Geo-Ecologic Dynamics in the Glacial Lakes
Duluth-Agassiz Region (Northern Minnesota)
During the Late Pleistocene and Early Holocene

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Studies of the late-Quaternary stratigraphy, geomorphology and vegetative
chronology of the area immediately west of the Lake Superior basin provide an
opportunity to evaluate the dynamic interactions between the geosphere and
the biosphere. These interactions have ramifications for understanding the
timing and character of local potential Paleo-American adaptations. Quater-
nary strata and landforms in northeastern Minnesota indicate a physical
context associated with ice margin, pro-glacial lakes, and changing drainage
systems, while the biostratigraphic record can be used to develop a postglacial

A series of glacial advances affected the region from prior to 12,500 to around
9,900 yr B.P. (Hill 1995; Phillips and Hill 1994). Ice lobes advanced from the
northwest, north, and northeast. In the central region, melting of the Rainy
lobe created a series of recessional moraines, eventually reaching the Vermilion
moraine ice margin by 12,500 yr B.P. Glacial lakes formed south of this margin.
At about this same time, the Automba-phase Superior ice lobe occupied the
region to the east. As this ice lobe melted back into the Superior basin, another
 glacial lake was created. Between about 12,000 and 10,500 yr B.P., Alborn-phase
ice advanced from the northwest and Thompson-Nickerson phase ice advanced
from the northeast. Meltpwater from the various ice lobes contributed to the
creation of Glacial Lakes Upham II, Koochiching, Norwood, and Nemadji (or

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incipient Duluth). A rise in the level of Lake Agassiz appears to have been a
response to the Marquette-phase advance of the Superior lobe which may have
reached the Marks-Mackenzie ice margin around 9,900 yr B.P.

Three major sets of proglacial lakes existed in northeastern Minnesota during
the end of the Pleistocene and earliest Holocene. Two intervals of lakes on the
Aitkin and Upham plains were separated by the Alborn-phase ice advance, with
the possibility of glacial lake persistence to about 9,000 B.P. (cf. Hobbs 1983).
North and west of this region, a series of lakes formed, eventually leading to the
development of Glacial Lake Agassiz which persisted in northern Minnesota to
about 9,000 yr B.P. Fluctuating ice margins resulted in different lake levels leading
to the Houghton low stand by about 8,000 yr B.P. in the Superior basin.

The dynamics associated with glacial ice margins and the locations of glacial
outwash lakes and drainage patterns influenced the postglacial biotic character
of the region. A tundra-type setting appears to have been established in some
deglaciated areas as early as 14,700 yr B.P. (Huber 1992). By 12,000 yr B.P. a shrub
or tundra parkland may have existed in the southern part of the region. There are
some indications for the presence of a late-Pleistocene mosaic ecologic pattern.
The region bounded between Glacial Lake Agassiz to the northwest and Glacial
Lake Duluth to the southeast between 11,000 and 10,500 yr B.P. may have been
characterized by two generalized vegetational landscapes as inferred from fossil
pollen assemblages (cf. Julig and McAndrews 1993). The southwest may have
been a “lichen woodland” or shrub parkland, while the area to the northeast may
have been tundra, tundra parkland or shrub parkland (Huber 1992, Julig and
McAndrews 1993). After the melting of the Marquette-phase Superior lobe and
during the Minong-Houghton transition within the Superior basin (starting ca.
9,500 to 9,000 yr B.P.), the region was likely a boreal forest landscape dominated
by spruce and pine (cf. Cushing 1967). A conifer or conifer-hardwood forest was
likely established in the region by 8,300 yr B.P. (Huber 1992). If the proposed
transition from a lichen woodland/shrub parkland and tundra-type/tundra or
shrub parkland ecotone setting—bounded by large glacial lakes and the
Laurentide ice margin—to a landscape dominated by a postglacial boreal forest
context sometime around 10,000 yr B.P. can be substantiated, it might be used to
predict the presence of two temporally distinct Paleo-American adaptive strategies
in the region between Glacial Lakes Duluth and Agassiz (cf. Julig and
McAndrews 1993). The interrelationships between physical environments and
biota (plants and animals) can viewed from a geo-ecologic perspective (Hugget
1995) combining landscape ecology and biogeography to model paleoecologic
dynamics. Based on the presence of a major geo-ecologic transition around
10,000 yr B.P. we propose that prehistoric human populations who may have occupied the area during the late Pleistocene and early Holocene would have had
temporally distinct adaptive strategies. These strategies may be reflected in the
prehistoric record by potentially distinct archaeological taxonomic entities represent-
ing the presence of local early-Paleo-American and late-Paleo-American
populations. A further postulate would argue that biotic adaptations, including
Paleo-American strategies, prior to about 10,000 yr B.P. may reflect a mosaic
habitat setting while later adaptations would be associated with a less variable,
more homogeneous ecologic context.
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References Cited


