Tree-group death in North American and Hawaiian forests: a pathological problem or a new problem for vegetation ecology?

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Abstract. The paper reviews five North American tree diebacks or forest declines that were recognized as "decline diseases" in a recent forest pathology text. They are the birch dieback, maple and oak declines in northeastern North America, the little-leaf disease of shortleaf pine in the southeastern United States and the western white pine pole blight in western North America. These so-called "decline diseases" are compared to the Metrosideros tree dieback or decline in the native Hawaiian rain forest, which has been researched over the past decade. A new theory of "cohort senescence" is offered as an alternative framework for renewed research into the five North American and the Hawaiian tree diebacks. This new theory views "cohort senescence" as the predisposing factor for synchronized tree dieback. Cohort senescence is defined as a uniform loss of vigor of a canopy cohort due to a combination of aging and gradually increasing environmental stress. The latter is considered to act in a site-specific manner. In common with the "decline disease" theory, the tree dieback following cohort senescence is viewed as a chain reaction mechanism involving as a second event, a "trigger", or dieback precipitating factor, and as a third event, possibly a dieback-"hastening" factor. In contrast to the "decline disease" theory, the "cohort senescence" theory does not view tree dieback as a disease, but as a normal phenomenon in the population dynamics of certain species. Such species include pioneer or seral species that may get established in larger cohorts following catastrophic disturbances. However, these catastrophic disturbances are considered to occur infrequently, i.e., at intervals longer than the life-span of the dieback species. Moreover, the theory leads to the necessity of focusing particular attention on the successional responses to dieback, for example, whether it results in displacement or replacement of the species exhibiting synchronized dieback.

New questions for research into vegetation types with synchronized population dieback are formulated in five areas of vegetation ecology: 1. spatial and temporal pattern analysis, 2. cohort detection analysis, 3. successional response analysis, 4. further site-correlation analysis, and 5. etiological dieback research. This last area requires experimental research and a multidisciplinary approach.

Introduction

A massive dying of forest stands in the indigenous Hawaiian montane rain forest (BURGAN & NELSON 1972) caught the attention of forest managers, pathologists...