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Terrestrial Ecology of the Dickey-Lincoln School Lakes Project

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TERRESTRIAL ECOLOGY OF THE

DICKEY-LINCOLN SCHOOL LAKES PROJECT

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Introduction

The St. John River watershed is situated in a transitional zone between the Boreal Forest Formation and the Eastern Deciduous Forest Formation. Second-growth forests representative of these two ecosystems cover extensive areas of the project site. The boreal forest forms a broad transcontinental belt in northern North America and Eurasia, with southern montane extensions. This northern forest is characterized by evergreen, coniferous trees, predominately spruce-fir The eastern deciduous forest, composed of broad-leaved hardwoods, extends throughout the eastern United States except Florida (Dasmann, 1968; Oosting, 1956).

Regional forest associations occur within the major ecosystems and tension zones. The northeastern spruce-fir type is the primary coniferous forest association in the project area. Red spruce (Picea rubens). a dominant softwood, is restricted to northeastern North America. Hemlock-hardwood forest is the general northern extension of the eastern deciduous forest but a northern hardwood-spruce association is more characteristic of northern Maine (Kuchler, 1964). This transitional forest lies between the northern limits of sugar maple (Acer saccharum) and southern limits of balsam fir (Abies balsamea)(Hill, 1923).

The biotic productivity of the project region is strongly influenced by the climate and soils. A short, cool, moist growing season and severe winters affect the area. Glacial drift, generally a meter or so thick, covers the bedrock (Boudette et al , 1976). Soils are young, infertile, and often have a seasonably high water table. Distribution of vegetation on the project site is strongly influenced by soil and moisture conditions.

Although the project site is predominantly commercial forest, ecological relationships and principles govern the results of natural and man-induced events. The expanse of the river valley provides a variety of habitat for plants and wildlife.

The remoteness of the project area and the lack of intense human alterations to the environment are conducive to the maintenance of a comparatively natural wildlife population. Animals typical of mature forested habitats are common whereas species typical of disturbed environments and early successional stages are either uncommon or have recently expanded into the project area.

Plant Ecology

Pure coniferous stands of red spruce (Picea rubens) and balsam fir (Abies balsamea), representative of commercial forest in the region cover 67% of the impoundment area. Other softwood constituents include northern white cedar (Thuja occidentalis), black spruce (Picea mariana), tamarack (Larix laricina) and white pine (Pinus strobus). Spruce-northern hardwood communities composed of sugar maple (Acer saccharum), yellow birch (Betula alleghaniensis), beech (Fagus grandifolia), white ash (Fraxinus americana), and spruce-fir cover 10% of the inundation area. Spruce-fir with pioneer hardwood species including paper birch (Betula papyrifera), trembling aspen (Populus tremuloides). bigtooth aspen (P. grandidentata), and balsam poplar (P. balsamifera) constitute 8% of the reservoir areas. Northern hardwoods are a minor cover type in the lowlands but common on surrounding ridges. Stands of aspen and birch are scattered through the cut-over lands. Young stands of all forest types, often with greater densities of shrubs, are distributed over the area. Various wetland and riparian communities occur within this cool moist region.

Bogs and seasonally flooded flats are dominant wetland types. The riparian habitat of the St. John River is particularly unique.

Forestry

A unique system of forest land management exists within the Dickey-Lincoln project area. Since 1840, owners have joined together in northern Maine to form a unified land-management system. With the exception of Allagash Plantation, the land area occurs in unorganized townships. Much of the forest land is held in undivided and common ownership. Under this system owners have formed organizations or retained firms to manage large tracts of forest land as one ownership. This land ownership and management system provides an opportunity for integrated and long-term forest management. Associated benefits can be the reduced risks and cost in managing the land. Other land in the area is owned by United States and Canadian forest industries which operate wood-processing plants and desire a sustained yield from their lands.

In the northeast, forest management has been extensive versus intensive. Under extensive management, capital investments and silvicultural treatments are limited. Past management must be considered in its economic setting. Forest management has been extensive for a number of reasons: there has been a surplus of wood in the past, and regeneration has been adequate for extensive management. Intensive forestry requires capital and high rate of return. In addition, the area has rough terrain which increases the problems of intensive tree culture. Equipment technology applicable to the northern woods is needed for intensive management.

Historically, many changes in logging practice have occurred in the St. John watershed. Early cutting near the French settlements along the St. John River began in 1785. Before 1840, in southern Maine, the major timber harvest was white pine. The era of spruce sawlogs began in the

1840's. As pine was depleted in the southern part of the state, harvesting of spruce and fir began in both the southern areas and accessible parts of northern Maine. Pine was less abundant, and often restricted to sandy and gravelly areas. In 1900, great quantities of virgin spruce still remained in the St. John, Allagash, and Aroostook River watersheds (Coolidge, 1963).

Early methods of cutting spruce for sawlogs were restricted only to trees 15 inches or larger at the stump. This provided conservation of the growing stand but there were defects in the early forestry practice. Balsam fir or deteriorating trees below 15 inches diameter were not used. Cutting was wasteful, leaving high stumps and large tops. Landowners in the headwaters of the St. John River saw depletion of their best stands and sought higher stumpage prices and utilization. In 1903, top diameter of logs dropped from about 11 inches to 8 or 9 inches and eventually to 6 inches in 1961 The most accessible spruce sawlogs near the St. John River had been harvested by 1923. Important reductions of stump height limits occurred in 1926 with curtailment of the log market and acceptance of the pulpwood market (Coolidge, 1963).

The waterway was important in past harvesting of the St. John River area. Great river drives occurred from 1904 to 1924. In the early part of the twentieth century, the price of pulpwood did not justify other means of transport. The St. John River was not well suited to river drives due to limited lakes or water holding grounds. Much wood in the Maine headwaters went to New Brunswick in Canada via the river

Other factors have influenced past forest harvesting in the project area. In 1916, merchantable volumes of Aroostook County stands were reduced significantly by spruce budworm. Blowdown of opened stands occurred for several years following budworm damage, and the depression of the 1930's curtailed much of the harvesting. In the past, hardwoods were not harvested because they did not float and lacked a pulpwood market.

Nutrients

The terrestrial ecosystem can be evaluated in terms of nutrient cycling. Each cycle is a complex interrelated system composed of various storage sites and fluxes between the sites.

The literature on nutrient cycling is extensive; studies range from simple, small investigations of a single subcompartment to worldwide models. Although the literature is extensive, to our knowledge there has not been any investigation of nutrient cycling on the St. John watershed. Thus the information included in this report is based upon the most applicable data available.

Within a watershed, there are several inputs into the nutrient capital which cycle relatively rapidly (from a geological view) through the ecosystem. These inputs include both dry and wet precipitation, and natural weathering of the substrate. The nutrient inputs then can enter the biological portion of the cycle, where they remain in various storage pools for differing periods of time. The nutrient input can also be lost directly through natural runoff which is comprised of both surface and subsurface drainage. Additions to this nutrient load in the natural runoff occur when nutrients are transferred from any of the storage sites. Thus the natural runoff contains nutrients in the form of:

1. organic particulates
2. inorganic particulates
3. organic dissolved substances, and
4. inorganic dissolved substances.

Determination of nutrient runoff is accomplished by chemical analysis of samples of stream water in conjunction with hydrological data on stream-flow characteristics and volumes.

A summary of the nutrient export is given in Table 1 A summary of the standing crop of nutrients on the project area is given in Table 2.

Entomology

As a natural ecosystem, the forest is subject to insects and diseases, fire, windthrow and animals. In this commercial forest, attempts have been made to limit losses from these agents. Their occurrence in the natural system provides changes in structure, composition and succession, thus creating more varied habitat.

The most destructive forect insect in northern Maine has been the spruce budworm (Choristoneura fumiferana), a defoliator of spruce and fir, but preferring fir. A history of periodic outbreaks has been traced back nearly 200 years, with outbreaks occurring in 1770, 1806, 1878, 1910, 1969 and from the mid-1960's until the present (Maine Bureau of Forestry, 1971). Early outbreaks during the white pine era were not well documented. It was not until the 1880's when spruce was an important commercial species that there was greater concern over large quantities being killed along the St. John River During the 1910-1918 budworm outbreak, 27,500,000 cords of fir and spruce were killed in Maine. The St. John watershed suffered moderate mortality of fir and spruce. In 1941, the Maine Forest Service initiated a forest insect survey which has monitored the spruce budworm population. Defoliation by budworms became evident in over four million acres in Maine in 1950. An attempt in 1948 to use a biological agent, a parasitic wasp, was unsuccessful. This brought about the first budworm control project using insecticides. In 1954, DDT was introduced into the environment by aerial spraying. Until 1967, limited areas were subjected to DDT applications when tree mortality was a threat. These spray programs focused on areas east of the St. John River watershed. Recent programs covering extensive

TABLE 1: ESTIMATES OF NUTRIENT EXPORT FROM THE DICKEY-LINCOLN PROJECT AREAS (kg/yr)

	Calcium	Magnesium	Potassium	Nitrogen	Phosphorus
			Whole Area		
Hardwoods	197,327	55,810	39,864	63,782	399
Softwoods	749,080	193,879	167,441	24,676	70,501
Mixed	443,458	120,505	96,404	86,764	19,281
Total	1,389,865	370,194	303,709	175,222	90,181
			910 Area		
Hardwoods	10,415	2,946	2,104	3,366	21
Softwoods	198,764	51,445	44,430	6,548	18,707
Mixed	57,592	15,650	12,520	11,268	2,504
Total	266,771	70,041	59,054	21,182	21,234
			610 Area		
Hardwoods	198	56	40	64	0.4
Softwoods	1,105	286	247	36	104
Mixed	1,049	285	228	205	46
Total	2,352	627	515	305	150

TABLE 2: ESTIMATED ABOVEGROUND STANDING CROP IN DICKEY-LINCOLN PROJECT AREA ($kg \times 10^5$)

	Calcium	Magnesium	Potassium	Nitrogen	Phosphorus
			Whole Area		
Hardwoods	147	14	42	77	7
Softwoods	500	58	179	410	62
Mixed	314	33	99	206	25
Total	961	105	320	693	94
			910 Area		
Hardwoods	8	7	2	4	0.4
Softwoods	133	15	48	109	16
Mixed	41	4	13	27	3
Total	182	19.7	63	140	19.4
			610 Area		
Hardwoods	0.1	0.01	0.04	0.08	0.007
Softwoods	0.7	0.09	0.3	0.6	0.09
Mixed	0.7	0.08	0.2	0.5	0.06
Total	1.5	0.18	0.54	1.18	0.157

areas have involved application of insecticides with short residual times, including Malathion, Zectran, Sumithion (fenitrothion) and Sevin 4 oil.

Herpetofauna

The literature is very sparse concerning the status of herpetofauna in northern Maine. Accounts of distribution for Maine were recently updated by Conant (1975). The Canadian Field Naturalist publishes reports of range extensions in eastern Canada of species which may occupy similar habitats in Maine. These reports strongly suggest the possibility of peripheral populations (Bonisteel, 1973; Pendlebury, 1973) but field checking or research must confirm presence. Burton and Likens (1975) offer population statistics of salamanders for the Hubbard Brook Experimental Forest, New Hampshire. The population densities at Hubbard Brook for salamanders may provide a rough estimate of densities for similar habitats in Maine. A state list of reptiles and amphibians of Maine includes those species suggested by the U.S. Fish and Wildlife Service (1976). At present, there is no definitive list of herpetofauna and their status for the State of Maine.

Terrestrial species of salamanders expected within the impoundment area are the red-backed salamander (Plethodon cinereus), spotted and blue-spotted salamanders (Ambystoma maculatum and A. eaterale) and northern dusky salamander (Desmognathus fuscus fuscus). Aquatic or quasi-aquatic species expected on site are the northern two-lined salamanders (Eurycea bislineata) and red-spotted newt (notophthalmus viridescens).

The northern spring salamander (Gyrinophilus porphyriticus) and the four-toed salamander (Hemidactylium scutatum) have ranges in habitats very similar to those found in northern Maine (Conant, 1975). Bonisteel (1973) found a specimen of Hemidactylium scutatum in southern Ontario.

The location of the record is approximately 47° 35'N latitude which is nearly equal to the latitude of the St. John River watershed. Bonisteel's specimen was about 100 miles north of normal range limits. The four-toed salamander is found in disjunct populations north of southern New England (Conant, 1975). The maritimes appear to have many records.

Avifauna

The literature is consistent in establishing a list of species that can be expected to be found in Maine. Palmer (1949) is the latest comprehensive volume of Maine avifauna. There have been many later reports of species occurring in Maine that do not appear in Palmer's work. These reports consist largely of accidentals and do not influence the avifauna and habitats of Maine. A species list of the St. John River watershed compiled by ERT would not differ significantly from the accounts of Palmer The only variation from Palmer would be the current status of breeding populations of northern Maine. The list of species presented in this section typifies those birds that would be affected by implementation of the project. The list includes species whose breeding, migratory, or feeding requirements may be influenced by the project regardless of their status.

Literature concerning avifauna in northern Maine was examined in terms of relevance of species to the proposed site, the two-mile study area boundary, the northern Maine woods of Aroostook County, and to the State of Maine. The literature does not contain many accounts of work conducted within the site area. There are, however, several accounts of research conducted in northern Maine on bird diversity, bird population dynamics in association with forest types, and populations in association with insect (spruce budworm) outbreaks. Research conducted in habitats similar to those of the site area by Kendeigh (1947) provide comparative

results. It is assumed that these results are relevant when comparing species encountered in similar habitats. Palmer (1949) gives many detailed accounts of Maine birds, based largely on the work of Arthur Norton. There are no recent data of this scope regarding the avifauna of Maine.

Mammals

The Dickey-Lincoln School Lakes project area serves as suitable habitat for an estimated 50 different species of mammals. It would be preferable to discuss each species within an appropriate habitat type to maintain consistency with other faunal and floral discussions. However, mammals are seldom restricted to a single habitat type; their survival requirements are met through contributions obtained from various habitat types.

Example of species: Deer (Order Artiodactyla)

Two members of the deer family occur on the project area. These are the moose (Alces alces) and the white-tailed deer (Odocoileus virginianus).

The moose is the largest mammal inhabiting the project area. Moose browse on hardwood sucker growths and strip bark on larger trees during winter Species preferences are for maples, aspen, and willow. During summer, moose feed on large quantities of aquatic vegetation including water lilies, grasses, sedges, and wild rice.

The moose population in Maine has undergone drastic change since the 1600's, when they were abundant throughout the state. By 1700 the moose population in southern Maine was severely depleted. Populations throughout the state have remained low until the late 1960's. Population estimates from 1934 through 1948 were generally around 2000 moose. Presently, moose populations throughout the state are showing a dramatic increase, and shifts in population densities are noticeable. In 1941, moose were considered rare in WMU 2. In 1971, this unit had the highest population

estimate in the state, at 78 animals per 100 square miles, or 7,228 animals in WMU 2. A 1975 survey indicates a population of 14,607 moose in WMU 2 (Dunn, 1976). The increase in moose in this unit is apparently a reflection of the current forestry practices. The clearcutting and selection cutting of hardwoods should increase the food supply for moose.

The white-tailed deer perhaps attracts the greatest attention of any mammal on the project area. It is most interesting to note that deer were not present on the project area until after 1880. Deer followed the opening of the virgin spruce-fir forests as the loggers moved northward. Deer can be considered an "edge" species and the more available habitat diversity within a local area, the better the deer population will do. The most critical habitat requirements of deer is the winter range. In the northernmost parts of its range deer yard up during winter in dense spruce-fir forests, and not only their survival, but their reproductive potential for the following spring depends upon their condition in the deer yards. Deep soft snow is the worst condition for deer, and the duration of winter conditions into the spring also appears to be critical

Deer consume browse during winter, feeding on northern white cedar, maples, willow, aspen, and hemlock. The remainder of the year, their diet is composed more of grasses, herbaceous material, and aquatic plants (Aldous and Mendall, 1941).

Density of deer within WMU 2 are the lowest in the state, ranging from 12 to 48 animals per 10 square miles. This is a deer population of 10,000 to 42,000 animals (Banasiak, 1975). For the project area, a population of 2.2 to 8.6 deer per square mile has been estimated (Hutchinson, 1976). For the two-mile limit, a population of between 1381 and 5399 deer, or a mean of 3390 deer, can be projected from the density. A study made to determine deer yards on the project area

indicated a total of 53 yards encompassing a total of 36,893 acres. This is 1/2 of the total wintering area within WMU 2.

Rare and Endangered Biota

Plants

The St. John River in northern Maine has long been famous for the rare plants which occur along its banks and on the islands within the river. These plants include the following:

Endangered:

Pedicularis furbishiae S. Wats.

Rare:

Carex josselynii (Fern.) Mackenz.

Castilleja septentrionalis Lindl

Anemone multifida Poir.

Oxytropis johannensis Fern.

Primula mistassinica Michx.

Juncus alpinus Vill and *J. alpinus* var *rariflorus* Hartm.

Astragalus blakei Egglest.

Astragalus alpinus var *brunetianus* Fern.

Hedysarum alpinum var. *americanum* Michx.

Tanacetum huronense var *johannense* Fern.

Pedicularis furbishiae and *Carex josselynii* are endemic to the St. John River Valley and are not found elsewhere. *Astragalus blakei* has been reported only from the St. John River and from northern Vermont. The remaining plants are boreal or arctic species which reach their southernmost limit in northern Maine or other northern states farther west. Some of these plants are wide ranging, extending from Labrador to Alaska and are not rare within the main area of their range.

Between June 27 and July 31, 1976, the Dickey-Lincoln School Lakes project area was surveyed for the presence of these 11 rare plants. Since all of them are restricted to river banks and islands, only these habitats were checked. A rather thorough survey of these areas was accomplished by the use of an army helicopter which was able to land in very small areas along the river bank and on most of the islands within the river both in the project area and below it as far as Fort Kent. In addition to the St. John River, its major tributaries, the Big Black River, the Little Black River, and a portion of the Allagash River were also checked for the presence of these plants.

Avifauna

Bird species requiring special attention are those which are currently endangered, rare, or significantly reduced in number in their preferred habitat. Many birds of prey are currently under stress from environmental contamination (Ames and Mersereau, 1964; Department of Interior, 1976, FR,41(134):28526; Singer, 1974; Wiemeyer, 1975), disruption of habitat and shooting (Department of Interior 1976, FR,41(134:28526). The literature has many accounts of research concerning some of the popularized species, such as the peregrine falcon, bald eagle and osprey (Dunstan and Harper, 1975; Henny and Ogden, 1970; Henny and Van Velzen, 1972; Singer, 1974; Weekes, 1975; Wright, 1953; Zimmerman, 1973). Research in northern Maine concerning these species is scattered. The status of birds of prey in northern Maine is not well known (Mendall, 1944). The endangered peregrine falcon has received much attention through the efforts of a captive breeding program at Cornell University Several peregrines have been released in New England in an effort to re-establish potential breeders (Evans, 1976). Palmer (1949) gave examples of peregrines in Maine but estimated that less than ten pairs nested in the state. Although

the St. John watershed is within the peregrines flyway, there is no recent evidence of this falcon in the project area. The U.S. Fish and Wildlife Service is currently collecting data on the nesting eagle and osprey populations in northern Maine as part of a statewide effort to monitor population trends. The bald eagle population in Maine is very low and has merited endangered status (Gramlich, 1976).

Special attention is also required for the Cooper's hawk which has undergone a reduction in population (Arbib, 1976). This is a species of the deep woods that feeds mainly on birds. Very little in known about its current status.

The pine grosbeak is a peripheral breeder in northern Maine. Its occurrence is irregular as a breeder or winter visitant. The cone crop of various softwoods appears to be a controlling factor in its abundance. It can be expected to breed irregularly within the watershed of the St. John. Although this bird is not considered rare or endangered, the Department of Interior considers it a peripheral breeder within the United States and therefore important.

Mammals

Only one mammal has been classified as endangered on the project area, the eastern cougar Although not confirmed to be onsite, it would appear that the project area contains suitable habitat and remoteness for this species. It is suspected that the eastern cougar is probably present in the area.

The woodland caribou (Rangifer tarandus) is classified as a peripheral species. Although caribou have been present in northern Maine, the species supposedly disappeared about 1910 (Palmer, 1949). The most recent record of a caribou in Maine is 1946 in extreme northwestern Somerset County, Maine.

A few species are listed by the U.S. Fish and Wildlife Service as status-undetermined. These are the marten, fisher, and lynx.

Future Without Project Implementation

Plants

Significant ecological considerations without the proposed project include the riparian habitat of the St. John River, future forest management, and natural events. The St.-John River Valley has long been famous as habitat for a number of plants found only in that area of Maine or, in a few cases, other isolated localities. Historically, forest communities have been altered by natural events and more recently by man; however, these changes have provided a more diverse wildlife habitat. The structure, composition, diversity and succession of forest communities will be strongly influenced by future forest management practices. This can be evaluated on the basis of continuation of current trends or intensified management. In general, forest management goals seek improved composition, growth rate and protection. The existing forest indicates the influence of past forest practices on the ecological composition.

The continuation of present forestry practices could create largely unevenaged forests. Mature evenaged stands could decrease but, presently, the occurrence of regenerating clearcuts and young, evenaged stands suggests that a totally selectively cut forest would be difficult to achieve in the near future. The present forest management practice will eventually remove the overmature stage of forest growth. Protection of the commercial forest has and will alter the influence of natural ecological changes such as fire and budworm attacks.

The establishment of a regular selective cutting cycle over large areas will modify plant communities. In the past, forest management has

not altered the tree species composition on most sites. Shade-intolerant communities such as a "raspberry" stage or aspen-birch stands occurred in some cases. These communities have existed in the region due to natural events and eventually are replaced by tolerant species. Selective cutting should decrease the number of aspen-birch stands and open shrub types. In northern hardwood stands, selective cutting will favor tolerant species (maple and birch), but yellow birch will decrease unless cutting is heavy Structure of the stands is more varied with potentially increased herbaceous growth. Increased disturbance may result in decreased herbaceous species common to mature climax forests. Overall, the selection system will tend to maintain the tolerant forest communities.

Intensified forest management can change the structure and composition of the forest. There is the possibility of change to more preferred species or greater utilization of all species. The nature of the forest may also be influenced by the demand for fiber This could lead to young, evenaged stands of all species. In northern Maine, it is unlikely that a monoculture will develop, as greater utilization of all species is occurring. Intensified management will probably lead to changes in hardwood stands. Old growth and rough and rotten trees would be replaced by younger, faster growing stands. Silvicultural treatments such as thinning or weeding may change understory and ground cover species comparable to the selective cutting system.

Fauna

Fauna are a function of existing habitats. Without suitable habitat, an organism will not survive in a specific area. Thus, the prediction of faunal presence and population size depends upon changes in habitats over the 100-year period in question. It is assumed that there will be an increased forest management program in the project area and that the

fauna will respond to changes created in the existing habitat over the next 100 years.

These changes in habitat may be summarized as:

1) reduction of acreage in mature or overmature stands of timber,
2) decline in average size of stands (e.g., dbh and height),
3) decline in average extent of single uniform stands, yielding greater diversity within a specific area,
4) decline in average density of larger trees through selective cutting,
5) increase in herbaceous growth under stands which have been selectively cut,
6) development of more unevenaged stands through selective cuts,
7) decrease in time between logging operations within each stand (20-year cutting cycle),
8) more complete coverage of cutting activities over the entire project area,
9) increase in density of the transportation system of roads,
10) increase in "edge" due to more roads and smaller logging areas,
11) increase in floral species indicative of disturbed sites and those species which require exposed mineral seedbeds,
12) decrease in slash piles and debris left in the woods due to harvesting of smaller materials,

13) decrease in disease and insect-infected mature and over-mature trees,

14) increased presence of man on the project area, including housing,

15) increased siltation of streams due to logging, road construction and maintenance,

16) decreased evapotranspiration and increased snow-pack, thereby causing increased subsurface flow and runoff,

17) decrease in balsam fir (for spruce budworm control),

18) increased management activities in northern hardwoods,

19) decrease in number and size of clearcut areas, and

20) initiation of thinning operations over the site, primarily, in overstocked stands.

In general, those species which are representative of mature forests will decline in importance, whereas those species typical of young, dense forests will be enhanced. Large, mature forest types will be less common under intensified forest management, which will create more "edge" Those species typically called "edge" species will be favored in the project area. Species which utilize hardwood browse will also be favored under a more intensive hardwood management program than presently exists in the project area. It is also anticipated that insect populations will be more diverse under intensive management, and that most insectivorous species will be favored.

Plants

The proposed project would inundate more than 80,000 acres of plant communities. Due to the natural distribution of plant communities in the St. John River Valley, there will be a proportionately greater loss of

spruce-fir forest. The resulting watershed would support lower proportions of spruce-fir habitat. There would be the loss of other tree species more prevalent in the lower valley, such as northern white cedar, elm and brown ash.

Inundation of the St. John River riparian zone will cause losses of one rare and endangered plant. The endangered species, Pedicularis furbushiae, was found only in six locations, all within the proposed impoundment area. The species has been found only along the banks of the St. John River in Maine and New Brunswick, Canada. The species was previously reported at Fort Kent, Frenchville and Fort Fairfield, Maine but specimens were not found during June and July, 1976. A rare species, Carex josselynii has been collected only along the St. John River between St. Francis and Fort Kent. Nine other species are rare within the State of Maine; these nine species are generally northern species which are occurring onsite near the southern extent of their range. In addition to the elimination of habitat within the impoundments, changes in river flow could affect the presence of these species on downstream islands and river banks.

The proposed project will inundate the most productive forest association in the project area. Spruce-fir stands have the greatest net growth of forest trees in the area, excluding paper birch. The shrub and herbaceous layers beneath spruce-fir stands are not as productive as in hardwood or mixed stands. There will be losses of "raspberry" shrub types which provide significant forage and browse.

Fauna

The conversion of terrestrial forested habitat into aquatic reservoir habitat will have an effect on the resident faunal populations as well as upon those animals which utilize onsite habitats for only a portion of the year (e.g., white-tailed deer wintering areas).

The reproductive potential of most species is high enough for each species to occupy all habitats which are suitable. Variations occur temporally which change population levels, but in general, most habitats are presently occupied at a carrying capacity which is at or near maximum for that specific time period.

As the reservoirs are being filled, the resident fauna either will perish or be displaced into adjacent habitats. If these habitats are already occupied at the maximum carrying capacity, the displaced animals will be literally forced to move on. These displaced animals will continue to move until they either find an unoccupied habitat or succumb to any of a number of causes (e.g., exhaustion, predation, exposure, and territorial fighting).

The conservative approach is to conclude that all displaced resident fauna will perish. This conclusion may not apply to all species, due to special circumstances which are presently influencing populations on the project area. The moose population is apparently benefiting from the current forest harvesting activities and is increasing in number each year It thus appears that some of the moose may survive and occupy habitats on areas outside of the reservoir. Other species seem to be increasing their population size within the project area, and these species may have more members survive than those species whose populations are either stable or declining.

Conversely, the filling of the reservoirs may influence more animals than those which reside only within the 910 elevational pool. The best example of this class of animals is the white-tailed deer Deer use wintering areas which are located within the 910 elevational pool, but for the remainder of the year may reside on areas outside of the project area. The distance that a deer will travel to a wintering area has not been

definitely established, but six miles has been suggested (Carson, 1970) as the distance deer will travel to a current logging operation in order to browse on the tops of felled trees. Deer may travel such distances to get to a wintering area. Thus, the removal of 36,893 acres of deer wintering area within the 910 elevational pool may affect deer from a much larger area. Hutchinson (1976) assumes that half (50%) of the deer within the St. John region (684,500 acres) would be affected by the impoundment. This amounts to an estimate of between 2,886 and 3,848 deer that would be directly affected.

Total standing crop of mammals within the two-mile area will be reduced due to the loss of 88,173 acres of habitat. This is approximately 22% of the acreage within two miles of the lake. For species which are nonspecific in habitat requirements (e.g., short-tailed shrew) this means a 22% reduction in their total standing crop on the two-mile area. For species which are more specific in their habitat requirements, the change in standing crop may be either greater or less than 22%, depending upon which habitat the species prefers. Species typical of the northern hardwood type (e.g., deer mouse) will be affected much less, as there is very little loss of hardwoods in the pool area. Species typical of the spruce-fir forest (e.g., marten) will be more severely affected, as a majority of the pool area is comprised on the softwood type. Changes in total standing crop cannot be specified as the percent habitat utilization by each species is not known. However, the maximum reduction in standing crop of a species should occur with the white-tailed deer where a 50% reduction in the population is expected.

Irreversible and Irretrievable Losses of the Dickey-Lincoln School Lakes Project

The conversion of 88,173 acres of terrestrial habitat into aquatic habitat is irreversible and irretrievable from a terrestrial viewpoint. All terrestrial biota existing on the 88,173 acres will be lost unless mitigative efforts are employed in habitats adjacent to the lake. The extent of implementation of mitigative efforts has not been determined and until such efforts have been agreed upon, the conservative approach is taken that the loss of all the terrestrial biota comprise an irreversible and irretrievable loss.

The land is presently owned by timber companies and private individuals who are harvesting sawlogs and pulpwood from the project area, generally on a sustained yield basis. The timber production from this land during the life of the project is an irreversible and irretrievable loss. This period of loss can be extended perhaps 80 years past the life of the project. This is due to the age of the timber currently existing on the project area and an estimate of time required to return the land to forest production.

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