

Private forest landowner's perceptions of forest grazing in Washington state

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Abstract

Nonindustrial private forest landowners (NIPF) control 21.4% of Washington's commercial forestland, much of which produces forage. Resident NIPF owners in 3 regions in the state were surveyed to determine their perceptions of forest grazing. Thirty-nine percent of the respondents grazed livestock on forestland they leased or owned, and grazing was perceived by practitioners to contribute significantly to household income. Nonincome-related motivations for owning and managing land were also significant: passing land on to children, keeping it 'natural', conservation, aesthetics, and as a current or future homesite. In western Washington, some forest grazing occurred year round while in eastern Washington it was all seasonal. Cow/calf pairs were the most commonly grazed livestock. The median size forestland parcel owned by forest grazers was 47 ha versus 24 ha for nongrazers. Leasing additional land increased the likelihood of forest grazing. Significant opportunities exist to improve both the condition and productivity of forested ranges. Achieving this requires a clear understanding of landowner's objectives and beliefs. Data are needed to evaluate landowner's perceptions that forest grazing has both economic and amenity benefits.

Key Words: woodland grazing, silvopastoral, motivations, survey, NIPF

Washington has the lowest proportion of publicly owned land and the highest proportion of privately owned land of the 11 western states. One-third of Washington is rangeland, half of which is forested. Approximately 21% (1.5 millions ha) of the state's commercial forestland is owned by nonindustrial private forest landowners (NIPF) (Hanley and Baumgartner 1990). Non-industrial private forest landowners are those who do not own facilities to process the wood they produce. Recent studies (Wetton 1988, Blatner et al. 1991, Lawrence and Hardesty 1992, Lawrence et al. 1992) suggest that a number of Washington NIPF owners practice forest grazing, and that as much as 65% of this land is not in acceptable condition (Harris and Chaney 1984). Current lack of knowledge about NIPF's forest grazing practices and motives constrain efforts to assist them in utilizing their resources more effectively.

Grazing in the Pacific Northwest has been documented since the 1840s (Coville 1898, Jardine and Anderson 1919, Pearson 1923, Ingram 1931, Reid 1947, Colwell 1954, Sharrow and Leininger 1983, Harris and Chaney 1984). Early forestland grazing in the Pacific Northwest region followed timber harvest to reduce

unwanted vegetation and the fire hazard this vegetation posed to forest regrowth (Judd 1911, Reid et al. 1938, Byington 1990). As a result, much of the forest land suffered from overgrazing (Hess 1966, Harris and Chaney 1984).

The degradation testifying to this history may have fostered the assumption that livestock grazing and forestry are incompatible (Daniel and Ensminger 1945), a perception that lingers unexamined in many quarters today. If, as some anticipate, public and government concern about fish and wildlife habitat, threatened and endangered species, and water quality results in reduction or elimination of timber harvest and livestock grazing on some public lands in this region, private forest lands may be subjected to increasingly intensive use. There is an urgent need for information on which to base technical recommendations for sound management of these lands in the future.

NIPF owners control over 58% of all commercial forestland in the US, and consequently, have been studied extensively. Activities such as livestock grazing have been addressed only indirectly, however, and generally from a timber management perspective (Weatherland et al. 1982, Bliss and Martin 1989). Our study examined how Washington NIPF owners perceive forest grazing as a means of meeting their land management objectives.

Objectives of this study were to:

- 1) determine the extent that forest grazing is used by Washington's NIPF owners,
- 2) develop insight into NIPF owner's motivations for forest grazing,
- 3) describe forest grazing practices of NIPF owners in Washington, and
- 4) determine the information needs of NIPF owners who practice forest grazing.

Methodology

Sample Frame

Using the sample frame of a concurrent study of NIPF agroforestry practices (Lawrence and Hardesty 1992, Lawrence et al. 1992), our survey was confined to 3 areas, each consisting of 4 counties where forestry and agriculture were primary land uses (Fig. 1). Geographic location, socioeconomic conditions, and agricultural and horticultural crops produced were considered to insure maximum diversity.

Area 1, in northcentral and northeastern Washington, is predominantly rural. This area is characterized by 400 to 650 mm annual precipitation, hot (16–24° C) dry summers and cold (–6–0° C) winters. There are 100 frost-free days in the mountains and 140 to 200 frost-free days in the valleys (Franklin and Dyrness 1973, Harris and Chaney 1984). Ranching, forestry, and agriculture (tree fruits, grain, and hay) are the dominant land uses. Forests are dominated by ponderosa pine (*Pinus ponderosa* Dougl), Douglas

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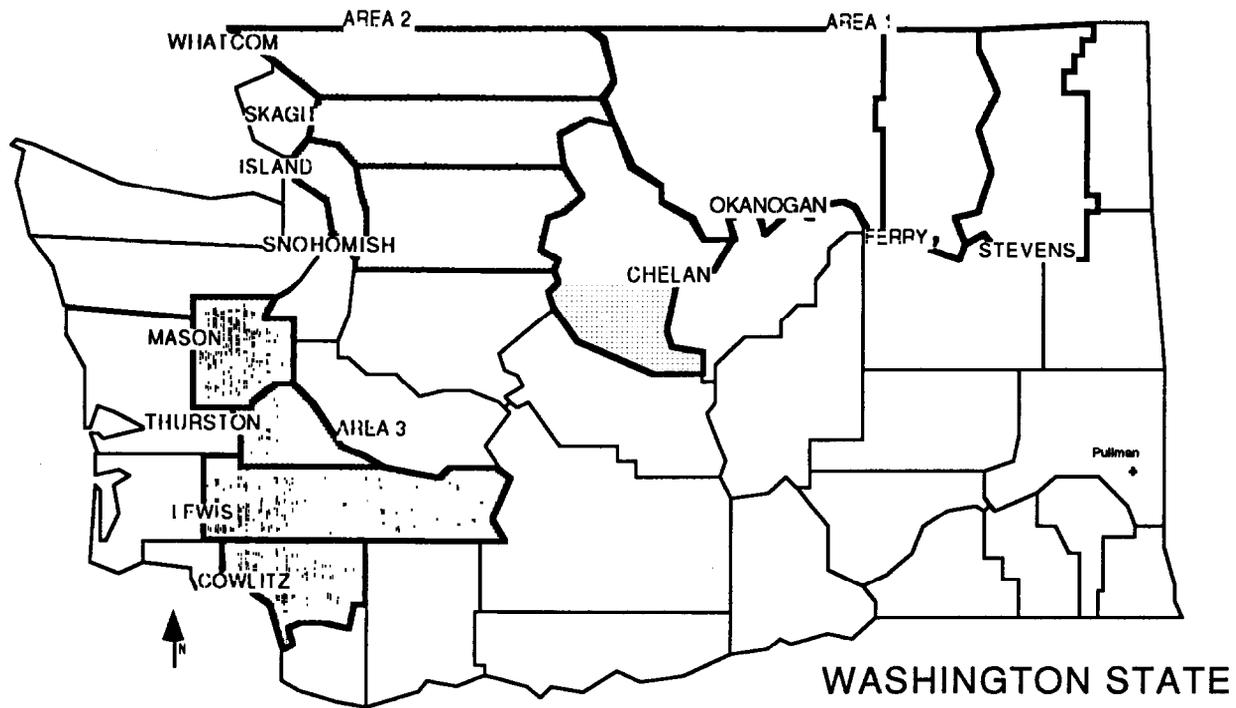


Fig. 1. Areas sampled for Washington State nonindustrial private forest landowner forest grazing practices survey.

fir (*Pseudotsuga menziesii* (Mirbel) Franco.), lodgepole pine (*Pinus contorta* Dougl.), western larch (*Larix occidentalis* Nutt.), and Engelmann spruce (*Picea engelmannii* Parry) mixed with true firs (*Abies* spp. Mill) (Franklin and Dyrness 1973).

Areas 2 and 3 are located in northwest and southwest Washington, respectively. Both are a mix of highly urbanized and rural environments. Important land uses in area 2 include forestry, growing vegetable seeds, potatoes, and bulbs. In area 3, forestry, mixed farming, and dairy farming are important. The climate of western Washington is relatively mild without the extremes of area 1. Temperatures in the coastal lowlands average from 7 ° C in January to 17° C in July. The frost-free season ranges from 200 to 240 days. Average rainfall in areas 2 and 3 ranges from 1,000 to 2,000 mm annually (Harris and Chaney 1984).

The forests of western Washington are some of the world's most productive. Douglas fir forests are the most extensive. Other common forest types include western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), true firs, and mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.) intermixed with western red cedar (*Thuja plicata* Donn.), red alder (*Alnus rubra* Bong.), and bigleaf maple (*Acer macrophyllum* Pursh) (Franklin and Dyrness 1973). Generally, the dense, humid westside forests are not suited for grazing except as transitory range.

Survey Tool

Data were collected using a mail survey based on Dillman's Total Design Methodology (Dillman 1978). A previously defined population of NIPF landowners randomly selected from county tax records (Blatner et al. 1991) was used to generate mailing lists. Only those forest landowners residing in a county where they owned forest land were surveyed, and we requested that the person most directly responsible for management of the land complete the questionnaire. The survey was pretested and 3 mailings and 3 follow-ups were sent to encourage response. The mailings included a 10-page questionnaire of 45 questions, cover letter, and pre-paid return envelope. The questionnaire was initially mailed to 680 NIPF owners in August, 1990, and responses were accepted through November, 1990. No survey of nonrespondents was

undertaken.

The questionnaire was developed after an earlier, open-ended questionnaire had defined the issues addressed herein (Lawrence and Hardesty 1992). Forest grazing was one of several agroforestry practices included in the study and although it is the only practice reported here, some of the questions addressed a broader range of agroforestry practices. The questionnaire was divided into 5 sections:

1. land: hectares owned and leased from others, location, and tenure;
2. forest grazing practices;
3. reasons for practicing agroforestry, and the potential advantages or disadvantages of agroforestry;
4. reasons for owning land, and the contribution of 12 different products or activities to household income; and
5. socioeconomic characteristics and agroforestry information needs.

Table 1. Percentage distribution of current occupations of forest grazers (FG) and non-forest grazers (NG) within geographic regions.

Occupation	N=	Overall		FG		NG	
		FG	NG	East	West	East	West
		113	138	65	48	56	82
		----- % -----					
Rancher/farmer		34.8	11.8	46.8	19.7	17.4	7.6
Retired		26.1	34.2	20.8	32.8	37.0	
Self-employed other		15.9	15.5	15.6	16.4	15.9	15.2
Full-time employee		11.6	22.4	7.8	16.4	23.2	21.7
Part-time employee		5.8	4.3	3.9	8.2	2.9	5.4
Professional		2.9	6.8	1.3	4.9	4.3	8.7
Full-time home-maker		2.2	3.1	2.6	1.6	2.9	3.3
Unemployed		0.7	0.6	1.3	0.0	1.4	0.0
Full-time student		0.0	1.2	0.0	1.4	1.1	
		100	100	100	100	100	100

regional NIPF studies (Baumgartner 1980, Weatherhead et al. 1982, Wetton 1988, Blatner et al. 1991, Force and Lee 1991), permitting us to omit a survey of nonrespondents. Respondents who grazed livestock on forestland were predominantly white (95.0%) and male (89.5%) with an average age of 58 years. The only notable difference between forest grazers and nonforest grazers was that over twice as large a percentage of nonforest grazers had done graduate study. Average gross annual household income for forest grazers and nonforest grazers were \$53,372 and \$42,615, respectively.

Forest grazers most often identified themselves occupationally as a rancher/farmer or retired. Nonforest grazers were most often full time employees or retired. Eastern Washington had a higher proportion of farmer/ranchers and fewer retirees among those who practice forest grazing (Table 1).

Forest grazers owned and leased more land and larger parcels than nonforest grazers (Table 2). Deeded and leased lands made up 53 and 47%, respectively, of all land managed by respondents. Forest grazers control 78.8% of all deeded land and 98.8% of the leased acreage managed by survey respondents. Forty-nine percent of the deeded land was forested as was 33% of the leased land. Dependence on leased land was most evident among eastern Washington forest grazers.

Motivations for Owning Land

A landowner's reasons for owning land can be expected to

influence land management strategies. Our respondents were similar to those in other NIPF studies regarding reasons for owning land (Baumgartner 1980, Weatherhead et al. 1982, Wetton 1988, Blatner et al. 1991, Force and Lee 1991). 'To pass on land to children' was the forest grazer's most frequently stated reason followed by 'income from timber' and 'income from livestock', 'for conservation', and 'to keep it natural' (Table 3). For non-forest grazers, the most frequently cited reasons for owning land were 'to pass on land to children', 'to keep it natural', 'a place to retire', 'a place to live/future building site' and 'for conservation'. Some reasons were cited significantly more often by forest grazers: 'income from timber' ($p \leq 0.042$), livestock ($p \leq 0.001$), farming ($p \leq 0.001$), and leasing out grazing rights ($p \leq 0.024$). These data suggest that forest grazers' land use is more financially motivated than nonforested grazers', an idea supported by employment and income data. Only 'income from Christmas trees' ($p \leq 0.046$) was more important to nonforest grazers than to forest grazers. The most frequent reason eastside nongrazers owned land was the 'land has always been in the family'. The importance of nonincome generating motives for owning land should not be underestimated.

Eastside forest grazers cited income from timber ($p \leq 0.019$), livestock ($p \leq 0.007$), farming ($p \leq 0.013$), leasing out grazing rights ($p \leq 0.002$) and income from recreation ($p \leq 0.008$) more often than their westside counterparts, perhaps because they control more land and are more likely to be supported by it. Further, farming, livestock, and forestry, as well as off-farm work may all be needed

Table 4. Percentage distribution of forest grazers (FG) and non-forest grazers (NG) indicating choices of potential advantages and disadvantages of agroforestry, as well as reasons others might not consider practicing agroforestry, by geographic region.

	Overall			FG			NG		
	FG	NG	P ¹	East	West	P ¹	East	West	
Advantages	----- % -----			----- % -----			----- % -----		
Integration of conservation and production goals	78.6	65.9	0.080	73.7	84.4	0.278	67.6	64.7	
Aesthetically pleasing	77.3	76.1	0.850	66.7	88.9	0.022	84.2	70.4	
Increases land unit income	76.7	69.9	0.292	75.0	78.9	0.667	73.2	67.7	
Diversifies productive and economic base	75.7	59.6	0.028	70.0	82.4	0.217	59.5	59.6	
Increases biological diversity	73.5	58.8	0.058	65.8	83.3	0.103	70.3	50.0	
Improves soil fertility and productivity	72.0	77.4	0.420	69.0	75.8	0.520	86.8	70.9	
Water conservation	71.6	69.1	0.723	75.0	66.7	0.414	84.6	58.2	
Soil erosion control	69.5	62.9	0.352	76.1	61.1	0.144	68.3	58.9	
Reduced need for pesticides/-fertilizer/fuel	61.4	53.9	0.343	56.8	66.7	0.395	60.0	50.0	
Microclimate improvement	53.7	52.8	0.909	51.4	56.3	0.693	75.0	37.7	
Disadvantages									
Financial assistance lacking for unknown practice	61.8	60.7	0.891	63.9	59.4	0.702	58.3	62.3	
Livestock damage trees and crops	58.0	69.9	0.103	44.5	71.1	0.026	64.9	73.2	
Establishment cost high	56.2	72.0	0.033	64.1	47.1	0.143	68.4	74.5	
Trees get in the way of farm equipment	42.3	40.7	0.844	40.5	0.760	41.2	40.4		
Increase in rodent/insect/weed pests	39.4	47.0	0.353	45.7	32.3	0.264	57.6	40.0	
Complicated/difficult to manage	35.9	53.5	0.033	37.1	34.5	0.825	55.9	51.9	
Livestock compact soil	31.9	39.6	0.306	11.1	52.8	0.001	40.0	39.6	
Reasons									
Lack of technical assistance/education support	62.7	63.4	0.917	63.4	61.8	0.882	73.7	56.4	
Not practical in commercial situations	53.4	57.1	0.634	44.7	62.9	0.121	63.9	52.7	
No access to livestock or livestock facilities	49.3	59.8	0.188	50.0	4.4	0.893	57.6	61.1	
Lack of scientific research	48.0	53.2	0.503	41.0	55.6	0.208	56.8	50.9	
Bias against combining grazing and forestry	38.7	33.3	0.484	27.5	51.4	0.034	33.3	33.3	
Bias of peers against unfamiliar practice	28.6	37.1	0.259	28.9	28.1	0.938	42.4	33.9	

¹Response of forest grazers and non-forest grazers overall and response of forest grazers by region. Chi square test for equality of means ($\alpha=0.05$).

Table 5. Comparison of median and total land area and herd size characteristics of forest grazers who do and do not lease land.

Leased land	All land owned	All land leased ¹	Forest land owned	Forestland leased ²	Forestland grazed	Head livestock ³	Years practiced
Yes (n=37)	----- (ha) -----						
Total	16,318	39,374	5,119	12,626	18,520	7,088	1,206
Median	219	166	51	146	138	65	26
No (n=77)							
Total	19,574	na	10,000	na	9,194	3,267	1,726
Median	87	na	32	na	26	20	20

¹Includes all land leased: forestland, pasture, agricultural land, etc.

²Includes land leased by one respondent for harvest of special forest products.

³Includes all livestock.

to reduce the risk of land based enterprises in the more extreme and variable climate of eastern Washington.

Respondents were asked to indicate important sources of household income (Table 3). Forest grazers most often chose 'sale of livestock', 'timber sales', 'off-farm work', 'income from grain farming', and 'leasing out grazing rights', while nonforest grazers chose 'timber sales', 'off-farm work', 'sale of livestock', 'Christmas trees', and 'income from special forest products' (evergreen boughs and understory plants with culinary or ornamental value). Significantly more forest grazers chose 'sale of livestock' ($p \leq 0.001$), 'off-farm work', ($p \leq 0.003$) 'income from grain farming' ($p \leq 0.001$), 'leasing out grazing rights' ($p \leq 0.003$), and 'CRP (Conservation Reserve Program) payments' ($p \leq 0.033$). These differences are consistent with the reasons forest grazers and nonforest grazers most often cited for owning land, suggesting that forest grazers place greater emphasis on nontimber resources.

Eastern and western Washington forest grazers did not differ in their 3 most frequent income sources: 'sale of livestock', 'timber sales', 'off-farm work'. However, on the eastside 'income from grain farming' replaced 'leasing out grazing rights' as the fourth most frequent choice. For westside forest grazers, 'Christmas trees' and 'income from special forest products' were the fifth most often chosen income sources, compared to 'leasing out grazing rights' in the east. Significantly more eastern forest grazers chose 'timber sales' ($p \leq 0.007$), 'income from grain farming' ($p \leq 0.001$), 'leasing out grazing rights other than CRP land' ($p \leq 0.034$) and 'CRP payments' ($p \leq 0.003$).

Eastern Washington forest grazer's greater reliance on 'income from timber sales' ($p \leq 0.007$) may relate to their larger holdings (Table 2). NIPF owners with more than 65 ha of forestland are more likely to actively manage their timber than those with less land (Weatherhead et al. 1982). Timber harvest practices might also be a factor. Westside forests are typically clearcut, an event occurring only rarely during a lifetime, depending on the acreage held. On the eastside, selection and partial cutting (Weatherland et al. 1982) allow landowners to harvest trees more often. Other regional differences; 'income from grain farming', 'leasing out grazing rights other than CRP land' and 'CRP payments', are consistent with region differences in climate and land use.

Motivations for Practicing Agroforestry, Including Forest Grazing

We asked respondents why other landowners such as themselves might not practice agroforestry. Both the forest grazers' and nonforest grazers' most frequent responses were 'lack of technical assistance/ educational support', 'not practical in commercial situations', 'no access to livestock or livestock facilities' and 'lack of scientific research' (Table 4). More western Washington forest grazers indicated 'general bias against combining grazing and forestry' ($p \leq 0.034$) as a potential obstacle. This is likely due to differing land use histories and forest types.

Based upon their own experiences, forest grazers most often chose as potential advantages of agroforestry: 'integration of con-

servation and production goals', 'aesthetically pleasing', 'increases land unit income' and 'diversifies productive and economic base' (Table 4). Differences between forest grazers and nonforest grazers were not significant except that more forest grazers chose 'diversifies productive and economic base' ($p \leq 0.028$), suggesting a greater concern for economic benefits. The importance of aesthetics to both groups emphasizes that we need to learn what is considered aesthetically pleasing and how these criteria affect, and are affected by, land management practices. Eastern and western Washington forest grazers perceived similar potential advantages of agroforestry, but 'aesthetically pleasing' ($p \leq 0.022$) was significantly more important to westside forest grazers.

Economic factors were highlighted in the potential disadvantages of practicing agroforestry perceived by forest grazers: 'financial assistance lacking for unknown practice', 'livestock damage trees or crops', and 'establishment costs high'. Nonforest grazers had similar views, although fewer forest grazers saw 'establishment costs high' as a potential obstacle ($p \leq 0.033$) (Table 4). Establishment costs may be overestimated by nonforest grazers relative to actual costs incurred by forest grazers. 'Complicated or difficult to manage' ($p \leq 0.033$) was cited twice as often by nonforest grazers. Again, the requirements may be overestimated by the inexperienced. No actual data concerning establishment costs and management inputs are available to clarify these differing perceptions.

Westside forest grazers were more concerned that "livestock damage trees and crops" ($p \leq 0.026$) and compact soil ($p \leq 0.001$). The former perception may be a result of regional differences in tree and crop species as well as silvicultural and agricultural practices. Higher precipitation probably explains the concern about soil compaction since eastside soils are often wet for extended periods. Both forest grazers and nonforested grazers recognized that forest grazing may be hazardous to other resources, although there are few data quantifying potential damages. Distinctions between proper and improper grazing were not drawn, but should be included in field studies. Because behavior is influenced by beliefs, it is important that the actual hazards and external costs of forest grazing be clarified and shared with land owners.

Forest Grazing Characteristics

Forest grazing was the most common agroforestry practice used by survey respondents, and the only agroforestry practice employed by 71.9% of the agroforesters (Lawrence et al. 1992). In eastern Washington, 46.0% of all respondents grazed livestock on forestland. Median herd size (cattle only) was 67. In western Washington, 31.0% of the respondents grazed livestock on forestland, but the median herd size was only 20 head. Cow/calf pairs constituted 76.0% of all livestock on forested ranges. One quarter of the forest grazing occurred year round in the counties west of the Cascade mountains. All other forest grazing occurred between early April and early November. Most of Washington's forest ranges are inaccessible for 4 to 6 months annually due to snow or mud.

The most common forest types grazed in eastern Washington

were Douglas fir, ponderosa pine or Douglas fir mixed with ponderosa pine and western larch. Understory vegetation associated with these forest types includes snowberry (*Symphoricarpos albus* Gray), oceanspray (*Holodiscus discolor* (Pursh) Maxim.), bitterbrush (*Purshia tridentata* (Pursh)), bluebunch wheatgrass (*Agropyron spicatum* (Pursh) Scribn. & Smith), Idaho fescue (*Festuca idahoensis* Elmer), needle-and-thread (*Stipa comata* Trin. & Rupr.) and Sandberg bluegrass (*Poa sandbergii* Vasey) (Reid 1964, Harris and Chaney 1984). Upland forests are important in the summer and autumn when grasses at lower elevations are dry and have little nutritive value (Reid 1947, Reid 1964). Understory forage production varies from 112–4,491 kg/ha and is closely associated with the density of the forest overstory, precipitation, soils, and topography (Harris and Chaney 1984).

The most common forest types grazed in western Washington were Douglas fir alone or in association with western red cedar and red alder. The understory offers few preferred forage species except on recent clearcuts: velvet grass (*Holcus lanatus* L.), trailing blackberry (*Rubus ursinus* Cham. & Schlecht.), hairy cat's ear (*Hypochaeris radicata* L.), pearly everlasting (*Anaphalis margaritacea* (L.) B. & H.), and coltsfoot (*Petasites frigidus* (L.) Fries) provide a significant amount of palatable and nutritious forage (A. Dobkowski personal communication). Forage production on these forest sites ranges from 0–5,614 kg/ha (Harris and Chaney 1984), again depending on both environmental and management influences.

Leased lands play an important role in the forest grazing practices of Washington's NIPF owners. Median herd sizes were larger for forest grazers who lease additional land and the median parcel size of deeded forestland was double that of forest grazers who did not lease land (Table 5). Most leased lands are private rather than publicly owned. No doubt there is a minimum acreage (deeded and/or leased) below which forest grazing is not feasible. Grazing permits may contribute to this threshold: 11% of all respondents held public land grazing permits and 86% of the permit holders were eastside agroforesters. Having established the importance of grazing on NIPF lands, we should now learn more details of actual forest grazing practices, efficiencies, and problems.

Agroforestry Information Needs

Both landowners and technical advisors (Lawrence and Hardesty 1992) cited lack of technical assistance, educational support and scientific research as obstacles to implementing agroforestry practices. The type of information respondents would request is another indicator of their concerns and priorities. When asked what, if any, types of agroforestry training or extension information would be useful to them, 46% of all forest grazers requested information, primarily concerning 'livestock management in agroforestry systems' (100% of forest grazers requesting information), 'management of trees in agroforestry systems' (83%), 'using trees and shrubs as shelter/forage for livestock' (65%) and 'managing forestland for special forest products' (63%). Nonforest grazers were most interested in managing for special forest products (100% of those requesting information) and managing trees in agroforestry systems (91%). Interestingly, 43% of the nonforest grazers were also interested in managing livestock in agroforestry systems, suggesting that some might consider forest grazing if they knew more about it.

Information should be targeted to specific groups of NIPF owners. For example, both forest grazers and nonforest grazers were interested in information about 'management of trees in agroforestry systems', but the 2 groups appear to have different views of the role of trees in agroforestry systems. While differences exist in their perceptions of agroforestry, NIPF owners are sufficiently homogeneous in regards to personal characteristics and

motivations to be well served by properly focused educational programs.

Implications and Recommendations

Forest grazing was practiced by 39% of the resident NIPF owners responding to our survey. Parcel size was related to the likelihood of forest grazing although it is unclear if more land was obtained in order to produce livestock, or if livestock are used to optimize management of lands already controlled. A larger land area may better support forest grazing by contributing more diverse forage resources and greater opportunities for proper livestock and range resource management. The role of leased lands in forest grazing operations should be clarified, as well as the minimum acreage requirements for successful forest grazing. Cooperative programs or grazing associations may be useful both in accessing sufficient acreage and encouraging proper management.

Assessing range condition on forest lands is complicated by the fact that succession ultimately precludes much forage production, and that the effects of timber management practices and grazing practices are confounded. Harris and Chaney (1984) cite 1981 data from the Soil Conservation Service indicating that 65% of Washington's State and privately owned grazeable woodlands are producing "less than acceptable" amounts of forage relative to their potential in a given successional state. The state's grazeable woodlands are estimated to be producing only 31% of the forage they could be producing if all were in satisfactory condition, hence significant opportunities exist to improve both condition and forage production on privately owned forest lands. They recommend thinning and pruning trees on 56% of the state's grazeable woodlands, and note that few additional practices, other than proper grazing management, and site stabilization following timber harvest, are needed to improve the condition and productivity of these lands. The landowners' willingness to do these improvements is strongly dependent upon their reasons for owning land and their perceptions of various land use practices.

Although forest grazing is perceived by practitioners to contribute significantly to household income, the importance of non-income related motives for owning and managing land cannot be overemphasized. Focusing exclusively on owners' economic or livestock production objectives could be a serious error given the importance of passing land on to children, keeping it 'natural', conservation, aesthetics, and a current or future homesite. The number of forest grazers reporting these objectives suggests that they are not seen as incompatible with forest grazing. Targeting these objectives should increase the success of programs to improve conditions on privately owned forested ranges.

As in any opinion survey, our results must be qualified: actual behavior is not always consistent with respondent's statements. However, behavior is influenced by beliefs, regardless of the factual basis of those beliefs. We need to verify the accuracy of respondents' perceptions. In some cases, information already exists that may counter some of these perceptions. For example, Halloin (1991) recently reviewed the literature on livestock damage to trees, concluding that little hazard exists with proper management. Education might reassure NIPF owners in this regard and promote such proper management. In other cases, such as soil compaction, data are not available to determine the potential for forest soil compaction due to grazing. Economic analyses of forest grazing are urgently needed given the prevalence of economic motives, and the fact that economic justification is needed to access funds for improvement of these ranges. The significance of regional differences, both environmental and socio-economic, should be explored in recognition to the range of conditions under which forest grazing is practiced.

This work emphasizes the importance of understanding land

owner's actual beliefs and practices. For example, an earlier study of land management advisors (Lawrence and Hardesty 1992) did not identify soil compaction as a potential hazard of agroforestry, yet the landowners surveyed frequently expressed this concern. Understanding landowner's values, perceptions, and practices should result in more effective research and extension programs, and ultimately, in better land management.

Literature Cited

- Baumgartner, D.M. 1980.** Nonindustrial private forestland owners: Stevens County, Washington. p. 266-268. *In: Proc. 1979 Convention Soc. Amer. Forest., Soc. Amer. Forest., Bethesda, Md.*
- Blatner, K.A., D.M. Baumgartner, and L.R. Quackenbush. 1991.** NIPF use of landowner assistance and education programs in Washington State. *Western J. App. Forest.* 6:90-94.
- Bliss, J.C., and A.J. Martin. 1989.** Identifying NIPF management motivations with qualitative methods. *Forest. Sci.* 35:601-622.
- Byington, E.K. 1990.** Agroforestry in the temperate zone. Chapter 7. *In: K.G. MacDicken and N.T. Vergara (eds.). Agroforestry: Classification and Management.* John Wiley & Sons, N.Y.
- Colwell, D.E. 1954.** Harmonizing forest and range management in the ponderosa pine forests of central Washington. p. 208-210. *In: Proc. : Soc. Amer. Forest. Soc. Amer. Forest., Bethesda, Md.*
- Coville, F.V. 1898.** Forest growth and sheep grazing in the Cascade mountains of Oregon. *U.S. Div. Forest., Bull.* 15.
- Daniel, T.W., and M.E. Ensiminger. 1945.** Grazing on the cutover land of western Washington. *State College of Washington. Agr. Exp. Sta. Population Bull.* 179.
- Dillman, D.A. 1978.** Mail and telephone surveys: The total design method. John Wiley & Sons, N.Y.
- Force, J.E., and H.W. Lee. 1991.** Nonindustrial private forest owners in Idaho. *Western J. App. Forest.* 6:32-36.
- Franklin, J.F., and C.T. Dyrness. 1973.** Natural vegetation of Oregon and Washington. *USDA Forest Serv. Gen. Tech. Rep. PNW-8.*
- Halloin, L. 1991.** Plantation grazing: A feasibility review. *Dept. of Natur. Resourc., Forest Land Manage. Div. Olympia, Wash.*
- Hanley, D.P., and D.M. Baumgartner. 1990.** Forest and forest products data: Washington State. *Washington State Coop. Ext., Pullman, Wash.* EB 1557.
- Harris, G.A., and M. Chaney. 1984.** Washington State grazing land assessment. *Washington State Univ. Coop. Ext. Pullman, Wash.*
- Hess, J.P. 1966.** Management of livestock grazing on private timberland. p. 231-232. *In: Proc. Soc. Amer. Forest. Soc. Amer. Forest., Bethesda, Md.*
- Ingram, D.C. 1931.** Vegetative changes and grazing use on Douglas fir cut-over land. *J. Agr. Res.* 43:387-417.
- Jardine, J.T., and M. Anderson. 1919.** Range management on the national forests. *USDA: Professional Paper. Bull.* 790.
- Judd, C.S. 1911.** Efficacy of goats in clearing brush land in the Northwest. p. 108-112. *In: Proc. Soc. Amer. Forest. Soc. Amer. Forest., Bethesda, Md.*
- Lawrence, J.H., and L.H. Hardesty. 1992.** Mapping the territory: Agroforestry awareness among Washington State land managers. *Agroforest. Syst.* 19:27-36.
- Lawrence, J.H., L.H. Hardesty, R.C. Chapman, and S.J. Gill. 1992.** Agroforestry practices of Washington State non-industrial private forest land owners. *Agroforest. Syst.* 19:37-55.
- Pearson, G.A. 1923.** Natural reproduction of western yellow pine in the Southwest. *USDA: Forest Serv. Bull.* 1105.
- Reid, E.H. 1947.** Forest grazing in the Pacific Northwest. p. 296-302. *In: Proc. Soc. Amer. Forest. Soc. Amer. Forest., Bethesda, Md.*
- Reid, E.H. 1964.** Forage production in ponderosa pine forests. p. 61-64 *In: Proc. Soc. Amer. Forest. Soc. Amer. Forest., Bethesda, Md.*
- Reid, E.H., L.A. Issac, and G.D. Pickford. 1938.** Plant succession on a cutover, burned, and grazed Douglas fir area. *Pacific Northwest Forest and Range Exp. Sta. Forest Res. Notes* 26.
- Sharrow, S.H., and W.C. Leininger. 1983.** Sheep as a silvicultural tool in coastal Douglas-fir forests. p. 219-232. *In: D.D. Hannaway (ed.). Proceedings foothills for food and forests: Int. Hill Lands Symp. Timber Press, Beaverton, Ore.*
- Weatherhead, D.J., R.C. Chapman, W.H. Kelso. 1982.** Characteristics of NIPF landowners of Spokane County, Washington. *Res. Bull. XB0928, Agr. Res. Center, Washington State Univ., Pullman, Wash.*
- Wetton, C.E. 1988.** A survey of private forest land owners in British Columbia. *FRDA Rep. 044. Forest Res. Develop. Agreement, Victoria, B.C.*