This developing plan content is under construction and is being shared as a snapshot of thinking. Additional changes based on Forest Service and public input are expected.

Forest-wide Geologic Resources Plan Components

Background

The geologic resources[1] in the Blue Ridge of western North Carolina are the foundation of the Nantahala and Pisgah National Forest's ecosystems and watersheds, representing a critical part of integrated resource management. The forests area endowed with a wide range of geologic resources including groundwater, groundwater-dependent ecosystems, springs, scenic and unusual landforms, waterfalls, minerals, field records of catastrophic events (floods and landslides), paleontological resources, and field records of climatic changes and Quaternary[2] ecosystems.

The Forests are located in the Blue Ridge Physiographic Province of the Southern Appalachian Mountains. The Blue Ridge forms a southwest to northeast mountain range through western North Carolina with many areas over 4,000 feet in elevation. The Nantahala & Pisgah NFs generally occupy the upper slopes of dissected, steep terrain and narrow, mountain valleys.

Surface geologic processes are an important part of the natural disturbance regime in the Forest. These processes include: the erosion, transport and deposition of sediment; mass wasting or landslides; flooding; stream processes; groundwater movement; waterfall processes. The processes are part of the natural disturbance regime in the mountains and affect the Forest in varying degrees every year. Some processes are geologic hazards that can create risks to public safety.

Desired Conditions

- As the foundation of the forests' ecological and biological diversity, geological settings provide diversity that enables ecological restoration as well as adaptation in a changing climate.
- Geologic resources provide, economic, ecological, scientific, educational, interpretative, scenic, recreational, paleontological, and other benefits.
- Geologic groundwater systems as well as groundwater-dependent ecosystems are functioning, producing water quality and quantity within their natural variations.
- Geologic hazards (e.g. rockslides, waterfalls, acidic rock, etc.) are recognized and associated risks to public health and safety or facilities and infrastructure are minimized.

[1] (Definition for glossary). Geological resources include geologic processes (fluvial, mass wasting (landslides), groundwater movement, weathering, climate change, etc.; geologic materials (Earth's solids, liquids, gases such variety of bedrock, surficial deposits including soils, surface water and groundwater, atmosphere, radon, methane, geothermal vapors); geologic structures: fractures, folds, faults, joints, strike and dip of planar surfaces, stratigraphy and the three dimensional distribution and arrangement of geologic materials; and geologic landforms at all scales: waterfalls, exfoliation domes (Looking Glass Rock), Blue Ridge escarpment, landslides, dip slope mountains, stream cascades/riffles/pools, etc.

[2] (Definition for glossary). The current and most recent of the three periods of the Cenozoic Era.

- Ground-disturbing management activities are not causing or contributing to geologic hazards, such as acid rock drainage and landslides.

Standards

- Management activities consider geologic setting and are located and designed to avoid, minimize, or mitigate adverse effects on groundwater, groundwater dependent ecosystems, and other geologic resources with identified values/
- Identify, using the appropriate type and scale of geological mapping, the geologic components (processes, structures, materials and landforms) relevant to proposed projects, and integrate the components into siting and design of the project, restoration, ecological sustainability, and environmental analysis.
- The location of proposed roads, trails, facilities and management activities shall be screened for the presence of landslide hazards, flood hazards, acid-producing rocks, asbestos-containing ultramafic rocks, waterfall hazards, and other hazards relevant to the geologic setting. If geologic hazards are present, then location and design measures shall be provided for management activities that may affect or be affected by the geologic hazards.
- Boulderfields shall not be permitted for any rock removal, unless for scientific research which would benefit management of the unique habitat.

Management Approaches

- Provide for slope stability when designing the cut-slopes and fill-slopes of roads, log landings, or other excavations by using site-specific engineering geologic data such as dip slopes, orientation and density of bedrock fractures, incipient slope failures, suitability of excavation for fill on steep slopes, and effects of shallow groundwater on stability of cut-slopes and fill-slopes.
- Include the North Carolina Geologic Survey Landslide Geodatabase (current version) and County Landslide Hazard Maps, when screening for landslide hazards. Where not available, the screening should include a functional equivalent relevant to the project area.
- On slope gradients of 40% or more, the design of cut-slopes and fill-slopes of road, log landings, or other excavations should be designed to avoid inducing debris flows, by::
    1. Delineate the potential downslope path of a debris flow caused by a potential cut-slope or fill-slope failure by using the same or similar method of debris flow pathway delineation in North Carolina Geologic Survey County Landslide Hazard Maps.
    2. Identify the risks to public safety, infrastructure, and resources in the pathway of the potential debris flow.
    3. Based on the nature of the risks, develop alternative designs to reduce the hazards.
- Identify and incorporate in Forest GIS the landslide (debris flow) hazards and conduct an assessment of the risk to Forest resources, infrastructure, and public safety as appropriate.
- Cooperate with the NPS to identify and assess unstable fill slopes on Blue Ridge Parkway that may be debris flow hazard to National Forest downslope.
- Conduct early detection and loss prevention of unstable fill slopes (roads, log landings, etc.) that may create a debris flow hazard and risk to public safety on National Forest and non-federal land downslope.

Other sources of information

- Groundwater Resources should be managed in accord with Chapter 2 of the "Technical Guide to Managing Ground Water Resources" (FS-881, May 2007 or latest).
- North Carolina Division of Water Quality (NC DWQ) procedures for "Assessing and Controlling Acid Rock Drainage on Projects Requiring Section 401 Water Quality Certification" (December 14, 2007).
- Collins, T. K., 2008, Debris flows caused by failure of fill slopes: early detection, warning, and loss prevention. Landslides. 5:107–120 http://link.springer.com/article/10.1007/s10346-007-0107-y#

See also: Climate change, Water, Facilities, Transportation and Forest Access, Mineral Resources.