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Research Note

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Montana Forest and Conservation Experiment Station, School of Forestry,
University of Montana, Missoula, Montana 59812.

Silvicultural Activities of Public Organizations and Forest Industry in Montana, 1976-1978

By Ervin G. Schuster and Hans R. Zuuring

Timber management practices in Montana can be partially gauged by understanding the nature of silvicultural activities undertaken. This report provides information on the area of commercial timber land in Montana receiving silvicultural treatments over the 1976-78 period. Data were developed with the assistance of forestry organizations. Silvicultural activities including regeneration cutting, site preparation, fertilization and others are considered.

This report provides data on the nature and amount of silvicultural activities in Montana. The data were collected during a study of the prospects and potentials for intensified timber management in Montana. That study required the development of baseline data concerning silvicultural activities by public and forest-industry owners of commercial timber land in Montana.¹ Due to large numbers and relative inaccessibility, collection of similar information on silvicultural activities in the nonindustrial private sector was beyond study capability.² Data in this study were obtained from records and interviews with personnel in Montana's forest industry and public land management organizations.³ In this study, the forest industry consists of Burlington Northern, Champion Timberlands, the St. Regis Corporation, and Pack River Co.; public organizations consist of the Bureau of Indian Affairs, Bureau of Land Management, State of Montana (consisting of the Division of Forestry, Department of State Lands and Lubrecht Experimental Forest) and the U.S. Forest Service. Identification and definition of all silvicultural activities were made in consultation with representatives of these land management organizations. Data were collected in the spring of 1979 for the years 1976, 1977 and 1978. Annual average levels of silvicultural activity, calculated as the arithmetic means of the annual activity level, comprise most of the

data presented in this report. They indicate general relationships only and should be so interpreted.

Over the 1976-1978 period, an annual average of 174 thousand acres of commercial forest land in public and industrial ownerships received some form of silvicultural activity. When compared to the listing below, this average annual level of silvicultural activity amounts to about 1.6 percent of the commercial timber-land base for the ownership classes studied.

	Commercial Timber Land in Montana ¹	
	Acres (Thousands)	Percent Total
Ownership Class		
Public	9,499.4	85.7
Forest Industry	1,588.0	14.3
Geographical Class		
East of Continental Divide	3,246.7	29.3
West of Continental Divide	7,840.7	70.7
TOTAL	11,087.4	100.0

¹Commercial timber land is forest land producing or capable of producing in excess of 20 cubic feet per acre per year of industrial roundwood in natural stands and not formally withdrawn from timber utilization. Specifically, this includes large amounts of public forest land that are currently undergoing evaluation for wilderness suitability, with the exception that U.S. Forest Service lands in the land-component category of "deferred" have been excluded.

²The most current information available on the nonindustrial private sector is found in: Schuster, Ervin G. 1979. Attitudes and activities of private forest landowners in Western Montana. USDA Forest Service R1-78-03. 76pp. (Missoula, Montana).

³Data presented in this paper represent acreages reported to the authors by the various participating organizations. Obviously, not all organizations use identical definitions in their record systems. These systems also vary in quality. Efforts were made to rectify irregularities in definitions and to verify reported acreages. Nevertheless, some errors beyond the control of the authors may still be present.

Table 1. Average annual number of acres of commercial timber land in Montana receiving silvicultural activities, by ownership and geographical class, 1976-1978.¹

Silvicultural Activity	Ownership Class		Geographical Class		Montana Total
	Public	Industry	East	West	
			(acres)		
Regeneration Cutting	30,855	34,286	4,087	61,054	65,141
Clear-cut	8,607	2,201	2,332	8,477	10,808
Partial cut	22,248	32,085	1,756	52,577	54,333
Site Preparation	27,107	9,621	6,619	30,109	36,728
Chemical	280	7	86	201	287
Mechanical	18,621	7,909	5,324	21,206	26,530
Burning	8,206	1,705	1,209	8,702	9,911
Artificial Regeneration	14,994	3,392	2,665	15,722	18,386
Seeding	2,151	1,434	103	3,482	3,585
Planting	12,843	1,958	2,562	12,240	14,802
Fertilization	—	183	—	183	183
Thinning	29,128	13,513	5,040	37,602	42,641
Precommercial	27,327	12,027	4,932	34,423	39,354
Commercial	1,801	1,486	108	3,179	3,287
Sanitation Cutting	6,052	4,979	898	10,133	11,031

¹Data may not sum to totals due to truncation. Dashes (-) indicate zero acres.

Table 1 provides a summary of the types and extent of silvicultural activities that took place in Montana. Highlights of this data summary follow.

Regeneration cutting is largest single silvicultural practice.

The single, most widespread silvicultural practice was regeneration cutting, accounting for over one-third of all acres treated in Montana. Over half of all acres receiving regeneration cuts occurred on forest-industry lands and over 93 percent occurred in western Montana. The intensity of regeneration cutting (rates of acres cut to total land) was almost seven times as great for forest industry (1:46) compared to public organizations (1:308) and about six times as great for western (1:128) compared to eastern (1:794) Montana.

Partial cutting systems dominate regeneration cuts.

For every ten acres receiving regeneration cuts, more than eight acres were cut under some form of partial cut regeneration system—selection, seed-tree or shelterwood. The remainder was clear-cut. But the relative intensity of use (percent of total) for partial versus clear-cutting varied widely between ownership and geographical class. Partial cutting systems were used relatively more often in western than in eastern Montana (86 percent compared to 43 percent of their totals, respectively) and by forest industry relative to public organizations (94 percent compared to 72 percent of their totals, respectively). Similarly, clear-cuts were used relatively more often in eastern than in western Montana (57 percent compared to 14 percent of their totals, respectively) and by public organizations relative to forest

industry (28 percent compared to six percent of their totals, respectively).

Regeneration cutting acres exceed site preparation, 2:1.

Roughly one acre of commercial timber land in Montana received site preparation for every two acres receiving some form of regeneration cutting. Almost three-fourths of all site preparation activities took place on public lands while about 82 percent occurred in western Montana. In principle, successfully applied regeneration cuts would be balanced by no more than the same area of site preparation. The only deviation from this principle was found in eastern Montana where about 62 percent more acres received site preparation than received regeneration cuttings. This result may be due to accelerated site preparation activities, use of clear-cuts which tend to require more site preparation compared to partial cuts, or some combination of factors. Mechanical site preparation dominated all organizations and both western and eastern Montana, accounting for almost three-fourths of all site-prepared acres.

One-fourth acre receives artificial regeneration for each acre cut.

In principle, since successfully applied regeneration cuts would require no artificial regeneration, artificial regeneration would be applied only to unsuccessful regeneration cuts and to establish stands in nonstocked areas. However, while artificial regeneration is commonly applied in conjunction with regeneration cuts, clear-cuts often use artificial regeneration more frequently than partial-cutting systems. In the aggregate, about one acre received artificial regeneration efforts for every 3.5 acres

**Table 3. Average annual number of acres of commercial timber
average annual number of acres associated with attempt
by ownership and**

Silvicultural Activities	Bureau of Indian Affairs				Bureau of Land Management			
	1976	1977	1978	Average	1976	1977	1978	Average
Regeneration Cutting	7731	6719	7118	7189	1375	651	663	896
Clear-cut	200	959	910	690	78	24	24	42
Partial cut	7531	5760	6208	6500	1297	627	639	854
Site Preparation	100	1008	1300	803	354	100	100	185
Chemical	-	-	-	-	-	-	-	-
Mechanical	-	1008	1000	669	354	100	100	185
Burning	100	-	300	133	-	-	-	-
Artificial Regeneration	231	698	958	629	1354	500	100	651
Seeding	-	-	-	-	354	100	100	185
Planting	231	698	958	629	1000	400	-	467
Fertilization	-	-	-	-	-	-	-	-
Thinning	7098	7387	4957	6481	156	324	277	252
Precommercial	6998	7287	4857	6381	134	311	250	231
Commercial	100	100	100	100	22	13	27	21
Sanitation Cutting	350	300	493	381	240	240	320	267
Attempted Stand Establishment	2931	2382	3118	2810	1454	600	200	751
Natural	2700	1684	2160	2181	100	100	100	100
Artificial	231	698	958	629	1354	500	100	651
Seeding	-	-	-	-	354	100	100	185
Planting	231	698	958	629	1000	400	-	467
Successful Stand Establishment	1916	2316	1436	1889	100	100	100	10
Natural	-	1503	-	501	100	100	100	100
Artificial	1916	813	1436	1388	-	-	-	-
Seeding	1700	305	500	835	-	-	-	-
Planting	216	508	936	553	-	-	-	-

¹Data may not sum to totals due to truncation. Dashes (-) indicate zero acres.

and in Montana receiving timber management activities and
 ted and successful stand establishment in Montana,
 ear, 1976-1978.¹

1976	Forest Industry			State of Montana				U.S. Forest Service			
	1977	1978	Average	1976	1977	1978	Average	1976	1977	1978	Average
32755	31755	38347	34286	3500	3550	3650	3567	20315	18231	19064	19203
2189	1972	2442	2201	500	500	550	517	9205	6138	6734	7359
30566	29783	35905	32085	3000	3050	3100	3050	11110	12093	12330	11844
5745	8875	14244	9621	1250	1314	1351	1305	26034	22161	26248	24814
-	20	-	7	-	-	-	-	309	238	294	280
4022	7733	11973	7909	1225	1274	1301	1267	17682	14412	17406	16500
1723	1122	2271	1705	25	40	50	38	8043	7511	8548	8034
2196	2584	5396	3392	212	23	1545	593	10436	14589	14337	13121
736	475	3090	1434	-	-	1500	500	842	2114	1443	1466
1460	2109	2306	1958	212	23	45	93	9594	12475	12894	11654
-	482	66	183	-	-	-	-	-	-	-	-
8135	11596	20808	13513	2710	2723	1271	2235	21385	19896	19201	20160
7253	10293	18536	12027	1890	1198	741	1283	20538	19408	18349	19431
882	1303	2272	1486	800	1525	530	952	847	488	852	729
3663	5444	5828	4979	1060	1040	3035	1712	2595	2078	6406	3693
34426	33305	39919	35883	1397	1254	2834	1828	28824	31585	27440	29286
32230	30721	34523	32491	1185	1231	1289	1235	18398	16996	13103	16166
2196	2584	5396	3392	212	23	1545	593	10436	14589	14337	13121
736	475	3090	1434	-	-	1500	500	842	2114	1443	1466
1460	2109	2306	1958	212	23	45	93	9594	12475	12894	11654
30270	28752	29423	29482	192	23	65	93	23813	26190	22978	24327
28691	27734	24960	27128	-	-	-	-	14421	13059	10075	12518
1579	1018	4463	2353	192	23	65	93	9392	13131	12903	11809
480	390	2347	1072	-	-	-	-	758	1903	1299	1320
1099	628	2116	1281	192	23	65	93	8634	11228	11604	10489

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receiving some form of regeneration cut and for every 1.7 acres receiving clear-cuts. The ratio of artificial regeneration acres to acres receiving regeneration cuts was about five times as great for public organizations (1:2.1) compared to forest industry (1:10.1), possibly caused by accelerated public regeneration efforts, relatively unsuccessful regeneration cuts, or some combination of factors. Similarly, this ratio was over twice as great in eastern (1:1.5) compared to western (1:3.9) Montana, possibly due to use of clear-cuts in the east. Planting was used more than seeding in all organization and geographical classes and accounted for over 80 percent of all artificial regeneration efforts. Two results are notable: only four percent of artificial regeneration efforts in the eastern portion of Montana were through seeding while 42 percent of forest industry efforts were through seeding.

Fertilization activities are virtually nonexistent in Montana, apparently being attempted only experimentally by forest industry.

Thinning dominates timber stand improvement practices.

The second most widespread silvicultural practice was thinning, accounting for about one-fourth of all acres treated in Montana. In total, about one acre in 260 received some form of thinning. Over two-thirds of these acres were on public lands while about 88 percent were on lands in western Montana. But the annual rate of thinning (ratio of thinned acres to total acres) varied widely. This rate for the forest industry (1:118) was almost three times that of public organizations and similarly the rate for western Montana (1:209) was about three times the rate for eastern Montana. Precommercial thinning dominated all organizations and geographical regions of Montana, accounting for 92 percent of all thinnings compared to eight percent for commercial thins.

Sanitation cutting is almost equally divided between public and forest-industry ownership, but occurs almost entirely in western Montana.

Table 2. Average annual amount of attempted and successful stand establishment in Montana, by ownership and geographical class, 1976-1978.¹

Stand Establishment Characteristics	Ownership Class		Geographical Class		Montana Total
	Public	Industry	East	West	
Attempted Establishment	34,676	35,883	8,202	62,358	70,560
Natural	19,682	32,491	5,537	46,635	52,173
Artificial	14,994	3,392	2,665	15,722	18,386
Seeding	2,151	1,434	103	3,482	3,585
Planting	12,843	1,958	2,562	12,240	14,802
Successful Establishment	26,410	29,482	7,054	48,837	55,891
Natural	13,119	27,128	4,729	35,518	40,248
Artificial	13,291	2,353	2,325	13,319	15,644
Seeding	2,155	1,072	93	3,135	3,227
Planting	11,136	1,281	2,232	10,184	12,416

¹Data may not sum to totals due to truncation.

The relationship between attempted stand establishment and successful stand establishment is an important aspect of timber management in Montana. Data relating to this topic are presented in Table 2.⁴

These data warrant the following major remarks:

Regeneration attempts exceed successes.

Stand establishment is attempted on about five acres for every four that are successfully established. This relationship does not vary much between organization or

geographical class.

Natural regeneration dominates both attempts and successes.

Almost three-fourths of all attempted and successful establishment acres were associated with natural methods of establishment, the remainder associated with seeding or planting. Variations from this acreage were that public ownerships used roughly equal amounts of natural and artificial methods and forest industry used artificial methods for one acre in ten.

Natural and artificial regeneration are about equally successful.

Except for public ownerships, the percentage of total acres attempted by natural and artificial means is virtually identical to the percentage of total acres

⁴Forestry organizations commonly evaluate stand establishment efforts to determine if they were successful (based on a stocking standard and stand age). Therefore the acres associated with stand-establishment attempts are different physical acres than those declared successful, the latter representing attempts at some previous time.

successfully regenerated, suggesting there is little difference in the likelihood of success for these methods. In the case of public organizations while about 58 percent of the acres attempted were through natural means, less than 50 percent of the successful acres were attributed to natural means; for this organization class, artificial regeneration is a relatively more successful method of regeneration.

Most artificial regeneration involves planting.

In total, about eight out of ten acres attempted or successfully regenerated by artificial means were done by planting, rather than seeding. However, public and private organizations differed considerably; while over 83 percent of public organization attempts and successes were associated with planting, only about 54 percent of private attempts were associated with planting, 46 percent with seeding.

Area of regeneration cuts exceeds area of attempted natural stand establishment.

In principle, all acres receiving regeneration cutting (as shown in Table 1) represent efforts at stand establishment by natural methods. Yet except for the case of the eastern portion of Montana, the acres of regeneration cutting always exceeded the acres of natural stand establishment

attempts. In total there were 25 percent more acres cut than claimed as regeneration attempts. Stated differently, for every five acres cut, only four were considered to be efforts to regenerate naturally. This discrepancy is shown for both forest industry where attempted acres of natural establishment represented about 95 percent of the regeneration cutting and public organizations where a percentage of 64 percent was found.

Area of regeneration cutting exceeds that of successful stand establishment.

One measure of the success of silvicultural activities is the relationship between the acres involved in regeneration cutting and successful stand establishment. In total for every 1.2 acres treated with a regeneration cut, one acre was successfully regenerated. This relationship was virtually identical for both public ownerships and forest industry. The single exception was found in eastern Montana where about 1.7 acres were successfully regenerated for each acre of regeneration cut.

Some readers may desire more detailed data than those presented in Tables 1 or 2. These data are presented by five ownership classes and three years in Table 3, without comment. They are totally comparable to data already presented, except that they also indicate year to year changes in the level of silvicultural activities.