

Evaluating aspen damage and decline in the Pacific Northwest

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Abstract

This study focused on assessing the stand conditions and causal agents affecting aspen in the Pacific Northwest (PNW) by ground-based sampling of damage areas identified in annual aerial detection surveys (ADS). Seventy-one sites dominated by quaking aspen (*Populus tremuloides*) were evaluated in Washington (WA) and Oregon (OR) in 2010 and 2011. Stand and site attributes, aspen regeneration, and the major damaging agents were recorded at representative plots. In this study, 65% of the stands evaluated were found to be in “stable” condition, while 35% were deemed “successional” or “decadent.” Conifer encroachment or competition was common and recorded in 48% and 78% of plots in WA and OR, respectively. Crown dieback in OR was more severe, but overstory mortality of aspen was similar between states and comprised less than one-third of the total number of trees on 72% of the plots. Aspen regeneration was detected in over 90% of the plots, but advanced regeneration was present in only 35% of WA and 63% of OR plots. Live aspen stems (>5 in dbh) were most frequently impacted by ungulate chewing/rubbing, stem decays, woodboring beetles, and cankers. Aspen regeneration (<5 in dbh) was most impacted by ungulate feeding, defoliating insects, and foliage diseases. This evaluation of aspen in the PNW did not appear consistent with the rapid overstory mortality and lack of regeneration characteristic of sudden aspen decline (SAD). Rather, the majority of areas showed evidence of slow, progressive decline resulting primarily from successional processes and ungulate damage. Management of PNW aspen stands, including conifer removal and exclusionary fencing of ungulates, would help to improve their overall health and may be needed to assure their long-term survival in some areas. Aerial surveyors in OR and WA have used these findings to develop a new code, ‘hardwood decline - aspen’ (HDA), that will be used to more accurately describe the complex of factors contributing to aspen damage and mortality in the PNW.

Introduction

Objectives of this study were to:

- 1) assess the condition of PNW aspen stands where damage was detected during recent annual aerial surveys,
- 2) determine the damage severity and major causative agents responsible, and
- 3) compare these findings to those from other regions as well as use them to inform ADS coding for aspen damage in the PNW.

The sudden aspen decline (SAD) phenomenon that has been recently described in the Interior West has raised awareness of aspen health throughout North America^{2,6}. While concentrated patches of aspen dieback and decline have been documented historically in central and northeast WA and OR^{3,4,5}, a more expansive, region-wide approach has not been undertaken.

Aspen is not as widely distributed in the PNW as in some regions, and thus has substantial ecological and aesthetic importance where it does occur. It increases forest structure and diversity, and contributes to wildlife habitat. The small size and distribution of remaining stands also may make them more highly susceptible to loss^{3,4}.

Over the last decade, increasing levels of aspen damage and mortality have been reported from ADS, state and federal forest managers, and the public in the PNW (Figure 1). ADS consistently maps damage in the region each year; however, it was unknown what the relative contributions were from specific damaging agents or contributing site factors.

This effort builds upon previous evaluations of aspen in the PNW by Forest Health Protection staff and uses similar techniques to that of recently completed aspen monitoring projects in other USDA Forest Service regions. Findings have refined our knowledge of aspen damage in the PNW as well as contributed to a broader assessment of its status in North America.

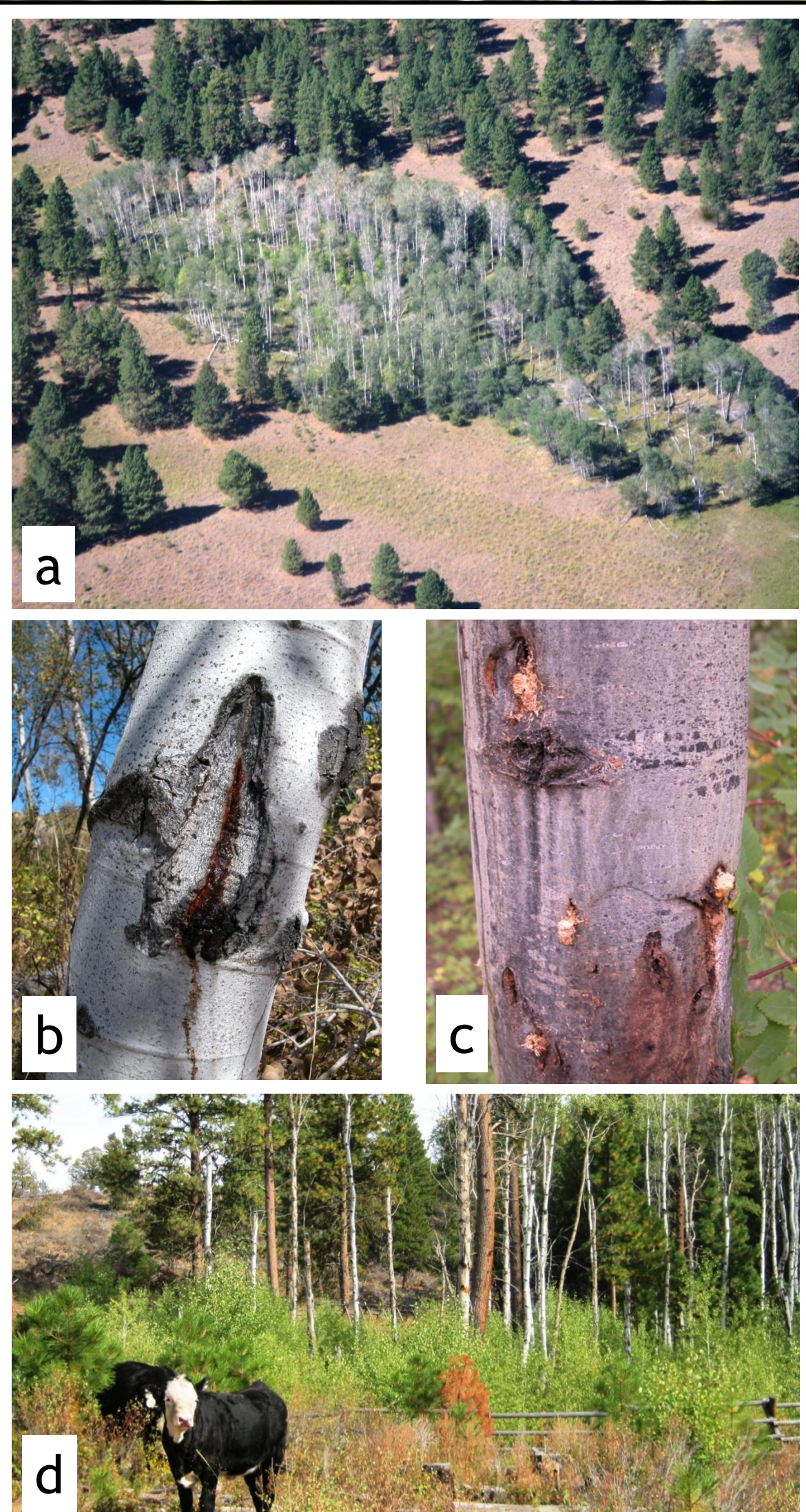


Figure 1. (a) Aspen damage as seen from ADS, (b) stem canker, (c) wood borers, and (d) ungulate damage.

Materials & Methods

Recent ADS data from the PNW were reviewed to locate areas where detectable levels of aspen damage or mortality had been observed over several consecutive years. Thirty-one sites in WA and 40 sites in OR were evaluated across federal, state, and private ownerships (Figure 2).

At each site, a representative 1/20th acre circular plot and three 1/300th acre subplots were established to separately examine trees (>5 in dbh) and regeneration (<5 in dbh). Each 1/20th acre plot contained >5 live aspen trees and all study sites were visited once from July to October in 2010 or 2011. A sub-set of plots were also visited twice, in early summer and late fall to try and assess the full range of damaging agents present.

At each site, general stand conditions (basal area, species composition, average DBH, crown condition, regeneration) and site attributes (slope, aspect, elevation) were recorded, along with the presence and intensity of the major damaging agents. These included insects, diseases, animals, fires, and weather-related damage.

The summary results presented here have not undergone statistical analyses, and are presented here so as to provide general trend information and descriptions of our overall observations.

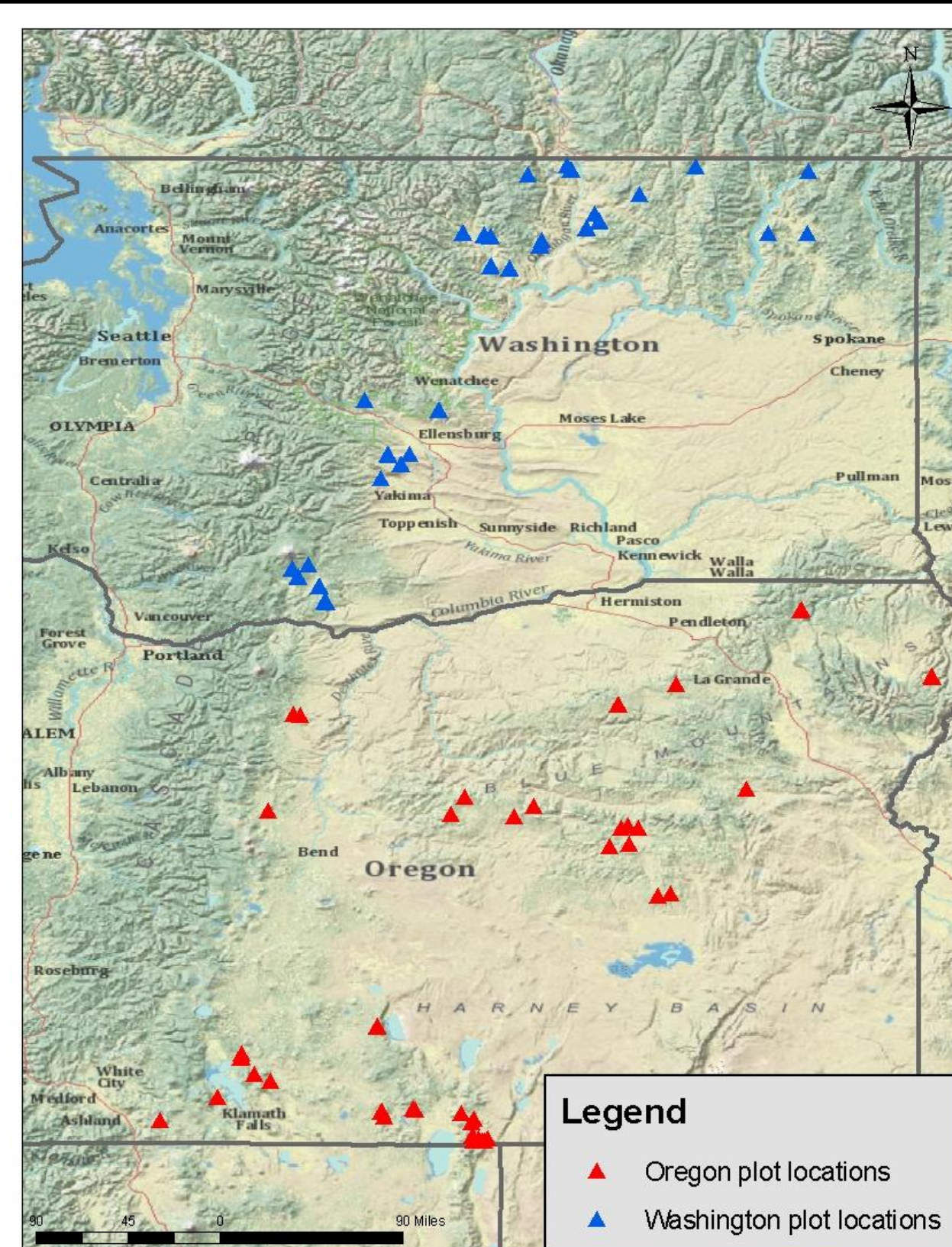


Figure 2. Location of aspen survey plots in OR and WA.

Results

- Observations of aspen plots evaluated in 2010 and 2011 suggested that 65% were “stable,” a condition represented by a diverse stand structure, the presence of regeneration, and limited tree mortality, while 35% of stands were deemed “successional” to conifers or “decadent,” due to there being ample mortality and little to no regeneration (Figure 3).
- Encroachment and competition from secondary tree species, primarily conifers, was detected in 63% of survey plots in WA and OR combined (Figure 4).
- Differences were observed in the severity of aspen crown dieback between states (Figure 5a). Crown dieback was observed on more than two-thirds of the trees in only 29% of WA plots but in over 85% of OR plots. However, overstory mortality of aspen was similar, with 72% of the combined plots showing less than one-third of the total stems dead. Live aspen sprouts (<2 in dbh) were found in 90% of plots, while advanced regeneration (>2-5 in dbh) was present in only 35% of WA and 63% of OR plots (Figure 5b).

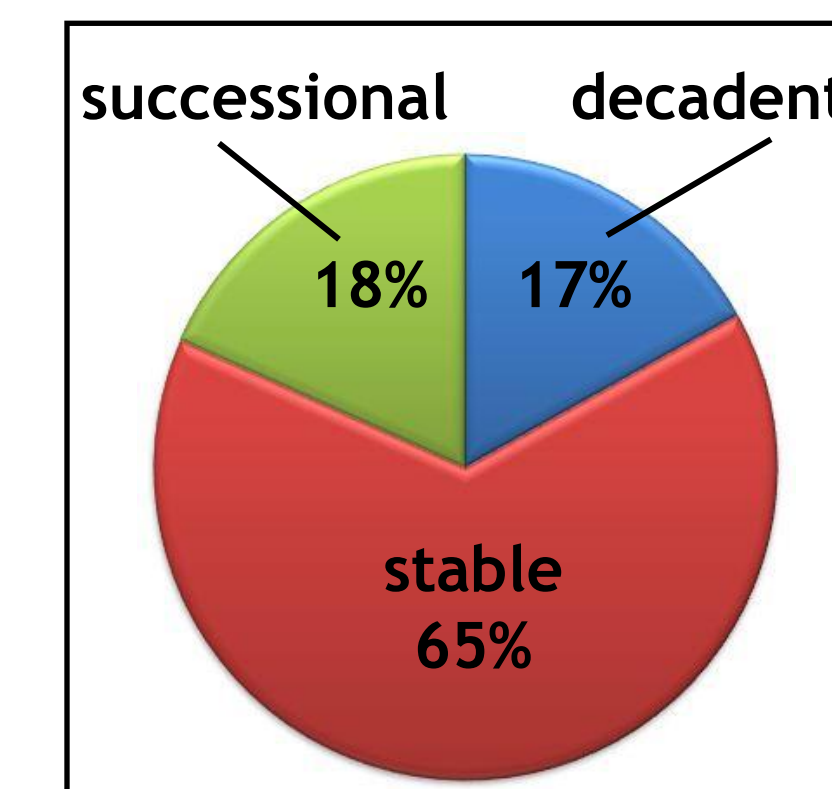


Figure 3. Percent of aspen dominated plots by stand condition (WA & OR combined).

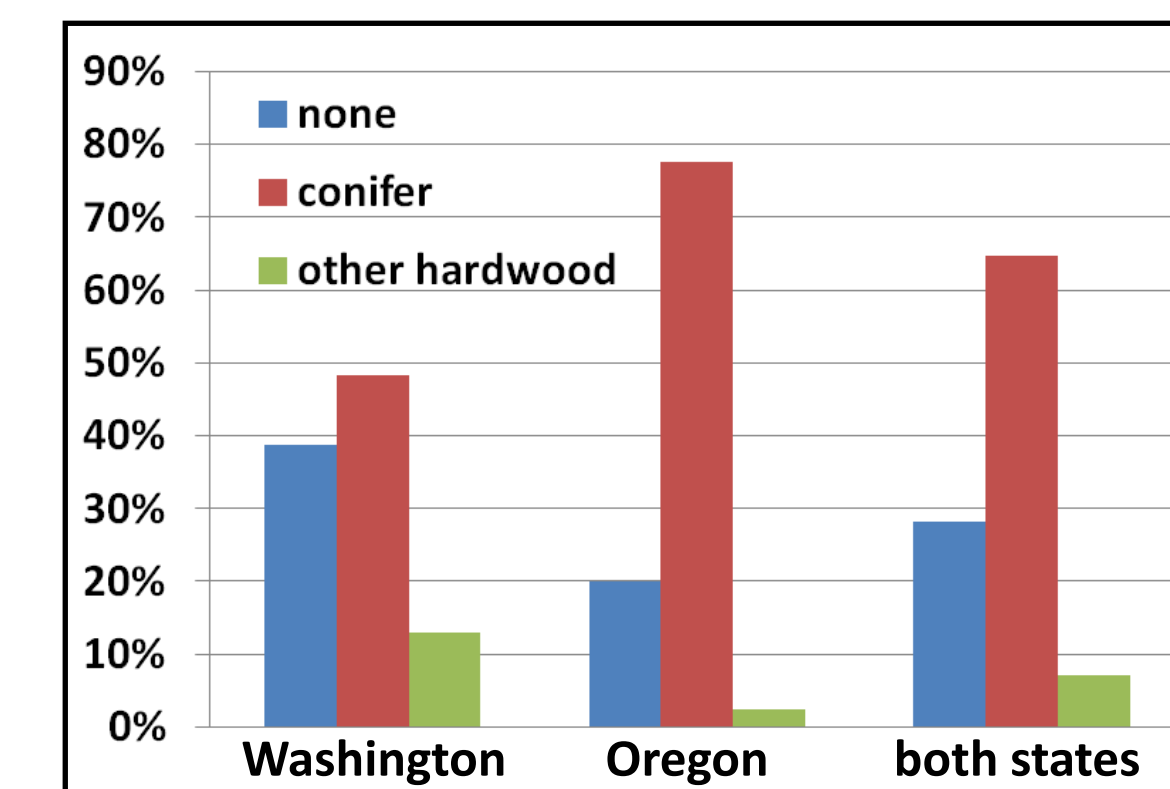


Figure 4. Percent of aspen dominated plots by percent of secondary tree species competition.

- Live aspen stems (>5 in dbh) were most affected by ungulate chewing/rubbing, stem decays, woodboring beetles, and cankers (Figure 6).
- Live aspen regeneration (<5 in dbh) was most affected by ungulate browsing, defoliating insects, and foliage diseases (Figure 6).

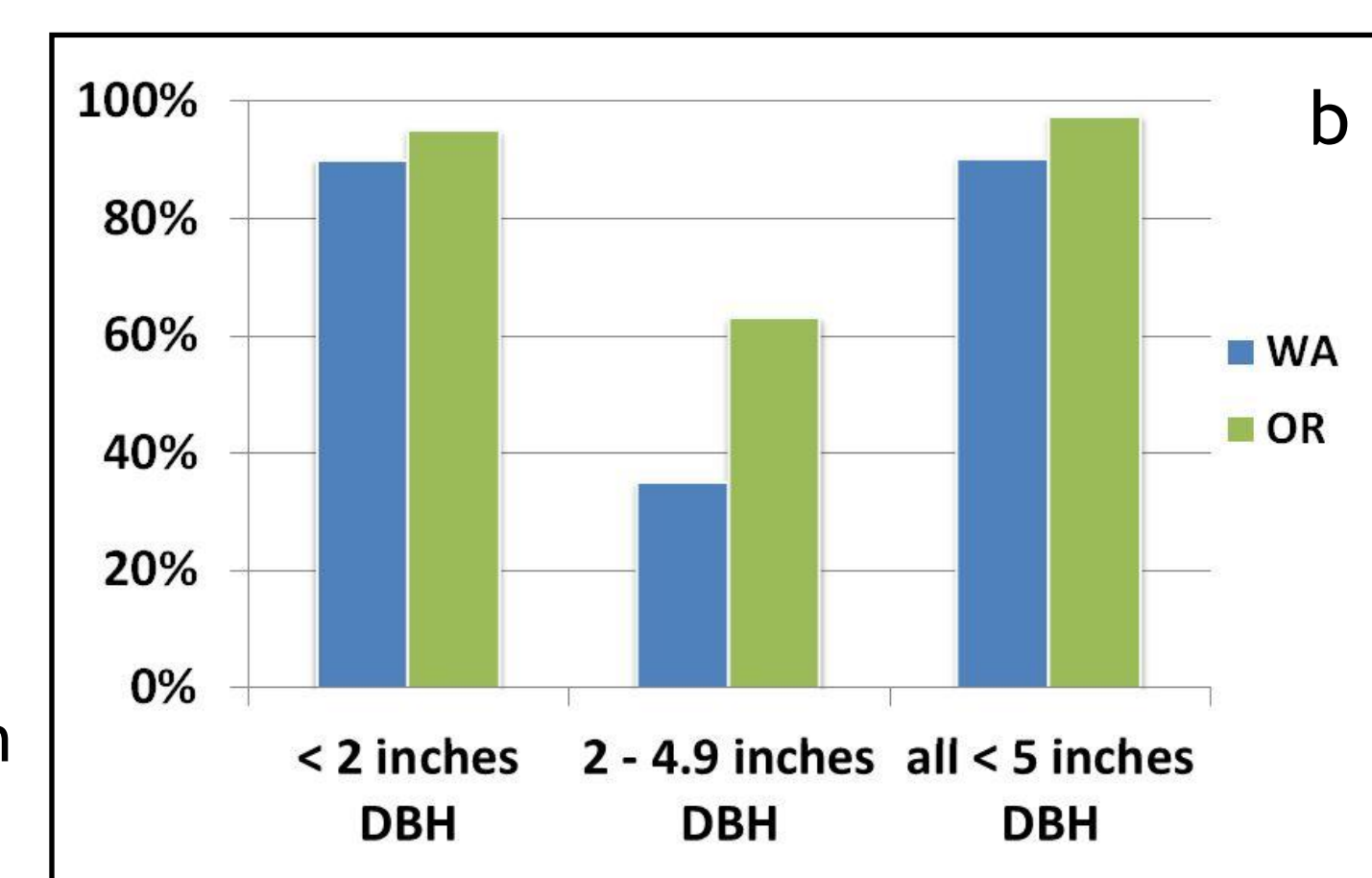
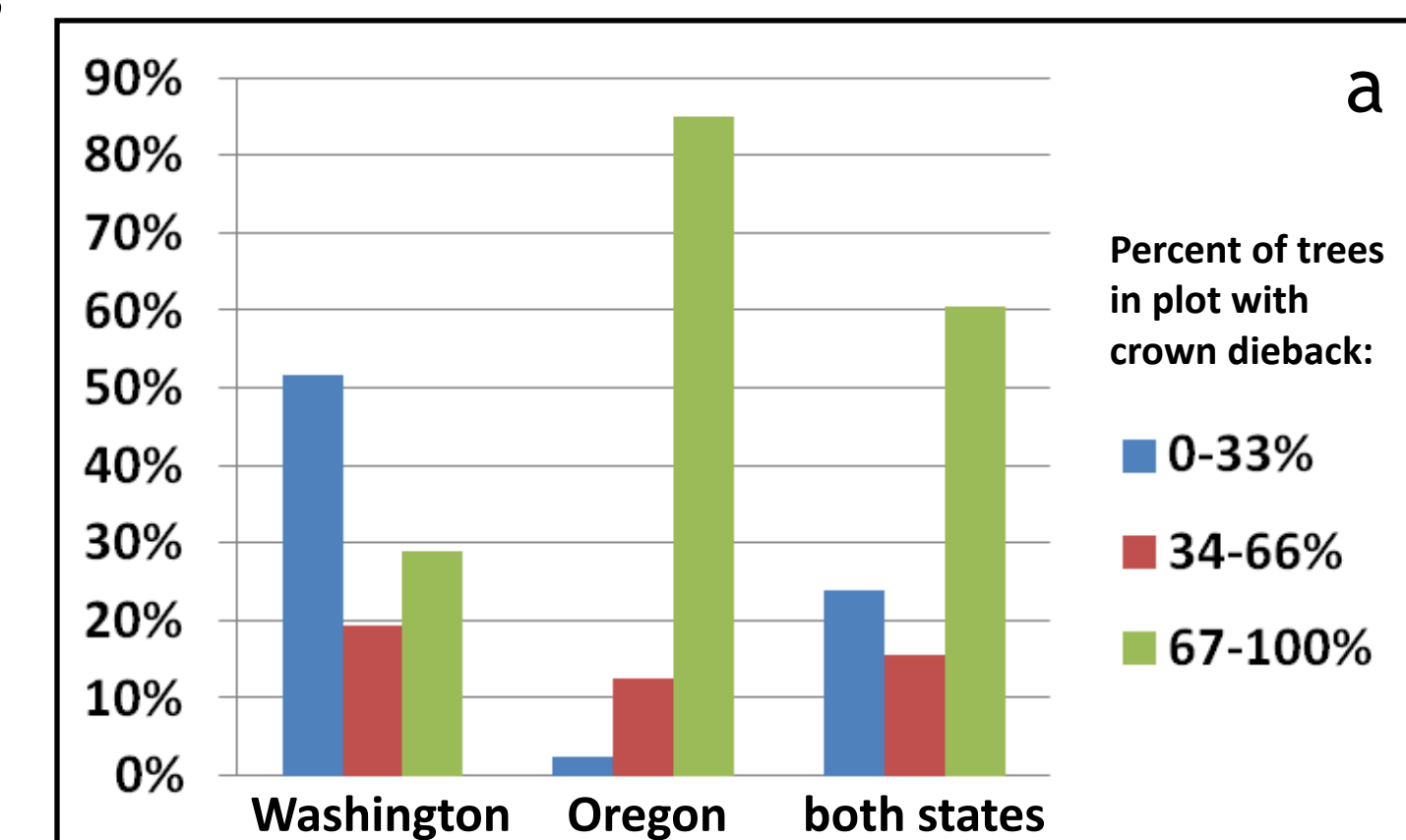


Figure 5. (a) Percent of plots with aspen crown dieback by percent of trees affected, and (b) percent of plots with aspen regeneration by state.

Discussion & Further Study

Approximately two-thirds of the aspen stands evaluated in 2010 and 2011 were classified as being in “stable” condition, while the remainder exhibited symptoms consistent with a slow, progressive decline. The occurrence of chronic mortality of overstory stems and new sprouts due to a combination of factors, coupled with a lack of recruitment to the advanced regeneration stage may lead to continued decline and perhaps even loss of some stands in the PNW.

This evaluation does not appear consistent with either the rapid overstory mortality and lack of regeneration characteristic of sudden aspen decline (SAD), or the primarily insect defoliator driven damage described in other regions^{1,6}. Rather, PNW aspen stands with evidence of slow, progressive declines appeared to result primarily from successional processes (conifer competition), and ungulate damage similar to earlier findings in WA^{3,4}. The high incidence of stem wounding by ungulates also appeared to facilitate attacks by many insects and diseases.

Active management of aspen in the PNW, including conifer removal and exclusionary fencing of ungulates among the treatments, would help to improve overall health and may be needed to assure their long-term survival in some areas.

As a result of these findings, aerial surveyors in OR and WA have developed a new code, ‘hardwood decline - aspen’ (HDA), that will be used to more accurately describe the complex of factors contributing to aspen damage and mortality in the PNW.

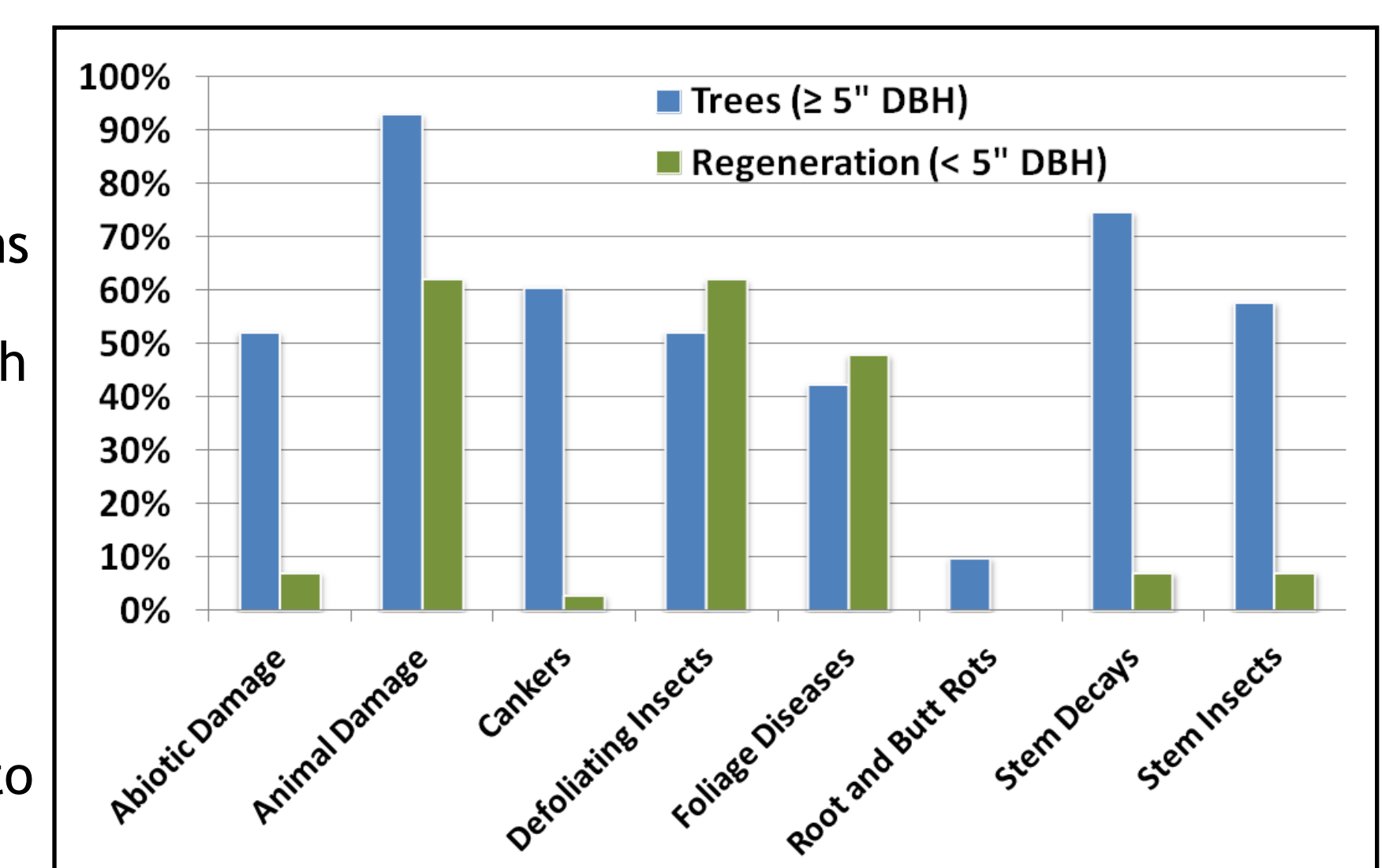


Figure 6. Percent of plots with damaged live aspen trees and regeneration by damage category (WA & OR combined).

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