

A Boreal Forest Park: Problems and Approaches

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Editor's Note: It is the policy of Park Science to hold footnotes, literature cited, and extensive use of Latin names to a minimum. However, in some cases the Bulletin's goal of reporting science in the parks in terms of management of the parks can be better served by adhering to a journal-like style. The questions addressed here, both scientific and managerial, can best be considered in the light of all the information contained in the literature cited. For that reason, the guidelines have been eased to accommodate this article's form and style.

The Park

Voyageurs National Park is in northern Minnesota and borders Canada on the north and east (see map). About two-thirds of the park is land and the remainder is made up of numerous lakes. Lake and land areas show the effects of glaciation that exposed Precambrian bedrock.

Voyageurs is the only U.S. national park on the mainland in a southern boreal forest region. Isle Royale is also in this region, but it has a characteristic island biology.

Explorations for gold, uncontrolled hunting and fishing, logging, homesteading and finally resort and summer home development occurred after the area was unsuccessfully proposed as a park in 1891. The park was finally established in 1975 and is to be administered in accord with the Act of 1916 (36 Stat. 535) and its amendments and supplements (16

U.S.C. 1-4). These Acts of Congress require that the park preserve representative examples of its scenic natural environments and native wildlife to the extent possible.

The establishment of the park led to research on its vegetation and wildlife. Research results are in a series of technical reports.¹⁻⁵ The following brief summaries of original and present conditions are from the data in these reports. Final recommendations attempt to follow the park's legislative mandate.

Original Conditions

Early land survey and logging records show original forests were a disturbance-influenced mosaic of different kinds of climax, subclimax and seral vegetation. Uplands mainly had spruce-fir (*Picea glauca* - *Abies balsamea*), Pine (*Pinus strobus*, *P. resinosa* or *P. banksiana*) or aspen (*Populus tremuloides*) dominated communities. Lowlands had black ash (*Fraxinus nigra*), eastern white cedar (*Thuja occidentalis*), willow (*Salix* spp.), alder (*Alnus rugosa*) or muskeg (stunted black spruce, sphagnum moss and evergreen shrubs) dominated communities.

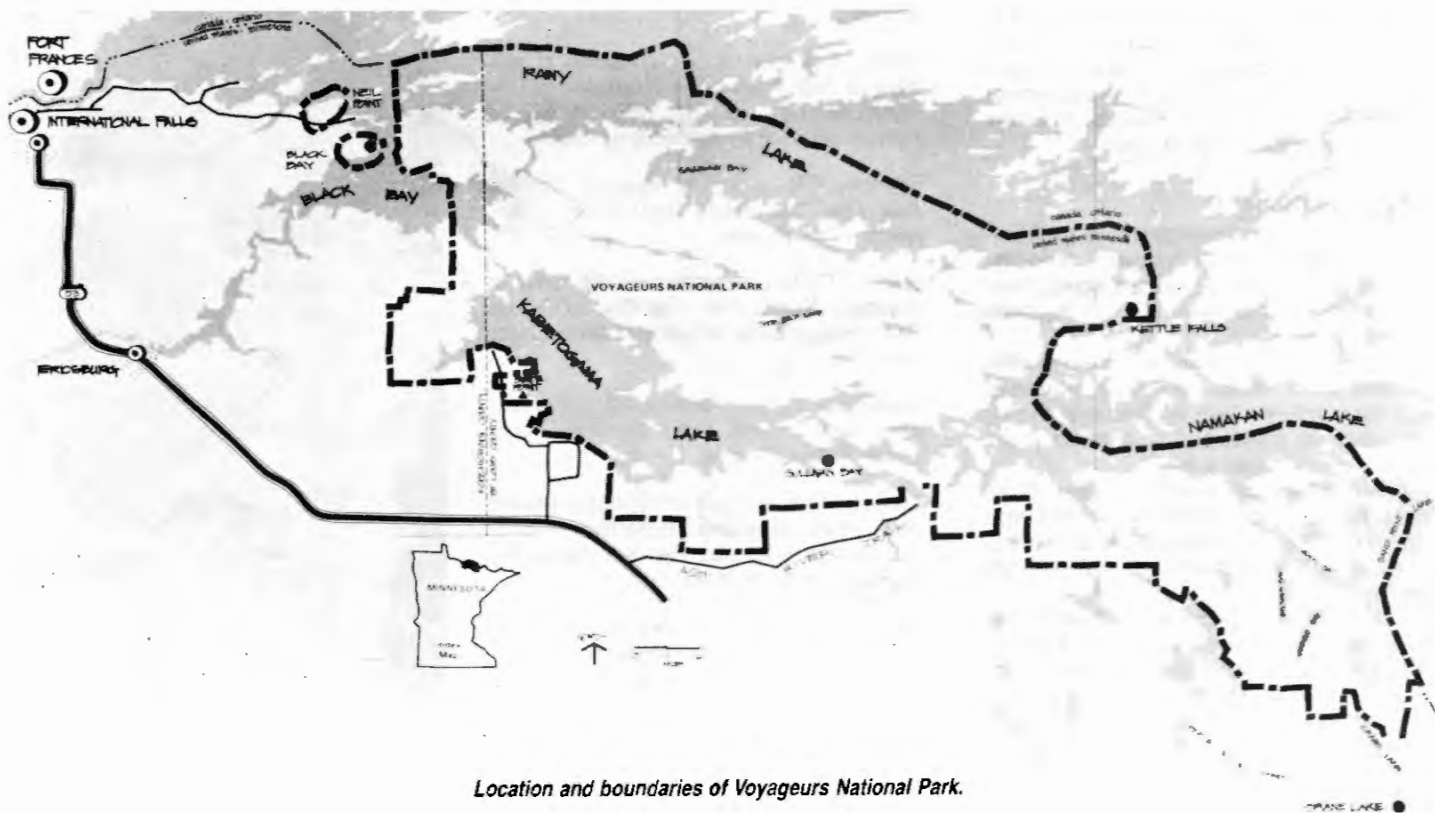
This diverse vegetation supported populations of four different cervid species. Woodland caribou (*Rangifer tarandus*) and moose (*Alces alces*) were more abundant than either white-tailed deer (*Odocoileus virginianus*) or elk (*Cervus elaphus*). These, and other smaller herbivores, supported a characteristic predator and scavenger fauna that included the eastern timber wolf (*Canis lupus*), wolverine (*Gulo luscus*), Canada lynx (*Lynx canadensis*), fisher (*Martes*

pennanti), pine marten (*Martes americana*), raven (*Corvus corax*) and bald eagle (*Haliaeetus leucocephalus*). Other records show the area's large lakes originally had extensive beds of wild rice (*Zizania palustris*) and indicate that a variety of associated fish and wildlife species were more abundant than at present.

Present Conditions and Causes

Logging and/or associated fires, mainly between 1913 and 1936, changed portions of the pine and spruce-fir communities on uplands to aspen communities. Natural succession and disturbances will reestablish representative natural conditions on these areas and maintain such conditions on other park areas. However, the present practice of suppressing all fires as rapidly as possible will eventually allow pines to be replaced by other vegetation, reduce other types of diversity, and increase the opportunities for catastrophic fires or insect outbreaks.

Uncontrolled hunting eliminated woodland caribou and elk from the region and reduced the moose population to such a low level that loss of genetic diversity due to inbreeding may prevent recovery. White-tailed deer temporarily increased following logging, but have since declined - initially because of forest succession and more recently, the additive effects of wolf predation. Calculations suggest that these overall declines in the numbers and kinds of native cervids have reduced the amount of winter and early spring food that they supply for native predators and scavengers to one-third of what it was originally.¹ Species



Location and boundaries of Voyageurs National Park.

such as the wolverine and Canada lynx no longer occur as breeding populations and the park's wolves and bald eagles are declining. In contrast, abundant food exists for woodland caribou, moose or elk (if moose densities remain low) because the niches for these species are essentially vacant.

Dams constructed at the outlets of Rainy and Namakan Lakes in the early 1900s also have influenced park ecosystems. Periodic reports by Canadian and U.S. engineers (park files) show that yearly water level fluctuations with the dams have averaged 1.1 meters (3.6 feet) in Rainy Lake and 2.8 meters (9.3 feet) in adjoining Namakan, Kabetogama, Sand Point and Crane Lakes. Calculated "natural" fluctuations over this same 1909-1980 period averaged 2.0 meters (6.7 feet) in Rainy Lake and 1.9 meters (6.4 feet) for the Namakan chain of lakes. These calculated values seem high in comparison to actual measurements of natural fluctuations in adjoining Lac La Croix, which averaged 1.6 meters (5.3 feet) from 1929 to 1981.⁶ Until the accuracy of calculated "natural" levels can be checked, the Lac La Croix average is considered to approximate what the mean natural fluctuations would be in both Rainy and the Namakan chain of lakes.

Regulated fluctuations also have differed from natural fluctuations in timing by their usually having lake levels rising through, instead of peaking, in June and usually having July peaks; by having stable instead of generally declining levels over summer and fall; and, in the case of the Namakan chain, by having declines of about 1.8 meters (6 feet) instead of about 1.1 meters (3.6 feet) over winter (November-March). In the Namakan chain of lakes, the once extensive beds of wild rice have been replaced by other aquatic vegetation in response to the changed water regime, and the greater over-winter water level declines leave beaver and muskrats without shelter or food and de-water northern pike (*Esox lucius*) spawning areas. In all four lakes, the rapidly rising lake levels through June regularly flood the nests of shore and marsh nesting birds, and the stable lake levels over summer and fall allow sand or silt to accumulate on walleye (*Stizostedion vitreum*) spawning areas.

Recommendations

Based on the data summarized above, the following actions seem necessary to preserve representative examples of natural southern boreal forest environments and their native wildlife in Voyageurs National Park:

1. Allow natural fires and/or prescribe burn within sub-units, where fires can be confined, to maintain pine stands and other kinds of vegetational diversity and reduce the opportunities for large catastrophic fires or insect outbreaks to occur;
2. Reestablish viable woodland caribou, moose and/or elk populations to restore food for native carnivores, develop a more representative native fauna, and increase opportunities for park visitors to see wildlife;
3. Approximate the magnitude and timing of natural fluctuations in lake levels, except in years with unusually high or low precipitation, to reduce the frequency of adverse water level effects on wild rice, fish, and other wildlife without conflicting with flood control, navigation needs or other authorized uses of water.

The first two actions initially can be carried out on a small scale and critically evaluated by applied re-

search. This approach has been used in other national parks^{7,8} and should show the most effective ways to carry out operational programs. Small scale reintroductions of native cervids also could test various hypotheses and wildlife management concerns about the effects of parasites in mixed cervid species systems⁹ and about the impact of inbreeding in moose.

The third action, effecting changes from the present system of regulating lake levels, would have to be authorized by an International Joint Commission. Because Rainy Lake has three times the storage capacity of Namakan, Kabetogama, Sand Point and Crane Lakes combined, allowing it to fluctuate 1.5 instead of the present 1.1 meters (0.4 m lower) could reduce the fluctuations in these other lakes from 2.8 to 1.6 meters (1.2 m from these becomes 0.4 m in Rainy). With mean fluctuations of about 1.5 meters in Rainy and 1.6 meters in the other lakes, runoff peaks in June instead of July, summer to fall declines of 0.4 meters in Rainy and 0.5 meters in other lakes, and over winter declines of 1.1 meters in all lakes, almost the same amount of water (about 2% less) is stored over winter as with the present mean fluctuations. Adjustments can easily be made to store the same amount of water if this is considered essential. The ecological effects of these or any other changes from the present regulation system also could be monitored and evaluated by applied research.

¹ Cole, G.F. 1979. Mission-oriented research in Voyageurs National Park. Proc. of 2nd Conf. on Sci. Res. in the Nat. Parks. San Francisco, Calif. Nat. Park Ser. Wash. D.C. 1980. 612 pp.

² Coffman, M.S., Rakestraw, L. and Ferris, J.E. 1980. The fire and logging history of Voyageurs National Park. Final Report, Mich. Tech. University. 108 pp. (Memo).

³ Kurmis, V. Merriam, L.C., Jr., Aaseng, N. and Webb, S. 1980. Primary plant communities of Voyageurs National Park. Rept. No. 3. College of Forestry. Univer. of Minnesota. 94 pp. (Memo).

⁴ Wetmore, C.M. Lichens of Voyageurs National Park. Final Rept. Botany Dept. Univer. of Minnesota. 37 pp. (Memo).

⁵ Swain, A.M. 1981. Vegetation and fire history at Voyageurs National Park. Final Rept. to National Park Service, Midwest Archeological Center, 20 pp. (Memo).

⁶ Anonymous. 1979. Historical water levels summary, Ontario. Inland Waters Directorate, Water Survey of Canada, Ottawa, Canada. 71 pp.

⁷ Cole, G.F. 1976. Management involving grizzly and black bears in Yellowstone National Park, 1970-75. U.S. Dept. of Interior, Nat. Park Serv. Natural Resources Rept. No. 9. 26 pp.

⁸ Houston, D.B. 1981. Yellowstone elk: some thoughts on experimental management. Pacific Park Science Vol. 1 - No. 3. National Park Service, U.S. Dept. of Interior. 4-6.

⁹ Cole, G.F. 1981. Alternative hypotheses on ecological effects of meningeal parasite (*Parelaphostrongylus tenuis*) J. Minnesota Acad. of Science. 47:(1)8-10.