

**CONFIRMATION OF THE CENTRAL APPALACHIAN XERIC SHALE WOODLAND
(CHESTNUT OAK/ BEAR OAK/ POVERTY OATGRASS WOODLAND)
COMMUNITY IN SOUTH-CENTRAL PENNSYLVANIA**

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ABSTRACT

The mid-Appalachian shale barrens are unique woodland and herbaceous plant communities restricted to steep slopes with an exposed shale substrate. These features support a remarkable assemblage of endemic and near-endemic taxa with diverse evolutionary pathways. The United States National Vegetation Classification System categorizes the mid-Appalachian shale barrens into six community types or associations — the Central Appalachian Xeric Shale Woodland association was documented in Huntingdon Co., Pennsylvania, while conducting shale barren surveys at Raystown Lake. This community type was previously documented only from Maryland and Virginia; it was described as potentially occurring in Pennsylvania but had not been recorded.

Mid-Appalachian shale barrens were identified, delineated, and classified at Raystown Lake, Huntingdon Co., Pennsylvania, from May - September, 2018. The lake is operated by the U.S. Army Corps of Engineers for the primary purposes of flood control, recreation, hydroelectric power, fish and wildlife, and low-flow augmentation for water quality. It is the largest lake located entirely within Pennsylvania, with a maintained pool of approximately 3,358 ha (8,300 acres), surrounded by 8,498 ha (21,000 acres) of managed land (USACE 2018). Raystown Lake is situated within the Ridge and Valley Province, an area of alternating linear ridges and continuous valleys occurring from New York to Alabama (Fig. 1; USEPA 2013). Ridges are underlain by rock strata that have experienced uplift and are resistant to weathering, while valleys are underlain by softer sediments, shale, and limestone that have weathered to a moderately level surface. Shale barrens occur on slopes in this province as woodlands and openings with short-statured trees, and total vegetative cover that is often sparse relative to adjacent areas. The barrens are distributed in Maryland, Virginia, West Virginia, and south-central Pennsylvania where Upper Devonian, Ordovician, and Silurian shales outcrop (Platt 1951; Keener 1983). The shale surface layer of these barrens, combined with other site factors, severely inhibits seedling development, leading to their characteristic open vegetation structure.

Barrens typically occupy south-east to west facing exposures with steep inclines of 20 to 70 degrees (Keener 1983). The porosity of the coarse rock fragments allows water to infiltrate the soil horizons below but maintains a xeric surface layer. Seedlings that do not rapidly establish their roots below the surface layer of rock fragments perish during the summer. The barrens experience high surface temperatures during summer months, often exceeding 55°C for several hours per day, and have been known to reach 63°C (Platt 1951). These temperatures are greater than the tolerance level of most plants.

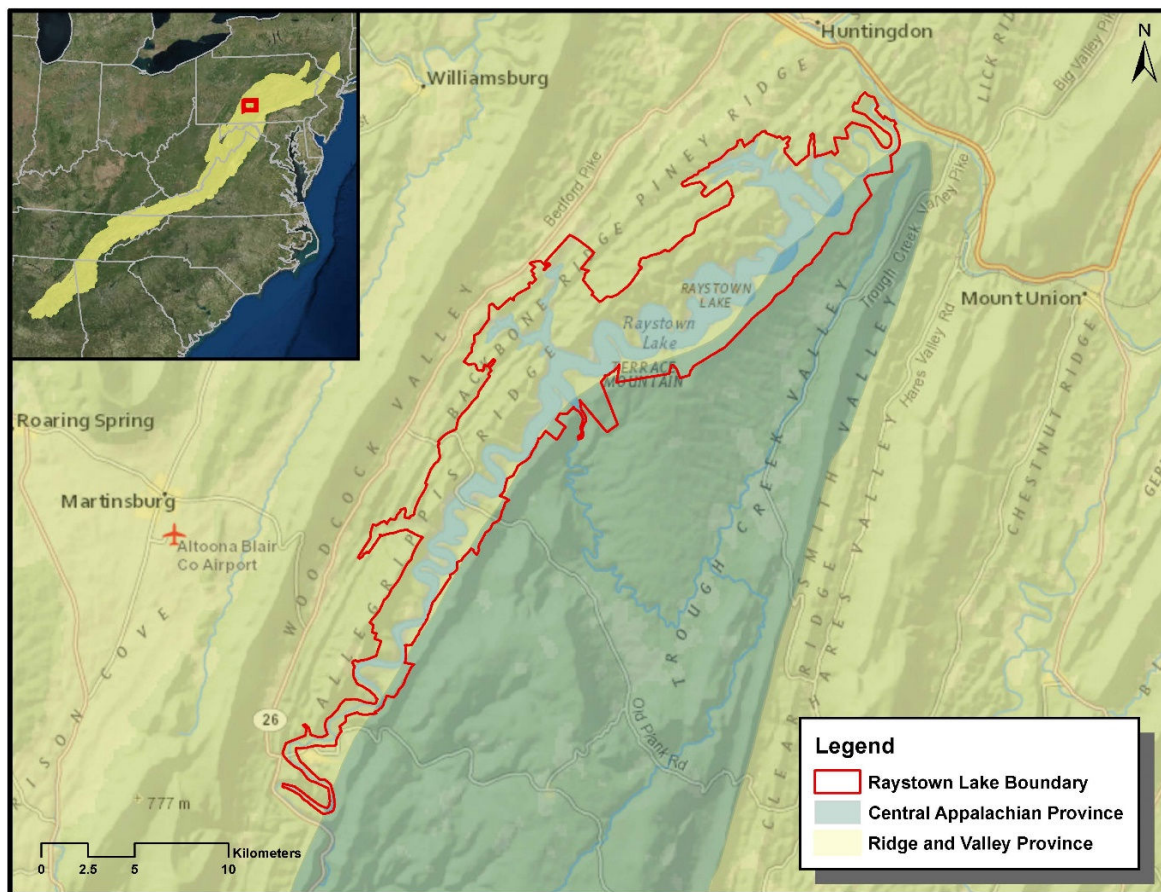


Figure 1. Extent of the Ridge and Valley Province (inset map), and Level III Ecoregions of the Raystown Lake area (USEPA 2013).

The openness of the barrens provides conditions of low competition and high available light in the herbaceous layer. Several plant species are adapted to occupy these features exclusively (shale barren endemic) and are unable to compete in other open habitats such as prairies, fields, and roadsides (Norris & Sullivan 2002). Several other taxa are considered near-endemics, most frequently occurring on shale barrens but also found occupying other suitable open habitats (e.g. rock outcrops, glades; Keener 1983). Seventeen taxa are regarded as shale barren endemics/near-endemics, with eight known to occur in Pennsylvania and tracked by the Pennsylvania Natural Heritage Program (Keener 1983; Weakley 2015; PANHP 2018). The remaining species, in addition to the eight known from Pennsylvania, occur primarily in Virginia and West Virginia.

The National Vegetation Classification System (USNVC 2017) describes two of the six mid-Appalachian shale barren associations as reported in Pennsylvania: the North-Central Appalachian Acidic Shale Woodland and the Central Appalachian Circumneutral Barrens. These associations differ in substrate pH, which leads to differences in species composition and structure. The former is often dominated by *Pinus virginiana* with a sparse understory, while the latter is often dominated by *Juniperus virginiana* with a variable understory of shrubs and herbs (USNVC 2018). The majority of areas delineated as shale barrens at Raystown Lake were classified within these two types; another shale barren association, however, was observed during our survey.

The USNVC (2017) lists the occurrence of the Central Appalachian Xeric Shale Woodland association as “potential” in Pennsylvania, with recorded sites only known from Maryland (6 sample

locations) and Virginia (12 sample locations). This association is also listed as potentially occurring in West Virginia. Select shale barren features and portions of larger features observed at Raystown Lake appeared to fit the description of this community type. Stunted and contorted specimens of *Quercus montana* dominate the overstory of this woodland community, with *Quercus rubra* and *Carya glabra* frequently occurring and occasionally occurring as co-dominants. Conifers such as *Juniperus virginiana* and *Pinus virginiana* were sparse or absent entirely. The shrub *Quercus ilicifolia* is a common component, though typically sparse or occurring as widely scattered patches. Other shrubs include *Rosa carolina* and *Vaccinium pallidum*. In some areas, *Quercus montana* and *Q. rubra* seedlings are the only woody subcanopy species encountered. The herbaceous layer is typically sparse (Fig. 2) but occasionally has significant cover represented by graminoids (Fig. 3). *Carex pensylvanica* and *Danthonia spicata* are frequently the dominant herbs.



Figure 2. *Quercus montana* dominates shale woodlands with sparse understory components, Raystown Lake. Note: What appears as open sky in the bottom photograph is the lake below the steep slope.



Figure 3. Shale woodlands dominated by *Quercus montana*, with a variable understory of graminoids, Raystown Lake.

Survey areas were identified based on estimates of tree canopy cover in aerial photography. Distinct features at Raystown Lake that appeared to have approximately 70 percent or less tree canopy cover were digitized in ArcGIS® for field sampling. Plots were established in a subset of survey areas to describe plant community structure and composition. A 100 m² rectangular plot (12.5 m x 8 m) was established in one of these features during the autumn sampling period in September 2018 (Fig. 4). Species composition and structure within the plot is shown in Table 1. Sixteen species were recorded, with *Quercus montana* dominating the tree and shrub strata. The herbaceous stratum was sparse with only eight species recorded, with a total of 16.5% cover.

According to USNVC (2017), the Central Appalachian Xeric Shale Woodland community frequently borders other shale barren vegetation types. This pattern was observed at Raystown Lake, while some areas occurred as inclusions within other shale barren communities. Five features were classified as this association and occupied approximately 4.2 ha (10.3 acres) or 5.1% of the total area categorized as shale barrens (81.0 ha [200.2 acres]). The average area of each feature was 0.8 ha (2.2 acres), with the largest occupying 2.2 ha (5.6 acres). Shale barren endemic/near-endemic species were not observed in this particular community type, but the state-listed *Lathyrus venosus* Muhl. ex Willd. was documented during the study (PANHP 2018).



Figure 4. Plot location described as Central Appalachian Xeric Shale Woodland, within a survey area at Raystown Lake.

The relatively small area occupied by features classified as Central Appalachian Xeric Shale Woodlands and their embedded positions within other shale barren communities may lead to overlooking this community. Additionally, the lack of shale barren endemic/near-endemic plant species and sparsely vegetated understory does little to encourage further study. However, these communities may have the potential to support endemic/near-endemic plants and provide suitable habitat for rare invertebrates and therefore are worthy of conservation and further study (PANHP 2018). Understanding the distribution of the various associations that are attributed to the mid-Appalachian shale barrens — their extent and community composition and structure — is vital for comprehensive study of this unique, geologically restricted community.

Table 1. Shale barren vegetation structure and composition within a 100 m² (12.5 m x 8m) plot, Raystown Lake, PA.

Stratum	Species name	% Cover
Canopy tree	<i>Quercus montana</i> Willd.	15
Canopy tree	<i>Quercus rubra</i> L.	8
Canopy tree	<i>Carya glabra</i> (Mill.) Sweet	5
Canopy tree	<i>Pinus virginiana</i> Mill.	1
Shrub >1 m	<i>Quercus montana</i> Willd.	5
Shrub >1 m	<i>Quercus rubra</i> L.	2
Shrub >1 m	<i>Quercus velutina</i> Lam.	1
Shrub >1 m	<i>Prunus serotina</i> Ehrh.	1
Shrub <1m	<i>Pinus virginiana</i> Mill.	0.5
Shrub <1m	<i>Ailanthus altissima</i> (Mill.) Swingle	0.5
Herb	<i>Hedeoma pulegioides</i> (L.) Pers.	5
Herb	<i>Avenella flexuosa</i> (L.) Drejer	3
Herb	<i>Carex pensylvanica</i> Lam.	2
Herb	<i>Danthonia spicata</i> (L.) Beauv. ex Roem. & Schult.	2
Herb	<i>Cunila origanoides</i> (L.) Britt.	2
Herb	<i>Erechtites hieraciifolius</i> (L.) Raf. ex DC.	1
Herb	<i>Trichostema dichotomum</i> L.	1
Herb	<i>Solidago bicolor</i> L.	0.5
Non-vascular	<i>Cladonia</i> sp.	5

ACKNOWLEDGEMENTS

We would like to thank Ms. Tara Whitsel, Mr. Don Hrdlicka, and Dr. Nathan R. Beane for their assistance in completing field data collection. We also thank Dr. Jacob F. Berkowitz for reviewing this article. This project was funded by the USACE Baltimore District. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. Permission was granted by the Chief of Engineers to publish this information. The views expressed are those of the authors and do not necessarily represent those of the U.S Army Corps of Engineers. The use of trade, product, or firms named in this paper is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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