



# On High Windy Ridges

By: Jim Vanderhorst

*Cave Mountain hosts some of West Virginia's rarest plant communities, including these ancient eastern red cedars.*

*Photo by Jim Vanderhorst*

I always enjoy walking an Appalachian ridgeline on a summer day, high above the heat, humidity and hubbub of the valley below, feeling on top of the world. Especially if I get a workout from the climb up, and particularly if I'm rewarded with a view. From on top of the mountain I can see the broad expanse of nature before me and contemplate its ecology and our place within it.

It seems like a different state on the ridge top. In spring it's still like winter, and in early summer it feels and looks like spring. A breeze usually blows. On a hot summer day the difference is refreshing, but in winter it can be downright uncomfortable. Trees don't grow so tall here, gnarled from the abuse of winter's ice and wind. The sedge on the ground looks like the one I know from the lower slopes, but on closer examination it turns out to be a different species, one that only grows in higher elevations.

Down in the valley, roads and wires connect farms and houses. A few roads climb up the mountain flanks to isolated dwellings, but none reach the ridgeline. The forests in the valley are in small patches, not like the extensive stands here on top. Across the valley is another forested ridge, with a succession of ridges beyond that. Only a few power- and gas-line corridors bisect the high ridgelines, following the shortest routes to out-of-state energy consumers. On one of these ridges I can see the smoke and stack of a coal-fired power plant along with a new feature — just arrived in recent years — lines of windmills.

High ridges are like islands of habitat for many species of wildlife. Endemic (native to a specific area) salamanders confined to a few high ridges evolved under harsh conditions that provide a competitive edge — a niche — for individuals that are adapted to those conditions, and exclude those that are not. The

Cheat Mountain salamander is a threatened species confined to a few high ridges in the red spruce zone of the Allegheny Mountains in West Virginia. A related, but different species, the Cow Knob salamander is similarly confined to a few high ridges (Shenandoah, North and Great North mountains) along the West Virginia/Virginia border. These species do not occur together, and they don't occur anywhere else on earth. Salamanders can be highly competitive and have limited ability to disperse to new locations. This has led to evolution of some species with very limited global ranges. It also makes their habitat particularly vulnerable to fragmentation by roads and gas and electric line rights of way.

The snowshoe hare and the Appalachian cottontail are another pair of animals that characterize our high ridges. The snowshoe hare is a game species that is more common in the boreal north. Its occurrence in West Virginia reflects a common pattern of northern species occurring at high elevations further south. Here it depends on red spruce saplings for cover when early snowmelts foil its winter white coat survival strategy. The Appalachian cottontail, a rare species tracked by the Wildlife Resources Section Natural Heritage Program, occurs from New York south to Alabama, but is rarely found at low elevations within this range. These rabbits find their home only in the high country.

West Virginia's high elevation ridges remain among the most remote and least disturbed habitats in the state. Their short growing seasons and rocky, infertile soils made them unattractive to pioneer farmers. Commercial timbering was often limited by difficult

access and low value of the misshapen trees that grow in these stressful environments. Coal mining has occurred on a few high ridges, but most ridges lack this economic resource. This lack of disturbance provides habitat for wildlife species that have been eliminated elsewhere. For example, the timber rattlesnake today

is most plentiful on high remote ridges, but once had a much broader distribution throughout the state.

As our valleys fill up, our ridges are becoming less remote. Ridge tops are increasingly fragmented by development for residences, transportation and energy. By building mountaintop homes and roads to access them, people crowd out the same nature they want to be close to. Species adapted to high elevations are likely to be especially vulnerable to climate change. Ironically, these are the same species that may be most impacted by development of wind farms being built in partial response to climate change concerns.

Considering these increasing pressures, the ecology team of the Wildlife Resources Section Natural Heritage Program initiated a project to classify and assess the natural communities on high elevation ridges in the state. The scope of this project focused on ridge tops that have high wind energy potential. Although future development will probably be concentrated on private lands, our studies were concentrated on public lands. This sampling bias reflects differences in past land use, ease of access, likelihood of protection, and our responsibility for public interests. Similar patterns are expected on ridges we didn't sample, but no two sites are exactly the same. Our results provide baseline

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*Cheat Mountain salamander.*



*Snowshoe hare.*

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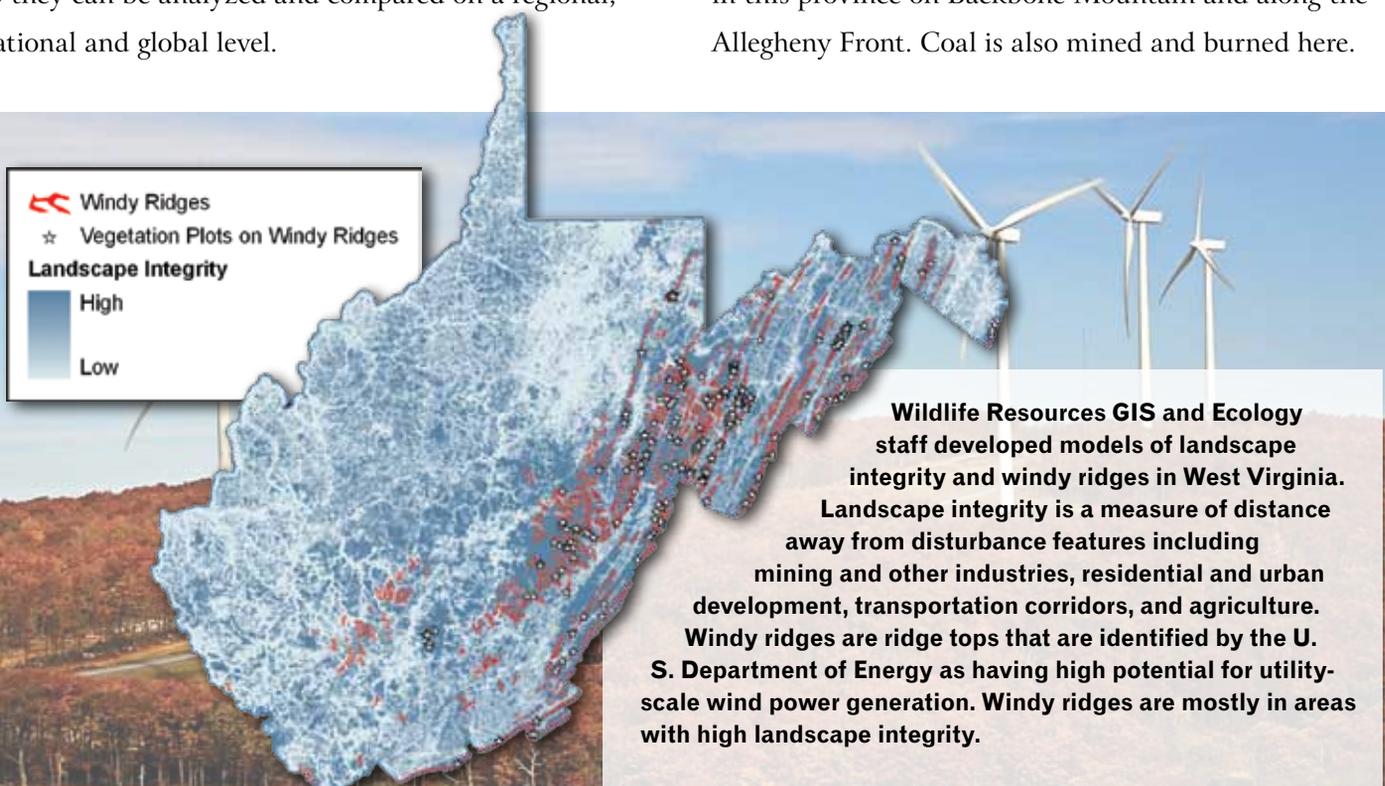
information on the natural communities that currently occupy these habitats, a list of what can be protected, and what might be lost.

Our methods and goals are the same as for other ecology projects we conduct throughout the state. We use vegetation, or plant community structure and composition, as the basis for classification. Our sampling unit is an approximately 4,300 square-foot plot. We collect the exact location of the plot using the global positioning system (GPS). We record environmental data such as which direction the slope faces, along with information on topography, hydrology and disturbance. We identify and estimate the abundance of all plant species occurring in the plot. We collect mosses and lichens for experts to identify. We measure tree heights and diameters, describe soils and collect a soil sample for chemical analysis by a lab.

Plot data from this project are archived in a computer database along with plot data collected from other projects, past and future. We analyze the data using a geographic information system (GIS) and modern multivariate statistical analysis tools. Our classification units, called associations, are designed to fit within the U. S. National Vegetation Classification so they can be analyzed and compared on a regional, national and global level.

To date, we have collected data from 442 plots on high windy ridges. We have not yet completed an association-level vegetation classification, but have assigned the plots to more generalized ecological system types. In the rest of this article I'll review a few of these types, but the diversity represented on these ridges is more than I can cover here. We found different patterns of vegetation on different ridges. These patterns reflect environmental conditions related to climate, geology, landforms, soil, natural disturbance and past land use by humans.

In the high Allegheny Mountains province west of the Eastern Continental Divide the climate is cool and moist, and forests on high ridges are dominated by red spruce, eastern hemlock and northern hardwoods (American beech, black cherry, birches and maples) along with some red oak. The ridges here are broad, weathered from nearly horizontal rock layers. Large wetlands can be found very close to some ridge tops. Windswept heath barrens became extensive on Dolly Sods following the destruction of red spruce forests during the logging boom around 1900, and are today only slowly reverting to red spruce. The largest wind farms in the eastern United States have been developed in this province on Backbone Mountain and along the Allegheny Front. Coal is also mined and burned here.



Ridges in this province are home for the Cheat Mountain salamander, snowshoe hare and Appalachian cottontail.

Few windy ridges exist west of the high Alleghenies, but a cluster of sites occurs in western Fayette, Raleigh and adjoining counties. These ridges are in the coal fields, and natural vegetation in some areas has already been eliminated by surface mining. We know little about the private lands in this area but our plots from a few ridges in the New River Gorge National

River give us some idea of the vegetation patterns here. Forests on these ridges are dominated by oaks and vary from rich oak-hickory forests on more fertile soils, to oak-heath forests on more sterile soils.

To the east of the Eastern Continental Divide is the Ridge and Valley province. Dramatic geologic folding and uplift followed by erosion created a landscape of parallel ridges and valleys with alternating exposures of shale, sandstone and limestone, each displaying its own vegetation. This province lies in the rain shadow of the high Alleghenies and the resulting aridity also has a great effect on the natural vegetation.

Ridge-top forests in this province are often dominated by oaks and hickories. On rocky sandstone-capped ridges, old-growth chestnut oaks grow over dense shrub layers of mountain laurel, huckleberries and blueberries. On more fertile soils, hickories (pignuts, mockernuts, shagbarks) grow together with oaks (red, white, black, chestnut). Understories of oak-hickory forests can have extremely high herb diversity, but ground disturbance in these communities often promotes invasions of non-native weeds that crowd out the native plant species.

Some of the highest elevations in the Ridge



*Lichen-covered boulderfields in the foreground, red spruce in the middle, dwarf pitch pine and more boulderfields in the distance, on Panther Knob in Pendleton County. Photo by Brian Sheets/WV DNR*

and Valley province support short-statured forests dominated by red oak. The climate on these ridges is too severe for the other oaks and hickories that prosper on lower ridges. Mature tree canopies may reach only 49 feet tall, compared to twice that or more for red oaks growing at lower elevations. Young oaks quickly grow as tall as the mature trees and then stop growing. Severe winters bring ice and winds which break limbs and bring down entire trees, creating an open canopy and sunny understory full of habitat-enriching woody debris.

Dwarf forests and woodlands dominated by pines grow on the hottest, driest sandstone-capped ridge tops in the Ridge and Valley province. Forests of pitch pine and table mountain pine rarely exceed 16 feet in height. Extensive patches of dwarf pines grow in areas that were burned, but narrow, pine communities on rock outcrops and along cliff tops can persist and reproduce without burning. The southernmost native populations of red pine in the world occur in West Virginia on Pike Knob and South Branch Mountain. They dominate small patches of dry woodland and forest here, 100 miles or more south of the nearest native populations in Pennsylvania.

Cave Mountain is one of a few high ridges in the



*The author contemplates nature from atop Big Schloss in George Washington National Forest.*  
*Photo by Brian Streets*



*Ecologists sample a lichen-dominated cliff face on North Fork Mountain in Pendleton County.*  
*Photo by Jim Vanderhorst*

Ridge and Valley province with extensive exposures of limestone. The soils on the mountain top are fertile and these areas were mostly converted from natural vegetation to pastures, as they remain today. But some side ridges and upper ridge flanks were never spoiled. They host some of West Virginia's rarest plant communities. Here exist woodlands of ancient eastern red cedars, some more than 500 years old, and amongst them grow numerous rare herbs including the Smokehole bergamot, blue flax and yellow nailwort. Extensive caves, which give the mountain its name, provide hibernacula for several species of bats, the group of animals that may be most vulnerable to direct mortality from collisions with windmills.

Many cliffs, rock outcrops and boulderfields occur on ridges along the Allegheny Front and in the Ridge and Valley province. These are natural communities dominated not by trees and shrubs, but by lichens, organisms composed of algal and fungal layers that take on many forms and defy the definition of what it means to be a species. In 2005, we collected a "species"

of lichen from a boulderfield on Kile Knob that was previously known in North America from just two other sites (in Montana and New York). We know so little about the diversity of these enigmatic organisms! Boulderfields also provide underground refuge for multitudes of millipedes and bats. Sterile sands weathered from cliff-top pavement host rare plants like silvery nailwort and false heather. Cliffs provide important nesting habitat for peregrine falcons and ravens. They also provide recreational opportunities for people — for rock climbing or just taking in a breathtaking view.

Go take a hike on a high, windy ridge. There are many trails to take you there. Try the Appalachian Trail, the Allegheny Trail, North Fork Mountain, or Big Schloss. Or take a drive up to Dolly Sods or along the Scenic Highway in the Yew Mountains. Several state parks such as Lost River and Cacapon and wildlife management areas such as Nathaniel and Short Mountain provide opportunities to explore high ridges. These fascinating natural communities provide a refuge from the rigors of daily life and the summer heat in the valleys. While you're there, consider your place in nature and nature's place in our future.

*Jim Vanderhorst is an ecologist with the Wildlife Resources section in Elkins.*