

## Exploring the Origins of Ecological Forestry in North America

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The use of ecological forestry to achieve management objectives, such as the maintenance of native biodiversity, has become increasingly common on public and private ownerships in North America. These approaches generally use natural disturbance processes and their structural and compositional outcomes as models for designing silvicultural prescriptions that restore or sustain complex structural and compositional conditions in actively managed forests. Although the origin of ecological forestry is generally credited to approaches developing out of the Pacific Northwest in the 1980s (Franklin 1989), there is a great richness and tradition in applying ecological principles to guide forest management in North America that far predates these important contributions. This Roots article explores the early history of ecological forestry, culminating in the contributions of early scientists at the Harvard Forest that resulted in the first use of this term in the North American forestry literature by Steven Spurr and Al Cline in their 1942 *Journal of Forestry* article (Spurr and Cline 1942).

Ecological forestry was certainly practiced long before 1942, and the following text discusses the historic origins of ecological forestry in North America as derived from European silvicultural practices and principles and the ultimate adoption of these approaches at the Harvard Forest in the early 20th century. Application of ecological principles to guide the development of silvicultural prescriptions is not a new advancement in forestry, as many early silviculturists recognized the importance of developing silvicultural treatments and prescriptions that were reflective of the general ecology of a given species or forest community (Hawley 1921, Toumey 1927, Phillips 1931). In most cases, the focus of these early silviculturists was on forest vegetation development as it related to site factors and the environment (Phillips 1931). For example, the earliest advocates for a more nature-based, ecological approach were silviculturists in Germany and Switzerland who during the mid to late 19th and early 20th centuries began advocating for managing locally site-adapted species and mixed-species stands, reflective of natural conditions, using selection-based silvicultural regimes as an alternative to the widespread promotion of even-aged, monocultures of conifers such as Norway spruce (*Picea abies*) (Gayer 1886).

As the fields of ecology and silviculture developed in the early 20th century, principles associated with plant succession and climax

theory became a common guiding element to nature-based silvicultural thinking. In particular, one of the earliest recognized forms of nature-based forestry was the Dauerwald (“continuous forest”) approach, which originated in Germany and emphasized the maintenance of mature forest cover in areas being managed for wood products (Troup 1927). Although this approach did not advocate for the use of any particular silvicultural system, its rejection of clearcutting-based systems and focus on retaining continuous forest conditions often led to the application of selection and irregular shelterwood systems to achieve these objectives. Consistent with the theories of plant succession being developed by Frederic Clements and other plant ecologists during this time period (Clements 1916), advocates for the Dauerwald approach justified their management philosophy on the premise that the forest was a living, highly interconnected organism (Möller 1922, Bauhus et al. 2013). Successional theories have been refined since these early formulations, but the ideas underlying much of the Dauerwald approach provide an early example of silviculture viewed from an ecosystem versus crop-tree management perspective.

Despite the developments outlined above, forestry practices and silvicultural systems in North America during the late 19th and early 20th centuries drew heavily from European approaches that were more production-oriented and less ecological. As such, early North American silviculture was largely concerned with converting historically unmanaged systems into highly regulated and predictable forests in relation to wood production (Hawley 1921), a condition common across Europe at the time. Interestingly, a silvicultural philosophy that was not widely imported from Europe was the Dauerwald approach, with one exception being its application in southern New England at the Harvard Forest in Petersham, Massachusetts.

The Harvard Forest was established as Harvard University's forestry school in 1907 under the leadership of Dr. Richard Fisher, a graduate of the first forestry class at Yale. Like those at other American forestry schools, early research and teaching efforts at the Harvard Forest were focused on refining European practices to develop sustainable silvicultural systems for forests in southern New England (Figure 1). After years of unsuccessful attempts to establish conifer plantations in areas historically supporting hardwood-dominated forests, a unique perspective on ecological silviculture that drew heavily from the Dauerwald principles developed in Europe decades earlier was developed and formalized at Harvard Forest in the early 1930s. In what was labeled a “naturalistic” approach to silviculture by other forestry schools in the region (Steen 1990), foresters and scientists at the Harvard Forest focused on studying natural processes, particularly those found in the few remaining old-growth forests in the region, to serve as templates for informing the development of silvicultural practices (Figure 2). This approach was

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**Figure 1.** Richard Fisher releasing white pine regeneration from hardwood competition in a shelterwood treatment in 1923. (Photograph courtesy of A.C. Cline.)



**Figure 2.** Old-growth hemlock (*Tsuga canadensis*)-white pine (*Pinus strobus*) forest on the Harvard Tract in southwestern New Hampshire in 1929. Early studies of the development and characteristics of this and other old-growth forests in the region were central to the advancement of ecological forestry principles at the Harvard Forest. (Photograph courtesy of A.C. Cline.)

clearly reflected in the writings of forest scientists at the Harvard Forest during this period, including the monograph on old-growth eastern hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) forests by Cline and Spurr (1942, p. 5):

the soundest basis for the development of the art of silviculture lay in an understanding of the “natural” forests of the region—the complex of trees, shrubs and herbaceous plants which would occupy a given piece of ground when free from interference from man.

An outgrowth of this period of silvicultural exploration at Harvard Forest was the first known application of the term “ecological forestry” and its associated principles in the forestry literature in the *Journal of Forestry* in 1942 (Spurr and Cline 1942), over four decades before its global popularization (Franklin 1989). In many respects, the Spurr and Cline (1942) article emphasized a framework similar to those ascribed to the Dauerwald approach and advocated for selection methods to protect the site and perpetuate multiaged, mixed-species stands composed of shade-tolerant species; however, this early article also included other advancements in silvicultural thinking that are very much reflective of contemporary ecological silviculture, including recommendations to vary the intensity and frequency of disturbance to perpetuate a mixture of less tolerant species on a site using an understanding of forest succession patterns and natural disturbance regimes.

An important distinction between this early practice of ecological forestry and the more contemporary ecological silviculture approaches developed in the late 20th century is that the primary focus of the early effort was on emulating natural models of regeneration to achieve desired tree composition goals (Spurr and Cline 1942), an approach also emphasized for reforestation efforts in European forests at the time (Robinson 1942). Although this remains a core component of modern ecological silviculture, an equal level of emphasis is placed on integrating other elements of natural disturbance regimes into silvicultural prescriptions, namely structural legacies of disturbance, including surviving overstory trees and coarse woody debris (Seymour and Hunter 1999, Saunders and Arseneault 2013), to more fully reflect natural disturbance dynamics and sustain core ecosystem functions and biodiversity that depend on these legacies. Since the publication of the

Spurr and Cline (1942) article, the Harvard Forest has become better known for its contributions to the fields of forest ecology and ecosystem science than to the field of silviculture; however, revisiting this article serves as a reminder of the linkages between these disciplines and the creative silvicultural thinking that arose by coupling scientific inquiry across them to develop an early formulation of a now widely advocated silvicultural approach for balancing a diversity of management objectives.

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