FIRE HISTORY OF THE BEVERLY CARIBOU WINTER RANGE, NWT, 1966-1982

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ABSTRACT

Fire history of the Caribou Range Subdistrict south of the treeline (116,778 km^2) was investigated by analyzing the fire statistics compiled by the Forest Service, Northern Affairs Program, Department of Indian Affairs and Northern Development. The Forest Service has been monitoring and mapping fires by aerial reconnaissance in the Caribou Range Subdistrict since 1966. From 1966 to 1982, 533 fires burned approximately 1.9 million hectares or 16.26 percent of the Caribou Range Subdistrict. The annual burn rate ranged from <0.01 to 6.43 percent, and averaged 0.96 percent for the 17 year period. Forty (40) percent of the total burned area was attributed to the 1979 fire season. The majority of fires (72%) and most of the burned area (79%) occurred west of $108^{o}W$ longitude. This pattern is consistent with earlier studies of fire history and reflects regional differences in lightning incidence and length of fire season. The annual burn rates reported for the Caribou Range Subdistrict should be regarded as preliminary estimates because of the limitations of monitoring and mapping fires by aerial reconnaissance.

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INTRODUCTION

In January 1983, the Caribou Management Board discussed the role of forest fires on the winter range of the Beverly and Kaminuriak caribou herds, and suggested an acceptable burn rate of 0.5 percent per year. Acceptance of this rate was based on a 200 year fire rotation for the winter range and reflects the importance of mature forest stands as winter habitat for caribou. Implementation of an acceptable burn rate requires a comprehensive understanding of fire history throughout the winter ranges. The member governments were requested to provide the Board with fire history information for their respective jurisdictions.

The purpose of this report is to summarize the recent fire history of the Beverly caribou winter range in the Northwest Territories (NWT).

METHODS

Fire statistics for the Beverly caribou winter range in the NWT were obtained from the Forest Service, Northern Affairs Program, Department of Indian Affairs and Northern Development (DIAND). The Forest Service has been monitoring and mapping fires by aerial reconnaissance in this area since a base camp was established at Porter Lake in 1966. In 1974 the Porter Lake camp was abandoned; thereafter, fires have been monitored from the Regional Fire Centre in Fort Smith.

The Caribou Range Subdistrict is an administrative subdistrict within DIAND's Fort Smith District and encompasses the NWT portion of the Beverly winter range (Fig. 1). This report concerns only the area south of the treeline (11,677,800 ha). This area was divided into two blocks, separated by 108°W longitude, in order to compare annual burn rates for eastern and western parts of the winter range. Earlier studies of fire history in this region suggest that fire incidence and fire size are greater in the closed forests west of 108°W than in the more open woodlands east of 108°W (Johnson and Rowe 1975).

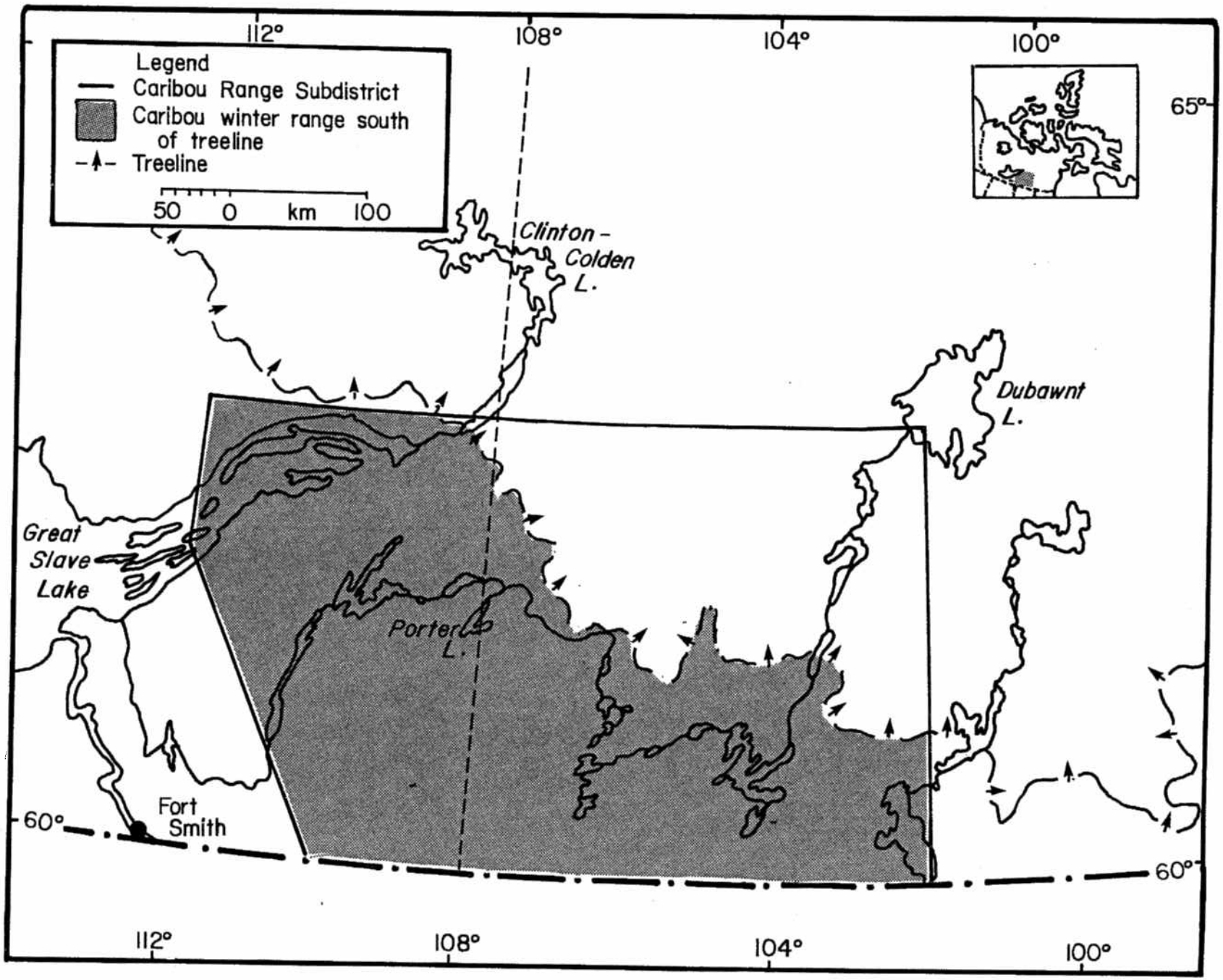

Figure 1. Location of Caribou Range Subdistrict, NWT.

RESULTS

A total of 533 fires was reported for the Caribou Range Subdistrict between 1966 and 1982 (Table 1). The number of fires in a year varied widely and ranged from one fire in 1968 to 88 fires in 1973. Similarily, the area burned per year ranged from 0.2 ha in 1968 to 750,981 ha in 1979. The 1979 fires accounted for 40 percent of the total area burned (1,899,122 ha) during the 17 year period (Fig. 2).

The annual burn rate, calculated as a percentage of the total area of the Caribou Range Subdistrict south of the treeline, ranged from less than 0.01 percent in 1968 and 1974 to 6.43 percent in 1979 (Table 1). The annual burn rate exceeded 0.5 percent in 8 of the 17 years (Fig. 3). From 1966 to 1982, 16.26 percent of the Caribou Range Subdistrict was burned, yielding an average annual burn rate of 0.96 percent (N=17 years). This calculation assumes that no area burned more than once during this period.

A comparison of fire statistics for the eastern and western blocks of the Caribou Range Subdistrict shows that the majority of fires (72%) and most of the burned area (79%) occurred west of 108°W longitude (Table 2). Calculations based on the conventional method of fire mapping produced average annual burn rates of 1.51 percent and 0.40 percent for the western and eastern blocks, respectively.

Table 1. Fire statistics and annual burn rates for the Caribou Range Subdistrict, 1966-1982.

Year	Number of fires	Area burned (ha)	Annual burn rate (% of caribou range[1])	Cumulative area burned (ha)
1966	41	13,485	0.12	13,485
1967	10	3,934	0.03	17,419
1968	1	0.2	<0.01	17,419
1969	24	3,970	0.03	21,389
1970	48	142,106	1.22	163,495
1971	48	201,716	1.73	365,211
1972	33	14,321	0.12	379,532
1973	88	113,855	0.97	493,387
1974	6	113	<0.01	493,500
1975	23	29,548	0.25	523,048
1976	35	176,963	1.52	700,011
1977	17	45,257	0.39	745,268
1978	18	6,943	0.06	752,211
1979	48	750,981	6.43	1,503,192
1980	27	228,646	1.96	1,731,838
1981	31	106,366	0.91	1,838,204
1982	35	60,918	0.52	1,899,122
Total	533	1,899,122	16.26[2]	----

1 Area of Caribou Range Subdistrict south of treeline (11,677,800 ha).

2 Average annual burn rate for 17 year period is 0.96 percent.

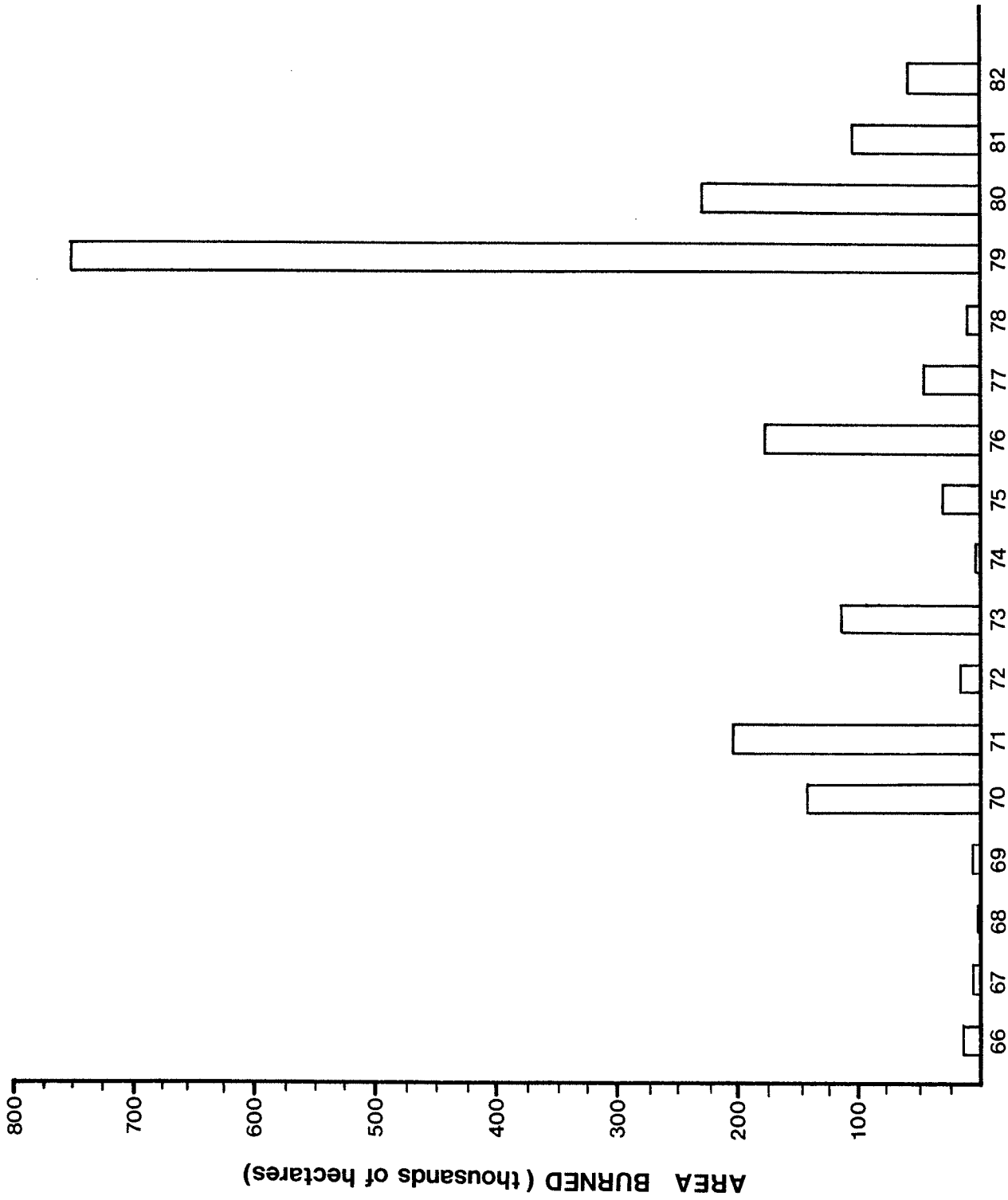

Figure 2. Annual variation in burn area for the Caribou Range Subdistrict, 1966-1982.

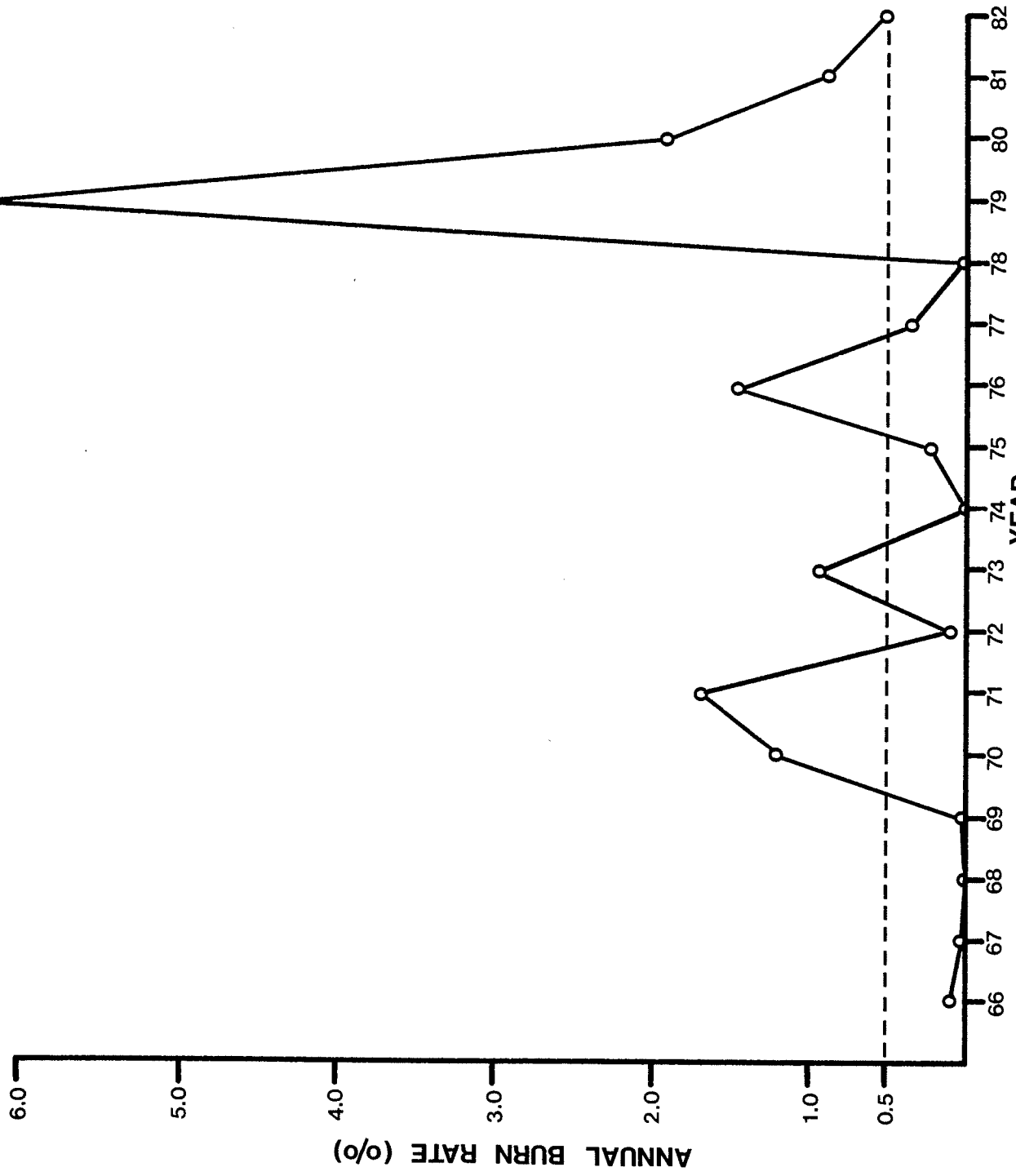

Figure 3. Variation in annual burn rate for the Caribou Range Subdistrict, 1966-1982.

Table 2. Comparison of fire statistics for the eastern and western blocks of the Caribou Range Subdistrict, 1966-1982.

	West of 108°W (5,849,800 ha)			East of 108°W (5,828,000 ha)		
Year	No. of fires	Area burned (ha)	Annual burn rate (%)	No. of fires	Area burned (ha)	Annual burn rate (%)
1966	30	9,332	0.16	11	4,153	0.07
1967	3	118	<0.01	7	3,816	0.07
1968	1	<1	<0.01	0	0	0
1969	19	3,754	0.06	5	216	<0.01
1970	35	96,068	1.64	13	46,038	0.79
1971	44	198,678	3.40	4	3,038	0.05
1972	25	13,433	0.23	8	888	0.02
1973	40	22,982	0.39	48	90,873	1.56
1974	5	113	<0.01	1	<1	<0.01
1975	19	28,168	0.48	4	1,380	0.02
1976	23	100,793	1.72	12	76,170	1.31
1977	15	44,556	0.76	2	701	0.01
1978	18	6,943	0.12	0	0	0
1979	39	749,149	12.81	9	1,832	0.03
1980	22	172,685	2.95	5	55,961	0.96
1981	23	16,136	0.28	8	90,230	1.55
1982	25	37,131	0.63	10	23,787	0.41
Total	386	1,500,039	25.64	147	399,083	6.85
Percent of all fires	72	79	---	28	21	---

DISCUSSION

Interpretation of the results in this report must recognize the limitations of conventional fire mapping methods. These limitations were presented at the January 1983 meeting of the Caribou Management Board, and are discussed in detail by Mychasiw (1983). The following points summarize the limitations of monitoring and mapping fires by aerial reconnaissance:

(1) Some burns are not detected and, therefore, are not mapped. This limitation is of greatest consequence in the early years of fire reporting and in remote areas from the Regional Fire Centre where fire incidence is poorly documented. It is the opinion of Northern Affairs that their fire records for the Caribou Range Subdistrict are more incomplete as the distance from Fort Smith increases (John McQueen pers. comm.).

(2) Area calculations based on fire perimeter mapping do not account for unburned areas nor water bodies within a burn perimeter, and overestimate the actual burned area. Unburned areas and water bodies represented from 10 to 52 percent of the area within individual fire perimeters for 18 fires west of $108^{o}W$ (Mychasiw 1983).

(3) Delineations of fire perimeters from aerial reconnaissance are imprecise. Discrepancies in fire boundaries between satellite imagery and Forest Service maps resulted in size differences as great as 85 percent for individual fires (Mychasiw 1983).

For these reasons, the annual burn rates reported for the Caribou Range Subdistrict should be regarded as preliminary estimates.

Since 1966 approximately 1.9 million hectares have burned within the Caribou Range Subdistrict south of the treeline -- an average annual burn rate of 0.96 percent. This is nearly double the annual burn rate considered to be acceptable by the Caribou Management Board. However, attempts to reduce the average annual burn rate to 0.5 percent by fire suppression may not be a realistic approach to fire management on the caribou winter range. Total fire exclusion until the year 1998 would be required before a 0.5 percent average rate is attained (Fig. 4). Each subsequent year represents a proportionately smaller fraction of the total time interval and has a progressively smaller effect on the long-term average. For this reason, an average burn rate is of limited value in practical fire management.

Average burn rates are useful for identifying areas where the long-term risk of burning is greatest. Within the Caribou Range Subdistrict, the average annual burn rate west of 108°W (1.51%) is considerably higher than that east of 108°W (0.40%). Although fire reporting is less complete for the eastern part of the area, this regional trend is consistent with Johnson and Rowe's (1975) analysis of fire history data in relation to weather patterns and lightning incidence. The fire season is generally longer in the western part of the Caribou Range Subdistrict, and becomes progressively shorter towards the treeline. Fire management strategies for the Caribou Range Subdistrict should reflect these regional differences in fire history. Implementation of a single, acceptable burn rate for the entire subdistrict is a questionable approach to fire management.

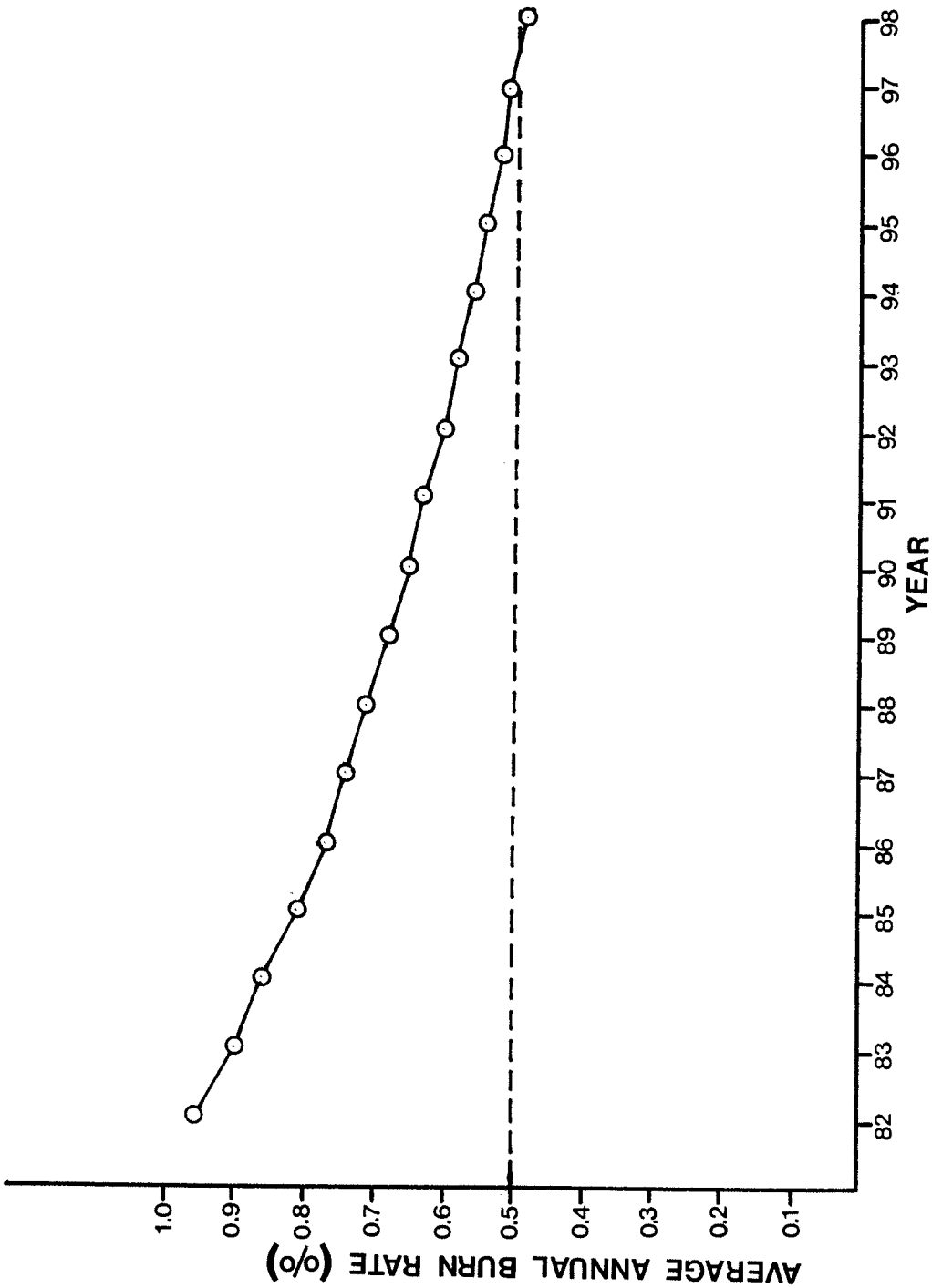

Figure 4. Projected decline in average annual burn rate for the Caribou Range Subdistrict, assuming total fire exclusion until 1998.

An acceptable annual burn rate of 0.5 percent for the Caribou Range Subdistrict implies a maximum, total burn area of 58,389 ha/year. This total was exceeded in 8 of the last 17 years, including 1970 (142,106 ha), 1971 (201,716 ha) and 1973 (113,855 ha) when a program of fire suppression was in operation. It is doubtful whether a fire control organization is capable of restricting the area burned to an acceptable limit in every year, regardless of the funding and manpower at its disposal. Early discovery and rapid initial attack of fires when they are small are critical to fire control effectiveness in the NWT (Forest Fire Review Panel 1980). Every fire in the Caribou Range Subdistrict would have to be fought because the final size of any fire cannot be predicted while it is still burning.

Inclusion of the Caribou Range Subdistrict within the Initial or Sustained Attack Zone would increase the present size of DIAND's protected area within the NWT (252,500 km^2) by 46 percent. At an estimated cost of \$40/km^2/year excluding fire suppression costs (DIAND's estimate), fire protection of the Caribou Range Subdistrict south of the treeline could exceed 4.67 million dollars per year in presuppression expenditures alone.

ACKNOWLEDGEMENTS

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PERSONAL COMMUNICATIONS

McQueen, John, Assistant Director of Operations, Northern Affairs Program, Department of Indian Affairs and Northern Development, Yellowknife, NWT.

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