation.

Strategies

Seek to update flood insurance studies and maps to understand risks more accurately.

Encourage the development of statewide databases and geographic information system layers to assist local government planning efforts.

Encourage collection and development of better hazard history locally and incorporate into geographic information systems.

Incorporate hazard mitigation information in the future in the local comprehensive planning process.

Utilize existing documents and programs from FEMA, the National Flood Insurance Program, the Virginia Department of Emergency Management, and the National Weather Service to educate the public about hazards and mitigation opportunities.

Produce and distribute local newsletters and/or other mitigation documents to residents in high-hazard areas.

Coordinate with and support Community Emergency Response Team (CERT) information distribution activities in the community.

Provide community workshops.

Educate citizens about the availability and value of NFIP policies and encourage greater participation.

1.5 Limit future development in floodplains.

Strategy

Consider utilizing the zoning ordinance to further restrict undeveloped floodplains.

1.6 Develop adequate drainage structures and maintenance procedures to prohibit "back-up" flooding in high-hazard areas.

Strategies

Seek grant and/or state funding for replacement of inappropriately sized culverts and drainage.

Pursue stream-bed clearance through citizen groups and/or the Natural Resource Conservation Service as needed to eliminate bottlenecks.

Encourage bottomland farm fences to catch debris before reaching culverts.

Schedule regular drainage system maintenance including before and after storms.

1.7 Develop stormwater facilities or upgrades as needed to limit flooding in high hazard areas.

Strategies

Seek grant funding for regional stormwater detention facilities as needed. Reconsider design frequency of occurrence.

Seek channel improvements or upgrades as needed to reduce peak flood flows.

Pursue combinations of regional stormwater management strategies and onsite strategies.

1.8 Pursue mitigation projects that achieve multiple community goals.

Strategies

Pursue partnerships with land trusts to promote conservation easements on undeveloped floodplains and wetlands to aid flood mitigation.

Pursue the affordable housing alternatives for low-income families now living in floodplains.

Seek economic development opportunities, such as Brownfields, which turn current "liabilities" to community assets.

Goal 2: Minimize economic losses and health risks during drought.

Objectives

2.1 Insure adequate water supplies and quality for household, agricultural and industrial/commercial use where public water is available.

Strategies

Investigate potential to improve security-of-source and quality of public water supplies by regional interlinking of systems.

Pursue upgrading of water systems through grant funding to bring additional water sources online and minimize leakage/loss.

Encourage public water conservation plans, including consideration of rainwater catchment systems.

Prepare drought contingency plans.

Identify and protect critical recharge zones in high-risk areas.

2.2 Insure adequate water supplies and quality for household and agricultural use where private wells and springs are now used.

Strategies

Encourage farmers to capitalize on available programs for more secure private sources of water for livestock and crops.

Assess feasibility of extending public water to high need areas.

Encourage private household water conservation plans, including consideration of rainwater catchment systems.

2.3 Pursue mitigation projects that achieve multiple community goals.

Strategy

Pursue partnerships with land trusts to promote conservation easements on undeveloped floodplains and wetlands to aid drought mitigation.

Goal 3: Minimize wildfire losses in the "urban wildland interface" area.

Objectives

3.1 Educate citizens about the threats of wildfires and mitigation opportunities.

Strategy

Encourage US and State foresters to continue educating homeowners associations and homebuilders through pamphlets, workshops and seminars about building techniques—including siding and roof material and defensible space.

3.2 Assure adequate access of fire and rescue vehicles to homes in wooded areas.

Strategies

Review and update zoning and subdivision ordinances as needed to assure adequate road width, turnaround and dual ingress/egress routes.

Encourage local government staffs to coordinate subdivision and development reviews with US and State Forestry departments.

3.3 Local governments should encourage "Fire-wise" development in wooded areas.

Strategies

Review and update zoning and subdivision regulations to be sure that building code provisions are enforced.

3.4 Assure that adequate people and equipment, including communication equipment, are available to fight wildland and structural fires.

Strategies

Encourage regional cooperation across local, state and federal agencies.

Encourage adequate state forestry personnel in each county.

Seek grant opportunities to increase and upgrade fire-fighting equipment, dry hydrants, and communication equipment.

3.5 Pursue mitigation projects that achieve multiple community goals.

Strategies

Seek grant opportunities to assure that ample water sources are available for fire-suppression and community health.

Consider limiting development on steep, wooded slopes to limit wildfire exposure and protect viewsheds.

Goal 4: Minimize structural damage due to landslides and sinkholes.

Objective

4.1 Limit grading and "cuts" that result in steep hills abutting new structures.

Strategies

Consider utilizing subdivision and erosion and sediment control ordinances to limit creation of high-risk scenarios, including steep slopes and shrink-swell soils.

Consider development of a regional ridgeline protection ordinance or policy.

Educate code enforcement personnel and contractors on engineering requirements for excavations and slopes.

Goal 5: Encourage personal safety given that severe winter weather, lightning, large hail and high winds are relatively frequent in the NRV.

Objective

5.1Capitalize on the National Weather Service and media outlets in informing the public about imminent hazards and precautions.

Strategies

Encourage voluntary use of the NWS or private warning mechanisms, such as the SAME and NOTIFY!

Develop reverse 911 warning systems to activate by NWS input.

Educate the public regarding the need to pre-plan for weather emergencies that may occur during outdoor events where large numbers of people are expected.

Provide an informational brochure or handout on emergency planning for weather events to those seeking a permit for a large outdoor event.

Goal 6: Recognize that earthquakes are possible in the NRV, especially in 30 km radius of Pearisburg.

Objective

6.1 Recognize that brick or stone structures and structures placed on deep soil (such as old floodplains) are most prone to damage

Strategies

Consider limiting new development on undeveloped floodplains, especially gas pipelines and other utilities.

Consider reinforcing stand-alone brick or stone walls in critical facilities or anywhere that groups of people gather in the "earthquake circle" in the NRV.

Educate the public regarding the possibility of earthquakes and mitigation techniques.

Goal 7: Capitalize on available mitigation information and funding through various federal, state and non-profit agencies.

Objective

7.1 Provide good information to citizens regarding hazards, risks and mitigation opportunities.

Strategies

Distribute free brochures and information to citizens in high-hazard areas.

Community workshops – work with lenders, insurance and real estate agents and developers, potentially through extension agents.

Keep hazard mitigation plan up-to-date in the event that an event occurs and new funding opportunities are available.

Review of the plan by staff annually; review every three years by committee, or following any major hazard event.

Goal 8: Use regional coordination and cooperation as needed.

Objectives

8.1 Pursue identified regional priorities.

Strategies

Develop a regional water supply plan.

Pursue development of a regional swift-water rescue team.

Pursue regional telecommunications and emergency communication equipment interoperatibility, including regional reverse 911 for events affecting more than one locality.

Improving geographic information system capacity, information and modeling abilities.

- Develop data layers for better risk assessment: floodplain, geologic hazards, dam-failure inundation, groundwater and surface water resources.
- Develop complete GIS databases of critical facilities.
- Develop local/regional disaster records database to better track histories.
- Develop local/regional database of started and completed mitigation projects.

8.2 Continue to seek forums and avenues for improved understanding, coordination and cooperation on mitigation efforts.

Strategies

Continue regional planners' forum and local government managers' forum.

Encourage regular meeting of emergency service providers and coordinators.

Weigh the interactions of natural hazards within and across jurisdictional boundaries before acting to address one.

Give highest priority to projects that meet multiple objectives and/or serve multiple communities.

PROJECTS AND IMPLEMENTATION

This process produced many specific project proposals. Several criteria were used by local governments to develop and prioritize these proposals:

- Importance of hazard addressed, based on ranking by frequency, impact and mitigation opportunity in (see Table 11, page 26)
- Community acceptance
- Contribution to saving lives and/or property
- Benefit-cost analysis
- Number of hazards addressed
- Sequential nature

The first four criteria listed above were considered minimum criteria to make the list. Beyond that, community acceptance, sequential nature, and priority of hazard(s) addressed (see Table 11, page 26) were weighted heavily in assigning priority level. Ultimately, the final rankings in the following pages were approved by the governing boards based on an intuitive combination of the above factors, presumably weighted heavily on priority of the hazard (vulnerability) and community acceptance of the mitigation strategies.

For each project, the hazards addressed, the benefits, the costs, the priority level, and potential funding partners are listed. Note that the benefit and costs estimates are very preliminary. For some projects, more detailed analysis would be beneficial. (In all cases where lives are at immediate risk, at least $2 million in benefit is attributed.)

The entity responsibility for implementation is listed. In some cases, due to local government staff sizes (to be discussed next), the PDC may assist in project management. In all cases, local personnel and financial constraints will require federal and/or state funding assistance. Less expensive policy reviews and changes are not included in this list, but are included in the preceding strategies list. Projects were not listed in the goals and strategies list because many projects address multiple objectives. The projects will be presented by locality. First, though, technical capacity and implementation are addressed. (See Appendix H for a complete list of projects for each locality).

Technical Capacity and Implementation

As evident in Tables 26 (Human Resources Available to Help in Hazard Mitigation by Locality) and 27 (GIS Capabilities by Locality) below, technical capacity varies dramatically among local governments in the New River Valley. Consequently, capacities to implement mitigation strategies vary significantly. Larger governments such as Blacksburg and Montgomery County are already integrating hazard mitigation thoughts and approaches into daily planning work, though even these jurisdictions are lacking significant geographic information system risk and mitigation components such as modeling capabilities. Other jurisdictions with more limited staff and GIS will implement mitigation strategies on a more gradual basis as comprehensive plans and

zoning ordinances are reviewed. In the current fiscal and political climate, all jurisdictions will be dependent on federal or state assistance to implement major projects, listed next. Consequently, the availability and timing of federal and state assistance will be the principal factor in determining implementation.

New River Valley Localities' Technical Capacity: Human Resources

Community Name	Part-time manager/admin only	Admin/mgr as Planner	Planner(s)	Inspections	Engineer(s)	Map professional(s)
Blacksburg, Town of			Yes	Yes	Yes	Yes
Christiansburg, Town of			Yes	Yes	Yes	Yes
Dublin, Town of		Yes				
Floyd, Town of		Yes				
Floyd County		Yes		Yes		Contract
Giles County			Yes	Yes	Yes	Yes
Glen Lyn, Town of	Yes					
Montgomery County			Yes	Yes	Yes	Yes
Narrows, Town of	Yes					
Pearisburg, Town of		Yes				
Pembroke, Town of	Yes					
Pulaski County			Yes	Yes	Yes	Yes
Pulaski, Town of			Yes	Yes	Yes	Yes
Radford, City of			Yes	Yes	Yes	Yes
Rich Creek, Town of	Yes					

TABLE 26

TABLE 27

New River Valley Localities' Technical Capacity: Geographic Information Systems

Community Name	E-911	"Improvements"	Natural Hazards	Avail. Online	Modeling
Blacksburg, Town of	Yes	Yes	Yes	Yes	
Christiansburg, Town of	Yes	Yes			
Dublin, Town of	County				
Floyd, Town of	County				
Floyd County	Yes	Yes		Yes	
Giles County	Yes	Yes	Yes	Yes	
Glen Lyn, Town of	County				
Montgomery County	Yes	Yes		Yes	
Narrows, Town of	County				
Pearisburg, Town of	County				
Pembroke, Town of	County				
Pulaski County	Yes				
Pulaski, Town of	County		Yes		
Radford, City of	Yes			Yes	
Rich Creek, Town of	County				

"Improvements" would include layers such as housing and public infrastructure.

Overall summaries and projects by locality follow. A detailed project list with benefit-cost analysis is included as Appendix H.

Monitoring and Evaluation

Monitoring will be done through the localities reporting back to the PDC any mitigation policy or project actions, or any requested plan additions or amendments. Since essentially all projects will require federal or state funding assistance, the PDC already receives notice of all grant applications (per Executive Order #12372.) Moreover, localities will be prompted to share their latest progress. Specifically, since local government administrators/managers and planners will principally be involved in policy and projects, they will be encouraged to share new information. Currently local government administrators and managers meet quarterly at the PDC, and a planners' forum is also held quarterly. Participants will be asked at least annually or after any disaster to provide updated information for the plan.

In particular, the PDC will measure progress based on the following:

- Integration of the hazard mitigation plan into local comprehensive plans and/or emergency operations plans.
- Local government bodies or planning commission actions to use land use policies and ordinance for mitigation.
- Applications for mitigation funding.
- Progress and completion of mitigation projects.

Floyd County
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

Floyd County's principal natural hazard is severe drought and related wildfire risks. About 95% of County residents rely on private water systems. The recent drought caused at least 500 households to lose their spring or well, requiring a new well. Even many new wells have very limited yields, however. Housing developments on sloped, wooded areas are at significant risk of wildfire damage. Floyd County also experiences some flooding, though there is no larger concentrated area. USGS also suggests that Floyd County is particularly prone to landslide incidents, though there have been no significant events in recent history.

Mitigation

Floyd County is pursuing small-scale water research to better understand the water issues. Floyd County is also participating in the regional water supply planning effort. Concerning wildfire mitigation, Floyd County collaborates with the Virginia Department of Forestry to do dry hydrants, firefighter training and outreach.

Floyd County participates in the National Flood Insurance Program, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The Town of Floyd does not participate in the program.

Mitigation Opportunities

Floyd County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Floyd County Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Water Resource Study	Drought, Wildfire, and Flooding	As funding is available	Co. Admin.	USDA/USGS/FEMA/VDEM
2	Communication Equipment interoperability with surrounding areas	All natural and man-made	As funding is available	Co. Admin.	FEMA / Homeland Security
3	Develop drought contingency plan	Drought and Wildfire	As funding is available	Co. Admin.	USDA / FEMA / VDEM
4	Additional water resources and reserves	Drought and Wildfire	As funding is available	Co. Admin. / PSA	CDBG / ARC / USDA / FEMA / VDEM / VA Tobacco Commission
5	Hazard-related GIS layers	All natural and man-made	As funding is available	Co. Admin.	USGS / FEMA / VDOF / VMME / VDEM
6	Additional fire hydrants	Wildfire	As funding is available	Co. Admin.	VDOF

Giles County
and the Towns of Glen Lyn, Narrows, Pearisburg, Pembroke and Rich Creek
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

Giles County's principal natural hazard is recurrent flooding in its towns and along Doe Creek and Little Stony. Giles County also has some mitigatable risks associated with drought and wildfire. Specifically, the water system servicing all five towns and much of the unincorporated area is dependent on only one well. Moreover, there is the predominance of forest land in Giles County and increasing residential development nearby. Also, Giles County was the epicenter of the 1897 earthquake, the 3rd largest in eastern United States history. Giles County is also prone to sinkholes and landslides.

Mitigation

Giles County as well as the Towns of Narrows, Pearisburg, Pembroke and Rich Creek participate in the National Flood Insurance Program, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The County also benefits from the Integrated Stream Flows (IFLOWS) of rain and stream gauges operated by the National Weather Service. Giles County has also worked with the Natural Resources Conservation Service to improve streambeds and streambanks in critical areas. Also County, Town and VDOT officials have stepped up drainage maintenance, before and after major weather events. The County's volunteer emergency personnel are also participating in the formation of a regional swift water rescue team.

In terms of drought, Giles County is participating in the regional water supply planning effort, to help insure reliability and maximum cost-effectiveness. Concerning wildfire mitigation, Giles County collaborates with the Virginia Department of Forestry and the National Forest Service to do firefighter training and outreach.

Mitigation Opportunities

Giles County and the Towns have identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Giles County Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Identify culvert replacement needs to reduce flooding	Flooding	August 2005	USACE/VDOT, Co. Admin.	VDOT, USACE
2	Replace culverts to reduce flooding	Flooding	Ongoing	USACE/VDOT, Co. Admin.	VDOT/FEMA/ USACE/VDEM
3	Structural Acquisition – Pembroke (repetitive losses)	Flooding	As funding is available	Co. Admin / Engineering	FEMA / VDEM
4	Emergency Services Coordinator position	All natural and man-made	January 2006	County Administration	FEMA/VDEM County
5	Pursue additional water sources	Drought and Wildfire	Ongoing	County Administration	USDA / FEMA VDEM
6	State Forestry position for Giles County	Drought and Wildfire	As funding is available	County Administration	VDOF

Town of Narrows Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Stormwater facilities	Flooding	As funding is available	Town Manager	CDBG/FEMA/VDEM
2	Replacement of Wastewater Treatment Plant	Flooding	As funding is available	Town Manager	USDA / FEMA / VDEM
3	Replacement of Critical Facilities buildings in High-Hazard Areas	Flooding & Earthquake	As funding is available	Town Manager	USDA / FEMA / VDEM

Town of Pearisburg Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Replacement of Wastewater Treatment Plant	Flooding	January 2015	Town Management	USDA/FEMA/VDEM
2	Upgrade Stormwater System	Flooding	As funding is available	Town Mgt, Engineering	USDA/FEMA/VDEM

Town of Pembroke Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Engineer Study of Structural needs	Flooding	As funding is available	USACE/VDOT/ Co. Admin.	USACE/FEMA/ VDOT/VDEM
2	Replace culverts/drainage	Flooding	As funding is available	USACE/VDOT/ Co. Admin.	USACE/FEMA/ VDOT/VDEM
3	Early Warning System	Flooding	As funding is available	Town / Co. Admin.	FEMA / VDEM
4	Streambank Clearance	Flooding	As funding is available	Town / Co. Admin.	NRCS-USDA

Town of Rich Creek Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Replacement of Wastewater Treatment Plant	Flooding	As funding is available	Town / Co. Admin.	FEMA / VDEM / USDA

Montgomery County
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

Montgomery County's principal natural hazard is recurrent flooding in its towns (discussed separately), in the eastern part of the County and along Plum Creek. Montgomery County also has some mitigatable risks associated with drought and wildfire. Specifically, agricultural interests have proven quite vulnerable to drought. Similarly, the County is experiencing the push of residential development into sloped, wooded areas, posing significant wildfire risks. Montgomery County is also prone to sinkholes and landslides, and has slight earthquake risks.

Mitigation

Montgomery County participates in the National Flood Insurance Program (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The County's floodplain regulation is slightly more stringent than what is required by the NFIP. Montgomery County has also worked with the Natural Resources Conservation Service to improve streambeds and streambanks in critical areas. The County also benefits from the Integrated Stream Flows (IFLOWS) of rain and stream gauges operated by the National Weather Service. Also, several of the County's volunteer fire and rescue squads are participating in the formation of a regional swift water rescue team.

Following the Presidential disaster declaration in February 2003, Montgomery County is actively pursuing several mitigation projects currently, including reverse 911 and flood mitigation projects. These are included in the table below

In terms of drought, Montgomery County is participating in the regional water supply planning effort, to help insure reliability and maximum cost-effectiveness. Concerning wildfire mitigation, Montgomery County collaborates with the Virginia Department of Forestry and the National Forest Service to do firefighter training and outreach.

Mitigation Opportunities

Montgomery County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. The top project, the Reverse-911 system, has just been awarded funding notification from the Hazard Mitigation Grant Program (April 2004). Appendix H is a more complete listing of projects.

Montgomery County Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Reverse 911	All natural and man-made	HMGP 2004 / Begin 2005	Co. ESC & Sheriff	FEMA/VDEM/ County
2	Property acquisition in floodprone area	Flooding	2005-2010	Co. ESC & Planning	FEMA/VDEM / County
3	Identification and study of floodplains: including GIS	Flooding	2005-2007	Co. Planning Dept.	FEMA/VDEM/ County
4	Flood map modernization	Flooding	2005-2008	Co. Planning Dept. / VT	FEMA
5	Develop swift water rescue capacity* (regional)	Flooding	2004-2005	Co. ESC	FEMA/VDEM/ County
6	Equalization Basin	Flooding	2006	PSA	FEMA/VDEM/ County
7	Pre-development database	Flooding, Geologic, Wildfire, Drought	2005	Co. ESC & Planning	VDCR/FEMA/ VDEM/VMME/VT
8	More hazard-related GIS data	Flooding, Geologic, Wildfire, Drought	2004-2010	Co. ESC & Planning	VDCR/FEMA/ VDEM/VMME/VT
9	Additional IFLOWS gauges	Flooding	2007 or as funding is available	NOAA/NWS/ County ESC	NOAA / NWS
10	Public Education: flooding, wildfire, karst	All natural and man-made	2005-2010	County ESC	FEMA/VDEM / County
11	Karst inventory and map	Geologic	2007	Co Planning Department	VDCR/FEMA/ VDEM/VT
12	Shrink-swell soil mapping	Geologic	2005	Co Planning Department	VDCR/FEMA/ VDEM/VT
13	Streambed-streambank restoration	Flooding	2007-2010	Co Planning Department	USACE/VDOT/ FEMA/VDEM
14	Residential acquisition (landslide) on Elliot Creek	Flooding/Landslide	2007-2008	Co Planning Department	FEMA / VDEM / County
15	Acquisition of Plum Creek area businesses	Flooding	2007-2008	Co Planning Department	FEMA / VDEM / County

Pulaski County
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

Pulaski County's principal natural hazard is recurrent flooding in its towns (Town of Pulaski discussed separately) and along streams like Big Reed Island Creek. The County also has some mitigatable risks associated with drought and wildfire. Specifically, agricultural interests have proven quite vulnerable to drought. Similarly, large, steep, wooded tracts with limited access, like Camp Powhatan, pose significant wildfire risks. The County is also prone to sinkholes and landslides, and has slight earthquake risks.

Mitigation

Pulaski County participates in the National Flood Insurance Program (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. (The Town of Dublin does not participate in NFIP.) The County also benefits from the Integrated Stream Flows (IFLOWS) of rain and stream gauges operated by the National Weather Service. Pulaski County has also worked with the Natural Resources Conservation Service to improve streambeds and streambanks in critical areas. Pulaski County's emergency personnel are also participating in the formation of a regional swift water rescue team.

In terms of drought, Pulaski County is participating in the regional water supply planning effort, to help insure reliability and maximum cost-effectiveness. Concerning wildfire mitigation, Pulaski County collaborates with the Virginia Department of Forestry and the National Forest Service to do firefighter training and outreach.

Mitigation Opportunities

Pulaski County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Pulaski County Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Reverse 911 / Early Warning System	All natural and man-made	June 2007	Co. Admin & Co. ESC	FEMA/VDEM/USDA
1	Elevating homes in high-hazard areas	Flooding	Ongoing	Planning	FEMA / VDEM
2	Upgrading New River Trail	Flooding	May 2008	Planning	FEMA/VDEM/VDOT
3	Upgraded rescue and utility communication equipment	All natural and man-made	June 2005	Co. Admin & Co. ESC	FEMA/VDEM/USDA
4	Additional IFLOWS rain and stream gauges	Flooding	April 2005	NOAA/NWS & Co. ESC	NOAA / NWS
5	Dredging of upper Claytor Lake	Flooding	January 2010	Planning	USACE/FEMA/AEP

City of Radford
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

The City of Radford's principal natural hazard is flooding along the New River and Connelly's Run. The City also has some vulnerability to drought and wildfire, particularly the abandoned tie-pile in the western portion of the City.

Mitigation

Fortunately, the City owns much of the floodplain along the New River, and has turned much of it is public park space. The City also recently completed a Radford Riverfront Plan to emphasis ecologic protection, public access and limited commercial development. The City also participates in the National Flood Insurance Program (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The City's emergency personnel are also participating in the formation of a regional swift water rescue team.

In terms of drought, the City is participating in the regional water supply planning effort, to help insure reliability and maximum cost-effectiveness.

Mitigation Opportunities

The City has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

City of Radford Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Swift Water Rescue Equipment and Training* (regional)	Flooding	2005-2006	Fire Chief	FEMA/VDEM
2	Tie-pile removal along New River	Flooding, Wildfire	2008-2009	City Mgr.	EPA / DEQ / FEMA / VDEM
3	Detention Pond at Sunset Park	Flooding	2004-2005	City Engineer	FEMA / VDEM / USACE
4	Regional Stormwater detention along Connelly's Run	Flooding	2008-2009	City Engineer	FEMA / VDEM / USACE

Town of Blacksburg
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

The Town of Blacksburg's principal natural hazard is recurrent flooding along Stroubles Creek. Blacksburg also has some mitigatable risks associated with wildfire, drought and earthquakes.

Mitigation

The Town of Blacksburg has the most stringent development restrictions in the New River Valley. New development is prohibited in floodplains, critical recharge areas and along steep slopes. The Town also participates in the National Flood Insurance Program. The Town has also developed a model public warning system that can notify citizens via phone call, fax, email, pager, in the event of an emergency. The Town's emergency personnel are also participating in the formation of a regional swift water rescue team.

Mitigation Opportunities

The Town of Blacksburg has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Town of Blacksburg Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Series of Stormwater Detention Ponds	Flooding	As funding is available	Town Mgr / VT	USACE/FEMA/VDEM
2	Hazard-Related GIS layers	Flooding, Drought, Geologic, Wildfire	As funding is available	Town Planners	USGS / FEMA / VDOF / VMME / VDEM
3	Creation of Development Guidelines for Wildfire Prevention	Wildfire	As funding is available	Town Planners	FEMA / VDEM / VDOF
4	Implement SCADA system for utility pressures	All	As funding is available	Public Works	FEMA / VDEM / VDOF
5	Provision of back-up power for critical structures	All	As funding is available	Public Works	FEMA / VDEM
6	Increase water storage	All	As funding is available	Public Works	FEMA / VDEM / CDBG
7	Underground utilities	Wildfire, wind, winter weather	As funding is available	Public Works	FEMA / VDEM / CDBG / VDOT

Town of Christiansburg
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

The Town of Christiansburg's principal natural hazard is recurrent flooding, including in areas which are not shown as flood hazard areas on the National Flood Insurance Rate Maps. Christiansburg also has some mitigatable risks associated with drought and earthquakes.

Mitigation

The Town of Christiansburg participates in the National Flood Insurance Program, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The Town's emergency personnel are also participating in the formation of a regional swift water rescue team.

Mitigation Opportunities

The Town of Christiansburg has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Town of Christiansburg Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Floodplain GIS layers	Flooding	2007	Town Planners	FEMA/VDEM
2	Series of stormwater ponds	Flooding	As funding is available	Town Manager	USACE / FEMA/VDEM
3	Home acquisition	Flooding	As funding is available	Town Manager	FEMA / VDEM
4	Underground utility lines	Wildfire, wind, winter weather	As development occurs	Town Manager	FEMA / VDEM

Town of Pulaski
Hazard Mitigation Plan Summary and Project List

Hazards and Risks

The Town of Pulaski's principal natural hazard is recurrent flooding in the downtown, along Dora Highway, and in Kersey's Bottom. According to the Army Corps of Engineers, the Town has suffered at least 11 100-year floods and 1 500-year flood in the past 90 years or so. At least 200 structures are affected by flooding in the Town.

Mitigation

The Town of Pulaski participates in the National Flood Insurance Program (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. Moreover, the Town has set up a special committee, composed of private citizens, Town staff and elected officials, which has drafted a Flood Mitigation Plan. The Town is also pursuing the Community Rating System to reduce flood insurance premiums in Town. The Town also benefits from the Integrated Stream Flows (IFLOWS) of rain and stream gauges operated by the National Weather Service.

In terms of drought, the Town of Pulaski is participating in the regional water supply planning effort, to help insure reliability and maximum cost-effectiveness.

Mitigation Opportunities

The Town of Pulaski has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance. Appendix H is a more complete listing of projects.

Town of Pulaski Hazard Mitigation Opportunities

Rank	Area	Hazards mitigated	Timeframe	Lead Dept.	Funding Source
1	Channel dredging, straightening	Flooding	As funding is available	Town Mgr / Town Eng.	USACE/FEMA/VDEM/ VDOT/EPA/DEQ
2	Replace or rehabilitation RR Bridge (acting as a dam)	Flooding	As funding is available	Town Mgr / Town Eng.	USACE/FEMA/VDEM/ VDOT / N&S
3	Acquisition of other repetitive loss homes	Flooding	As funding is available	Town Mgr / Town Eng.	FEMA / VDEM
4	Integrated Early warning system (perhaps Reverse-911)	All natural and man-made	As funding is available	Emer Ser. Coordinator	FEMA / VDEM
5	Flood education / outreach	Flooding	Ongoing	Emer Ser. Coordinator	FEMA / VDEM

NRV Hazard MITIGATION Plan Maintenance

The NRV Hazard Mitigation Plan will be reviewed annually by the staff of the New River Valley Planning District Commission for the next four years, in conjunction with local government staffs, to insure that the project list stays up-to-date (and completed projects moved to a separate list). Cost-effective projects may be added to the locality project list each year, with that local government's approval.

As funding is available, the entire Plan will reviewed by the NRV Hazard Mitigation Planning workgroup every five years and after every major event to insure that hazard history and risk assessment are continuously updated and improved. This will include a public input session on the existing document and/or any proposed changes. Apart from major influxes of mitigation project dollars from this planning effort, local jurisdictions may not see the benefit of another new planning process. Realistically, the costs of any major plan revisions will likely largely fall to FEMA or the State.

Additionally, all local governments anticipate integrating the hazard mitigation plan into their comprehensive plan document, which is updated at least every five years. Comprehensive Plan updates always include public involvement opportunities. Some jurisdictions will add a major new hazard mitigation component to their plan that will be fully integrated into the goals and future land use guides. This is what Pembroke has done. Other jurisdictions may include only the high-hazard information in the body of their Comprehensive Plans and simply reference the regional plan or an appendix for less urgent hazards. In a few cases, the hazard mitigation plans may also be used to supplement Emergency Operations Plans, but these types of decisions will be decided at the jurisdiction level.

Ideally, new federal and state resources would be put toward developing better data resources and databases, to meet the information needs identified in this plan—especially GIS hazard layers, critical infrastructure value and location, and damage database. If this information is developed, future revisions will be able to provide much more specific analysis and alternatives.