
COMMONWEALTH of VIRGINIA

A NATURAL HERITAGE INVENTORY OF VIRGINIA OUTDOORS FOUNDATION PROPERTIES ON BULL RUN MOUNTAIN, VIRGINIA

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Department of Conservation & Recreation

CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

**A NATURAL HERITAGE INVENTORY OF
VIRGINIA OUTDOORS FOUNDATION PROPERTIES
ON BULL RUN MOUNTAIN, VIRGINIA**

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INTRODUCTION

In January 1998, the Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR-DNH) was contracted by the Virginia Outdoors Foundation (VOF) to conduct a natural heritage inventory of property owned by VOF on Bull Run Mountain in the northern Virginia Piedmont. Natural heritage resources are defined as "the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest" (Virginia Natural Area Preserves Act, Section 10.1-209 through 217, *Code of Virginia*). This report details the findings of that inventory.

DCR-DNH is the state agency responsible by statutory authority under the Virginia Natural Area Preserves Act for inventory, database maintenance, protection, and management of Virginia's natural heritage resources. The Division provides the first comprehensive attempt to identify the Commonwealth's most significant natural areas through ongoing scientific biological survey. Data gathered during this state-wide survey is assembled and managed through a sophisticated Biological and Conservation Data System (BCD), in which information on ecosystems and species, their biology, habitats, locations, conservation status, and management needs is continually updated and refined. The Division is part of an international network of natural heritage programs and other conservation organizations which utilize standardized inventory methodologies and BCD technology.

The intent of the VOF site inventory is to document the presence (or absence), distribution, and population status of specific elements of biological diversity. These include Federally listed threatened and endangered species pursuant to the Endangered Species Act of 1973, as amended; species listed under the Virginia Endangered Species Act (Section 29.1-564 through 570, *Code of Virginia*) and the Virginia Endangered Plant and Insect Act (Section 3.1-1020 through 1030, *Code of Virginia*); other rare plant and animal species monitored by DCR-DNH; and communities considered to be rare or significant by DCR-DNH. The practical goal of the inventory is to assist VOF in decisions concerning land use and management of areas containing natural heritage resources.

DCR-DNH staff began work on the project during the spring of 1998 with a review of existing information about the study areas and the surrounding regions. Field surveys were conducted from May to October 1998. During this period, DCR-DNH botanists, zoologists, and community ecologists carried out targeted surveys in selected parts of the study areas determined to have a high potential for natural heritage resources. All results of these inventories have been incorporated into the DCR-DNH BCD.



The exposed quartzite cliff at High Point north of Thoroughfare Gap is a state-significant geological feature of Bull Run Mountain. Growing along the clifftop is a scrubby, pine-oak/heath woodland dominated by table-mountain pine (*Pinus pungens*). This natural community type and pine species, both characteristic of the higher Appalachians, occur here as rare outliers in the Piedmont. Photo: G.P. Fleming.

STUDY AREA

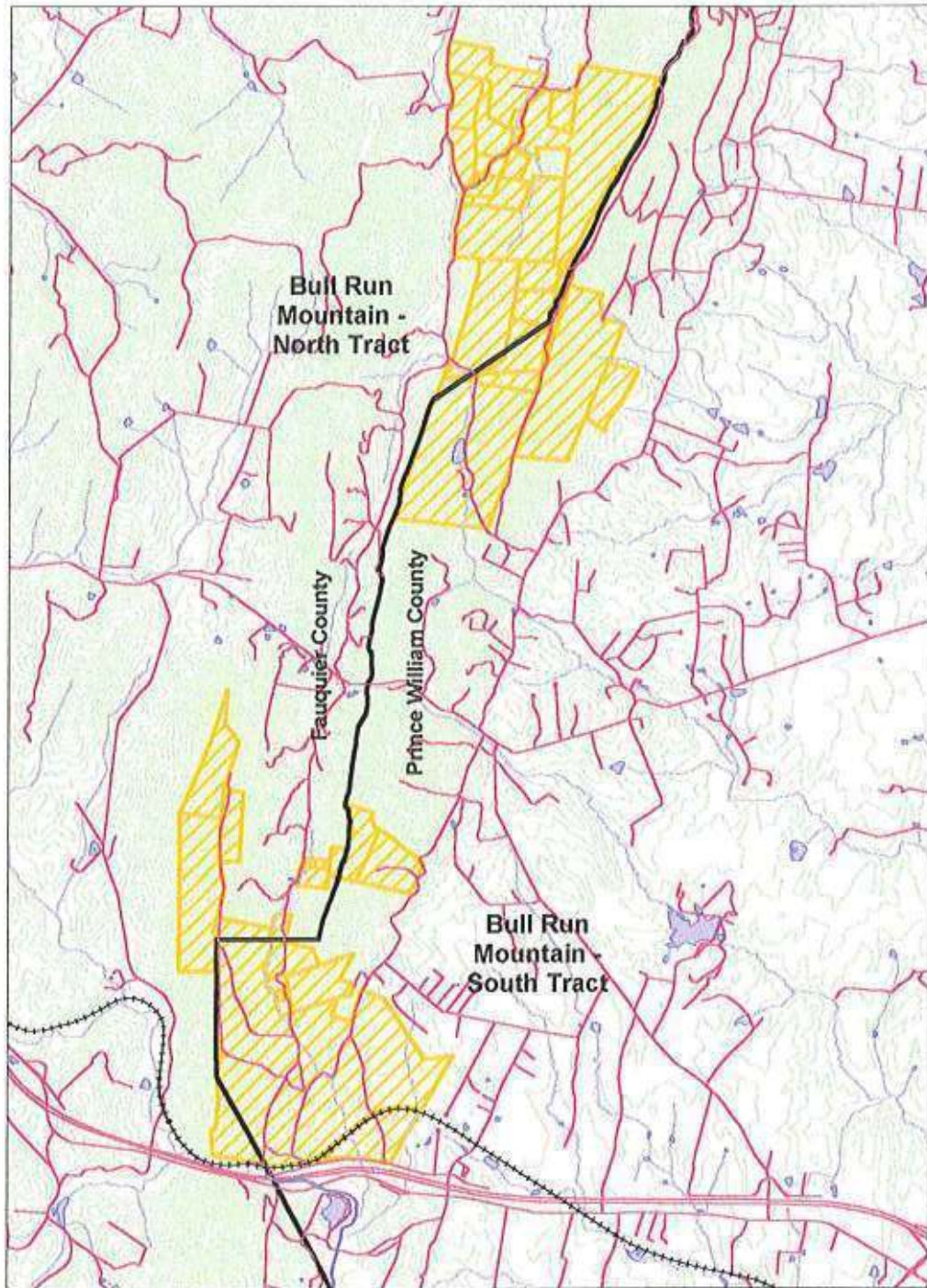
The study area, located in western Prince William County and eastern Fauquier County, is comprised of three tracts of land (Fig. 1). The northern tract, referred to as Bull Run Mountain - North (or BRM-N) roughly parallels Co. Rt. 629 (Bull Run Mountain Road) and is comprised of approximately 1,353 acres (Middleburg U.S. Geological Survey 7.5' topographic quadrangle). The smaller of two southern tracts is east of Co. Rt. 629 Extension (High Point Road) and covers approximately 107 acres. The larger southern tract, mostly comprised of the Bull Run Mountain Natural Area, is north of I-66 and east of Co. Rt. 628 and contains about 1,119 acres. Both southern tracts are located on the Thoroughfare Gap U.S. Geological Survey 7.5' topographic quadrangle. For purposes of this report, the two southerly parcels are grouped together and are collectively referred to as Bull Run Mountain-South (BRM-S).







While situated in the physiographic Piedmont Plateau, the Bull Run Mountain ridges geologically represent the eastern limb of the Blue Ridge anticlinorium, a linear uplift that extends northeasterly across Virginia and Maryland into southern Pennsylvania (Espenshade 1986). The higher ridges and peaks of the Blue Ridge proper lie along the western limb of the anticlinorium, while the eastern limb is marked by a discontinuous series of low, isolated foothills that include the Catoctin Mountains in Maryland and northern Virginia, Bull Run Mountain, the Watery Mountains (Fauquier Co.), Clark Mountain (Orange Co.), and the Southwest Mountains east of Charlottesville.

Most of the Bull Run Mountain area is underlain by Lower Cambrian metasedimentary rocks of the Chilhowee Group, primarily white quartzite of the Weaverton Formation. This bedrock is highly resistant and well exposed along the summit of the High Point ridge north of Thoroughfare Gap, at White Rocks north of Hopewell Gap, and in numerous other places. The eastward-dipping or even vertical strata of this quartzite are powerful ridge-forming features that have shaped the topography of Bull Run Mountain into long, steep, narrow-crested ridges with narrow, intervening valleys or hollows. The highest elevations on the ridges are between 366-417 m (1200-1369 ft), and lie about 180-215 m (600-700 ft) above an irregular, rolling plain underlain by Precambrian metavolcanic rocks to the west, and about 215-245 m (700-800 ft) above a nearly flat Triassic basin to the east. A very small area of VOF lands is located on Triassic substrates east of Beverly Mill.

Within the study area, the Bull Run ridges are interrupted by two major gaps: Thoroughfare Gap, cut by the passage of Broad Run, and Hopewell Gap, cut by the headwaters of Little Bull Run. The major interior valleys are drained by Catletts Branch, a tributary of Broad Run; Catharpin Creek (Jackson Hollow), a tributary of Little Bull Run; and the headwaters of Bartons Creek and Hungry Run, tributaries of the Little River. The interior drainages are characterized by cold, spring-fed brooks and streams, with numerous lateral seeps. The abundant and seemingly continuous outflow of groundwater seepage in the valleys is due in large part to the favorable geotechnical properties of quartzitic bedrock and soils in the hydrologic recharge zones of these drainage systems.

Figure 1. Location of Virginia Outdoors Foundation Bull Run Mountain properties surveyed by DCR-DNH in 1998.



-  VOF Properties Surveyed by DCR-DNH
-  Water
-  Roads
-  20' Contour Interval
-  County Boundary
-  Railroad Tracks



2 0 2 4 Kilometers



The study area is generally forested except in a few small areas around dwellings and along roads or powerline rights-of-way. The prevailing forest growth on most of the drier, rocky slopes is dominated by *Quercus montana* (chestnut oak), with abundant undergrowths of the ericaceous (heath family) shrubs *Kalmia latifolia* (mountain-laurel), *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (early lowbush blueberry), and *Vaccinium stamineum* (deerberry). Also common, on subxeric to submesic, usually east-facing slopes, are mixed oak forests of *Quercus montana*, *Q. alba* (white oak), *Q. rubra* (northern red oak), *Q. velutina* (black oak), *Q. coccinea* (scarlet oak), *Carya alba* (mockernut hickory), and *C. glabra* (pignut hickory), with understories of *Cornus florida* (flowering dogwood), *Viburnum acerifolium* (maple-leaf viburnum), and deciduous ericads. On the moister ravine slopes and well-drained flats along streams, mesic mixed hardwood forests are well developed. These are dominated by variable mixtures of *Liriodendron tulipifera* (tulip-poplar), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Quercus* spp., and *Carya* spp., with understories of *Carpinus caroliniana* (ironwood), *Asimina triloba* (paw-paw), and/or *Lindera benzoin* (spicebush), and a lush, diverse herbaceous flora. Successional mesic hardwood forests that have grown up on formerly cleared lands are typically occupied by nearly monospecific stands of *Liriodendron tulipifera*.

Specialized habitats on Bull Run Mountain support vegetation and natural communities that are less extensive, more localized, and in some cases regionally rare. The cool, swampy habitats developed along interior streams of the area support outstanding examples of montane acidic seepage swamp communities. These forested wetlands are characterized by canopies of *Acer rubrum* (red maple), *Nyssa sylvatica* (black gum), and *Liriodendron tulipifera*, and shrubs such as *Ilex verticillata* (winterberry) and *Toxicodendron vernix* (poison sumac). The herbaceous layers of these swamps are lush. Among the most abundant and typical herbaceous plants are *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (American false-hellebore), *Osmunda cinnamomea* (cinnamon fern), and *Chrysosplenium americanum* (water-carpet). Sedges (*Carex* spp.) and ferns are particularly abundant and diverse in this community type.

The very dry, infertile ridge crests and clifftops of the area support open, stunted, fire-prone woodlands of *Pinus rigida* (pitch pine), *P. pungens* (table-mountain pine), *P. virginiana* (Virginia pine), scrubby oaks, and dense ericaceous shrubs. These plants comprise a vegetation type, known as Pine-Oak/Heath, that is well adapted to these exposed, rocky and shallow-soiled habitats.

As a rule, the rugged terrain and vegetation of Bull Run Mountain is distinctly montane in character, contrasting sharply with the topography and plant communities of surrounding Piedmont lowlands. The specialized communities of this area, and even the abundant Chestnut Oak Forest, are outliers of common mountain community types that quickly become rarer and more localized eastward in the Piedmont and Coastal Plain provinces. Similarly, the flora of the study area contains a substantial number of mountain disjuncts that reach or approach their eastern limits in the state. Also of interest are a small number of typical lowland or Coastal Plain plants that reach their western limits in the Bull Run Mountain area. Examples of species in each group will be discussed in the individual site reports and in the Discussion section (p.27).

EXPLANATION OF THE NATURAL HERITAGE RANKING SYSTEM

Each of the significant natural features (species, community type, etc.) monitored by DCR-DNH is considered an element of natural diversity, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant; Table 1). The primary criterion for ranking elements is the number of occurrences, *i.e.*, the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of occurrences, so that ranks essentially are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Virginia (its State or S-rank) and the element's rarity over its entire range (its Global or G-rank). Subspecies and varieties are assigned a Taxonomic (T-) rank in addition to their G-rank. Taken together, these ranks give an instant picture of an element's rarity. For example, a designated rank of G5S1 indicates an element which is abundant and secure range-wide, but extremely rare in Virginia. Ranks for community types are provisional, or in many cases lacking, due to ongoing efforts by the natural heritage network to classify community syntaxa. Rarity ranks used by DCR-DNH are not legal designations, and they are continuously updated to reflect new information.

Table 1. Definition of natural heritage State rarity ranks. Global ranks are similar, but refer to a species' range-wide status. Note that GA and GN are not used and GX means extinct. Sometimes ranks are combined (*e.g.* S1S2) to indicate intermediate or somewhat unclear status. Elements with uncertain taxonomic validity are denoted by the letter Q after the global rank. Ranks for most community types have not been generated due to ongoing community classification efforts. These ranks should not be interpreted as legal designations.

- | | |
|----|---|
| S1 | Extremely rare; usually 5 or fewer occurrences in the state; or may have a few remaining individuals; often especially vulnerable to extirpation. |
| S2 | Very rare; usually between 5 and 20 occurrences; or few occurrences with many individuals; often susceptible to becoming endangered. |
| S3 | Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. |
| S4 | Common; usually more than 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats. |
| S5 | Very common; demonstrably secure under present conditions. |

Table 1 (continued). Definition of natural heritage State rarity ranks.

SA	Accidental in the State.
SH	Historically known from the State, but not verified for an extended period, usually more than 15 years; this rank is used primarily when inventory has been attempted recently.
SN	Regularly occurring migrants or transient species which are non-breeding, seasonal residents. (Note that congregation and staging areas are monitored separately).
SU	Status uncertain, often because of low search effort or cryptic nature of the element.
SX	Apparently extirpated from the State

The spot on the landscape that supports a natural heritage resource is an **element occurrence**. DCR-DNH has mapped over 7,500 element occurrences in Virginia. Information on the location and quality of these element occurrences is computerized within the Division's BCD system, and additional information is recorded on maps and in manual files.

In addition to ranking each element's rarity, each element occurrence is ranked to differentiate large, outstanding occurrences from small, vulnerable ones. In this way, protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Species occurrences are ranked in terms of quality (size, vigor, etc.) of the population; the condition (pristine to disturbed) of the habitat; the viability of the population; and the defensibility (ease or difficulty of protecting) of the occurrence. Community occurrences are ranked according to their size and overall natural condition. These **element occurrence ranks** range from A (excellent) to D (poor). Sometimes these ranks are combined to indicate intermediate or somewhat unclear status, *e.g.* AB or CD, etc. In a few cases, especially those involving cryptic animal elements, field data may not be sufficient to reliably rank an occurrence. In such cases a rank of E (extant) may be given. Historical records are indicated as H. Element occurrence ranks reflect the current condition of the species' population or community. A poorly-ranked element occurrence can, with time, become highly-ranked as a result of successful management or restoration.

Element ranks and element occurrence ranks form the basis for ranking the overall significance of sites. Site **biodiversity ranks** (B-ranks) are used to prioritize protection efforts, and are defined as follows:

- B1 Outstanding Significance: only site known for an element; an excellent occurrence of a G1 species; or the world's best example of a community type.

- B2 Very High Significance: excellent example of a rare community type; good occurrence of a G1 species; or excellent occurrence of a G2 or G3 species.
- B3 High Significance: excellent example of any community type; good occurrence of a G3 species.
- B4 Moderate Significance: good example of a community type; excellent or good occurrence of state-rare species.
- B5 General Biodiversity Significance: good or marginal occurrence of a community type or state-rare species.

Note: sites supporting rare subspecies or varieties are considered slightly less significant than sites supporting similarly ranked species.

METHODS

NATURAL HERITAGE INVENTORY METHODOLOGY

DCR-DNH staff approach natural heritage inventories in a systematic and prioritized manner. In general, the rarest, most threatened geographic areas, habitats, and species receive inventory priority. Inventories of the VOF properties were conducted through the five basic stages listed below. Although a natural areas inventory can logically be broken down into these steps, in practice the work is often iterative and tasks may be performed simultaneously.

1) Review of aerial photographs. Aerial photographs of the survey area were reviewed in detail to identify areas to be studied in the following stages. To aid in their interpretation, the photographs were compared with topographic maps, soil surveys, and other available maps.

2) Gathering existing information. Museum collection records were reviewed by DCR-DNH staff, and specimen label information was recorded for rare species. Published and unpublished information on the inventory area was collected and assimilated in conjunction with review of aerial photographs. BCD databases were accessed, and the known distribution of natural heritage resources in the area were examined. Local naturalists and other experts were consulted for additional information.

3) Planning for field survey. Based on the preceding efforts, a field plan was developed to maximize the productivity of limited field time. Among the factors considered were: when the survey can best be conducted; which staff scientist(s) should be involved (*i.e.*, what is the potential for rare plants, rare animals, or exemplary communities); and how much time should be budgeted for completing the survey.

4) Field survey. During this stage, detailed information was collected on the rare species and exemplary natural communities present within the study area. Portions of a site not visited on foot were evaluated on the basis of aerial photographs and other information. The area of land needed to protect the special biological features was determined. Threats and past or present disturbances were also evaluated. Element occurrence data were transcribed onto DCR-DNH maps and entered into the BCD system. Throughout this stage of concentrated field inventory, continual communication between DCR-DNH project team members (botanists, zoologists, and ecologists) was emphasized to ensure that all significant natural areas were visited by appropriate specialists and that data was coordinated.

5) Compilation of results and preparation of final report. As field work was completed, DCR-DNH biologists reviewed the information gathered and ranked the site according to its ecological significance, and protection and management recommendations were written. These were combined with the site reports and other required information in preparing this report to VOF.

The materials and methods employed by the major disciplines in carrying out the VOF site inventories are summarized as follows:

BOTANICAL INVENTORY METHODS

For purposes of this study, rare plants are defined as the rarest known species in the Commonwealth. They include species with global ranks of G1, G2, and G3, and state ranks of S1, S1S2, S2, S2S3, SH, and SX. Data on these species are maintained in the BCD system and summarized annually on a master list of Virginia's rare plants (Belden, 1998).

To initiate the inventory of rare plants, existing data on element occurrences in the vicinity of the VOF site were obtained from the BCD database and reviewed. Additional information was gathered from botanical literature and from examination of collections at the following institutions: College of William and Mary, George Mason University, Longwood College, Lynchburg College, National Arboretum, Old Dominion University, University of Richmond, U.S. National Herbarium (Smithsonian Institution), University of North Carolina, Virginia Commonwealth University, and Virginia Polytechnic Institute and State University. Of particular importance to this process of gathering data on the potential rare plant species is a series of papers on the flora of Bull Run Mountain by Allard and Leonard (1943, 1944, 1952). More recent botanical explorations and collecting in the area were done by Charles E. Stevens in the 1970's and mid-1980's (C. Stevens, pers. comm.) and Gary P. Fleming in the late 1980's. Some previous work by DCR-DNH staff in evaluating communities and potential rare plant habitats on VOF lands in the southern parcel was done in a brief visit in 1989 and no rarities or habitat with high potential for plant rarities were found at that time (Ludwig and Fleming 1989). The list of species developed from the above sources is presented in Table 1.

Information on the site's landscape was gathered through examination of aerial photographs and topographic maps. These sources were examined to delineate the distribution of plant habitats and

Table 2. List of Potential Rare Plant Species in the Bull Run Mountains. Based primarily on historical collections reported by Allard and Leonard (1943, 1944, 1952). *Poa paludigena* was included as a potential rarity based on occurrences in nearby areas. The following species that are rare or unknown in Virginia were reported in error by Allard and Leonard: *Phegopteris connectilis* (= *Dryopteris phegopteris*), *Sparganium androcladum*, *Sphenopholis filiformis*, and *Gentiana andrewsii*.

<u>Species</u>	<u>Common Name</u>	<u>Ranks</u>	<u>Historical location (Bull Run Mtns.)</u>
<i>Aster ericoides</i>	white heath aster	G5S2	Edge of Triassic area 8 mi. S. of Aldie
<i>Buchnera americana</i>	blue-hearts	G5?S1S2	W. slope Pond Mtn., S. of Thoroughfare Gap
<i>Crataegus calpodendron</i>	pear hawthorn	G5S1	Pond Mountain; just N. of Hopewell Gap
<i>Crataegus pruinosa</i>	a hawthorn	G5S1	Near Hopewell Gap
<i>Eupatorium maculatum</i> var. <i>maculatum</i>	spotted joe-pye-weed	G5T?S2	Triassic area near Antioch
<i>Filipendula rubra</i>	queen-of-the-prairie	G4G5S1	W. slope Pond Mtn., S. of Thoroughfare Gap ¹
<i>Gnaphalium helleri</i>	catfoot	G4G5S1	Old field in valley E. of High Point cliffs
<i>Liparis loeselii</i>	bog twayblade	G5S2	W. slope Bull Run Mtn. near Hopewell Gap
<i>Lycopodiella inundata</i>	northern bog clubmoss	G5S1	wet sand in quarry just W. of Antioch
<i>Penstemon hirsutus</i>	hairy beardtongue	G4S2	Wooded ridge just N. Of Beverly Mill
<i>Platanthera peramoena</i>	purple fringeless orchid	G5S2	W. slope Pond Mtn., S. of Thoroughfare Gap ¹
<i>Poa paludigena</i>	bog bluegrass	G3S2	(western Fauquier Co.)
<i>Populus tremuloides</i>	quaking aspen	G5S2	Wooded slope near White Rocks ²
<i>Pyrola elliptica</i>	shinleaf	G5S2	Moist woods 3 mi. N. of Hopewell Gap
<i>Ranunculus longirostris</i>	white water crowfoot	G5S1	In Broad Run W. of Thoroughfare Gap
<i>Rosa setigera</i>	prairie rose	G5S1	Rt. 628 S. of Hopewell Gap
<i>Silene nivea</i>	snowy campion	G4?S1	along Broad Run east of Pond Mountain
<i>Spiranthes lucida</i>	shining ladies'-tresses	G5S1	Edge of spring, 1 mi. N. of Hopewell Gap
<i>Spiranthes ochroleuca</i>	yellow ladies'-tresses	G4S1	E. slope Bull Run Mtn. below High Point cliffs ³
<i>Stachys eplingii</i>	Epling's hedgenettle	G5S1	W. slope Pond Mtn., S. of Thoroughfare Gap ⁴
<i>Toxicodendron rydbergii</i>	western poison ivy	G5S1	Pond Mountain ridges ⁵
<i>Trillium cernuum</i>	nodding trillium	G5S2	Jackson Hollow, 2 mi. N. of Hopewell Gap ⁶

Notes:

1 - searched for unsuccessfully by DCR-DNH in 1992.

2 - extant in 1989 (G.P. Fleming); population is not on VOF property.

3 - reported incorrectly as *Spiranthes cernua* by Allard and Leonard (1943).

4 - reported incorrectly as *Stachys nuttallii* by Allard and Leonard (1943). This is the type locality of *S. eplingii*; the population was relocated in 1992 by DCR-DNH, but is not on VOF property.

5 - may be based on misidentified specimens.

6 - extant in 1982 (C.E. Stevens, pers. comm.); population is not on VOF property.

to identify areas with high potential for rare species occurrences. Data compiled on the area's rare plants, along with information on the distribution of plant habitats, was used to formulate field plans and direct the field investigation.

Field work was conducted from May to July 1998. The rare plant surveys targeted sections of the VOF property thought to have the highest potential for plant rarities, particularly Jackson Hollow and the stream valley to the north of Jackson Hollow on the northern parcel. On the southern VOF tracts, areas along Cattlet Creek and the area in the southeast corner underlain by more basic Triassic rocks were also high priorities. DCR-DNH Field Botanist Nancy Van Alstine was responsible for most of the botanical field work.

In general during a botanical investigation, field data are recorded during the site survey and are coordinated with data collected from the same site by ecologists and zoologists. These data include the site location, directions, and a site description, as well as comments on land use, potential hazards, exotic flora and fauna, and off-site considerations. When rare plant occurrences are located, additional data are recorded, including the date(s) when the species was found, population boundaries and concentrations within those boundaries, approximate number of individuals, reproductive and phenological status, and species viability. Habitat factors such as moisture, light, and associated species, as well as any apparent immediate or long-term threats to the rare species populations are also noted. Photographs are taken or voucher specimens are collected to verify the identity of rare species, and each occurrence is ranked on the basis of all available data.

ZOOLOGICAL INVENTORY METHODS

For purposes of this study, rare animals are defined as the rarest known species in the Commonwealth. They include species with global ranks of G1, G2, and G3, and state ranks of S1, S1S2, S2, S2S3, SH, and SX. Data on these species are maintained in the BCD system and summarized annually on a master list of Virginia's rare animals (Roble, 1996).

To initiate inventory of rare animals, existing data on element occurrences in the vicinity of the VOF study sites were obtained from the BCD database and reviewed. Additional information was gathered from zoological literature and from examination of selected collections at the following institutions: U.S. Museum of Natural History, the Carnegie Museum, Lord Fairfax Community College, Eastern Mennonite College, Old Dominion University, Virginia Polytechnic Institute and State University, Virginia Commonwealth University, and the Virginia Museum of Natural History. There were no existing records of rare animals from the study area and adjacent areas of the Bull Run Mountains.

Aerial photographs and various map sources were consulted to determine the extent of potential rare animal habitats. Subsequently, a field plan, based on all the available preliminary information, was developed to direct investigation of potential rare species habitats for all animal groups.

Field work was conducted from May through October, 1998 and took place on both designated VOF inventory tracts. DCR-DNH Field Zoologists Christopher S. Hobson and Anne C. Chazal, and DCR-DNH Zoologist Steven M. Roble were responsible for the field work. Inventory was largely focused on crustaceans, odonata (dragonflies and damselflies), and lepidoptera (butterflies and moths). However, birds, amphibians, reptiles, fish, and other invertebrates were also noted. Surveys were conducted using the following methods:

Sweep nets - odonates, butterflies, and other flying invertebrates were sampled in terrestrial and aquatic habitats using sweep nets.

Hand collection - reptiles and amphibians, as well as some invertebrates, were collected by hand.

Ultraviolet light traps - moths and other invertebrates were captured using standard bucket traps equipped with a blacklight powered by a 12-volt wheelchair battery. Ethyl acetate was used as a killing agent.

As in the botanical inventory, complete data were recorded for each site surveyed and additional data were recorded when rare animal occurrences were located. In cases where these sites were also visited by botanists and ecologists, the data were coordinated. All occurrences were ranked on the basis of available data.

COMMUNITY INVENTORY METHODS

The need to protect indigenous biotic communities and ecosystems has become a major focus of conservation efforts by Federal, state, and private organizations in recent years. Community classification, inventory, and protection should be regarded as an essential complement to rare species inventories. Natural communities represent functioning units of the landscape which:

1. support a myriad of life forms too cryptic or poorly known to be catalogued and prioritized individually;
2. provide critical habitat for both common and rare species;
3. contribute to the maintenance of larger ecosystems, and
4. possess unique intrinsic scientific, educational, and aesthetic values.

It is therefore important to locate, classify, and evaluate these features as part of any comprehensive inventory of natural heritage resources.

Most community types have not yet been fully defined or ranked due to ongoing classification efforts by the Federal Geographic Data Committee, The Nature Conservancy and the network of natural heritage ecologists (Anderson *et al.* 1998). In Virginia, the current definition of communities is at

a broad, natural community group level. Classification at the natural community level groups together community types with similar structural, floristic, and habitat similarities, *e.g.*, dry oak-hickory forests. Thus, a natural community group is essentially a group of ecologically allied community types. A few community types that have been quantitatively sampled and studied intensively by DCR-DNH ecologists have been formally classified at the association level. Units at this level are defined by a high degree of compositional and environmental similarity, and are named using diagnostic species of the association, *e.g.*, the *Acer rubrum* - *Nyssa sylvatica* / *Ilex verticillata* / *Osmunda cinnamomea* (Red Maple - Black Gum / Winterberry / Cinnamon Fern) Saturated Forest. The ongoing goal of Division ecologists is a comprehensive classification of Virginia's communities at the association level. Refer to Appendix A for the preliminary DCR-DNH classification of natural community groups.

For purposes of this study, significant communities are defined to include both outstanding examples of common community types (*e.g.*, old-growth oak forest) and all examples of uncommon or rare community types.

Field preparation began in the spring of 1998 with a review of BCD database information, scientific literature, topographical maps, and aerial photographs. Journal articles by Allard and Leonard (1943,1944,1952) and Allard (1961) provide a vegetational and floristic overview of Bull Run Mountain and were helpful in field preparation. Previous field work in the area by DCR-DNH Vegetation Ecologist Gary P. Fleming also assisted in prioritizing potential areas for significant community occurrences. Field work was conducted on the VOF property tracts in May and July 1998 by Fleming and DCR-DNH Field Ecologist Kathleen M. McCoy. Community inventory involved reconnaissance to identify outstanding communities. Because of limited resources available for the project, the exact boundaries of every significant community occurrence could not be determined; this was especially true of very large forest communities which extended off of VOF property onto adjacent private land. Likewise, most of the significant occurrences were documented with species lists and general descriptions of the vegetation and environmental / habitat conditions. In two cases, significant communities were more fully documented by the collection of quantitative floristic data from standard 400 square meter plots. Standard site information was collected at each site where significant communities were found. All data collected were coordinated with data collected by botanists and zoologists.

RESULTS

SUMMARY OF FINDINGS

Nine community element occurrences of five natural community types were documented on VOF's Bull Run Mountain properties. The types and locations of the community elements are summarized below. A brief description of the site is also included. No animal or plant element occurrences were recorded, but a number of "watchlist" (uncommon to rare, usually S3-ranked) animals were

documented. Because financial and time resources for this project were very limited, inventory of this area for rare species must be considered incomplete.

Bull Run Mountain - North

This site is notable for being an outlier of montane topography and biota in the Piedmont. Microclimatic conditions induced by the regionally high elevations, steep slopes, and sheltered valleys play a large role in maintaining habitat conditions for northern and mountain disjuncts.

Four community element occurrences representing two natural community types were recognized in the northern tract:

<u>Community Type</u>	<u>Survey Site</u>
Mesic Mixed Hardwood Forest	Bartons Creek Hollow
Montane Acidic Seepage Swamp	Jackson Hollow
Montane Acidic Seepage Swamp	Hungry Run Headwaters
Montane Acidic Seepage Swamp	High Acre Ridge

Bull Run Mountain - South

Major features of this site are the dry, rocky ridge crests which rise 180-240 m. (600-800 ft.) in elevation above the general level of the surrounding Piedmont landscape. Most significant are the exposures of white Weaverton quartzite along the crest of the High Point ridge. Such exposures and the plant communities associated with them are frequent in the mountains of western Virginia, but very rare eastward in the Piedmont. In addition to supporting two significant natural communities, the High Point cliffs may be considered a state-significant geologic feature.

Five community element occurrences representing four natural community types were recognized in the southern tract:

<u>Community Type</u>	<u>Survey Site</u>
Chestnut Oak Forest	High Point Ridge
Mesic Mixed Hardwood Forest	Catletts Branch
Piedmont/Mountain Acidic Cliff	High Point Ridge
Pine-Oak/Heath Woodland	High Point Ridge
Pine-Oak/Heath Woodland	Eastern Ridge

INTRODUCTION TO THE SITE REPORTS

To enhance protection and facilitate management of biodiversity in the Bull Run Mountains, boundaries are provided for two landscape units that have been identified as conservation sites. A conservation site is a natural area that contains one or more element occurrences and has been assigned a biodiversity rank of at least B5 (see pp. 6-7 for ranking description). The following standard reporting format is used for the two sites:

SITE NAME: Site names generally reflect a geographic locality and, in some cases, a prevalent landscape feature.

LOCATION: The county (or counties) containing the site is listed.

SIZE: The approximate area of the site, as determined using ArcView GIS, is given in acres.

QUADRANGLE: The name of the USGS 7.5' quadrangle(s) that includes the site is listed.

BIODIVERSITY RANK: The overall significance of the natural area, in terms of the rarity of natural heritage resources and the quality of their occurrences, is indicated. As described previously, these ranks range from B1 (very high significance) to B5 (general biodiversity significance).

DIRECTIONS: Location of the site using geographical landmarks

NATURAL HERITAGE RESOURCE SUMMARY TABLE: This field provides a synopsis of the natural heritage resources (rare species and significant communities), together with their status ranks (global and state) and element occurrence (EO) ranks.

SITE DESCRIPTION: A brief narrative describing the site, its significant elements, vegetation, habitat, and current land use is presented. The first reference to a species in a narrative is by scientific name, followed by its common name in parentheses. Subsequent references to the same species are by scientific name only.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary delineated in this report contains all known occurrences of natural heritage resources and adjacent lands determined to be important for their long-term protection based on available information. This information field explains the basis for that boundary.

THREATS: Threats to the site's natural heritage resources are described. These may include both real, imminent threats and potential threats posed by types of land use activities or other factors that currently are not impacting the site.

MANAGEMENT RECOMMENDATIONS: This field is a summary of the major issues and factors that should be considered in management of the site for its biodiversity and natural heritage

resource values. As a rule, generalized recommendations are provided based on potential threats identified during the survey work. The expertise of inventory biologists familiar with each site, as well as input from DCR-DNH natural areas program biologists, has been used in preparing these recommendations. However, within the context of a relatively short-term inventory (one year) effort on large sites, it may be difficult to identify highly specific management strategies. Additionally, the management needs of some element occurrences are so complex or obscure that additional study by experts may be needed. In many cases, monitoring of element occurrences or site factors is recommended to determine the best long-term management practices. In all cases, if land use changes or specific high-impact actions are proposed within a site's boundary, consultation with DCR-DNH staff is recommended to assess impacts on the natural heritage resources.

PROTECTION RECOMMENDATIONS: A summary of the actions and priority needed to ensure long-term protection of the site and its elements is provided.

REFERENCES: References mentioned in the text of the site report are listed at the end of the text.

SITE MAP AND ELEMENT LOCATIONS: The site map, delineated in Arcview on the USGS 7.5' quad(s), shows the preliminary conservation planning boundary which contains all known element occurrences and the land determined to be important for long-term maintenance of the elements based on available information. The following factors are considered when drawing these boundaries:

- the extent of current and potential habitat for rare species and exemplary natural communities;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of groundwater resources;
- land intended to mitigate a wide variety of off-site impacts;
- land or activities necessary to preclude or minimize exotic species; and
- land necessary for management activities, *e.g.* prescribed burning.

The boundaries are intended for conservation planning purposes and, at the very least, should prevent inadvertent damage to the natural areas.

The exact location of each element occurrence within a site are included on the Site Map. The location information is intended to provide resource managers with requisite site-specific data.

BULL RUN MOUNTAINS - NORTH

LOCATION: Fauquier and Prince William Counties

SIZE: ca. 2,183 acres

U.S.G.S. QUADRANGLE: Middleburg

BIODIVERSITY RANK: B4

DIRECTIONS: The site encompasses portions of the three main ridges of the Bull Run Mountains north of Hopewell Gap, from the southern ends of Jackson Hollow and Signal Mountain north for about 4.2 km.

Table 3. NATURAL HERITAGE RESOURCES:

Scientific Name	Common Name	Survey Site	Global Rank	State Rank	EO Rank
Communities:					
Mesic Mixed Hardwood Forest	-	Bartons Creek Hollow	-	S5	BC
Montane Acidic Seepage Swamp	-	High Acre Ridge	-	S3?	AB
Montane Acidic Seepage Swamp	-	Hungry Run Headwaters	-	S3?	B
Montane Acidic Seepage Swamp	-	Jackson Hollow	-	S3?	AB
Plants:					
<i>Fraxinus nigra</i> #	Black ash	Bartons Cr., Hungry R.	G5	S3	D
<i>Penstemon hirsutus</i> *	Hairy beardtongue	-	G4	S2	H
<i>Pyrola elliptica</i> *	Shin leaf	-	G5	S2	H
<i>Trillium cernuum</i> *	Nodding trillium	-	G5	S2	H
Animals:					
<i>Amphiagrion saucium</i> #	Eastern red damsel	Jackson Hollow	G5	S3	-
<i>Argia bipunctulata</i> #	Seepage dancer	Jackson Hollow	G4	S3	-
<i>Arigomphus villosipes</i> #	Unicorn clubtail	Jackson Hollow	G5	S3	-
<i>Gammarus pseudolimnaeus</i> #	Northern spring amphipod	Hungry Run Headwaters	G5	S3	-
<i>Lanthus vernalis</i> #	Single-striped clubtail	Jackson Hollow	G4	S2S3	-
<i>Libellula flavida</i> #	Yellow-sided skimmer	Jackson Hollow	G5	S3	-
<i>Stygobromus tenuis</i> #	A groundwater amphipod	Jackson Hollow	G4G5	S3	-
<i>Tachopteryx thoreyi</i> #	Gray petaltail	Jackson Hollow	G4	S3	-

* = historical records from the site that were not relocated during the current survey

= indicates a "watchlist" (uncommon to rare) species. Occurrences of watchlist species are neither ranked nor entered into BCD, but general population trends are recorded and periodically reviewed.

Site Description: This site is characterized by steep, forested terrain. Although situated in the Piedmont, the environmental and biotic character of the site is distinctly montane, with extensive *Quercus montana* (chestnut oak) and ericad forests occupying the steep, rocky slopes and ridges. In the intervening valleys, more mesic mixed hardwood forests and forested seepage wetlands have developed on lower slopes and along small streams, and contain a large number of more or less disjunct, mountain species occurring at relatively low elevations here. Among the more notable

mountain plants in this Piedmont range are *Pinus pungens* (table-mountain pine), *Veratrum viride* (American false-hellebore), *Maianthemum canadense* (Canada mayflower), *Glyceria melicaria* (slender mannagrass), *Fraxinus nigra* (black ash), *Lycopodium clavatum* (staghorn clubmoss), and the state rare *Trillium cernuum* (nodding trillium; Allard and Leonard, 1943). Growing among them are typical coastal plain/low elevation species such as *Toxicodendron vernix* (poison sumac), *Woodwardia areolata* (netted chain fern), *Carex seorsa* (weak stellate sedge), and *Dulichium arundinaceum* (three-way sedge). Moreover, the occurrences of eight “watchlist” animal species requiring high quality wetland habitats further enhance the area’s significance. The survey work conducted at this site in 1998 was, with one exception, confined to tracts owned by the Virginia Outdoors Foundation, and the level of funding made it necessary to focus attention only on the highest potential habitats within these relatively large tracts.

The area has probably always been lightly settled due to its rugged topography. Most of the timber was cut in the late 1800s or early 1900s and many stands are now in relatively mature, second growth. A number of vacation and permanent homes, an active quarry and several inactive quarries, and a weather station are located within the site boundaries. A sizeable tract (> 1300 acres) is owned by the Virginia Outdoors Foundation, and others are in conservation easements administered by this agency. To date, four significant community occurrences have been documented within the site (Fig.2):

MESIC MIXED HARDWOOD FOREST

This small but high-quality occurrence of old-age mixed mesic hardwood forest covers at least 10 acres. It occurs along the headwaters of Bartons Creek on a west-facing lower slope with soils that are apparently quite acidic and infertile. Co-dominant trees are *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Liriodendron tulipifera* (tulip-tree). Some trees in this stand have diameters at breast height (dbh) exceeding one meter. Characteristic small trees and shrubs of this community include *Cornus florida* (flowering dogwood), *Viburnum acerifolium* (maple-leaf viburnum), *Lindera benzoin* (spicebush), and *Carpinus caroliniana* (American hornbeam). The herbaceous layer is somewhat sparse with *Polystichum acrostichoides* (Christmas fern), and *Carex laxiculmis* (spreading sedge) prominent. The condition of the community is excellent and probably represents a climax forest type for the region. The upslope boundaries were not completely determined and a return visit is recommended to collect additional data and more accurately assess the boundaries and size of this occurrence.

MONTANE ACIDIC SEEPAGE SWAMP

The montane acidic seepage swamp at Hungry Run headwaters encompasses springy, saturated flats and swales along a ravine bottom stream. This forested wetland covers approximately six acres. Soils are evidently strongly acidic and oligotrophic based on vegetation present. Dominant and/or characteristic plants of this occurrence include *Acer rubrum* (red maple), *Nyssa sylvatica* (black gum), *Liriodendron tulipifera*, *Ilex verticillata* (winterberry), *Kalmia latifolia* (mountain laurel), *Vaccinium fuscatum* (hairy highbush blueberry), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (American false hellbore), *Carex leptalea* (bristly-stalk sedge), *Carex gynandra* (a sedge), *Glyceria melicaria* (slender mannagrass), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis*

(royal fern), and *Viola cucullata* (marsh blue violet). The occurrence is of high quality, although the site was probably logged in the distant past. A surprising population of the high mountain plant *Trientalis borealis* (northern starflower) occurs here at an exceptionally low elevation.

Another occurrence at Jackson Hollow is comprised of three suboccurrences covering five, six, and one-half acres. These springy, saturated flats and swales along the bottom of Jackson Hollow have soils that are evidently strongly acidic and oligotrophic. Dominant and/or characteristic plants include *Acer rubrum*, *Nyssa sylvatica*, *Liriodendron tulipifera*, *Toxicodendron vernix* (poison sumac), *Ilex verticillata*, *Kalmia latifolia*, *Vaccinium fuscatum*, *Symplocarpus foetidus*, *Veratrum viride*, *Carex leptalea*, *Glyceria melicaria*, *Maianthemum canadense* (Canada mayflower), *Osmunda cinnamomea*, and *Viola cucullata*. The area is notable for an abundance of disjunct mountain species in the Piedmont. Forest stands, especially those east of Co. Rt. 629, are of exceptionally high quality. The occurrence has been reduced in size, however, by beaver activity in the middle and lower part of Jackson Hollow and by a telephone line right-of-way near Co. Rt. 629.

A third element occurrence of montane acidic seepage swamp is in a rocky ravine on the western slope of High Acre Ridge. This property is on private land and access was arranged by Leslie Grayson (VOF). This cool, sheltered ravine bottom is filled with bouldery quartzite colluvium and is relatively steep. This environmental setting differs considerably from that of other forested seepage wetlands in the Bull Run Mountains, and the soil environment may be somewhat less acidic. The occurrence is relatively large (5-10 acres) and of high quality, with slight disturbance by blowdowns and human activity at the downslope and upslope ends. Dominant and/or characteristic trees include *Liriodendron tulipifera*, *Acer rubrum*, *Nyssa sylvatica*, and *Quercus rubra* (northern red oak), with mature specimens 60-100 cm dbh common. There is a high diversity of small trees and shrubs, including *Lindera benzoin*, *Asimina triloba* (pawpaw), *Chionanthus virginicus* (fringetree), *Alnus serrulata* (smooth alder), *Ilex verticillata*, *Vaccinium fuscatum*, *Rhododendron periclymenoides* (wild azalea), and *Hamamelis virginiana* (witch-hazel). The fern-rich herbaceous layer contains *Osmunda cinnamomea*, *Osmunda regalis*, *Dryopteris celsa* (log fern), *Dryopteris carthusiana* (Spinulose wood-fern), *Dryopteris goldiana* (Goldie's wood-fern), *Athyrium filix-femina* (Lady fern), *Carex* spp., *Viola cucullata*, *Aster divaricatus* (white wood aster), *Lycopodium obscurum* (common tree clubmoss), and *Platanthera clavellata* (small green wood orchid).

Boundary Justification: The boundary encompasses the four community element occurrences, the historical locations for three rare plants, and most of the surrounding rugged, forested landscape in this part of the Bull Run Mountains. There is little doubt that more intensive and wide-ranging inventory would reveal additional significant community occurrences.

Threats: Development of vacation and permanent homes is increasing in this area. Several tracts not currently in conservation easements or owned by VOF are high priorities for protection. The potential impact of beaver populations and excessive deer browse on significant community occurrences is a concern. Gypsy moth infestations, in concert with several droughty years, led to considerable mortality of oaks on the Bull Run Mountain ridges in the late 1980s and early 1990s. The period of massive gypsy moth outbreaks appears to have passed, but these pests remain a threat to forest health.

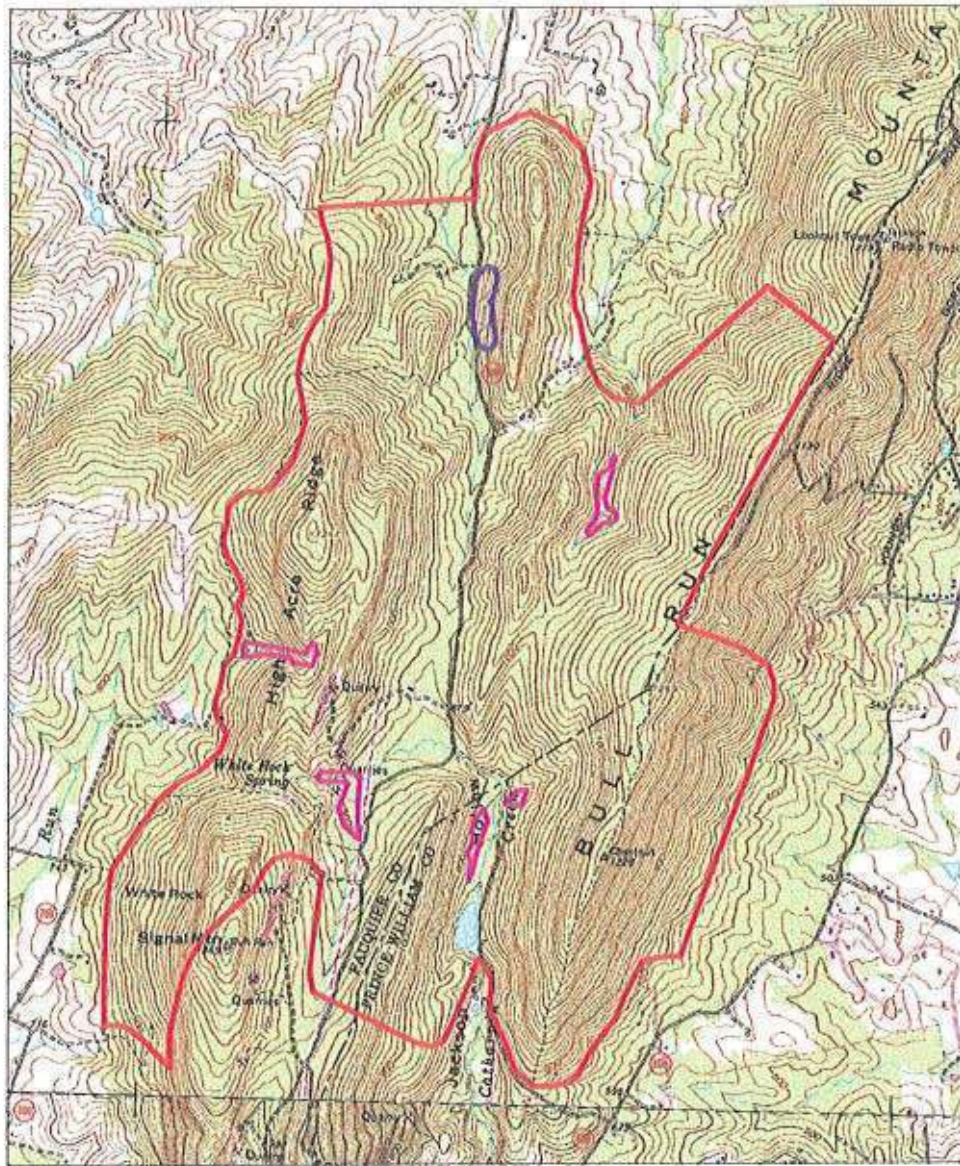
Management Recommendations: On VOF lands, maintain current land use and management as a natural area. Low-level recreation (hiking), nature study, and scientific research are appropriate activities that are compatible with long-term conservation goals. The impact of deer populations on vegetation and forest reproduction may need study, assessment, and remedial action in certain localities. Beavers have already destroyed a portion of the Jackson Hollow seepage swamp and have recently become re-established in a marsh at the lower end of the hollow. Regular monitoring of this population is recommended, to prevent upstream invasion of intact seepage swamp forests. Use of broad-spectrum insecticides to control gypsy moth is not recommended because of their negative impacts on other lepidopterans and crustaceans. If the need to control gypsy moth arises in the future, contact DCR-DNH for recommendations of the use of gypsy moth-specific treatments.

Protection Recommendations: Under current ownership and land uses, the VOF lands at this site are relatively well protected, and additional conservation easements are held by VOF on several adjacent private tracts. However, State Natural Area Dedication would provide much stronger, permanent conservation of these lands and other critical tracts at this site. Natural Area Dedication is biologically justified, and is recommended by DCR-DNH. Potential land acquisitions that could enhance this proposed Natural Area should be studied and prioritized. Additional acquisitions or conservation easements by VOF are justified as means to ensure the long-term protection of the ecological systems and species of potential conservation concern. Conservation actions that can improve linkages between VOF properties and/or private conservation lands and increase the scope of natural area corridors should be given highest priority. See the Discussion section (p. 27) for additional information.




References:

Allard, H. A. and E. C. Leonard. 1943. The vegetation and floristics of Bull Run Mountain, Virginia. *Castanea* 8, nos. 1-3:1-64.

Figure 2. Site map and element locations of Bull Run Mountain - North tract. Boundaries are approximate.



from Middleburg USGS 7.5" quadrangle

-  Mesic Mixed Hardwoods Forest
-  Montane Acidic Seepage Swamp
-  Conservation Boundary



900 0 900 Meters



BULL RUN MOUNTAINS - SOUTH

LOCATION: Fauquier and Prince William Counties

SIZE: 2,523 acres

U.S.G.S. QUADRANGLE: Thoroughfare Gap

BIODIVERSITY RANK: B3

DIRECTIONS: The site encompasses portions of the two main ridges of the Bull Run Mountains north of Thoroughfare Gap, from the Southern Railroad tracks on the south for ca. 4.7 km to the north.

Table 4. NATURAL HERITAGE RESOURCES:

Scientific Name	Common Name	Survey Site	Global Rank	State Rank	EO Rank
Significant Geological Feature:					
Weaverton Quartzite Cliff/Exposures		High Point Ridge	-	-	-
Communities:					
Chestnut Oak Forest	-	High Point Ridge	-	S5	AB
Mesic Mixed Hardwood Forest	-	Catletts Branch	-	S5	B
Piedmont / Mountain Acidic Cliff	-	High Point Ridge	-	S3?	A
Pine-Oak / Heath Woodland	-	Eastern Ridge	-	S4	B
Pine-Oak / Heath Woodland	-	High Point Ridge	-	S4	B
Plants:					
<i>Crataegus pruinosa</i> *	A hawthorn	-	G5	S1	H
<i>Fraxinus nigra</i> #	Black ash	Catletts Branch	G5	S3	C
<i>Spiranthes ochroleuca</i> *	Yellow ladies'- tresses	-	G4	S1	H
Animals:					
<i>Cordulegaster erronea</i> #	Erroneous biddie	Catletts Branch	G4	S3	-

* = historic records from the site however they were not relocated during the current survey

= indicates a "watchlist" (uncommon to rare) species. Occurrences of watchlist species are neither ranked nor entered into BCD, but general population trends are recorded and periodically reviewed.

Site Description: This site is characterized by steep, forested terrain. Although situated in the Piedmont, the environmental and biotic character of the site is distinctly montane, with extensive *Quercus montana* (chestnut oak) and ericad forests occupying the steep, rocky slopes and ridges. In the intervening valley of Catletts Branch, more mesic mixed hardwood forests and forested seepage wetlands occur on lower slopes and along small streams. Major features of this site are the dry, rocky ridge crests which rise 180-240 m (600-800 ft) in elevation above the general level of the surrounding Piedmont landscape. Along the crest of the High Point Mountain ridge are large exposures of white Weaverton quartzite that are considered a state-significant geologic feature by DCR-DNH. Such exposures and the plant communities associated with them are frequent in the mountains of western Virginia, but very rare eastward in the Piedmont. The survey work conducted

at this site in 1998 was confined to tracts owned by the Virginia Outdoors Foundation, and the level of funding permitted made it necessary to focus attention only on the highest potential habitats within these relatively large tracts.

The area has probably always been lightly settled due to its rugged topography. Most of the timber was cut in the late 1800s or early 1900s and many stands are now in relatively mature, second growth. A number of vacation and permanent homes and several old quarries are located within the site boundaries. A sizeable tract (>1100 acres) is owned by the Virginia Outdoors Foundation, some of it managed as a nature preserve by Friends of Bull Run Mountain under an agreement with VOF. To date, five significant community occurrences have been documented within the site (Fig. 3):

CHESTNUT OAK FOREST

A relatively mature, mixed oak forest covering at least 600 acres is found on the slopes of both flanks of the westernmost (High Point) ridge in the Bull Run Mountains north of Thoroughfare Gap. The slopes are submesic to subxeric, often steep and rocky, and with variable aspect. The underlying bedrock is Weaverton quartzite. Soils are sandy and oligotrophic. *Quercus montana* (chestnut oak) is the most abundant and characteristic oak, but *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus coccinea* (scarlet oak) are common associates. Other tree associates are *Carya alba* (mockernut hickory) and *Carya glabra* (pignut hickory), *Nyssa sylvatica* (black gum), *Acer rubrum* (red maple), and *Liriodendron tulipifera* (tulip-tree). Shrub layers are variable. Some areas are dominated by *Cornus florida* (flowering dogwood) and patchy *Vaccinium pallidum* (early lowbush blueberry), while others have dense thickets of *Kalmia latifolia* (mountain laurel) and/or *Gaylussacia baccata* (black huckleberry). Herbaceous growth is rather sparse. At least sizeable patches within this forest appear to be greater than 100 years old. Trees with diameters at breast height exceeding 60 cm (2 ft) are common. Mixed oak and oak-hickory variants are most prevalent on the east-facing slopes while more monospecific *Quercus montana* stands are prevalent on the upper west-facing slopes. This is probably the largest most continuous stand of chestnut oak/ericad forest in the central and eastern portion of the Virginia Piedmont. Views from rock outcrops within the occurrence area are spectacular and the area is notable as an outlier of montane environments and biota in the Piedmont. There is some residual damage from heavy gypsy moth outbreaks in the late 1980s and early 1990s.

MESIC MIXED HARDWOOD FOREST

A mature, mixed hardwood forest covering approximately 40 acres is found on the slopes and well-drained terrace flats along both sides of Catletts Branch. Soils are moderately fertile, sandy loams derived from Weaverton quartzite. Characteristic species are *Fagus grandifolia* (American beech-tree dominant), *Liriodendron tulipifera* (tulip-tree), *Quercus alba*, *Quercus rubra*, *Lindera benzoin* (spicebush), *Carpinus caroliniana* (American hornbeam), *Polystichum acrostichoides* (Christmas fern), *Cimicifuga racemosa* (black bugbane), *Amphicarpaea bracteata* (hog peanut), and *Athyrium filix-femina* ssp. *asplenioides* (lady fern). Large trees in the 60-125 cm (2-4 ft) dbh range, especially of *Fagus grandifolia*, are common. Selective logging was probable in the past, which may have favored *Fagus* by cutting of the more valuable *Quercus* spp. An abundance of *Fagus* in all strata suggests that this species will continue to dominate barring disease or other stochastic events. This

is a moderate size occurrence, in good to excellent condition but slightly degraded by exotics. The exotic plants *Lonicera japonica* (Japanese honeysuckle) and *Microstegium vimineum* (eulalia) are locally invasive.

PIEDMONT/MOUNTAIN ACIDIC CLIFF

This Piedmont/mountain acidic cliff is defined by massive Weaverton quartzite exposures on the upper west slope of Bull Run Mountain, just below the crest, from High Point Mountain south for ca. 0.5 mi. Habitats for rooted plants are on xeric cliff faces, ledges, and surfaces of room-sized talus, and are essentially limited to crevices and a few narrow ledges with mats of organic matter. The sparse lithophytic vegetation consists of scattered scrubby specimens of *Pinus* spp., *Quercus montana*, *Populus grandidentata* (bigtooth aspen), *Rhus typhina* (staghorn sumac), *Parthenocissus quinquefolia* (Virginia creeper), and *Kalmia latifolia*, along with a few herbaceous, rock-loving species such as *Heuchera americana* (American alumroot), *Asplenium montanum* (mountain spleenwort), and *Polypodium virginianum* (Rock polypody). Rock-tripe lichens of the genus *Umbilicaria* (sensu lato) are dominant. The cliff supports a nesting occurrence of Common Ravens (*Corvus corax*), a very local breeding bird in the Piedmont (Flemming, pers. obs.). Crevices near the base of the outcrop serve as hibernacula for an isolated population of *Crotalus horridus horridus* (timber rattlesnake). This disjunct population is one of a handful of known Piedmont rattlesnake populations and must be considered in danger of extirpation because of its isolation and unwarranted killings by rattlesnake hunters and other people (M. Martin, pers. comm. to L. Grayson). The Piedmont/Mountain Acidic Cliff is a poorly known community type and is therefore difficult to rank. This is a sizeable occurrence of high quality, however, and is certainly very significant as a montane outlier in the Piedmont.

PINE-OAK/HEATH WOODLAND

Along the ridge crest at the top of the High Point cliff is an open-canopy Pine-Oak / Heath Woodland dominated by *Pinus pungens* (table-mountain pine), a species that is rare and local east of the mountains in Virginia. This xeric, rocky habitat has minimal soil development and the soil fertility regime is highly oligotrophic. The shallow pockets and thin layers of soil that are present consist of sand and loamy sand with numerous rock fragments and a 2-5 cm deep layer of flammable pine needle and ericaduff. The occurrence is long and linear, covering probably less than ten acres, with stunted trees (less than ten meters tall) forming an open to very open canopy. Associates include scrubby *Quercus montana*, *Carya* spp., *Pinus virginiana* (Virginia pine), *Quercus rubra*, *Quercus velutina*, and *Sassafras albidum* (sassafras). Dense ericaceous shrub layers of *Kalmia latifolia*, *Gaylussacia baccata* (black huckleberry), and *Vaccinium pallidum* are typical except where bare rock surfaces prevail. Herbs are sparse, but include scattered individuals of *Baptisia tinctoria* (yellow wild indigo), *Carex umbellata* (hidden sedge), *Danthonia spicata* (poverty oat-grass), *Dichanthelium depauperatum* (starved panic grass), and *Tephrosia virginiana* (goat's-rue). This is a rather small occurrence, but it is of high quality and is very significant as a montane outlier in the Piedmont.

Another occurrence of this community type is located at and near the summit of the easternmost ridge of the Bull Run Mountains north of Thoroughfare Gap. The exposed ridge crest habitat is xeric with highly oligotrophic soils and a history of fire as evidenced by burn scars and charcoal on the

ground. The underlying bedrock here is also Weaverton quartzite. This occurrence, covering about ten acres, has an open to somewhat closed canopy and is dominated by *Pinus rigida* (pitch pine). *Pinus* trees are mostly about 15 m tall and 20-40 cm dbh. Associates include scrubby *Quercus prinus*, *Quercus velutina*, *Quercus marilandica* (blackjack oak), *Nyssa sylvatica*, and *Castanea dentata* (American chestnut). Dense ericaceous shrub layers of *Kalmia latifolia*, *Gaylussacia baccata*, and *Vaccinium pallidum* are typical except on bare rock surfaces. *Comptonia peregrina* (sweet fern) is abundant in a powerline clearing. Herbs are sparse, but include scattered individuals of *Baptisia tinctoria*, *Danthonia spicata*, and *Pteridium aquilinum* var. *latiusculum* (bracken fern). Although this community type is locally frequent in the mountains, it is exceedingly rare in the Piedmont due to a general lack of suitable habitat and elevation. Several species including *Pinus rigida*, *Comptonia peregrina*, and *Spiraea betulifolia* var. *corymbosa* (dwarf spiraea) are at their easternmost limits in Virginia here. This occurrence of Pine-Oak / Heath Woodland is a rather small, but of high quality and very significant as a montane outlier in the Piedmont.

Although the physiognomy and composition of the area's Pine-Oak / Heath communities are largely influenced by stressful edaphic (soil) conditions, the long-term viability of many component species is also dependent on periodic fire. This is particularly true of both dominant pines (*Pinus pungens* and *P. rigida*), which have serotinous, heat-responsive cones and seeds that require a mineral soil substrate for germination (Fowells 1965).

Boundary Justification: The southern site boundary encompasses the five community element occurrences, the historical locations of two rare plants, and most of the surrounding rugged, forested landscape in this part of the Bull Run Mountains. More intensive and wide-ranging inventory would likely reveal other significant community occurrences. In 1978, the botanist C.H. Racine conducted an evaluation of the western slope of Bull Run Mountain north of Thoroughfare Gap for eligibility as a National Natural Landmark (Racine 1978). Although much of this area is on private land and was not surveyed by DCR-DNH in 1998, Racine's findings make clear that extensive stands of mature forest extend to the lower, more mesic portions of the western slope and comprise an important element of biological diversity within the large site delineated here. An old-age mesophytic hardwood forest dominated by *Liriodendron tulipifera* and *Lindera benzoin* is also reported from the lower part of the western slope near Rt. 628 by Godfrey (1980).

Threats: Development of vacation and permanent homes is increasing in the area. Gypsy moth infestations, in concert with several droughty years, led to considerable mortality of oaks on the Bull Run Mountain ridges in the late 1980s and early 1990s. The period of massive gypsy moth outbreaks appears to have passed, but these pests remain a threat to forest health. Long-term fire suppression is a threat to the viability of Pine-Oak / Heath Woodlands at this site, since fire is a natural ecological process in this ecosystem. Without at least periodic fire, the dominant pines will evanesce and the communities will undergo successional change to a more closed, xeric oak-heath forest.

Management Recommendations: On VOF lands, maintain current land use and management as a natural area. Low-level recreation (hiking), nature study, and scientific research are appropriate activities that are compatible with long-term conservation goals. The trail development, interpretive

activities, and natural area management by Friends of Bull Run Mountain in a portion of this area have been positive activities, focusing attention on the biological value of Bull Run Mountain and the need to protect it. The impact of deer populations on vegetation and forest reproduction may need study, assessment, and remedial action in certain localities. Use of broad-spectrum insecticides to control gypsy moth is not recommended because of their negative impacts on other lepidopterans and crustaceans. If the need to control gypsy moth arises in the future, contact DCR-DNH for recommendations of the use of gypsy moth-specific treatments.

The Pine-Oak / Heath Woodlands of this site are generally considered pyrophytic (fire-dependent) vegetation types, with an average fire-return interval of 25+ years probably required to maintain the viability of dominant pines. Until fairly recently, both natural and anthropogenic fires were frequent enough in the Bull Run Mountains to ensure the perpetuation of these communities, but it is uncertain whether that will be the case in the future. As a result, the use of prescribed fire as a management tool may become a conservation issue at this site.

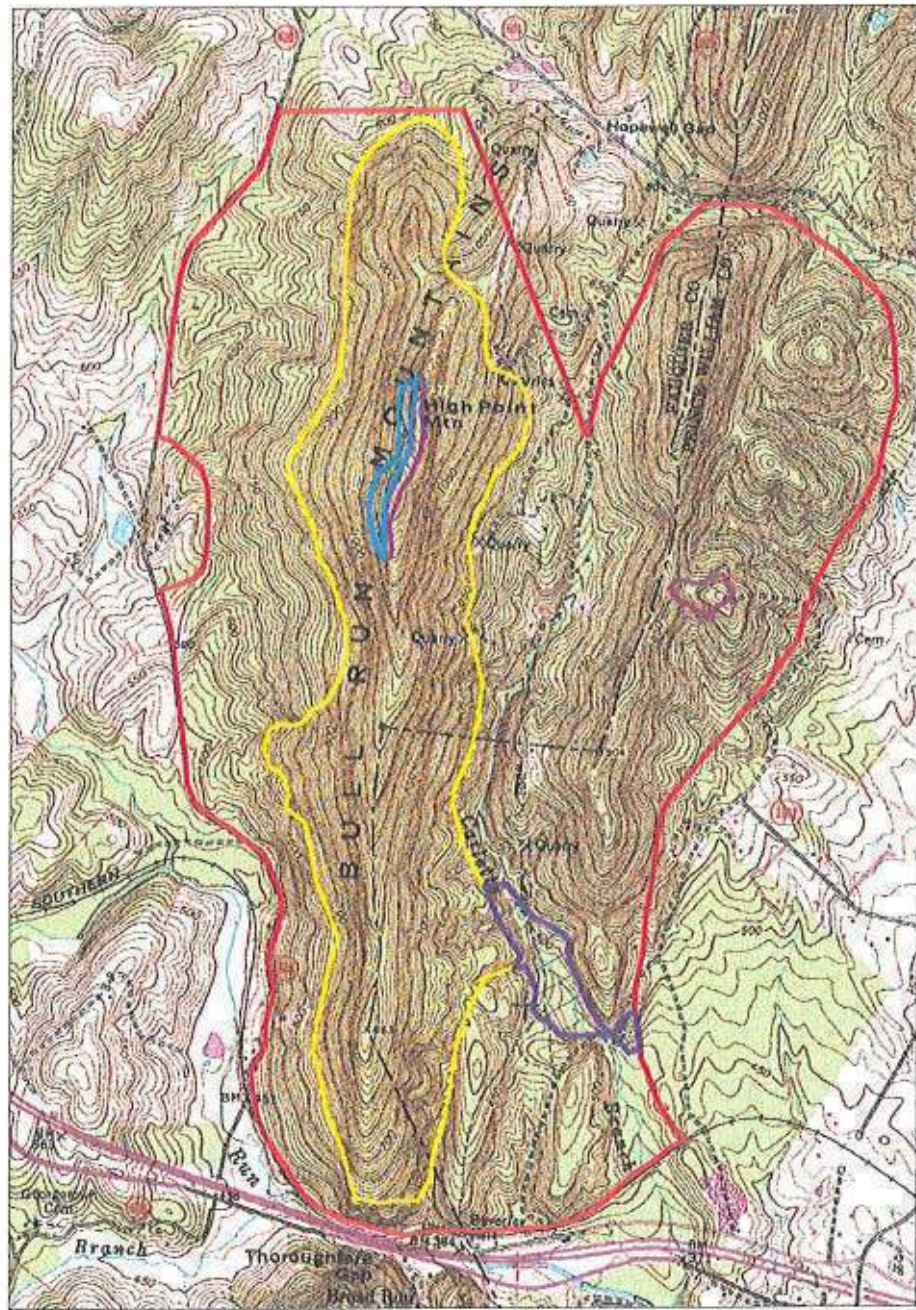
Protection Recommendations: More than 20 years ago, Racine (1978) considered the undisturbed, old-age forest and mountain disjuncts of the High Point Ridge to be “truly unusual” for the Piedmont and “nationally significant.” Under current ownership and land uses, the VOF lands at this site are relatively well protected. However, State Natural Area Dedication would provide much stronger, permanent conservation of these lands and other critical tracts at this site. Natural Area Dedication is biologically justified, and is recommended by DCR-DNH. Potential land acquisitions that could enhance this proposed Natural Area should be studied and prioritized. Additional acquisitions or conservation easements by VOF are justified as means to ensure the long-term protection of the ecological systems. Conservation actions that can improve linkages between VOF properties and/or private conservation lands and increase the scope of natural area corridors should be given highest priority. See the Discussion section (p. 27) for additional information.

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¹ This book discusses the High Point ridge. While it provides a good overview, some of the specific information given is inaccurate. For instance, there is no sourwood (*Oxydendrum arboreum*) or bear oak (*Quercus ilicifolia*) at the summit of High Point, as stated, nor is the western base of this ridge underlain by diabase rocks.

Figure 3. Site map and element locations of Bull Run Mountain - South tract. Boundaries are approximate.



from Thoroughfare Gap USGS 7.5' Quadangle

- Piedmont/Mountain Acidic Cliff
- Mesic Mixed Hardwood Forest
- Pine-Oak/Heath Woodland
- Chestnut - Oak Forest
- Conservation Boundary



400 0 400 Meters

DISCUSSION

This report presents detailed information on two sites in the Bull Run Mountains that are important to the conservation of ecosystems, community types, and uncommon to rare species in the mid-Atlantic region. Although no rare species monitored by DNH-DCR were located, nine significant natural community occurrences and a number of uncommon to rare "watchlist" species were documented. Because of very limited funding, it was not possible to intensively survey all parts of these sites, nor to visit them at every season. For the most part, field work was limited to reconnaissance inventories of high priority areas within the two large sites. Therefore, the possible occurrence of rare species cannot be ruled out, especially considering the sizeable list of historical rare plant records in the general Bull Run Mountain area (Table 2, p. 9). In addition, although our preliminary identifications of collections in certain animal groups (e.g., some beetles, mayflies, stoneflies, and amphipods) did not reveal any rarities, taxonomically difficult specimens have been sent to experts and confirmed determinations are still pending. Identifications for odonates (dragonflies and damselflies), lepidoptera (butterflies and moths), and all vertebrates may be considered verified.

It should be noted that seven species of odonates and two groundwater amphipods currently on DCR-DNH's watch list were observed (See Site Survey Reports for listing). The odonates and amphipod from Jackson Hollow are closely associated with acidic seepage wetlands. These habitats and their associated faunal assemblages are widely distributed throughout the state but are very localized in occurrence. The presence of so many uncommon species in a discrete area is clearly indicative of a high quality habitat which merits protection.

Additional biotic inventory of the VOF tracts and other sites in the Bull Run Mountains is certainly recommended if funding becomes available. In many respects, however, the presence of so many excellent natural community occurrences is a better indicator of biological diversity and significance than the documented presence of rare species.

Biogeographic Significance of the Bull Run Mountains

Because of their geographic location, the Bull Run Mountains are a meeting ground for plants and animals with divergent biogeographic affinities (Harvill *et al.* 1992). The flora of this isolated Piedmont mountain range contains a number of typical northern/Appalachian plants occurring in more or less isolated populations at or near their eastern, low elevation limits at this latitude. While the overall vegetation and flora is generally montane in character, certain habitats (particularly acidic seepage wetlands) support a number of typical Coastal Plain/lowland plants occurring at or near the western limits of their distribution in Virginia (Table 4).

This peculiar mingling of phytogeographic elements is not only interesting and noteworthy from a floristic and scientific perspective, but contributes to the Bull Run Mountains' potential significance as a conservation area. Because biological species tend to vary morphologically, physiologically, and/or behaviorally across their geographic ranges, it is now generally accepted that peripheral and disjunct populations may be particularly important to the conservation of a species' overall genetic

Table 5. Phylogeographic elements of the Bull Run Mountain flora. Representative, peripheral species of a northern/Appalachian group and a Coastal Plain/low elevation group are listed. Species reported by Allard and Leonard (1943, 1944, 1952) but not observed during 1998 DCR-DNH field surveys are asterisked.

Northern/Appalachian species

Comptonia peregrina (sweet-fern)
Corydalis sempervirens (pale corydalis)
Dryopteris goldiana (Goldie's woodfern)
Fraxinus nigra (black ash)
Glyceria melicaria (slender mannagrass)
Isoetes caroliniana (Carolina quillwort)
Lycopodiella inundata (no. bog clubmoss)*
Lycopodium clavatum (staghorn clubmoss)
Maianthemum canadense (Canada mayflower)
Pinus pungens (table-mountain pine)
Populus tremuloides (quaking aspen)*
Pyrola elliptica (shinleaf)*
Spiraea betulifolia var. *corymbosa* (dwarf spiraea)
Trientalis borealis ssp. *borealis* (no. star-flower)
Trillium cernuum (nodding trillium)*
Veratrum viride (American false-hellebore)

Coastal Plain/lowland species

Carex atlantica ssp. *capillacea* (Howe's sedge)
Carex seorsa (weak stellate sedge)
Cuscuta compacta (sessile dodder)
Dulichium arundinaceum (three-way sedge)
Ilex opaca (American holly)*
Juncus canadensis (Canada rush)
Juncus scirpoides (a rush)
Lobelia puberula (downy lobelia)*
Mikania scandens (climbing boneset)
Phoradendron leucarpum (American mistletoe)*
Polygala incarnata (pink milkwort)*
Quercus falcata (southern red oak)
Toxicodendron vernix (poison-sumac)
Woodwardia areolata (netted chain-fern)

diversity and potential for evolutionary adaptations (Meffe *et al.* 1997; see also Ellstrand 1992 and Hawley and DeHayes 1994). Because the Bull Run Mountains harbor so many peripheral plant species, conservation of large natural areas and communities here would serve as an effective way to conserve important populations of individual species.

Similar biogeographic factors are present in the Bull Run Mountains' fauna. A prime example is the Timber Rattlesnake (*Crotalus horridus horridus*) which, although not seen during this survey, is well documented in the area (M. Martin, unpublished data on file at DCR-DNH). This species has declined in all northeastern states where it occurs and has been extirpated from two states, primarily because of habitat loss and direct killing by humans (Mitchell, 1994). In Virginia, the Bull Run Mountain population is one of the easternmost occurrences of this subspecies in the state and probably one of the last populations in the Piedmont (Mitchell, 1994). Overall, its future persistence in the Bull Run Mountains is questionable because of its proximity to urban areas and an increasing human presence in these foothills. Urbanization, along with accompanying loss of habitat, is the main contributing factor to the decline in the state-endangered, Canebrake Rattlesnake (*C. horridus atricaudatus*) in the southeastern Coastal Plain. Conservation of the Bull Run Mountains populations of Timber Rattlesnake would help maintain the genetic diversity of the

species. Protection of large blocks of habitat are important to maintain the integrity of this population. Information on den site locations should remain confidential and should not be distributed to the public. A second example of an animal occurring along the edge of its range at Bull Run Mountain is the Common Raven (*Corvus corax*) which is an uncommon breeder east of the Blue Ridge in Virginia (VSO, 1987).

Opportunities for Natural Community and Ecosystem Conservation

The Bull Run Mountain sites described in this report contain a good diversity of ecological communities, particularly for the Piedmont region. These include excellent occurrences of several deciduous forest types, seepage wetlands, edaphic/pyrophytic pine woodlands, and a lithophytic outcrop community. Of particular interest is the fact that most of the area's significant natural communities are montane outliers (see p. 4). Just as it is important to conserve peripheral and outlying populations that contribute to a species' genetic diversity, so too is it important to protect good outliers of natural communities. Such isolated stands are often compositionally unique or at least different from average expressions of a type, and help circumscribe the limits of variation within defined community types. They also contribute to biological richness at the ecosystem and ecoregional scales (The Nature Conservancy 1997).

Protection of individual sites containing significant elements of biodiversity is a good first step toward conservation of critical habitats in the Piedmont of Virginia. However, it is an inescapable fact that ecosystem-level conservation requires an approach that emphasizes the linkage of natural areas and the viability of conservation sites within a larger landscape context. The two conservation sites identified in this report are relatively large (2,183 acres and 2,523 acres), with core natural areas (VOF lands) and largely natural adjacent tracts that create many possibilities for linkage. These are compelling attributes in the Piedmont region, whose natural landscapes have been extensively destroyed, modified, and fragmented by several centuries of settlement, farming, and most recently urban/suburban development. Fragmentation is one of the greatest threats to biological diversity (Meffe *et al.* 1997; Noss and Cooperrider 1994). Therefore, intact, large-patch natural community occurrences are important for maintaining the viability of larger ecosystems, as well as populations of individual species, particularly those sensitive to human intrusion (*e.g.*, timber rattlesnakes) or sensitive to edge effects (*e.g.*, parasitism of migratory songbird nests by brown-headed cowbirds). The relatively unfragmented character of the Bull Run Mountains' landscape provides opportunities for effective large scale natural area conservation in the Piedmont.

Recommendation for Long-Term Conservation and Protection: Natural Area Dedication

In recent years, there has been a shift away from conservation of small areas protecting specific populations of rarities toward landscape-level approaches that protect ecosystems and entire assemblages of species before they become endangered (Noss and Cooperrider 1994). Such approaches frequently use vegetation, natural communities, or surrogates thereof as "coarse filters" for the conservation of biotic resources representative of those ecosystems and assemblages. The protection recommendations presented in this report are consistent with this kind of proactive, large-scale approach to conservation.

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The Virginia Piedmont is now a highly disturbed and fragmented region in which natural areas of substantial size are sparsely distributed. The Bull Run Mountain area is important to conservation

in the Piedmont because of its relatively rugged, undeveloped terrain, its comparatively large and unfragmented natural areas, its role as a biogeographic center of peripheral to disjunct biota, and its diversity of high quality natural communities.

Under current ownership, VOF lands in the Bull Run Mountains are relatively well protected. In some cases, these tracts adjoin privately owned lands subject to conservation easements administered by VOF. In addition, a sizeable portion of the VOF tract located just north of Thoroughfare Gap is currently managed as a natural area under an arrangement with a private conservation group, Friends of Bull Run Mountain. However, DCR-DNH believes that Natural Area Dedication is the most appropriate conservation tool for strong, permanent protection of VOF lands and other key tracts comprising the two conservation sites. Natural Area Dedication is a protection option available to private landowners, state agencies, and other public bodies excepting the federal government. Dedication of a property places it in the Virginia Natural Areas preserve system managed by DCR. The landowner retains ownership rights and the right to sell or transfer the property, but permanent deed restrictions ensure that the land is preserved in its natural state in perpetuity. The owner of a dedicated natural area may receive certain financial benefits, such as a reduction of federal estate taxes and Virginia inheritance taxes, a reduction of real estate assessment values, and entitlement to a charitable deduction for state and federal income tax purposes.

Dedication of VOF lands and possibly other tracts in the Bull Run Mountains would create a substantial Natural Area and would be consistent with VOF's organizational mission and ongoing conservation efforts in the region. Potential land acquisitions and other conservation actions that could enhance and enlarge this proposed Natural Area should be studied and prioritized. Additional acquisitions by VOF or DCR, private land dedications, or conservation easements within the boundaries of the two conservation sites are justified as means to ensure the long-term protection of this area's landscape and ecological systems. Actions that could improve linkages between state-owned properties and/or private conservation lands and increase the size and scope of natural area corridors should be given highest priority.

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**APPENDIX A:
A PRELIMINARY CLASSIFICATION OF
VIRGINIA NATURAL COMMUNITY GROUPS**

**A Preliminary Classification of
VIRGINIA NATURAL COMMUNITY GROUPS**

Virginia Dept. of Conservation and Recreation - Division of Natural Heritage

February 1, 1998

TERRESTRIAL SYSTEM

High Mountain Communities

Red Spruce - Fraser Fir Forest
Red Spruce Forest
 Southern Appalachian Subtype
 Central Appalachian Subtype
Southern Appalachian Grassy Bald
Northern Red Oak Forest
Northern Hardwood Forest
 High Allegheny Subtype
 Central Appalachian Subtype
 Southern Appalachian Subtype
High Elevation Boulderfield Forest/Woodland

Low Elevation Mesic Forests

Rich Cove/Mesic Slope Forest
Acidic Cove Forest
Eastern Hemlock Forest
Mesic Mixed Hardwood Forest
Basic Mesic Forest
Arborvitae Slope Forest

Low Elevation Dry and Dry-Mesic Forests and Woodlands

Eastern White Pine Forest
Low Elevation Boulderfield Forest/Woodland
Carolina Hemlock Forest
Pine - Oak / Heath Woodland
Chestnut Oak Forest
Montane Oak - Hickory Forest
Dry Oak - Hickory Forest
Dry-Mesic Oak - Hickory Forest
Basic Oak - Hickory Forest

Oak - Hickory Woodland/Savanna
 Typic Subtype
 Basic Subtype
Dry Calcareous Forest/Woodland
 Montane Subtype
 Coastal Plain Subtype
Dry-Mesic Calcareous Forest
Montane Basic Woodland
Montane Shale Woodland
Ultramafic Woodland
Xeric Hardpan Forest
Mixed Moisture Hardpan Forest

Rock Outcrops and Barrens

High Elevation Outcrop Barren
Low Elevation Acidic Outcrop Barren
Low Elevation Basic Outcrop Barren
Limestone/Dolomite Barren
Xeric Calcareous Cliff
Mesic Calcareous Cliff
Piedmont/Mountain Basic Cliff
Piedmont/Mountain Acidic Cliff
Alluvial Cobble Barren
Montane Pine Barren
Piedmont/Coastal Plain Heath Bluff
Central Appalachian Shale Barren
Granitic Flatrock
Diabase Flatrock
Ultramafic Barren
Riverside Outcrop Barren
 Typic Subtype
 Terrace Woodland Subtype
Moss/Lichen Boulderfield

Maritime Zone Communities

Maritime Dune Grassland
Maritime Scrub
Maritime Dune Woodland
Maritime Evergreen Forest
Maritime Loblolly Pine Forest
Maritime Mixed Forest

Sandy Woodlands of the Coastal Plain and Outer Piedmont

Pine/Scrub Oak Sandhill
Fluvial Terrace Woodland
Loblolly Pine Savanna

Early Successional Terrestrial Communities of Altered Habitats

Loblolly Pine Forest
Mafic Old Field/Clearing
(additional community types to be defined at a later date)

PALUSTRINE SYSTEM

Alluvial Floodplains

Coastal Plain Levee Forest
Baldecypress - Tupelo Swamp
Coastal Plain Bottomland Hardwoods
Oxbow Pond
Coastal Plain Semipermanent Impoundment
Piedmont/Mountain Levee Forest
Piedmont/Mountain Swamp Forest
Piedmont/Mountain Bottomland Forest
Piedmont/Mountain Semipermanent Impoundment
Piedmont/Low Mountain Alluvial Forest
Montane Alluvial Forest
Sand/Gravel/Mud Bar and Shore
Rocky Bar and Shore
Riverside Prairie
River Scour Woodland

Non-alluvial Wetlands of the Mountains

Montane Basic Seepage Swamp
Montane Acidic Seepage Swamp
High Elevation Seepage Swamp
Appalachian Bog
High Elevation Seep
Mountain Pond

Shenandoah Valley Sinkhole Pond
Wet-Mesic Prairie
Calcareous Fen
Prairie Fen
Calcareous Spring Marsh/Muck Fen
Mafic Fen
Mafic Woodland Seep
Spray Cliff
Inland Salt Marsh

Non-alluvial Wetlands of the Coastal Plain and Piedmont

Sea Level Fen
Coastal Plain Depression Pond
Natural Lake Drawdown Shore
Non-Riverine Pine - Hardwood Forest
Non-Riverine Wet Hardwood Forest
Non-Riverine Swamp Forest
Longleaf Pine/Mixed Pine Flatwoods
Coastal Plain/Piedmont Seepage Bog
Coastal Plain/Piedmont Acidic Seepage Swamp
Coastal Plain Calcareous Seepage Swamp
Upland Depression Swamp

Pocosin and Peatland Communities of the Coastal Plain

High Pocosin
Pond Pine Forest/Woodland
Peatland Atlantic White Cedar Forest
Streamhead Atlantic White Cedar Forest

Non-tidal Maritime Communities

Maritime Wet Grassland
Maritime Shrub Swamp
Maritime Swamp Forest
Interdune Wet Pine Woodland
Interdune Pond
Estuarine Fringe Pine Forest

Freshwater and Oligohaline Tidal Wetlands

Tidal Freshwater Marsh
Tidal Oligohaline Marsh
Tidal Shrub Swamp
Tidal Baldcypress Woodland/Savanna
Tidal Baldcypress - Tupelo Swamp
Tidal Hardwood Swamp
Tidal Freshwater Pool/Gut
Estuarine Fringe Swamp Forest

Palustrine Algal Communities

Freshwater Algal Wetland

Early Successional Palustrine Communities of Altered Habitats

Coastal Plain Wet Meadow
(additional community types to be defined at a later date)

ESTUARINE SYSTEM

Low Salt Marsh
High Salt Marsh/Salt Meadow
Brackish Marsh
Salt Flat
Salt Scrub
(additional Estuarine community types to be defined at a later date)

MARINE SYSTEM

Upper Beach/Overwash Flat
High Energy Beach/Shore
(additional Marine community types to be defined at a later date)

LACUSTRINE SYSTEM

(Lacustrine community types to be defined at a later date)

RIVERINE SYSTEM

Alkaline Cold Spring and Spring Run
Acidic Cold Spring and Spring Run
Cool High Gradient River
Cool High Gradient Large Creek
Cool High Gradient Small Creek
Cool Medium Gradient River
Cool Medium Gradient Large Creek
Cool Medium Gradient Small Creek
Warm Medium Gradient River
Warm Medium Gradient Large Creek
Warm Medium Gradient Small Creek
Warm Low Gradient River
Warm Low Gradient Large Creek
Warm Low Gradient Small Creek

SUBTERRANEAN SYSTEM

Appalachian Karst Phreatic Community
Appalachian Cave Stream Community
Appalachian Cave Drip Pool/Epikarstic Community
Appalachian Terrestrial Riparian Cave Community
Appalachian Terrestrial Dung/Transitory Organic Matter Cave Community
Appalachian Edaphobitic/Epikarstic Terrestrial Cave Community
Significant Cave [with undefined community]