



---

Historical Considerations of Conifer Expansion in Maryland Serpentine "Barrens"

Author(s): R. Wayne Tyndall

Source: *Castanea*, Vol. 57, No. 2 (Jun., 1992), pp. 123-131

Published by: [Southern Appalachian Botanical Society](#)

Stable URL: <http://www.jstor.org/stable/4033718>

Accessed: 01/09/2013 09:44

---

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



*Southern Appalachian Botanical Society* is collaborating with JSTOR to digitize, preserve and extend access to *Castanea*.

<http://www.jstor.org>

## Historical Considerations of Conifer Expansion in Maryland Serpentine "Barrens"

R. WAYNE TYNDALL

### ABSTRACT

Conifers have spread rapidly in four protected serpentine areas in Maryland during the past 50 years. In three areas, more than 80% of grassland and savanna seral stages have succeeded to woodland and forest dominated by *Pinus virginiana* or this species with *Juniperus virginiana*. Before settlement was effected circa 1750, Native American fire hunting practices maintained vast areas of serpentine grassland and oak savanna. After settlement, livestock grazing apparently replaced Indian fires as the primary factor inhibiting woody plant succession in many areas including Soldiers Delight. Areas not grazed succeeded to forest, probably deciduous, and the regional abundance of these relatively fire-intolerant conifers probably increased substantially. Cessation of grazing and other disturbances such as logging by the mid-1900s apparently have allowed these conifers to spread rapidly in remaining serpentine openings. Although seasonal drought may slow the rate of conifer succession, extant grasslands and savannas will disappear without major perturbations such as logging and fire.

### INTRODUCTION

Four serpentine areas in Maryland (Figure 1) are managed primarily for conservation of rare and endangered species populations, especially *Agalinis acuta* Pennell, *Sporobolus heterolepis* Gray, *Aster depauperatus* (Porter) Fern., *Talinum teretifolium* Pursh, *Linum sulcatum* Riddell, and *Panicum flexile* (Gatt.) Scribn. (*vide* Maryland Natural Heritage Program 1991). Since these species do not occur in forested sections of serpentine and, with the exception of *S. heterolepis*, are most abundant in grassland and early savanna seral stages (Tyndall and Farr 1989, 1990, personal observations), woody plant succession is a fundamental management concern.

Rapid spread of *Pinus virginiana* Mill. (Virginia pine) and *Juniperus virginiana* L. (red cedar) was apparent during ground layer vegetation studies in the Cherry Hill serpentine area, voluntarily protected by a private camp, and in the Pilot serpentine preserve of The Nature Conservancy (Tyndall and Farr 1989, 1990). Subsequent inspection of historical aerial photographs confirmed a rapid expansion of conifers in these sites as well as in the State-owned Soldiers Delight Natural Environmental Area and in Robert E. Lee Park protected by the City of Baltimore. Therefore, this study was initiated to quantify the spread of conifers at each site during the 50-year period of available aerial photography, 1937/8-1988. To better understand these recent changes, ecological conditions prior to 1937 were studied using published historical and

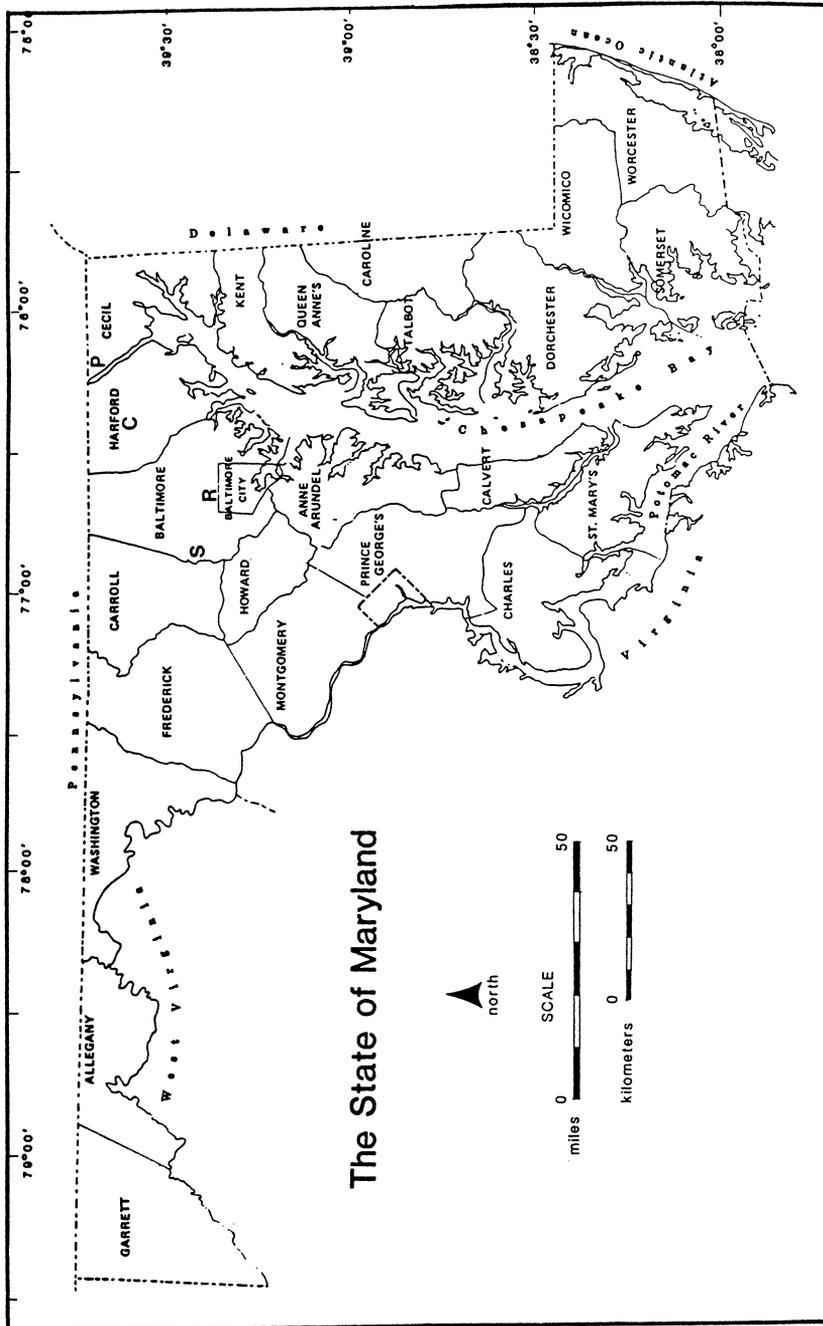


Figure 1. Pilot (P), Cherry Hill (C), Soldiers Delight (S), and Robert E. Lee (R) serpentine areas.

scientific accounts. To understand extant tree species composition and structure, the last remaining opening at Pilot and a representative southwest-facing ridge at Soldiers Delight were sampled and compared with the two largest remnant openings at Cherry Hill (Tyndall and Farr 1989). Data collection at Robert E. Lee was precluded by a major fire. Since sampling at Pilot coincided with a three-month drought (mid-May to mid-August 1988) and the latter is an important ecological factor on serpentine (Brooks 1987), pre- and post-drought data were used to assess the importance of this factor in the spread of conifers.

## METHODS

Black and white contact prints (254 mm x 254 mm) for 1937/8 (ASCS/SCS; National Archives and Records Administration, Alexandria, Virginia), 1952/3 (ASCS/SCS; USDA-ASCS, Aerial Photography Field Office, Salt Lake City, Utah), 1971/2 (ASCS/SCS), and 1988 (NAPP) were used to planimeter (Lasico Polar Planimeter L-30, Los Angeles) ground surfaces without contiguous or overlapping branches; i.e., areas in grassland or savanna stages of succession. Separate estimates of grassland and savanna were not precise due to indefinite boundaries, and oak and pine canopies could not be distinguished. All estimates for 1988 were ground-truthed, sections lost to housing or commercial mining were not measured, and a minimally disturbed region of the 800-ha Soldiers Delight was selected as a representative area.

To describe extant tree species composition and structure on the ridge in Soldiers Delight, ten transects were established perpendicular to its long axis at stratified-random intervals of 5 m. The center of a 4 m x 4 m plot was then randomly located within each 5-m interval of each transect for a total of 54 plots. Diameter-at-ground-level (dgl) was measured in November 1989 of seedlings (0-24 mm), saplings (25-99 mm), and trees ( $\geq 100$  mm). Frequency, density, and basal area were calculated and their relative values added to obtain importance values. Basal area and density were compared between Soldiers Delight, Cherry Hill (using Tyndall and Farr 1989), and Pilot using post-drought data. For collecting pre- and post-drought data at Pilot, transects established for ground layer sampling (Tyndall and Farr 1990) were converted to 1 m wide belt transects, and plants with green leaves were measured (dgl) on 2 August 1988 (pre-drought data) and one year later (post-drought). Pre- and post-drought statistics were calculated and compared. A drought did not occur before the second sampling event.

## RESULTS AND DISCUSSION

At Pilot, Cherry Hill, and Robert E. Lee, conifer spread was almost complete in 1988 (Figure 2), and grassland and savanna coverage in Soldiers Delight had declined more than 50%. In all four sites, conifers generally became established first in steep ravines and then in shallow ravines between ridges, followed by expansion from each end of ridges toward their midsection.

Historical vegetative conditions of "The Great Pennsylvania-Maryland [Serpentine] Barrens" have been documented mostly by historian William Bose Marye (1886-1979). In 1682 the Pennsylvania barrens were "...extensive treeless spaces in the wilderness..." according to a Quaker (Marye 1955a) and

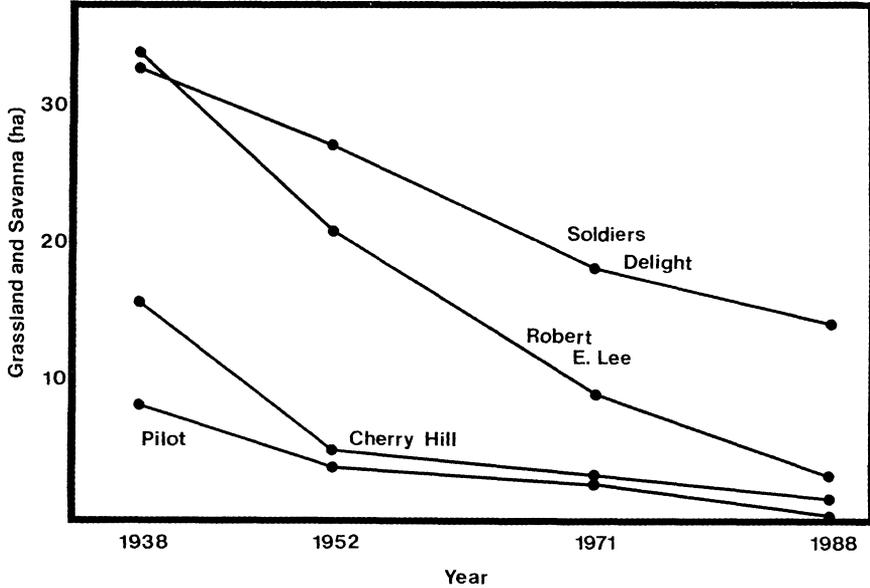


Figure 2. Grassland and savanna coverage at Pilot, Cherry Hill, Robert E. Lee, and the representative area at Soldiers Delight from 1937/8 to 1988.

comprised 52,000 ha with a width of 32 km at the Maryland border circa 1737 (Marye 1955b). In 1722 the Maryland barrens were described as “a Vast Body of Barrens....what is called so, because there is no wood upon it” and “the Lands...all along the west side of Baltimore Co[unty], are cutt off and separated...by large Barrens, many miles over...” (Marye 1955a). In 1753, “...about thirty miles from Navigable Water is a Range of barren dry Land without Timber about nine miles wide which keeps a Course about North East and South West parallel with the mountains thro this province Virginia & Pennsylvania...” (Marye 1955a). “Soldiers Delight was an immense barrens” circa 1730 (Marye 1920).

Marye concluded that fires deliberately set by Native Americans for hunting and game management were primarily responsible for maintaining the barrens. According to one source (Marye 1955b), “It was the custome of the Indians in the autumn to set fire to and burn the barrens of York [Pennsylvania] and Baltimore [Maryland] Counties.” Another reported that the York Barrens of Pennsylvania originated “from the circumstances that the Indians for many years, and until 1730 or 1731, to improve this portion of their Great Park for the purpose of hunting, fired the copse or bushes as often as their convenience seemed to call for it; and thus, when the whites commenced settling here, they found no timber, hence they applied the term Barrens... however fertile the soil” (Marye 1955b). A resident of a Baltimore County plantation gave sworn testimony in 1697 that it was located “in the ‘walks’ which Indians usually take when they move to their hunting Quarters...Their

time of moving...was in June from whence they return'd not till September...laden with their pelt" (Marye 1955c). The plantation "was situated on or very near a highway followed by Indians in going to or returning from certain hunting grounds or when travelling 'on the warpath'," and the "highway" was commonly referred to as the Indian Road or Old Indian Road in "a considerable number" of eighteenth century records (Marye 1920). The Old Indian Road was within 1.7 km of Pilot, 2.4 km of Cherry Hill, 5.3 km of Robert E. Lee, and about 6 km to the north, east, and south of Soldiers Delight (Marye 1920).

Once settlement of "the barrens" was effected circa 1750 (Porter 1975, 1979) many barrens were used by the settlers for livestock grazing (Marye 1955c), and "lands which lay within easy distance of the Barrens, were considered to be more valuable on that account" (Marye 1955c). For example, one parcel was advertised in 1746 in the *Maryland Gazette* as "convenient for stock, there being an outlet to the Barrens of Patapsco." "This 'outlet'... must have been by way of Soldiers Delight. The name of 'Graziers Delight,' 892 acres, surveyed... on Soldiers Delight, October 8, 1771, implies that the barrens of Soldiers Delight were a favorite range for stock" (Marye 1955c).

Barrens which were not farmed, grazed, or burned by settlers became wooded and, by 1800, timber was advertised in Annapolis and Baltimore, Maryland publications as growing in the barrens (Marye 1955a). Referring to the "York Barrens in Pennsylvania," one source stated "Portion of the country that were sixty or seventy years ago (1775-1785) without any timber are now (1845) thickly covered with sturdy oaks and large hickories" (Marye 1955b). Although the use of fire by settlers to maintain and create grazing land may have been widespread initially, the practice was "largely abandoned" by 1780 (Marye 1955b).

In 1910 Shreve et al. reported that "Barrens... in the Soldiers Delight area... have an open park-like stand of trees... The Black Jack Oak and Post Oak are often the sole trees of the thinnest soil, or they may be accompanied by Red Cedar." In a corresponding photograph, Virginia pine is not evident as first reported by Knox (1984) nor is red cedar. Oak trees are scattered or absent on ridges of various aspect. In 1914 the first State forester did not map Virginia pine in Soldiers Delight, and only three populations of scrub pine were within 10 km (Besley 1914). Furthermore, over 80% of Virginia pine coverage in the County was located east of Baltimore City, and most of this was along the Chesapeake Bay and tidal tributaries. In 1929 the Maryland Geological Survey reported "stunted vegetation of cedar and meagre grass" at Soldiers Delight and "a scanty vegetation of pine and cedar" at Bare Hills near Robert E. Lee. In 1937 aerial photographs, conifers were scattered in upland areas of Soldiers Delight, and the oldest tree on the study ridge, Virginia pine, became established in 1944 based on tree rings. The paucity of conifers is also evident in 1937/8 aerial photographs of the other three sites.

In 1989 Virginia pine comprised all trees and 96% of saplings on the study ridge at Soldiers Delight (Table 1). Red cedar was unimportant at Soldiers Delight in contrast to its codominance with Virginia pine at Pilot (Table 2) and Cherry Hill (Tyndall and Farr 1989). Oak trees were absent in all

**Table 1. At Soldiers Delight, frequency (F), relative frequency (RF), density (D=plants/ha), relative density (RD), basal area (BA=m<sup>2</sup>/ha), relative basal area (RBA), and importance value (IV=RF + RD + RBA) of tree species**

<u>Trees (≥ 100 mm)</u>	<u>F</u>	<u>RF</u>	<u>D</u>	<u>RD</u>	<u>BA</u>	<u>RBA</u>	<u>IV</u>
<i>Pinus virginiana</i>	29.6	100.0	185.2	100.0	2.9	100.0	300.0
<u>Saplings (25-99 mm)</u>							
<i>P. virginiana</i>	61.1	88.9	914.4	96.3	2.01	97.4	282.6
<i>Sassafras albidum</i>	7.6	11.1	34.7	3.7	0.05	2.6	17.4
<u>Seedlings (0-24 mm)</u>							
<i>P. virginiana</i>	59.3	43.0	1388.9	46.7	0.24	89.1	178.8
<i>Quercus marilandica</i>	53.8	39.0	1009.6	33.9	0.02	6.3	79.2
<i>S. albidum</i>	11.5	8.3	480.8	16.2	0.01	4.5	29.0
<i>Prunus serotina</i>	9.6	7.0	72.1	2.4	0.0005	0.2	9.6
<i>Acer rubrum</i>	1.9	1.4	11.6	0.4	0.0001	0.01	1.8
<i>Juniperus virginiana</i>	1.9	1.4	11.6	0.4	0.0001	0.02	1.8

three sampling areas, oak saplings were absent in plots at Soldiers Delight and Pilot and infrequent at Cherry Hill, and oak seedlings were numerous at Soldiers Delight but uncommon at Cherry Hill and absent in plots at Pilot.

Red cedar importance values increased 24-44% after the drought (Table 2). Of Virginia pine, one-third of the trees, half of the saplings, and two-thirds of the seedlings died, while mortality calculated for red cedar saplings and seedlings was negligible and only 10% for trees. During the same period of study, adverse effects were not apparent at Cherry Hill and only one Virginia pine, a sapling, died on the study ridge in Soldiers Delight.

#### CONCLUSIONS

Based on Marye (1920) and Pearre and Heyl (1960), the term "barrens" referred to individual exposures of serpentine as well as a vast serpentine-centric region which included large areas of contiguous non-serpentine soil. The abundance of relatively fire-intolerant species such as Virginia pine and red cedar was probably low throughout "the barrens" region prior to Indian extirpation. With settlement effected circa 1750, the regional abundance of these conifers probably increased, but their expansion was inhibited in many areas until the cessation of livestock grazing.

Logging may have been another post-settlement factor important in controlling woody plant succession. For example, "cedar" was a descriptor for vegetation at Soldiers Delight in 1929 (Maryland Geological Survey 1929), but it is currently rare. In addition, a lifetime resident of Cherry Hill (E. Bosley 1991, pers. comm.) described the cutting of large red cedars by his father before 1940.

Colonial descriptions of barrens in Maryland are very similar to those in Kentucky, Tennessee, and adjacent states (DeSelm 1990, Dicken 1935). As in Maryland, the term "barrens" was used to describe land that was "tree-

**Table 2. At Pilot, density (D=plants/ha), relative density (RD), basal area (BA=m<sup>2</sup>/ha), relative basal area (RBA), and importance value (IV=RD + RBA) of tree species before (upper row) and after (lower row) the 1988 drought. The percent change is indicated by parentheses**

Trees ( $\geq 100$ mm)	D	RD	BA	RBA	IV
<i>Pinus virginiana</i>	916.0	70.6	18.1	65.3	135.9
	610.7	64.0	11.8	56.7	120.7
	(-33.3)		(-34.8)		(-11.2)
<i>Juniperus virginiana</i>	381.7	29.4	9.6	34.7	64.1
	343.5	36.0	9.0	43.3	79.3
	(-10.0)		(-6.5)		(+23.7)
<u>Saplings (25-99 mm)</u>					
<i>P. virginiana</i>	3473.2	73.4	7.7	75.5	148.9
	1755.7	58.2	5.3	67.9	126.1
	(-49.5)		(-31.2)		(-15.3)
<i>J. virginiana</i>	1183.2	25.0	2.4	23.5	48.5
	1183.2	39.2	2.4	30.8	70.0
	(0)		(0)		(+44.3)
<i>Sassafras albidum</i>	76.3	1.6	0.1	1.0	2.6
	76.3	2.5	0.1	1.3	3.8
	(0)		(0)		(+46.2)
<u>Seedlings (0-24 mm)</u>					
<i>P. virginiana</i>	3396.9	50.0			
	1183.2	26.3			
	(-65.2)				
<i>J. virginiana</i>	3320.6	48.9			
	3244.3	72.0			
	(-2.3)				
<i>S. albidum</i>	76.3	1.1			
	76.3	1.7			
	(0)				

less, with tall grass and a few shrubs, but in some cases the term was applied to areas in which there was a sparse growth of small post oaks or other stunted trees" (Dicken 1935). Origin and maintenance of the Kentucky barrens also was attributed to Native American fires, plus buffalo grazing and characteristics of limestone soil (Dicken 1935). Tennessee settlers also used barrens for pasture with one report of thousands of cattle and sheep subsisting on them (DeSelm 1990). Many barrens that were not burned or grazed succeeded to forest. For example, in Kentucky "the lands described as 'barren' at the close of the 18th century, were covered with a heavy growth of young timber in the first or second decade after settlement was effected" (Dicken 1935). In Ohio, all relict prairie and prairie glade sites studied by Annala and Kapustka (1983) and Annala et al. (1983) exhibited some degree of forest encroachment on

1938-1971 aerial photographs. Invasion of red cedar, scrub pine, and deciduous woody species reduced prairie coverage in one preserve from 47% to 16% during this period (Annala et al. 1983). A slower rate of encroachment at another site may have been related to fire (Annala and Kapustka 1983).

The role of large indigenous herbivores on Maryland serpentine has not been reported. Although a refuse pit of the Shenk's Ferry culture, predecessor of the Susquehannock group, contained elk as well as deer bone (Witthoft et al. 1959), the regional abundance of elk before settlement is uncertain (Mansueti 1950, Paradiso 1969). The regional abundance of bison before extirpation in 1775 also is unknown (Mansueti 1950), and remains of bison were not reported from Susquehannock or Shenk's Ferry sites by Witthoft and Kinsey (1959).

Although the three-month drought at Pilot inhibited the spread of Virginia pine and altered tree species structure, it had little effect on red cedar distribution and abundance. Furthermore, a prolonged drought may be able to revert Virginia pine savanna to grassland, but it may not be able to convert conifer forest to woodland or woodland to savanna. Manual clearing of woodland and forest followed by prescribed burns targeted to periods of drought may be needed to restore habitat for shade-intolerant rare and endangered species.

#### ACKNOWLEDGMENTS

Special appreciation is extended to P.M. Farr for sampling and photographic assistance; F.D. Bishop of Soldiers Delight Natural Environmental Area for assistance in selecting the study area; and J.C. Hull, T.M. Dudley, and R.R. Brooks for review of an earlier manuscript. This study was funded by the Maryland Natural Heritage Program, but contents of this publication do not in any way reflect the views, opinions, or policies of this agency.

#### LITERATURE CITED

- ANNALA, A.E. and L.A. KAPUSTKA. 1983. Photographic history of forest encroachment in several relict prairies at the Edge of Appalachia Preserve System, Adams County, Ohio. *Ohio J. Sci.* 83:109-114.
- ANNALA, A.E., J.D. DuBOIS, and L.A. KAPUSTKA. 1983. Prairies lost to forests: A 32-year history of two sites in Adams County, Ohio. *Ohio J. Sci.* 83:22-27.
- BESLEY, F.W. 1914. Map of Baltimore County and Baltimore City showing the forest areas by commercial types. Maryland Board of Forestry, Baltimore.
- BROOKS, R.R. 1987. *Serpentine and its vegetation; a multidisciplinary approach*. Dioscorides Press, Portland, Oregon.
- DESELM, H.R. 1990. Flora and vegetation of some barrens of the eastern Highland Rim of Tennessee. *Castanea* 55:187-206.
- DICKEN, S.N. 1935. The Kentucky barrens. *Bull. Geog. Soc. Phil.* 33:42-51.
- KNOX, R.G. 1984. Age structure of forests on Soldiers Delight, a Maryland serpentine area. *Bull. Torrey Bot. Club* 111:498-501.
- MANSUETI, R. 1950. Extinct and vanishing mammals of Maryland and District of Columbia. *Maryland Naturalist* 20:7-12.
- MARYE, W.B. 1920. The Old Indian Road. *Maryland Hist. Mag.* 15:107-124, 208-229, 345-395.
- MARYE, W.B. 1955a. The great Maryland barrens. *Maryland Hist. Mag.* 50:11-23.

- MARYE, W.B. 1955b. The great Maryland barrens: II. *Maryland Hist. Mag.* 50:120-142.
- MARYE, W.B. 1955c. The great Maryland barrens: III. *Maryland Hist. Mag.* 50:234-253.
- MARYLAND GEOLOGICAL SURVEY. 1929. Baltimore County. John Hopkins Press, Baltimore.
- PARADISO, J.L. 1969. Mammals of Maryland. *North American Fauna* No. 66. Washington, D.C.
- PEARRE, N.C. and A.V. HEYL, JR. 1960. Chromite and other mineral deposits in serpentine rocks of the Piedmont upland, Maryland, Pennsylvania, and Delaware. *U.S. Geol. Surv. Bull.* 1082-K:707-833.
- PORTER, F.W., III. 1975. From backcountry to county: the delayed settlement of western Maryland. *Maryland Hist. Mag.* 70:329-349.
- PORTER, F.W., III. 1979. The Maryland frontier, 1722-1732: Prelude to settlement in western Maryland. *In: Mitchell, R.D. and E.K. Muller (eds.). Geographical perspectives on Maryland's past. Occasional Paper No. 4. Geography Department, University of Maryland, College Park.*
- SHREVE, F., M.A. CHRYSLER, F.H. BLODGETT, and F.W. BESLEY. 1910. The plant life of Maryland. Johns Hopkins University Press, Baltimore, Maryland.
- TYNDALL, R.W. and P.M. FARR. 1989. Vegetation structure and flora of a serpentine pine-cedar savanna in Maryland. *Castanea* 54:191-199.
- TYNDALL, R.W. and P.M. FARR. 1990. Vegetation and flora of the Pilot serpentine area in Maryland. *Castanea* 55:259-265.
- WITTHOFT, J. and W.F. KINSEY, III. 1959. *Susquehannock miscellany.* Pennsylvania Historical and Museum Commission, Harrisburg.
- WITTHOFT, J., W.F. KINSEY, III, and C.H. HOLZINGER. 1959. *In: Witthoft, J. and W.F. Kinsey, III. 1959. Susquehannock miscellany.* Pennsylvania Historical and Museum Commission, Harrisburg.

MARYLAND NATURAL HERITAGE DIVISION  
 RESOURCE CONSERVATION SERVICE  
 DEPARTMENT OF NATURAL RESOURCES  
 TAWES STATE OFFICE BUILDING (E-1)  
 ANNAPOLIS, MARYLAND 21401

*Received August 29, 1991; October 21, 1991.*