PALEOECOLOGY OF PEATLANDS AT HUFF AND HAGER LAKES, IDAHO PANHANDLE NATIONAL FOREST:

FY92 YEAR-END SUMMARY

by

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INTRODUCTION

Peatlands are generally defined as wetlands with waterlogged substrates and at least 30 cm of peat accumulation. Bursik (1990) recognized two types of peatlands in Idaho based on vascular floristic composition: (1) *Valley Peatlands*, which generally occur around lakes and ponds at relatively low elevations in major river valleys, from near Bonners Ferry, in the panhandle, to near Driggs, in eastern Idaho; and (2) *Subalpine Peatlands*, which are more common throughout the same portion of Idaho, but generally form along low-gradient, subalpine streams. Subalpine peatlands are generally characterized by plant species common throughout the western cordillera, while valley peatlands are characterized by numerous boreal species whose Idaho populations are disjunct by hundreds of miles from the main portion of their range in boreal regions of Canada.

The biodiversity value of Idaho's valley peatlands is high. Although wide-ranging across the state, the occurrence of valley peatlands is very rare on the landscape as a whole and they contain some of the highest concentrations of rare species found in Idaho. Approximately 12% of Idaho's rare vascular flora is more or less restricted to peatland habitats, as is one rare mammal. The narrow suite of environmental conditions that lead to the formation of peatlands create conditions suitable only for species specifically adapted to these sites.

Peatlands are an important terrestrial habitat worldwide where they cover an estimated one percent of ice-free continental land masses. As much as 15 percent of Canada is covered by peatlands where they are not only important from a biodiversity perspective, but also economically important from an industrial and energy perspective (in the form of peat mining). Globally, peatlands have long been looked at as worthless, forbidding land. Every effort was made to drain them for forestry or to mine them for peat fuels. Northern European countries with once immense peat reserves are now scrambling to preserve their last remaining tracts of pristine peatland habitat. Finland has drained more than half of its 25 million acres of peatlands for forestry. Only five percent of Ireland's 3 million acres of peatland remain untouched (Breining 1992). Although North American peatlands have fared far better, the continued threat of development exists, particularly if conventional sources of fuel and electricity generation become limiting or expensive.

Worldwide, peatlands exert a tremendous influence on the earth's climate. Methanogenic anaerobic bacteria inhabiting peat soils produce as much as 40 percent of the methane (an important "greenhouse gas") released into the atmosphere annually (Breining 1992). On the other hand, peatlands act as immense sinks of carbon dioxide, the most important greenhouse gas. In fact, it is estimated that peatlands store 15 to 20 percent of terrestrial carbon reserves, more than twice the amount in all living northern latitude forests (Breining 1992).

Idaho's peatlands also provide an important historical perspective through the plant fossils and volcanic ash preserved in their peat deposits. Peat contains a postglacial record of regional and on-site vegetation (in the form of pollen and plant macrofossils), which allows ecologists to reconstruct the regional vegetation patterns and climatic history, as well as the historical development of the peatland itself. Peat deposits enable ecologists to address questions about landscape and community development and evolution in the context of centuries or millennia rather than over one or a few field seasons (Schoonmaker and Foster 1991). Models for ecosystem development and landscape evolution supported from studies of the peatland archives can provide more enlightened and long-term management strategies, not only for valley peatlands in Idaho, but for Rocky Mountain ecosystems as a whole.

The Idaho Conservation Data Center (CDC) is presently involved in a multi-faceted program directed toward the conservation and restoration of valley peatlands in Idaho (Bursik and Moseley 1992). As a first step toward this goal, we are beginning to fill in gaps in our knowledge of the compositional, structural and functional attributes of Idaho's peatland ecosystems through inventory, research and long-term monitoring. No paleoecological studies of valley peatlands of Idaho have been undertaken to reconstruct *in situ* bog vegetational history as has been done elsewhere (Watts and Winter 1966; Miller and Futyma 1987). This study begins to piece together the late Pleistocene - Holocene puzzle of valley peatland development.

During July, August, and September, 1992, paleoenvironmental sampling took place at Hager Lake, Bonner County, Idaho, and Huff Lake, Pend Oreille County, Washington. Sampling was done under the direction of Peter Mehringer, Washington State University (WSU). Field assistants included faculty and graduate and undergraduate students from the WSU Archeology Field Camp, CDC ecologists, a USFS Intermountain Research Station botanist, and USFS Idaho Panhandle National Forest personnel.

METHODS AND RESULTS

Multiple, 10-cm diameter piston cores were collected in plastic core barrels from fen and bog surfaces, and from a raft over the deepest area of Hager Lake (ca. 12.2 m in depth). Frozen sections of the mud-water interface were also collected from deep water at Hager Pond; these remain in frozen storage. The plastic core barrels were sawed to the length of sediment recovery, capped, sealed, and returned to cold storage at the Department of Anthropology, Washington State University.

Upon finding that most sediments in the upper one-half of the cores were soft and wet and that they deformed and dried rapidly upon exposure, Mehringer decided to leave most core barrels uncut and capped to guarantee their integrity until they are sampled. Enough cores were opened, however, to assure that complete sections of the bog and lake sediments are on hand. Sediments were exposed by cutting the barrels lengthwise and removing one-half of the barrel. Thus, the cores were protected during transport and not distorted by extrusion or by splitting.

Several distinct volcanic ashes were observed in the opened cores and in mixed deposits adhering to core barrels. Though none of these tephras has been identified, based on relative position and thickness they are referred to in this report by their most probable source and age: Mount St. Helens A.D. 1980, Mount St. Helens T (A.D. 1800, Mount Mazama (6850 B.P.), "tawny" unknown tephra (10,600 B.P.), and Glacier Peak (11,250 B.P.). Following is a general narrative of what was found at the five core localities at Hager and Huff lakes. See Appendix 1 for a detailed log of these cores; the core logs will be expanded as work begins on analyzing particular sections. All cores are in cold storage facilities at the Department of Anthropology, Washington State University, Pullman.

Hager Lake - Core Locality 1

We first cored on the floating mat ca. 12 m south of its abrupt edge with open water. Because the coarse fibrous peat was difficult to core, we pushed the core barrel through four or five meters of floating mat and the water column below until lake sediment could be detected. From this point we collected a single core from ca. 9.2 to 11.9 m depth.

The 2.7 meter core was opened and logged; it began in Mazama tephra and organic lake deposits, and extended into blue gray clays at its base. A couplet of Glacier Peak ash at ca. 10.85 m was especially significant because earlier researchers had not found this tephra. They therefore concluded that the depression of Hager Lake became ice free and began collecting sediments only 10,500^{14}C years ago (Mack *et al*. 1978). Deposits representing another 1000 to 1500 years lie below those previously analyzed. These contain records of the first organisms to arrive after deglaciation.

Sediments of this first core offered another important clue to bog history. Peaty deposits that formed after the fall of Glacier Peak tephra suggest a short period of very shallow water (10,000-9,000 B.P. or so) that by itself would have influenced the early success of shallow water and fringe invaders and development of bog and fen communities. In other words, climate-caused changes in the water table have, since earliest time, interrupted and influenced the direction and pace of biological developments.

Hager Lake - Core Locality 2

The second core was taken from a raft near the center of Hager Lake in its deepest area. Before coring, however, we collected frozen sections to provide detailed records of lake history in the recent past. The first section of about 40 cm contained the mud-water interface and two volcanic ashes that we assume to be Mount St. Helens 1980 and Mount St. Helens T (A.D. 1800). The second frozen slab overlaps the first, holds the lower tephra, and extends the frozen section to ca. 60 cm.

Four overlapping cores of 1.8, 2.4, 2.5, and 2.6 m lengths give a complete coverage from just above the mud-water interface (ca. 12.10 m) through 5.3 m of lake deposits to clays at 17.4 m. Several layers of clean and mixed Mazama tephra occur around 15.6 m depth, suggesting sinking and mixing of this tephra in soft lake sediments.

Though the cores penetrated into tough clayey sediments, Glacier Peak tephra was not seen in the deepest core and must lie below what we were able to obtain at this locality. Judging from the sedimentary sequence, the older Glacier Peak-bearing cores from Core Locality 1 overlaps the basal core from Core Locality 2. These two localities together give a complete record of 12,000 years or so from beneath open water.

Hager Lake - Core Locality 3

To obtain as long a record as possible of bog and fen deposits that lie beneath the present *Sphagnum* mat Locality 3 was selected from near the bog edge, adjacent to *Spiraea* and *Kalmia* communities southeast of the pond. To avoid compression of these exceedingly fibrous deposits the upper 1.1 m was taken by cutting the peat with sharpened tiling spades as a sharpened 15 cm diameter plastic pipe was being pushed into the deposits.

Six additional cores of 1.16, 1.37, 1.38, 2.39, 2.5, and 2.67 m lengths give nearly complete coverage from the bog surface through 11.4 m of organic deposits with abundant and well preserved macrofossils. Though Mazama tephra was present, Glacier Peak tephra was not seen in the deepest core and must lie below what we were able to obtain at this locality. Judging from the sedimentary sequence, the older, Glacier Peak-bearing core from Core Locality 1 overlaps the basal core from Core Locality 3.

Hager Lake - Core Locality 4

Locality four was selected to give a continuous record from the sub-basin northwest of Hager Lake. Here we collected overlapping cores through peat and basal clay into gravel (till). We tested three different areas hoping to locate the deepest part of the depression but came far short of the 7 m reported by Rumely (1956). Our deepest core, with overlapping drives of 0.7, 1.21, and 1.83 m, encountered till at 2.66 m. These cores have not been opened, however, judging from resistance encountered at ca. 1.5 m and tephra adhering to the core barrel near 2.6 m, both Mazama and Glacier Peak tephras are probably present.

Huff Lake

We cored the south end of the Huff Lake depression from the bog surface about 10 m south of its abrupt edge with open water. Because the peat was coarse and fibrous we excavated two peat blocks from the upper 50 cm and began coring in the open holes. Eight drives in two cores (1.85, 2.27, 2.45 and 2.83 m long, and 1.78, 2.25, 2.73, and 2.97 m long) gave a completely overlapping sequence from 0.5 to ca. 10.8 m depth. We recovered both Mazama and Glacier Peak tephra, and perhaps a different tawny-colored volcanic ash just 10 cm above the light gray Glacier Peak tephra.

Describing deposits of the three deepest drives revealed that some sediments in the two meters above the "tawny" tephra had been mixed and that intact beds had been tilted. The chaotic condition of these deposits could have resulted from a debris flow entering the depression in its narrow, steep-sided southern end near the coring site. Perhaps deposits of the Huff Lake basin at its widest point in the area of the present deepest open water (ca. 5.5 m) would have been far enough from a steep slope to have escaped disturbance.

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APPENDIX 1

Core logs from Hager and Huff lakes, Idaho Panhandle National Forest.