Biology 208 – Principles of Ecology and Evolution

Field Trip to Snyder-Middleswarth State Park Natural Area – Tall Timbers

This week, we will make a trip to the Tall Timbers National Natural Landmark in nearby Snyder County, within Snyder-Middleswarth State Park and Natural Area in the Bald Eagle State Forest. Although it is somewhat far from campus, this area is a true ecological gem.

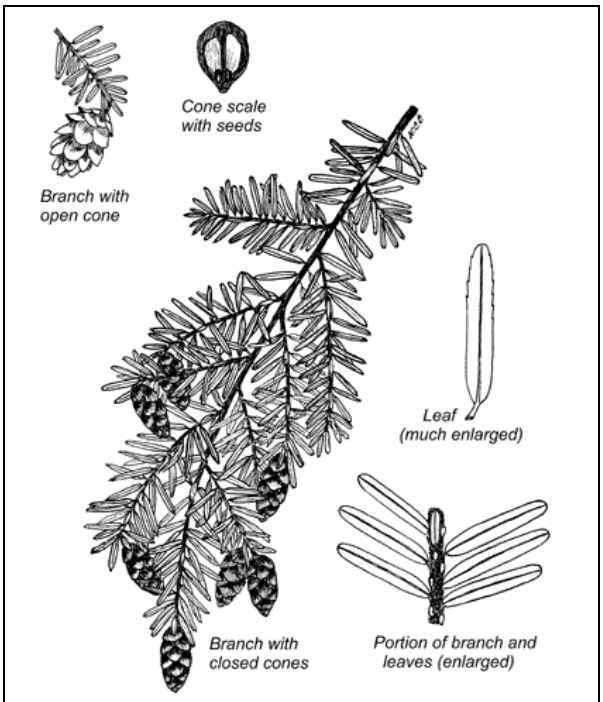
We will essentially be hiking up a ravine with steep sides. This forest was never logged due to its isolation and the complicated family politics of the land owners. The first part of the trail runs along the north bank a stream called Swift Run. Based on the amount of rain and snow we have had in the last three weeks, it should be rushing.

You will notice many epiphytic plants here: these are plants that grow on top of other objects (like trees). There are ample mosses, woodferns, and other plants that are water-loving. Clearly, life in a ravine can be a humid affair!

Background on Tall Timbers Natural Area

(Based on material originally written by Dr. Abrahamson)

Old-growth forests have become increasingly rare in North America since the time of European colonization and today represent a tiny fraction of the total forested area of the eastern United States. Old-growth forest is particularly rare in central Pennsylvania because of intensive logging for lumber, mine props, and charcoal production during the past 150 years. As a consequence, eastern old-growth forests, and Pennsylvania old-growth forests in particular, exist in small stands that are isolated from other old-growth forests by an intervening matrix of successional, second-growth forests.



Eastern Hemlock – *Tsuga canadensis*

Snyder-Middleswarth Natural Area is 500 acres (200 ha) within Bald Eagle State Forest and includes one of the few stands of old-growth forest remaining in Pennsylvania. Five tree species dominate the Snyder-Middleswarth landscape including eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), black birch (*Betula lenta*), red maple (*Acer rubrum*), and chestnut oak (*Quercus montana*). Eastern white pine (*Pinus strobus*) and striped maple (*Acer pensylvanicum*) are present but are far less common. The dominant tree species are visibly segregated within this forest owing to variation in climate and soils ranging from the Swift Run bottomlands to the slopes and ridge tops, adaptations

of species to microenvironmental conditions, differential exposure to wind and storm events, and years of competitive interactions among species.

Thanks originally to the inaccessibility of this ravine, confusion among the heirs of the timber baron who owned it, and in 1965 to its preservation as a National Natural Landmark, a 330-acre (135-ha) portion of this forest has never been logged. The huge cathedral-like towers formed by the hemlocks of the Snyder-Middleswarth old-growth forest are impressive. Although the large hemlocks dominate the scene, there are, however, far more young hemlocks than old. The Snyder-Middleswarth Natural Area exhibits the expected characteristics of a well-developed old-growth forest, e.g., tree ages exceeding 300 yr (ages determined from fallen log sections and coring in nearby forests), low tree densities distributed among all size classes, trees with diameters > 70 cm, and volumes of dead wood.

The old-growth forest is located in a narrow and steep ravine between two ridges that run east to west – Buck Mountain to the north and Thick Mountain to the south. The ravine, created by Swift Run, has well-developed north-facing and south-facing slopes as well as a bottomland. Elevations range from 1480-1800 ft (450 m to 550 m), with slopes varying in steepness from 1-68%. The predominant soils are extremely stony and sandy well-drained materials weathered from sandstone and shale and have low to moderate available water capacity.

Particularly striking is the uniqueness of the species compositions of the bottomland versus the northern ridge top. Hemlock and yellow birch almost equally dominate the bottomland to the exclusion of other tree species whereas on the northern ridge top, chestnut oak, red maple, and black birch dominate, while neither hemlock nor yellow birch are present. The shrub layer is not particularly well developed but does contain considerable hobblebush (*Viburnum alnifolium*) and some rhododendron (*Rhododendron maximum*). The herbaceous layer contains abundant woodferns (*Dryopteris* spp.), painted trillium (*Trillium undulatum*), wild lily-of-the-valley (*Maianthemum canadense*), sweet white violet (*Viola blanda*), and others.

The extent of direct human impact to the area is a footpath that runs along the northern bank of Swift Run and loops back along the north-facing slope. Hunting of deer and other game is allowed in the adjoining state forestlands. There have been many natural disturbances within this old-growth forest during the past three decades. Windstorms, especially those associated with snow or ice events, have toppled a number of the larger hemlock and yellow birch throughout the stand. The crowns of trees located on the slopes and ridge tops frequently show evidence of wind and/or ice damage. Gypsy moth outbreaks have occurred periodically within central Pennsylvania since the mid-1970s and have markedly impacted the oak canopies within the area during one or two growing seasons. Furthermore, deer browsing might affect recruitment of young saplings to replace trees lost to old age or disturbances.

In addition to natural impacts, human activities outside the natural area inadvertently affect the forest. Acid precipitation has seriously impacted the area by enhancing the

acidity of Swift Run. The water that enters Swift Run moves through Tuscarora sandstone, the hardest of the sandstones in our region. Tuscarora sandstone contains so little carbonate that it is unable to buffer strongly acidic precipitation. As a result, Swift Run within the old-growth forest area has a pH too low for fish such as the native brook trout to survive (low pH releases aluminum, which in turn is toxic to fish and other aquatic organisms). The stream that joins Swift Run near the parking area has a substantially higher pH because its waters percolate through Juniata sandstone, which has greater buffering ability. As a result, fish such a brook trout occur as far upstream as the confluence of these two creeks.

The continued domination of the Snyder-Middleswarth old-growth forest by hemlock could be appreciably impacted by an outbreak of the hemlock woolly adelgid. This exotic herbivore was first reported in southeastern Pennsylvania in the late 1960s and has been observed in this old-growth forest since 2003. Should appreciable hemlock mortality occur due to adelgid damage, black birch would likely gain considerable importance. Other herbivores including the elongate hemlock scale, spruce spider mite, hemlock rust mite, and cryptomeria scale could also threaten hemlock survival at the Snyder-Middleswarth Natural Area. Finally, climate change will likely cause unknown modifications to temperature and precipitation within the forest. Given the strong gradients of microclimate and their influence on vegetation, the impacts of climate change might be severe, including increased susceptibility to forest pests, like hemlock wooly adelgid.

Things to think about before and during this hike:

1. What characteristics would you expect in the stream water in this location?

2. Can you identify the following tree species?

Eastern hemlock	Black birch	Chestnut oak	Red maple
Yellow birch	White pine	Striped maple	

3. Become familiar with the following key words and concepts:

Old-growth forest	Acid precipitation	Gypsy moth	Recruitment
Hemlock wooly adelgid	Shade tolerance	Disturbance	P/R ratio
Second-growth forest	Sandstone	Rhododendron	Detritus

4. Note how the vegetation changes as we visit different parts of this forest.

5. What invertebrates and vertebrates would you expect to see here?

6. What impacts have human activities had on this community?

7. Enjoy this hike in this unique landscape!