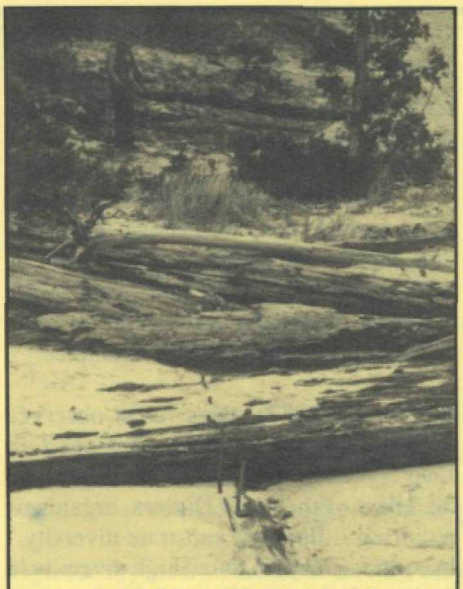

"Beaver Lake Logging Dam" is one of a series of Pictured Rocks Resource Reports. The Reports are intended to communicate the results of specific investigations and to educate the reader on the values of the natural, cultural, and human resources of Pictured Rocks National Lakeshore. Management alternatives and implications are offered based on these scientific studies. Readers comments on the results and recommendations of the Reports are invited.

Grant A Petersen, Superintendent
Pictured Rocks National Lakeshore

Pictured Rocks RESOURCE Report

PIRO 93-2

EVIDENCE OF PHYSICAL AND BIOLOGICAL CHANGE WITHIN THE BEAVER LAKE WATERSHED ATTRIBUTABLE TO A TURN-OF-THE-CENTURY LOGGING DAM

by Walter L. Loope, Research Ecologist

INTRODUCTION

Between 1880 and 1910, spring "log drives" in which pine logs were cut in winter and floated toward market on snowmelt swollen streams were common in central Upper Michigan. To assure sufficient hydrologic gradient and discharge, streamflow was often manipulated by means of constructed dams. Log drives brought about changes in some stream and lake characteristics (Martin, 1944; Reimann, 1953; Ahlgren and Ahlgren, 1983; Alexander and Hansen, 1983; Karamanski, 1989). The pine logging era came relatively late to the pinelands surrounding Beaver Lake within Pictured Rocks National Lakeshore (Figure 1). The area was logged starting in 1893. A logging dam (approximately 5 feet high) was constructed near the mouth of Beaver Creek in 1905 and used for 5 to 10 years (Hall, 1912; Stonehouse, 1985; Symon, 1985).

The resource exploitation of the logging era has implications for present day land management. This paper describes the initial phases of a case study illustrating the utility of historical context in assessment of natural resource condition and potential for management.

THE DAM AND ITS HISTORY

The logging dam on Beaver Creek was primarily earthen with a central wooden sluiceway and protective pilings (Figure 2). During operation of the dam, water was backed up Beaver Creek and into Beaver and Little Beaver Lakes, affording access to the surrounding red and white pine and white cedar forests. The mouths of Little Beaver, Lowney, Bill's and Arsenault Creeks (tributaries to Beaver and Little Beaver Lakes) were annually inundated during the spring melt. Large scale logging of the area was over by 1910 and the dam was abandoned (Symon, 1985).

Remnants of the dam remained for many years and logging and natural stream debris caught in the wreckage of the dam forming a more or less permanent obstruction. Annual (spring) high water extremes on Beaver and Little Beaver Lake thus continued after the dam was abandoned. Historical evidence for this scenario comes from personal accounts of annual activities at a resort that was established in Beaver Basin near the mouth of Lowney Creek in the 1950s (Symon, 1985); Peter W. Barrow, who worked for Michigan-

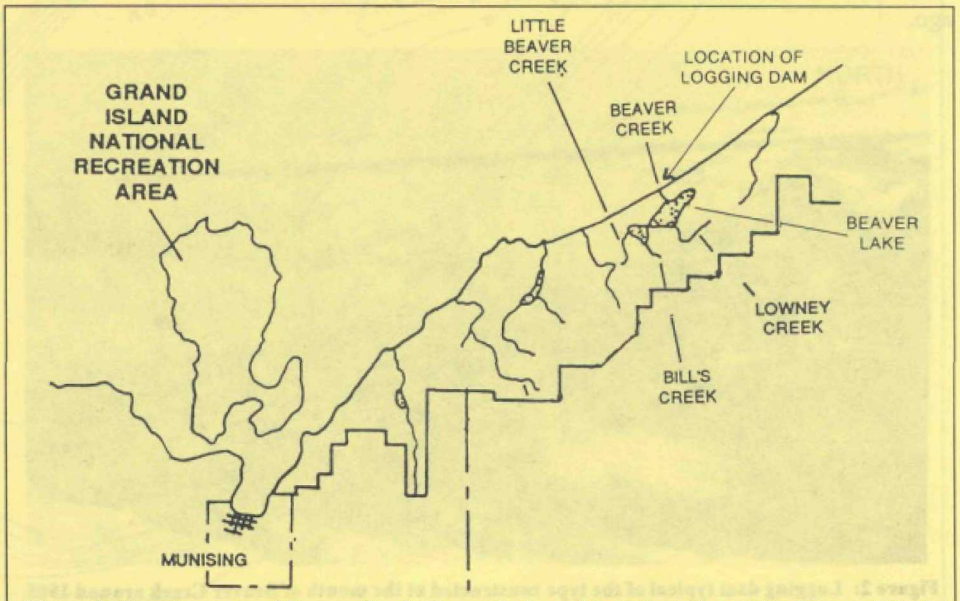

Figure 1: Location map of Beaver Creek, Beaver Lake and its tributaries within Pictured Rocks National Lakeshore. Note location of logging dam.

Wisconsin Pipeline Co. subsequent owners of the resort through 1970, has provided specific documentation.

According to Barrow (personal communication, 1992), the resort maintained a boat house at the mouth of Lowney Creek for the use of its clients. Each spring water rose until it was 12 to 18 inches deep inside the boat house. Because of this inconvenience, the resort went to great lengths to try to remove the remnants of the dam and the resultant log jam. After several years of effort, employees of the resort successfully removed the debris in the early 1960s.

PHYSICAL AND BIOLOGICAL EVIDENCE

Since the substrate of bluffs and banks surrounding the Beaver Lakes consists primarily of coarse and medium sand with little inherent strength, artificially high water levels each spring (between about 1910 and 1960) caused banks near the water's edge to be undermined and collapse. Today the dramatic, artificial fluctuations of the level of Beaver Lake no longer occur but evidence of these events is abundant. This evidence takes several forms:

1) A narrow terrace about a half meter above lake level is evident along the shores of Little Beaver and Beaver Lakes (Figure 3). Ages from increment cores and stem cross sections from woody plants are consistent with the hypothesis that the terrace was exposed as high spring levels of the lake were eliminated about 30 years ago.

2) Raw banks on the steep bluffs of the north shore of Beaver Lake occur adjacent to sandy flats at the water's edge. The oldest trees on these flats are 15-35 years old.

3) Along Beaver Creek, a narrow terrace today stands about .3 meters above the level of Beaver Creek.

4) Tag alder (Alnus rugosa) presently occupies many of the terraces and sandy "emergent islands" along Beaver Lake. Shoots are uniformly young (less than 10 years) and apparently have arisen from seed (Huenneke, 1987);

5) The littoral zone of the lakes is characterized by a uniform underwater shelf generally devoid of aquatic vegetation (Figure 4).

Doepke (1972) and Kamke (1987) comment on the distinctive littoral shelf of Beaver Lake. Doepke attributed this shelf to pronounced wind action accentuated by the lake's long oval shape. Kamke found diversity of littoral benthos in Beaver Lake to be much lower than that of Grand Sable Lake, which is of similar size and shape. While natural wind action certainly causes periodic destabilization of the banks and along the lake shores of both of these large lakes, I suggest that Beaver Lake's littoral shelf was formed when spring high water levels behind a debris dam at the mouth of Beaver Creek caused erosion and sedimentation upstream. Lake and Stream terraces became exposed along the water's edge only when the logging dam was finally removed around 1960.

Figure 2: Logging dam typical of the type constructed at the mouth of Beaver Creek around 1905. Earthen materials may have been more important in construction of the wings of the Beaver Creek Dam.

LANDSCAPE/ECOLOGICAL CONSEQUENCES OF LOGGING ACTIVITIES

If the proposed explanation for landscape features described above can be further substantiated, the area can serve to test several hypotheses that relate to the response of aquatic ecosystems to man-caused perturbations. Some examples:

1) Kamke (1987) states "most observed diversity (in the shallow sand shelf of Beaver Lake) was due to Mollusca and members of the order Diptera, organisms requiring little or no substrate diversity." In contrast, Kamke found high diversity in the benthic fauna of Grand Sable Lake and attributed it to substrate diversity that includes patches of sand, cobble, pebble and organic material.

While many factors have certainly influenced this contrast in properties between the two lakes, annual influx of sand into Beaver Lake's littoral zone through the 1950's may have buried substrate patches and/or retarded establishment of aquatic plants and accompanying fauna that form the base of the aquatic food chain. This influx may have influenced environmental factors critical in reproductive functions of some fish species. If this hypothesis is valid, how long will it take the littoral environment to "recover"?

Several management prescriptions turn directly on this issue. The Fisheries Management Plan for Pictured Rocks National Lakeshore (Schrouder and Loope, 1987), developed jointly by the Michigan Department of Natural Resources and the National Park Service, outlines several actions on Beaver Lake. Rough fish management and the proposed planting of walleye (Stizostedion vitreum) fingerlings are among these. High populations of suckers (Catostomus commersonii) are perceived presently as a problem of trophic structure; they may indeed be associated with substrate configuration. Cobble and rubble shallows required for walleye reproduction (Scott and Crossman, 1974) may be quite rare in Beaver Lake at the present time due to impacts of the logging dam.

2) The emergent islands and shoals along the periphery of Beaver Lake have supported several rare plant species

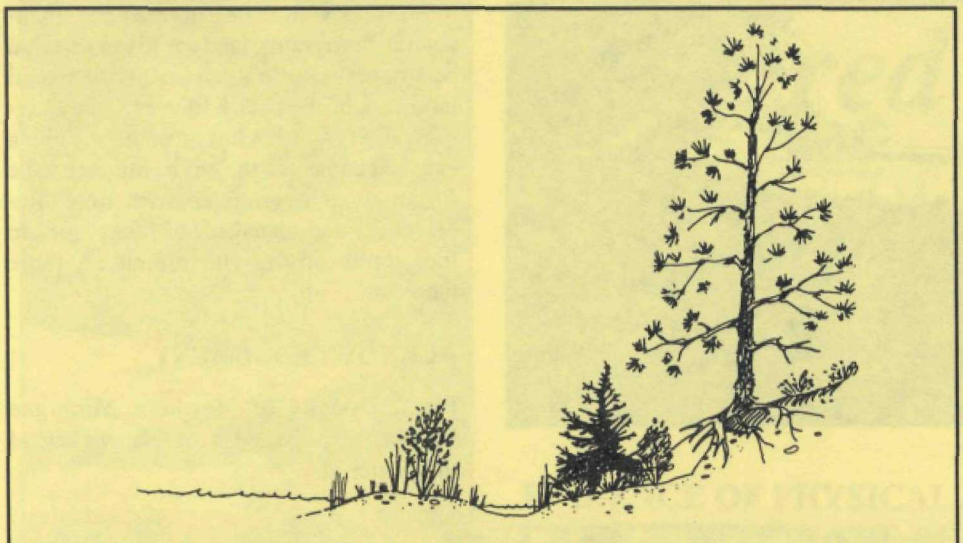

Figure 3: Typical cross-section of the wave cut terrace surrounding Beaver Lake; the terrace was developed under a regime of high lake levels between 1910 and 1960 caused by remnants of a logging dam.

~~1984~~) in the recent years. Since these habitats may be quite recent in origin and largely "artificial," what can inferred about these species pre-settlement distribution and population dynamics? What strategies

(~~Michigan Natural Features Inventory~~, for conservation biology can be derived from this scenario?

3) Common loons (Gavia immer) nest in the northern Michigan at water's edge in clumps of vegetation or on small rock islands (Edde et al., 1988). Although loons are seen regularly during migration on Beaver Lake, no nesting presently occurs there. Use of Beaver and Little Beaver Lake by loons may have been precluded by annual water level fluctuations 1910-1960. The 1910-1960 fluctuations may have mimicked longer term periodic natural changes in lake levels associated with beaver activity on Beaver Creek. With lake fluctuation now greatly diminished, what prevents loons from establishing nests on Beaver Lake?

4) Rapid invasion of tag alder (Alnus rugosa) after the logging era is a phenomenon suggested by many hydrologists and fisheries biologists in northern Michigan (e.g. USDA, 1986). A recent study of tag alder demography (Huenneke, 1987) suggests that rapid clonal spread is not common in several ecological settings. The newly exposed terraces and emergent islands afford good sites for study of riparian plant succession in a situation that may mimic post logging environments. Will alder establish more or less deterministic dominance along the Beaver Creek terrace?

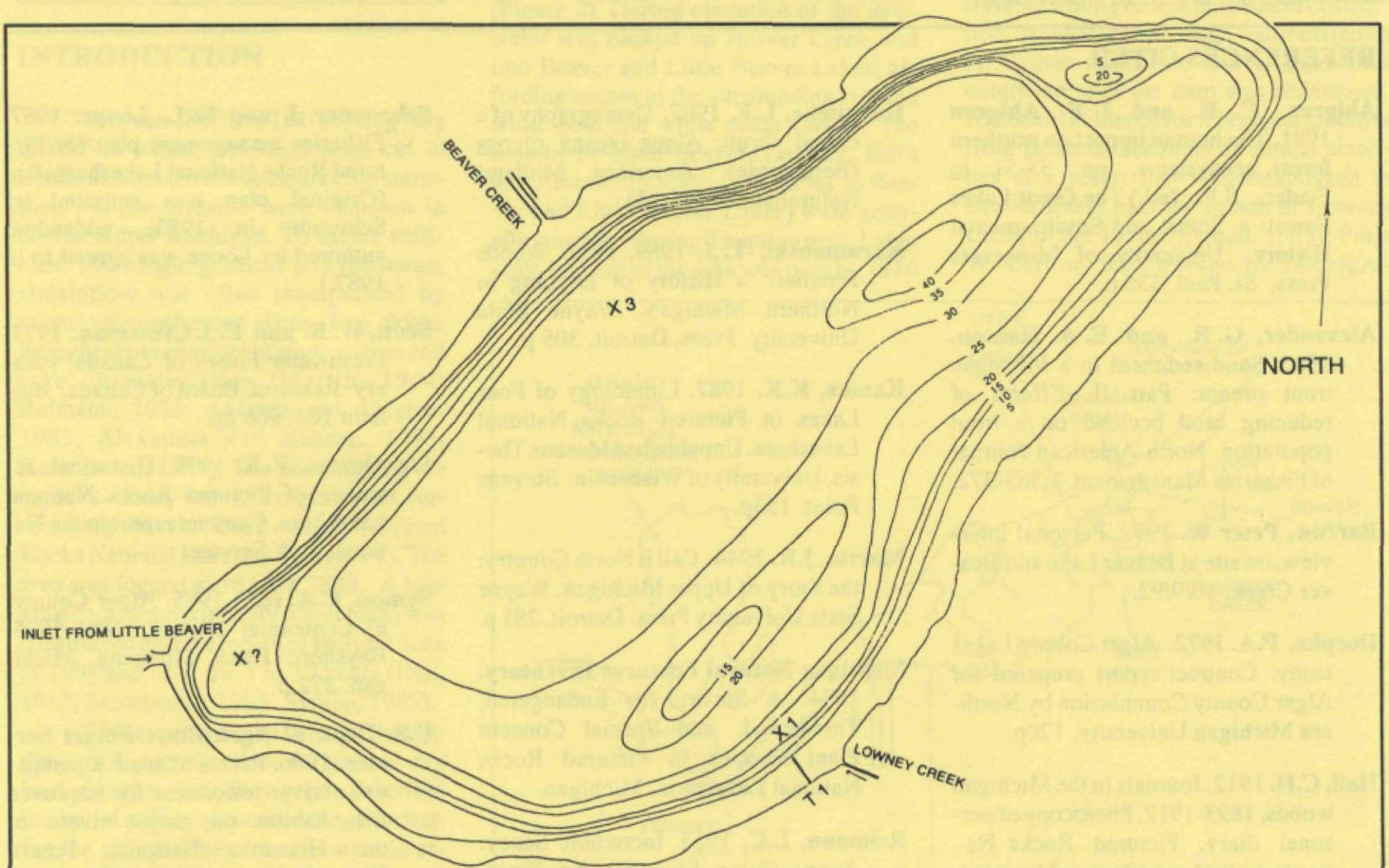

Figure 4: Bathymetric map showing the uniform shelf that dominates littoral portions of Beaver Lake (from Kamke, 1987).

Downstream view of Beaver Creek logging dam.

CONCLUSIONS

The recent use history of the Beaver Lake area provides several opportunities to test ideas about the impacts of land use and the persistence of impacts of the logging era in a small area. A variety of hypotheses regarding the development of riparian vegetation and the resilience and structure of littoral ecosystems can be developed and tested here. In this endeavor, the utility of detailed historical accounts of resource use in a small area is clear.

In development of resource management programs, land use history should be integrated into assessments of extant land capabilities. The Beaver Creek logging dam is an example of how human caused changes in the environment can be forgotten or overlooked with time. Researchers and managers of today need to look at phenomena with reference to those who came before.

ACKNOWLEDGEMENT

P. A. Doepke of Northern Michigan University provided a timely review of this material.

Sluiceway - Beaver Creek logging dam.

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