MOOSE USE OF GRAND FIR/PACIFIC YEW COMMUNITIES AND IMPLICATIONS FOR TIMBER MANAGEMENT

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Abstract: Shiras moose (Alces alces shirasi) on the Nezperce National Forest are highly selective for old-growth grand fir (Abies grandis) stands with an understory of dense Pacific yew (Taxus brevifolia). Timber management practices during the 1970's reduced winter habitat from about 29,950 ha to 24,280 ha. Beginning in 1977 changes in land allocation, timber management practices, and access management were made to maintain suitable winter habitat. The costs to log, dispose of slash, and manage for moose winter habitat are 47% to 142% greater than costs for the same practices when no consideration is given to moose. The draft Forest Plan (USDA 1985) proposes to maintain about 77% of the existing winter habitat in a condition suitable for moose. Additional monitoring and research are needed to determine the long term response of Pacific yew to silvicultural practices and the long term response of moose to habitat manipulation.

During the mid-1970's wildlife biologists on the Nezperce National Forest in central Idaho observed that Shiras moose used old-growth grand fir/Pacific yew communities extensively during fall and winter. Timber practices at that time readily eliminated this plant community. In 1977 the Forest Supervisor issued a moratorium on planning additional timber harvest within Pacific yew communities until the ecology of Pacific yew and its importance to moose could be adequately investigated.

Federal legislation in 1978 that established the Gospel-Hump Wilderness and the Gospel-Hump Multi-resource Development Area resulted in two research projects whose purposes were to investigate the ecology of Pacific yew and the relationship between moose and grand fir/Pacific yew. Pierce (1983) investigated food preferences and habitat use by moose. Crawford (1983) investigated the ecology of Pacific yew and its relation to forest management. These studies provided the basis for subsequent Forest Service planning and management of Pacific yew communities. This paper briefly reviews the results of this research and describes proposed forest management for moose winter habitat.

MOOSE FOOD PREFERENCE AND HABITAT USE

Pierce (1983) demonstrated that during summer months, moose used open canopied, pole, mature, and old-growth stands in roughly the same proportion as those stands were available. However, over 90% of all use during fall and winter occurred in either old-growth or mature stands; and approximately 50% of all moose locations

during fall, winter, and spring were in old-growth grand fir stands that comprised only 18% of the study area. About 35% of the winter locations were in "dense" Pacific yew stands which made up less than 5% of his study area. The stands used by moose had an average Pacific yew crown cover of 25%, whereas the average crown cover of yew stands within the study area was approximately 10 percent. Thus, an apparent shift towards older-aged stands with a Pacific yew understory occurred during fall and winter. Pierce (1983) speculated that moose were selecting these double-canopied stands because of their ability to intercept snow and provide forage.

Of the important browse species found within old-growth forests, Pacific yew was the most abundant species on sites used by moose during fall and winter (Pierce and Peek 1984). Pierce (1983) found Pacific yew and Scouler's willow (Salix scouleriana) dominated the diet of moose during the fall (42 and 48 aggregate percent use, APU, respectively). Although Pacific yew was one of the least preferred browse species during the winter judged on its relative availability, it was the most important winter food item in the diet of moose (41 APU). Pacific yew was followed in importance by menzesia (Menziesia ferruginea) with 29 aggregate percent use. Pimlott (1961) observed that Canada yew (Taxus canadensis), a species closely related to Pacific yew, is highly palatable to moose. Murie (1934) and Aldous and Krefting (1946) considered Canada yew to be an important indicator of moose habitat condition.

The moose in Pierce's study area displayed no selectivity for landforms of various slopes. There was no significant difference between the percent of use on various slopes and the percent

availability of those slopes across his study area (D. J. Pierce, pers. commun.).

PACIFIC YEW ECOLOGY AND IMPLICATIONS FOR TIMBER MANAGEMENT

Crawford (1983) studied the effects of overstory removal and broadcast burning on Pacific yew. Two years after removing the overstory and piling slash using tractors, 22% of the Pacific yew within his study area died as a result of either mechanical damage or being buried by slash. In Crawford's study plots that were broadcast burned, 92% of the Pacific yew died as a result of damage from the fire. None of the Pacific yew died due to sun scalding on either the tractor piled or broadcast burned plots. Forest Service personnel have observed Pacific yew surviving in clearcuts, 13 years after logging. Thus, it appears that yew can adapt to high light intensities created by timber harvest, but is extremely intolerant of even low intensity fires and/or mechanical damage.

Crawford (1983) postulated that harvested sites that are broadcast burned are unlikely to provide functional moose winter habitat within the normal timber harvest rotation period of 120 years. Pacific yew is very slow to invade new sites because seeds are animal disseminated and require both shade and a duff substrate to germinate. In addition, once established, Pacific yew is very slow growing, requiring approximately 37 years to grow about 5.0 cm in diameter (Crawford 1983).

HABITAT MANAGEMENT

Pierce (1983) leaves little doubt that grand fir/Pacific yew communities are an important component of the fall and winter habitat for moose on the Nezperce National Forest. Crawford (1983) clearly demonstrated that timber management may have direct adverse impacts on this habitat. Thus, alternative timber management practices must be developed to manage timber and moose concurrently if functional winter habitat is to be achieved during the timber harvest rotation.

About 5,670 ha, 19% of the original or potential fall and winter habitat (29,950 ha), had been logged without regard to moose. Of the remaining 24,280 ha (81% of total potential), 11,090 ha are on slopes > 25% (cable ground) and 13,190 ha are on slopes < 25% (tractor ground).

Cable Ground

Broadcast burning is currently the only economically feasible and environmentally acceptable method of disposing of logging slash and preparing logged sites for conifer regeneration on cable ground. Maintaining Pacific yew after logging and disposing of slash on slopes > 25% is economically prohibitive (Table 1). Because Pacific yew is intolerant of fire (Crawford 1983), broadcast burning is not an acceptable method of slash disposal and site preparation within Pacific yew communities where the management objective is to retain Pacific yew for moose habitat. Therefore, we either manage timber on these lands in an economical fashion that precludes managing for moose or we manage for moose that precludes timber management.

Table 1. Costs ($/ha) Of Slash Abatement Practices, Nezperce National Forest, 1983[a].

Logging Method	Standard Slash Treatment	Managing for Pacific yew[b]	% Increase
Tractor <25% slope	$529	$ 778	47
Cable >25% slope	$882	$2,135	142

[a]Costs determined by Dave Lukens, Assistant Fire Management Officer, Elk City Ranger District, Elk City, ID.
[b]Maintaining 50 percent of Pacific yew throughout a harvest unit.

The Forest's goal is to manage the existing moose winter habitat to provide for a continuing presence of Pacific yew suitable for moose (USDA 1985). The Forest is proposing that grand fir/Pacific yew communities on slopes in excess of 25% be allocated to moose management with no scheduled timber harvest until an economical method of logging and slash disposal is developed that would provide for a continual presence of Pacific yew.

Tractor Ground

The remaining 13,190 ha (54% of existing habitat) is on slopes < 25%. Tractor equipment that enables retention of the Pacific yew component can be used economically for logging and slash disposal (Table 1). The draft Forest Plan (USDA 1985) proposes direction to

retain 57% of the winter habitat on tractor ground in a condition suitable for moose throughout the rotation of the stand. The rotation age of the timber stand must be extended to about 210 years, 90 years longer than the normal rotation age of about 120 years. Harvest will occur within no more than 5% of the Pacific yew communities per decade. Because these communities occur as isolated patches or along elevational lines (Peek et al. 1984), uncut corridors between yew stands must be maintained within a habitat complex to provide travel lanes for moose. This management strategy is required to ensure that no portion of a habitat complex is isolated from the remainder of the complex.

The preferred silvicultural treatment for winter habitat management includes both selection cutting and shelterwood cutting (USDA 1985). Patch clearcuts, if necessary for timber management, should be no larger than 8 ha. Silvicultural direction should be written to retain at least 50% of the stand's live Pacific yew component scattered throughout the unit in 0.1 to 0.2 ha patches.

Logging slash will be piled using tractors and burned in place. Slash piles will not be placed within the residual patches of Pacific yew. Broadcast burning of slash will not be prescribed.

Logged units will be reforested by planting or natural regeneration to achieve a 30% crown closure for conifers within 20 years and a 30% crown closure for Pacific yew within 20 to 30 years. Planting and thinning practices are to achieve a conifer overstory canopy coverage of 34% to 42% (100 to 175 stems/ha) and a Pacific yew understory canopy coverage of 53% to 60% at 90 years (Crawford 1983, USDA 1985).

Pierce (1983) hypothesized that high quality moose winter habitat may develop within 90 years after harvest if Pacific yew is maintained in the stand. The proportion of winter habitat that is available after logging can be determined if two factors are known: the proportion of habitat harvested, and the proportion of habitat available during the rotation age of the stand. Based on his model that was modified to reflect a 210-year rotation (USDA 1985), the management strategies described for tractor and cable ground would result in 77% of the total existing winter habitat (24,280 ha) functioning as winter habitat throughout the rotation.

Access Management

Roads are being built within moose winter habitat as a direct result of timber management. Improved access increases the potential for legal and illegal harvest of moose (Pierce 1983, Peek et al. 1984). Pierce (1983) observed that 58% of all known moose mortality in his study area was due to unregulated hunting by Native Americans and to poaching. The Idaho Department of Fish and Game estimated that 48% and 32% of the total moose harvest on the Forest during 1982 and 1983 respectively was due to poaching (S. McNeill, pers. commun.). Nearly 100% of the known unregulated harvest by poachers and Native Americans and 85% of the regulated harvest occurred within 50 m of an open road (Pierce 1983). To minimize poaching, the Nezperce Forest is proposing to close the majority of roads within moose habitat during the fall and winter (USDA 1985).

FURTHER STUDIES

Many questions regarding the effects of timber management on moose and moose habitat on the Nezperce National Forest are unanswered. Pierce's (1983) model is presently being used on the Forest to predict moose winter habitat development and subsequently, the degree of moose use. However, the model has not been field tested to determine the validity of its predictions. Regeneration and growth of both conifers and Pacific yew will be monitored within harvest units to refine the model's prediction of winter habitat development. Post-treatment surveys of yew will be conducted to determine the effectiveness of the management direction to save at least 50% of the yew component. A crucial element of Pierce's model is the assumption that conifers can regenerate and compete with the residual yew stand to develop into a multi-storied stand with a conifer overstory and a Pacific yew understory. Stocking level surveys will be conducted to monitor the success of conifer regeneration within a residual yew stand and the natural regeneration of Pacific yew occurring on the site.

Although Pacific yew has never been propagated artificially in a forest environment, the Forest is attempting to root and plant cuttings clipped from plants growing on-site. If this method of regenerating Pacific yew is successful, the recovery period necessary to reestablish moose winter habitat on logged sites may shorten considerably.

Several radio-instrumented moose displayed a strong tendency to return to the same wintering area in successive years and restricted

their winter movements to about 183 m/day (Pierce 1983). Traditional use of wintering areas and the lack of moose mobility elicited concern regarding the effects of habitat modification on individual and population behavior. Thus, the Forest is developing a plan to evaluate the effects of timber harvest activities and associated road construction on moose behavior. The degree of use within logged winter habitat will also be monitored to refine predictions of moose use throughout the different stages of stand development.

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