Cost of Timber Harvest Under Traditional and "New Forestry" Silvicultural Prescriptions

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ABSTRACT. *Harvest costs were estimated for New Forestry silvicultural prescriptions designed for application on national forest lands in western Montana. Estimates were derived using an expert opinion format and were compared using constant dollars with actual 1991 costs based on more traditional prescriptions. Costs were developed for three major logging systems (tractor with hand-felling, tractor with mechanical-felling, and uphill skyline with hand-felling) and four major stand types [lodgepole pine* (Pinus contorta), *mature ponderosa pine* (P. ponderosa)*/Douglas-fir* (Pseudotsuga menziesii), *second-growth pine/fir, and mixed conifer]. Average harvest costs for New Forestry prescriptions ranged from no increase to 48% ($72/mbf) higher. In light of stumpage price increases of >$200/mbf since 1991, these increased costs should be a minor factor in determining the feasibility of future timber harvest. West. J. Appl. For. 10(1): 36–42.*

Forestry is undergoing an accelerated transition since Franklin first espoused the concept of "New Forestry" (Franklin 1989). In contrast to other emerging philosophies over the years, acceptance of New Forestry principles has been relatively rapid and unchallenged. Atkinson (1992), however, voiced alarm that "New Forestry" has been promulgated without the rigorous testing typically required before practices are recommended for operational use. Indeed, a wide array of public and industrial entities have already incorporated some form of New Forestry practices into their management systems, yet the impacts of these practices on growth and yield, biodiversity, and harvest costs are just now being evaluated.

Recently, Long and Roberts (1992) analyzed the growth and yield implications of a New Forestry silvicultural system, and Birch and Johnson (1992) evaluated the effects on growth, yield, and financial costs of leaving varying patterns and numbers of large trees at regeneration harvest. In this paper, we examine the costs of harvesting timber under traditional and New Forestry silvicultural prescriptions using three dominant logging systems: (1) tractor systems with hand-felling, (2) tractor systems with mechanical-felling, and (3) uphill skyline systems with hand-felling. Costs are estimated for applying New Forestry prescriptions in four stand types in western Montana: (1) lodgepole pine (*Pinus contorta*), (2) mature ponderosa pine (*P. ponderosa*)/Douglas-fir (*Pseudotsuga menziesii*), (3) second-growth pine/fir, and (4) mixed conifer.

New Forestry prescriptions are typically modifications of traditional prescriptions. However, they differ from traditional prescriptions in several important ways, both ecologically and operationally. For example, leaving some large live trees in clearcuts and group selection openings provides greater species and structural diversity. Leave trees also ameliorate visual impacts, and provide for eventual snag replacement. Leaving snags provides refugia for invertebrates, and a source of inoculum for some mycorrhizal communities (Franklin 1989). Snags are also a source of down woody material and organic matter for the future Leaving scattered clumps of understory trees provides additional structural diversity, as well as hiding cover and nesting sites for some animals and birds. Although residual trees provide important ecological functions, they also provide additional constraints and complexity in the harvest operation compared to traditional prescriptions, particularly in the felling and skidding/yarding phases. Leaving residual trees also results in lower harvest volumes per acre.

Because many of the practices associated with New Forestry are experimental in nature, responses to these changes will take years to evaluate. Yet managers need baseline information immediately for application in the forest planning process (Forest Perspectives 1991).

NOTE: Funding was provided by the USDA Forest Service Pacific Northwest Research Station. The authors thank Hal Salwasser, Steve Tesch, and two anonymous reviewers for comments on earlier versions of this manuscript.

Methods

Cost information associated with New Forestry practices could be developed using either elaborate time-and-motion studies, or through an industry-wide survey after New Forestry prescriptions have been implemented over an extended period. To develop information more quickly, we chose an expert opinion format. This approach provides realistic estimates of the magnitude of logging cost differences until hard cost data become available.

We conducted a two-phase survey of the 25 largest logging companies and log processors in western Montana to obtain harvest cost information. In the first phase, we surveyed respondents to determine their average actual 1991 stump-to-loaded truck harvest costs. We recognize that the mix of silvicultural prescriptions and stand types that produced the harvest in 1991 (and the associated cost/mbf) was not identical to that in the latter 1980s. However, respondents noted that the 1991 harvest generally reflected traditional practices, and that neither the 1991 mix of silvicultural prescriptions and stand types, nor inflation-adjusted (baseline) costs differed materially from those in the previous five years. Moreover, national forest personnel verified that the New Forestry prescriptions they designed for this study were indeed different than what they had been using in the past.

In the second phase of the survey, we solicited estimates of harvest costs per thousand board feet (mbf) under alternative New Forestry prescriptions for the four major stand types. We initially provided respondents with detailed descriptions of each stand type, along with postharvest illustrations of the associated New Forestry prescriptions. Respondents then estimated their specific costs during lengthy face-to-face interviews.

Survey respondents represent companies processing >85% of the annual timber harvest in western Montana. Given the survey was a virtual census of the population, and that the same companies responded to both phases of the survey, there should be little error in extrapolating the survey to the population.

The four major stand types (described below) comprise a majority of the planned timber harvest on national forest lands in western Montana. More detailed descriptions are presented in Figures 1–4.

1. Lodgepole Pine Stand Type.—Mature lodgepole pine with scattered western larch (*Larix occidentalis*) and Douglas-fir relics. Three New Forestry prescriptions were proposed for this stand type: (1) clearcut with reserve trees/seed tree, (2) clearcut with reserve trees/seed tree with required removal of small trees suitable for roundwood products, and (3) commercial thinning/shelterwood prescription (Figure 1).
2. Mature Ponderosa Pine/Douglas-fir Stand Type.— Mature ponderosa pine and Douglas-fir. Two New Forestry prescriptions were proposed for this stand type: (1) individual tree selection, and (2) shelterwood (Figure 2).
3. Second-Growth Pine/Fir Stand Type.—Ponderosa pine and Douglas-fir ranging from 70–110 years old. Only one New Forestry prescription, a group selection, was proposed for the second-growth pine/fir stand type (Figure 3).
4. Mixed Conifer Stand Type.—Primarily mature Douglas-fir and western larch, with some true firs and Engelmann spruce (*Picea engelmannii*). Three New Forestry prescriptions were proposed for the mixed conifer stand type: (1) shelterwood, (2) clearcut with reserve trees/seed tree, and (3) group selection (Figure 4).

Costs were reported or estimated for five activities or components of the overall logging operation, including operator planning and administration, felling, bucking and limbing, skidding or yarding, and loading. However, costs do not include the cost of moving to the site, setting up equipment, road building, log hauling, or postharvest activities. All costs are expressed in 1991 dollars.

Our objective was to estimate the impacts of New Forestry prescriptions on stand-level harvest costs; therefore we did not address landscape-scale considerations. However, harvest activities associated with management at the landscape scale may entail treatment units spread over larger areas, or a greater concentration of units—factors which could affect costs associated with some phases of the harvest operation.

Results

Costs by Harvest System

Estimated stump-to-loaded-truck logging costs (1991 dollars) averaged over an array of stand types and New Forestry prescriptions were $8/mbf higher ($96 vs. $88) than actual 1991 logging costs for hand-felling, and $10/mbf higher ($98 vs. $88) for mechanical-felling on tractor ground (Table 1). In percentage terms, estimated harvest costs/mbf on tractor ground were 9% higher for the typical hand-felling system, and 11% higher for the typical mechanical system. On cable ground, estimated harvest costs increased $32/mbf ($150 to $182), or 21%, compared to average 1991 skyline logging costs.

Virtually all of the estimated cost increases for New Forestry prescriptions were associated with three activities—felling, bucking and limbing, and skidding or yarding. On tractor ground, respondents indicated nearly equal increases ($2–$3/mbf) in each of these three harvest phases. On cable ground, the major increase was in yarding, which increased $21/mbf. Both felling and bucking and limbing activities increased $3/mbf.

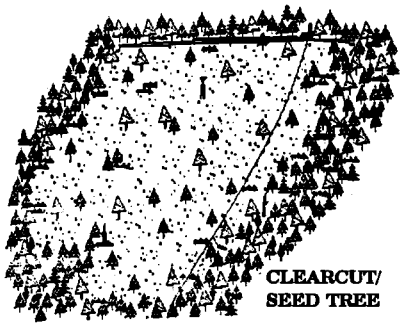
Costs by Silvicultural Prescription

Tractor Ground.—Harvest costs under the individual tree selection prescription (PPDF1) were estimated to increase $11/mbf, or 13%, over the actual 1991 cost of $88/mbf for hand felling systems (Table 1). Looking at specific activities under the individual tree selection prescription, felling costs increased by 23% ($3/mbf), skidding costs by 15% ($5/mbf), and bucking and limbing costs by 11% ($2/mbf).

Estimated average logging costs under the shelterwood prescription in the mature ponderosa pine/Douglas-fir stand

STAND INFORMATION

Species	Lodgepole pine, with scattered larger western larch and Douglas-fir relics > 16"
Average dbh of merchantable timber	8"
Merchantable trees per acre	300
Volume per acre	15 MBF
1-4 snags/acre left on the site	



CLEARCUT/
SEED TREE

LODGEPOLE PINE - PRESCRIPTION # 1 (LP1)

Clearcut/Seed Tree 2-10 western larch or Douglas-fir reserve tpa > 10" dbh. Cone bearing lodgepole pine tops left on the site or returned to the site. Units 10-40 acres, 30 acres typical.

REMOVALS		RESIDUALS	
Average dbh	8"	Average dbh	> 10"
Trees per acre	290	Trees per acre	2-10
Volume per acre	14-15 MBF	Volume per acre	0-1 MBF

LODGEPOLE PINE - PRESCRIPTION # 2 (LP2)

Clearcut/Seed Tree 2-10 western larch or Douglas-fir reserve tpa > 10" dbh. Cone bearing lodgepole pine tops left on the site or returned to the site. Units 10-40 acres, 30 acres typical. On tractor ground, operator will be required to remove small roundwood products to a minimum dbh of 4" and a minimum top of 3". Average dbh of this material is 5", average tpa is 100, and average converted MBF/ac is 1.5.

REMOVALS		RESIDUALS	
Average dbh	8"	Average dbh	> 10"
Trees per acre	290	Trees per acre	2-10
Volume per acre	14-15 MBF	Volume per acre	0-1 MBF

COMMERCIAL THIN/
SHELTERWOOD PREP CUT

LODGEPOLE PINE - PRESCRIPTION # 3 (LP3)

Commercial Thin/Shelterwood Preparation Cut Remove 50-60% of merchantable volume. Leave larger trees so the average dbh of removals is 7". Residual trees will be evenly spaced throughout the stand. Units 20-100 acres, 60 acres typical.

REMOVALS		RESIDUALS	
Average dbh	7"	Average dbh	> 8"
Trees per acre	150	Trees per acre	150
Volume per acre	7 MBF	Volume per acre	8 MBF

Figure 1. Preharvest and postharvest descriptions of the lodgepole pine stand type and postharvest illustrations of alternative prescriptions.

type (PPDF2) increased only 5%, or $4/mbf, over the actual logging costs of $88/mbf for the typical hand felling system.

Under the typical mechanical-felling system, two prescriptions involving the harvest of small timber (clearcut/seedtree with small roundwood removal—LP2, and commercial thin/shelterwood preparation—LP3) showed the largest cost increases ($17/mbf). This is 18% above actual stump to loaded truck costs of $88/mbf for mechanized systems. Most of the increased costs were associated with just two activities—felling, and bucking and limbing.

Estimated stump to loaded truck costs for the two group selection prescriptions (PPDF3; MC3) increased slightly more than 10%, with most of the increase coming in felling and skidding activities.

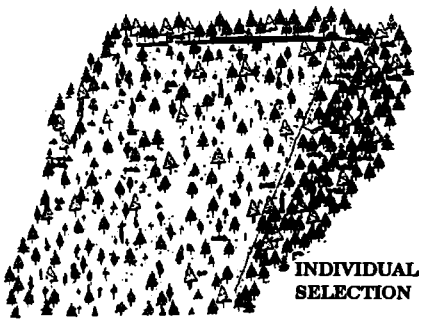
Estimated harvest costs for the lodgepole pine type under the clearcut/seed-tree prescription (LP1) were $93/mbf, only $5 more than the actual 1991 average cost of mechanical-felling.

The lowest estimated costs were associated with the shelterwood (MC1) and clearcut/seed-tree (MC2) prescriptions in the mixed conifer stand type; stump-to-truck costs under these prescriptions were virtually the same as the average mechanical system logging cost in 1991 of $88/mbf

Cable Ground.—The most costly New Forestry prescriptions on cable ground were the group selections (PPDF3, MC3). Respondents estimated that logging costs would increase 48% under group selection in both the second-growth ponderosa pine/Douglas-fir stand type and in the mixed conifer stand type compared to the average uphill skyline system cost—an increase of $72/mbf. The estimated cost of the commercial thin/shelterwood prescription in lodgepole pine was about one-third higher than the actual logging cost—$204 vs. $150. Approximately two-thirds of the cost increase for these three prescriptions was associated with the yarding phase of the harvest operation.

STAND INFORMATION

Species	Ponderosa pine and Douglas-fir
Average dbh of merchantable timber	16" (range 8-24")
Merchantable trees per acre	70
Volume per acre	10 MBF
1-4 snags/acre left on the site	

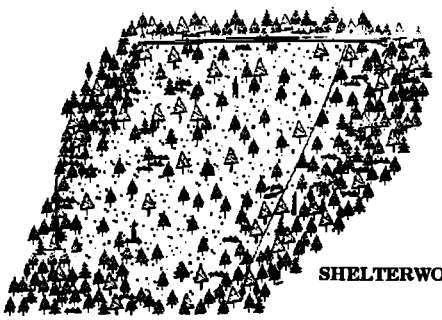


INDIVIDUAL TREE SELECTION

PONDEROSA PINE/DOUGLAS-FIR - PRESCRIPTION # 1 (PPDF1)

Individual Tree Selection Leave 50% of the volume in merchantable trees, preferably ponderosa pine, across the diameter range. Residual trees relatively evenly distributed across stand. 50-75 submerchantable tpa meeting crop tree standards will also be marked for leave. Units 100-200 acres, 150 acres typical.

REMOVALS		RESIDUALS	
Average dbh	16" range 8-24"	Average dbh	16" range 8-24"
Trees per acre	35	Trees per acre	35, plus 50-75 submerchantable
Volume per acre	5 MBF	Volume per acre	5 MBF



SHELTERWOOD

PONDEROSA PINE/DOUGLAS-FIR - PRESCRIPTION # 2 (PPDF2)

Shelterwood Leave 20-30% of volume in larger diameter trees, preferably ponderosa pine. Residual trees relatively evenly distributed across the stand. Clumps of submerchantable trees will also be left. Units 20-100 acres, 60 acres typical.

REMOVALS		RESIDUALS	
Average dbh	16" range 8-24"	Average dbh	16"
Trees per acre	45	Trees per acre	25
Volume per acre	7-8 MBF	Volume per acre	2-3 MBF

Figure 2. Preharvest and postharvest descriptions of the mature ponderosa pine/Douglas-fir stand type and postharvest illustrations of alternative prescriptions.

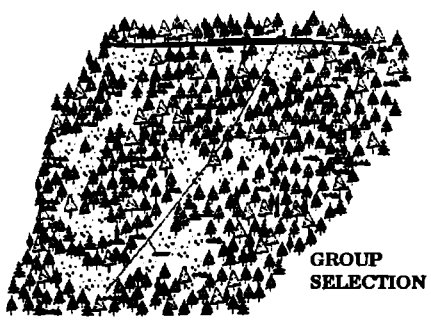
The shelterwood cut in the mature ponderosa pine/Douglas-fir type (PPDF2) was the least costly prescription; estimated logging costs of $150 were the same as actual costs. Estimated costs for the other New Forestry prescriptions on cable ground increased from 4 to 14%.

Discussion

Estimated harvest costs for New Forestry prescriptions ranged from no increase to 48% ($72/mbf) higher than average logging costs for traditional prescriptions. The fun-

STAND INFORMATION

Species	Ponderosa pine and Douglas-fir
Average dbh of merchantable timber	11"
Merchantable trees per acre	150
Volume per acre	9 MBF
1-4 snags/acre left on site	



GROUP SELECTION

PONDEROSA PINE/DOUGLAS-FIR SECOND GROWTH - PRESCRIPTION # 1 (PPDF3)

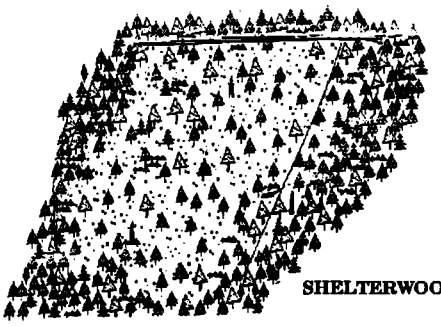
Group Selection Remove 20% of the stand in small groups averaging 1 acre in size. Some larger diameter trees left within removal groups. Units 20-100 acres, 60 acres typical.

REMOVALS		RESIDUALS	
Average dbh	11"	Average dbh	> 11" within groups
Trees per acre	140-148	Trees per acre	2-10 within groups
Volume per acre	>8 MBF within groups	Volume per acre	< 1 MBF within groups

Figure 3. Preharvest and postharvest descriptions of the second-growth ponderosa pine/Douglas-fir stand type and postharvest illustrations of alternative prescriptions.

STAND INFORMATION

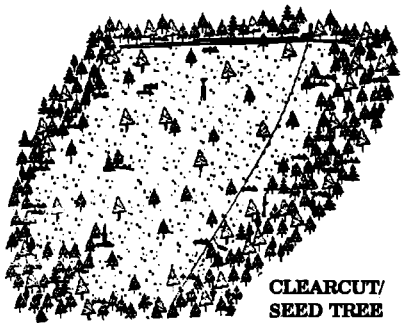
Species	Douglas-fir and western larch, with some true firs and Engelmann spruce
Average dbh of merchantable timber	11" dbh (range 7-22")
Merchantable trees per acre	160
Volume per acre	10 MBF
1-4 snags/acre left on site	



MIXED CONIFER - PRESCRIPTION # 1 (MC1)

Shelterwood Leave 20-30% of volume in larger diameter trees, preferably ponderosa pine. Residual trees relatively evenly distributed across the stand. Clumps of submerchantable trees will also be left. Units 20-100 acres, 60 acres typical. *NOTE: Clumps would be protected on tractor ground but not on cable ground.*

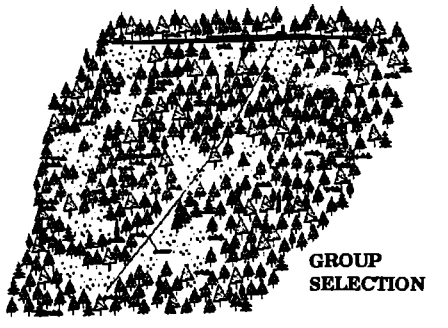
REMOVALS		RESIDUALS	
Average dbh	11" (range 7-22")	Average dbh	> 11"
Trees per acre	130	Trees per acre	30
Volume per acre	7-8 MBF	Volume per acre	2-3 MBF



MIXED CONIFER - PRESCRIPTION # 2 (MC2)

Clearcut/Seed Tree Leave 10% volume, about 6-10 trees per acre of the largest trees. Clumps of submerchantable material may also be left. Units of 10-40 acres, 30 acres typical. *NOTE: Clumps would be protected on tractor ground but not on cable ground.*

REMOVALS		RESIDUALS	
Average dbh	11" (range 7-22")	Average dbh	> 11"
Trees per acre	150	Trees per acre	10
Volume per acre	9 MBF	Volume per acre	1 MBF



MIXED CONIFER - PRESCRIPTION # 3 (MC3)

Group Selection Remove 20% of the stand in small groups averaging 1 acre in size. Some larger diameter trees left within removal groups. Units 20-100 acres, 60 acres typical. *NOTE: Clumps would be protected on tractor ground but not on cable ground.*

REMOVALS		RESIDUALS	
Average dbh	11"	Average dbh	> 11" within groups
Trees per acre	150-158	Trees per acre	2-10 within groups
Volume per acre	>9 MBF within groups	Volume per acre	< 1 MBF within groups

Figure 4. Preharvest and postharvest descriptions of the mixed conifer stand type and postharvest illustrations of alternative prescriptions.

damental question is whether these cost differences are large enough to either limit or prohibit application of New Forestry prescriptions. Insight into this question can be gained by examining two major aspects of the changing operating environment: (1) prices of national forest timber, and (2) social and biological concerns which strongly influence the nature and amount of timber harvest on public lands.

Prices paid for national forest sawtimber in Montana, measured in constant 1991 dollars, have risen from an average of $50/mbf in fiscal year 1986 to $336/mbf in 1993, an increase of $286/mbf. The average inflation-adjusted price of national forest stumpage in Montana jumped from $135/mbf in 1991 to $220/mbf in 1992, and increased another $116/mbf in 1993 (USDA FS Region One 1993) (Figure 5).

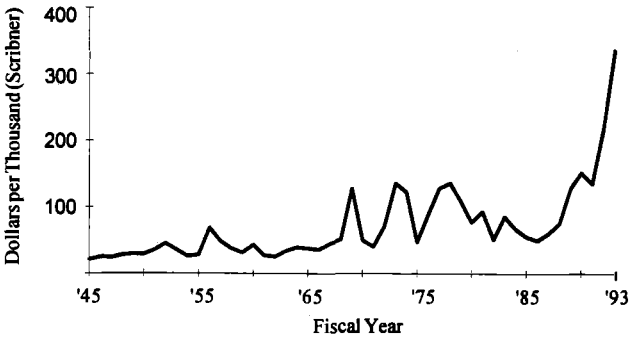


Figure 5. Average national forest winning-bid stumpage prices—Montana, 1945-1993 (1991 dollars).

TABLE 1. Average stump to loaded truck logging costs for various harvest systems and stand types under traditional and New Forestry harvest prescriptions (1991 dollars).

Harvest system	Activity					
	Operator planning and administration	Felling	Bucking & limbing	Skidding or yarding	Loading	Total stump to truck cost
	Costs/mbf (1991 $)					
Tractor ground—typical hand-felling system						
Traditional prescriptions (based on 1991 actual costs)	11	13	19	33	12	88
New Forestry prescriptions (estimated costs)						
Individual tree selection ponderosa pine/Douglas-fir (PPDF1)	11	16	21	38	13	99
Shelterwood ponderosa pine/Douglas-fir (PPDF2)	11	15	21	34	11	92
New Forestry average	11	16	21	36	12	96
Tractor ground—typical mechanical-felling system						
Traditional prescriptions (based on 1991 actual costs)	12	19	20	25	12	88
New Forestry prescriptions (estimated costs)						
Clearcut/seedtree lodgepole pine (LP1)	12	20	22	25	14	93
Clearcut/seedtree lodgepole pine w/roundwood removal(LP2)	13	24	26	27	15	105
Commercial thin/shelterwood prep. Cut lodgepole pine (LP3)	13	25	24	29	14	105
Group selection 2nd growth ponderosa pine/Douglas-fir (PPDF3)	12	22	22	29	14	99
Shelterwood mixed conifer (MC1)	11	20	21	25	13	90
Clearcut/seedtree mixed conifer (MC2)	11	19	20	23	13	86
Group selection mixed conifer (MC3)	12	23	21	28	14	98
New Forestry average	12	22	23	27	14	98
Cable ground—typical uphill skyline system with hand felling						
Traditional prescriptions (based on 1991 actual costs)	8	13	19	98	12	150
New Forestry prescriptions (estimated costs)						
Clearcut/seedtree lodgepole pine (LP1)	8	16	22	101	14	161
Commercial thin/shelterwood prep. Cut lodgepole pine (LP3)	10	20	26	133	15	204
Individual tree selection ponderosa pine/Douglas-fir (PPDF1)	8	16	21	114	12	171
Shelterwood ponderosa pine/Douglas-fir (PPDF2)	8	14	19	97	12	150
Group selection ponderosa pine/Douglas-fir (PPDF3)	12	20	25	149	16	222
Shelterwood mixed conifer (MC1)	8	16	21	107	13	165
Clearcut/seedtree mixed conifer (MC2)	8	15	20	101	12	156
Group selection mixed conifer (MC3)	12	21	27	147	15	222
New Forestry average	9	17	23	119	14	182

Even without further timber price increases, the higher logging costs associated with New Forestry appear insignificant on tractor ground, where the most expensive prescription examined was only $17/mbf more than the average logging cost in 1991. The impacts on cable ground were considerably greater, yet even here the most expensive prescription was only $72/mbf more—barely one-third the $201/mbf increase in stumpage price since 1991 and about a quarter of the inflation adjusted increase since 1986.

Given renewed political interest in the below-cost timber sale issue, potential impacts of prescriptions that substantially increase logging costs cannot be dismissed. However, the slightly to moderately higher logging costs associated with the New Forestry prescriptions we examined, especially on tractor ground, appear to be a very minor factor in determining the feasibility of future timber harvest on national forest lands in western Montana.

Timber harvest on national forest lands only occurs after a lengthy process which identifies and evaluates an array of issues and concerns. Accommodation of a variety of complex biological and social issues has required the development of modified silvicultural prescriptions. Traditionally used prescriptions of the past are often unacceptable today. Clearcutting, for example, was a staple regeneration cutting prescription in western Montana from the 1950s through the 1980s. It has now become a prescription of last resort on national forest lands in western Montana (Lolo National Forest 1991). Consequently, alternative prescriptions that better accommodate visual and biological concerns will be essential in managing national forests in the future. Findings from this survey provide strong preliminary evidence that the logging costs associated with most of these prescriptions do not prohibit their application given the recent increase in stumpage prices.

Literature Cited

ATKINSON, W.A. 1992. Silvicultural correctness: The politicalization of forest science. West. Wildlands 17(4): 8–12.

BIRCH, K.R., and K.N. JOHNSON. 1992. Stand-level wood-production costs of leaving live, mature trees at regeneration harvest in coastal Douglas-fir stands. West. J. Appl. For. 7(3): 65–68.

FOREST PERSPECTIVES. 1991. Retrospective studies: Exploring the effects of New Forestry practices. p. 17.

FRANKLIN, J. 1989. Toward a new forestry. Am. For. 95: 37–44.

LOLO NATIONAL FOREST. 1991. Lolo National Forest Annual Report. 8 p.

LONG, J.N., and S.D. ROBERTS. 1992. Growth and yield implications of a "New Forestry" silvicultural system. West. J. Appl. For. 7(1): 6–9.

USDA FOREST SERVICE REGION ONE. 1993. Timber stumpage appraisal reporting system.

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