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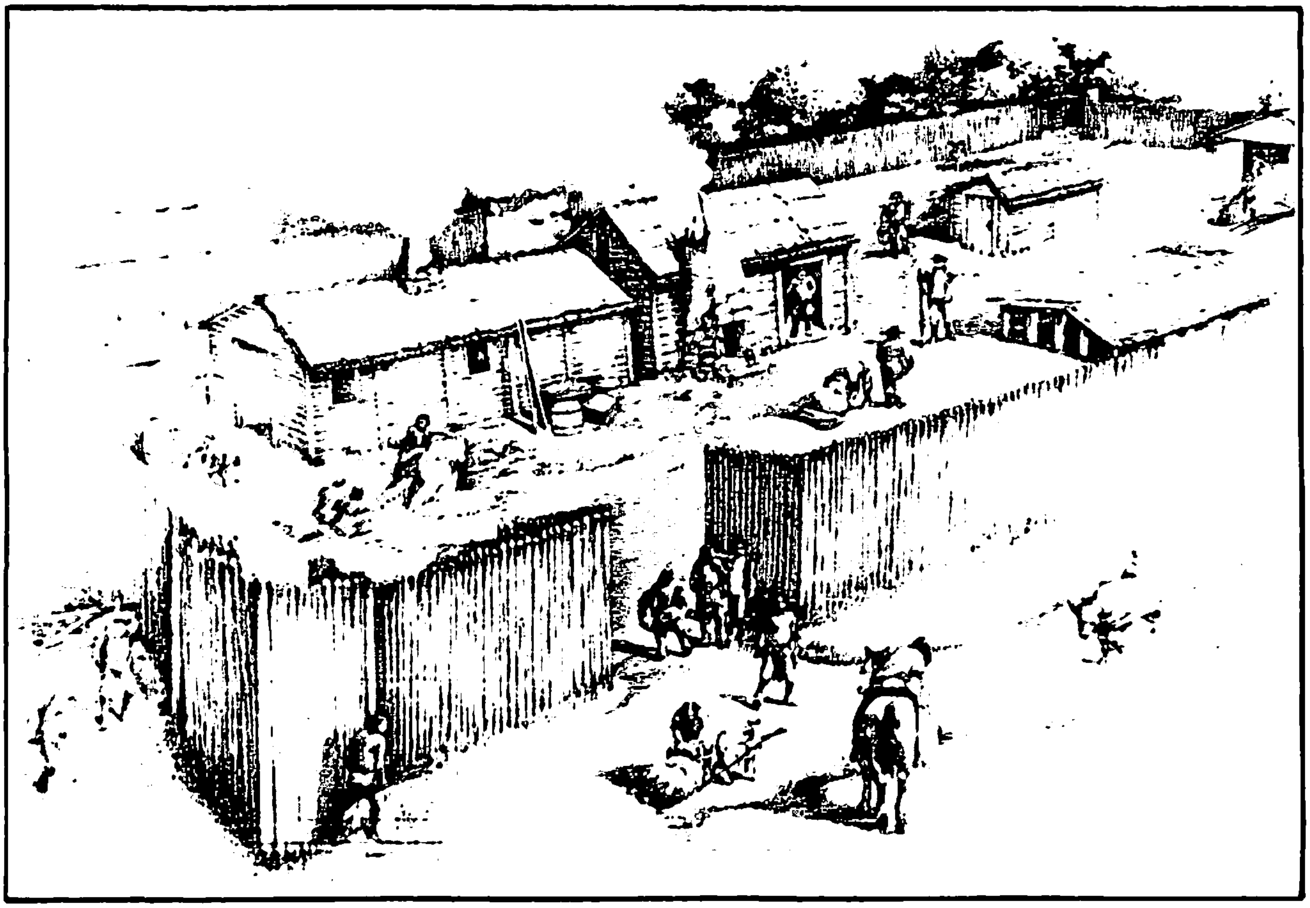

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PALEOBOTANICAL STUDIES AT THE FORKS: ANALYSIS OF SEEDS, CHARCOAL AND OTHER ORGANIC REMAINS

A PRELIMINARY REPORT

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Abstract

People have lived at the junction of the Red and Assiniboine rivers (The Forks) for millennia. This is confirmed by archaeological excavations conducted by the Canadian Parks Service and other agencies. Excavations at The Forks in 1984 and 1988 exposed a sequence of cultural layers in stratified river deposits dating from the 5th century AD to the early 19th century. Cultural debris included pottery, stone tools and thousands of fragments of broken animal bone. In addition, a variety of small-scale remains have been retrieved from soil samples through flotation. Our study of 35 soil samples has yielded quantities of charred seeds, charcoal, bone, shell, lithic flakes and small (less than 0.5 mm) organic remains tentatively identified as fungal sclerotia, flatworm cocoons and snail eggs. These assorted remains offer insight into the local environment and cultural plant use over the past 1500 years.

The past environment of The Forks appears to have been a low floodplain covered by a riverbottom forest of trees such as ash, cottonwood and/or willow, elm and maple. Oak could be found on higher ground. The surface soils were apparently moist and rich in organic matter and a variety of shrubs and herbs covered the ground. People camped among the trees from which they gathered firewood. Plant foods included the starchy seeds of goosefoot and dock, the nuts of hazel and acorn, and vitamin-rich fruits such as raspberry, wild rose, saskatoon, pin cherry, wild plum, hawthorn and mooseberry. The major trend in plant food seems to have been an increase in the use of goosefoot during Late Prehistoric and Historic times compared with the earlier Blackduck occupations.

Introduction

The junction of the Red and Assiniboine rivers ("The Forks") has always been a meeting place. Historical studies and archaeological excavations reveal that the area has been the scene of human activity for several thousand years. These historical and archaeological studies aim to investigate the nature of early occupation of this strategic crossroads and to reconstruct the sequence of occupation and how various groups lived in the past.

As a contribution to these studies, our research focuses on how past peoples used the plant resources of the area during Late Prehistoric and Early Historic times. Our objective is to determine which plant communities existed at the junction and which plants were used for food, fuel and other purposes. In pursuit of our interests we have analyzed the seeds, charcoal and other organic remains in soil samples from the 1988 excavations of the Canadian Parks Service on the west bank of the Red River within The Forks National Historic Park. This report describes the site and its sequence of occupation, and covers work conducted from May 1989 to May 1990. It is part of a long-term study of past environments and the human history of the region.

We use the approach of human adaptability in which human populations adjust to each other and to specific environmental opportunities and limitations (Chapman 1979; Moran 1979). As used here the approach involves five major steps which include (1) formulation of objectives, (2) compilation of background information on the environment and plant resources of the area, (3) formulation of predictions about the type and relative abundance of plant remains expected, (4) recovery and analysis of the evidence and (5) evaluation of the predictions in light of the evidence.

The Site

Location and Description

The Forks-North Point Site (DlLg-33-88A) is located at the junction of the Red and Assiniboine rivers (Fig.1) and extends northward from the junction along the west bank of the Red River (Priess *et al.* 1986).

A number of events have greatly altered the site over its long history. Erosion and deposition associated with flooding of the two rivers have periodically reshaped the banks. Levelling and infilling with cinders, gravel and trash by the Canadian National Railway have made the greatest changes to local topography. The railway fill covers the area to depths varying from 0.5 m to 5.0 m. It is deepest along the water's edge and has moved the bank outward and increased its elevation (Priess, personal communication, 1989). Recent landscaping activities as part of the development of the site as a National Historic Park have further altered the topography.

The Canadian Parks Service undertook excavations at The Forks-North Point Site in 1984 and 1988 (Fig.1). Test excavations in 1984 were placed southwest and northeast of the railway maintenance shop close to where the remains of historic Forts Gibraltar I and II may have been located. In 1988, excavations took place on the river bank southwest of the maintenance shop where a pedestrian ramp was to be constructed. Historic and prehistoric remains were recovered both years.

History of Occupation

Prehistoric and Early Historic Use (ca. 4000 BC to AD 1780) – Prior to recent archaeological excavations, a few historical accounts were the only source of information about the Native occupation of the area. These accounts suggest that during the 17th and 18th centuries, The Forks was not only a meeting place but, more importantly, a disputed territory bordering a no-man's land in the Red River valley to the south (Guinn 1980:15,23). The disputants were the Assiniboine, Western Cree, Ojibwa and Sioux who each considered The Forks a part of their own territory (Guinn 1980:15). The Assiniboine inhabited the area in the 17th and 18th centuries. Initially, the area was used by Siouan speakers, perhaps Yonktonai and/or Santee. Between 1640 and 1780, the Assiniboine allied themselves with the Cree in fighting the Sioux (Guinn 1980:15,16). By the late 18th century the impact of the fur trade, coupled with introduced diseases, had caused Native groups to shift their territories. The Assiniboine and Cree moved to the west and the Ojibwa moved in from the east (Guinn 1980:23). These groups were attracted to The Forks perhaps because of its accessibility and favourable geographical position between the grasslands and boreal forest (Guinn 1980:15, 23).

Archaeologists have begun to uncover a long record of prehistoric use extending back at least three thousand (Kroker 1989:175) and perhaps six thousand years (Kroker, personal communication, 1990).

The remains dating to approximately 3000 years ago appear to represent numerous short (perhaps seasonal) occupations and suggest that The Forks was then a place where groups from different areas came to trade and perhaps hunt. Trade is suggested by the recovery of projectile points typical of boreal forest groups as well as stone tools made of materials derived from western Manitoba and North Dakota (Kroker 1989:195).

Late Prehistoric ceramics found in the Canadian Parks Service excavations belong to several different cultural groups who also occupied the area on a short term or seasonal basis (M.A. Tisdale, personal communication, 1989). These cultural groups included Blackduck (ca. 1200-1350 BP), and possibly Selkirk (*ca.* 1000-250 BP) and Sandy Lake.

Historic Use (AD 1780 to present) -- The later Historic period (*ca.* 1780 to 1850) is represented primarily by artifacts of the fur trade. The North West Company built Fort Gibraltar (later designated Fort Gibraltar I) in 1810. The fort was captured and dismantled in 1816 by the Hudson's Bay Company and the Selkirk Settlers, but was rebuilt the following year by the North West Company. The new fort was erected several hundred metres south of the old one, nearer the junction of the two rivers, and named Fort Gibraltar II. It was renamed Fort Garry in 1821 when the North West and Hudson's Bay companies amalgamated. The fort was used until the construction in 1835 of Upper Fort Garry, the new centre of trade for the Red River district. In the mid-19th century, the site was used as an experimental farm, and since the late 19th century it has been an industrial and railway yard.

Methods

Vegetation Survey

A vegetation survey was conducted along the lower terrace slope of the Red River's west bank, beginning about 15 m from the southern extent of the Riverside Promenade and ending approximately 300 m north of this, roughly 13 m from the present site of the amphitheater structure (Fig.1). A total of 30 randomly-located 5 x 5 m quadrats, each having a 2 x 2 m quadrat nested in its lower left-hand corner, were used to sample vegetation on two separate occasions. In August 1989, sampling covered nearly 200 m of the area and consisted of two transects of 10 quadrats along the upper and lower slope. In October, sampling continued from the end of the previous transects where the forest narrowed. The additional 10 quadrats were confined to the lower slope. Within each large quadrat, the circumference of each tree (≥ 10 cm) was measured and relative density, frequency and dominance were calculated and summed to give an importance value (Curtis 1959). Within the smaller quadrats, a visual estimate of the downward projection of the cover of shrubs, tree saplings (circumference < 10 cm) and vines was made using a slightly modified Braun-Blanquet (1932) cover scale (i.e., 1 = < 5% ground cover, 2 = 6 to 25%, 3 = 26 to 50%, 4 = 51 to 75%, 5 = 76 to 100%). The area of bare ground was also estimated in October. When possible, tree stumps were identified and tree species of particular interest occurring outside the sampled quadrats were recorded. The abundance of a few conspicuous herbs was noted in the surveyed area using a five-part scale (abundant, frequent, occasional, rare, present). In addition, the angle of the slope was estimated and three soil samples were taken from each transect.

Collection of Sediment Samples

As part of the 1988 excavations, numerous sediment samples were collected for flotation. Samples were taken from hearths and pit features as well as general cultural and non-cultural layers. Samples

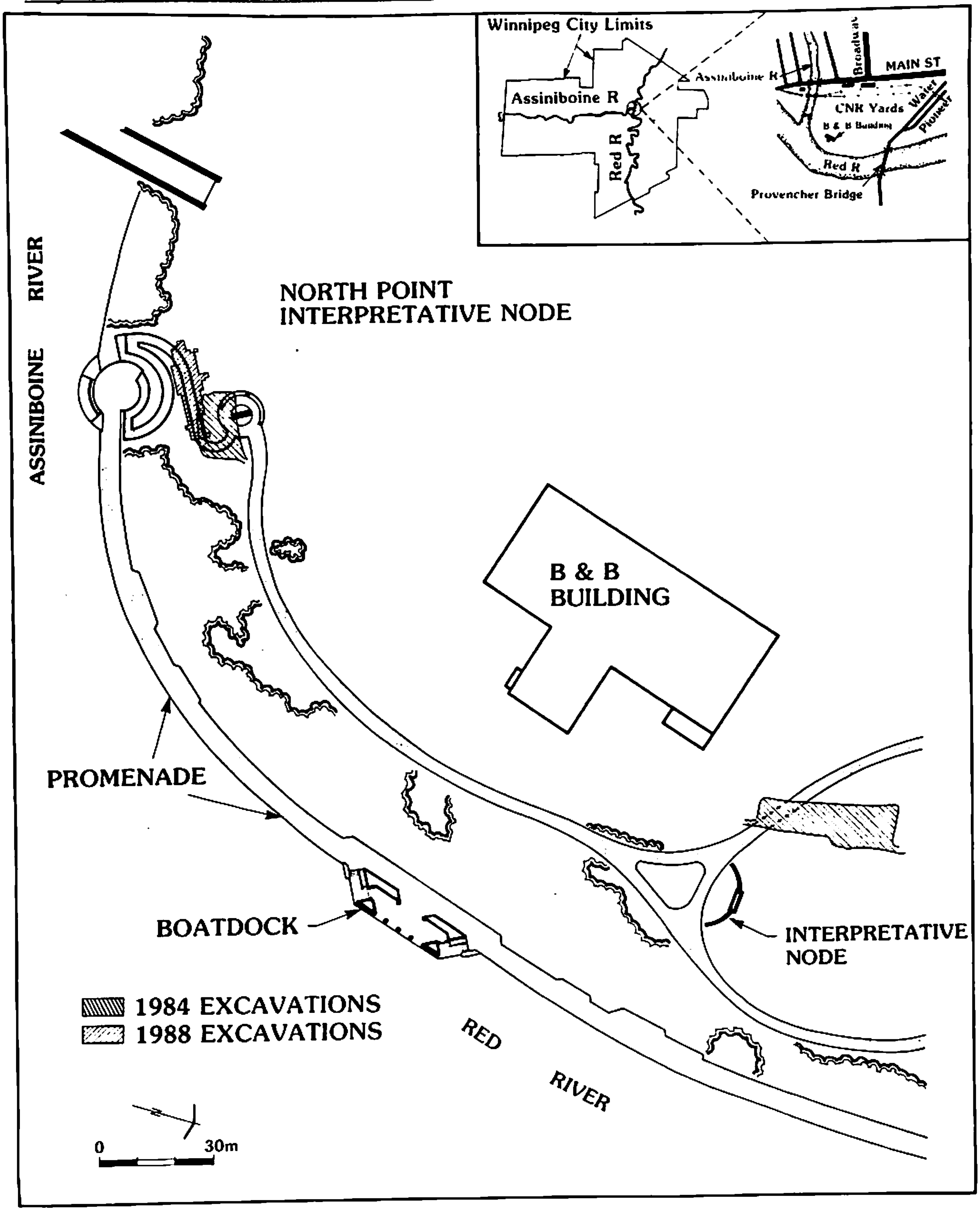

Figure 1: Areas excavated and vegetation survey area (A to B). Map courtesy of Canadian Parks Service.

from features were given highest priority because they were expected to contain the most cultural information.

Processing of Soil Samples

The sediment samples chosen for analysis spanned the various occupations at the site. They were selected in a non-random manner in part based on their darkness of colour, the assumption being that dark samples would contain more charred organic remains than lighter-coloured sediments. This assumption was subsequently tested by comparing seed and charcoal content with soil color using a Munsell soil colour chart. Sediment samples were processed at the University of Manitoba (Appendix 1).

Data Analysis

All charred and uncharred seeds were counted, and for purposes of enumeration, one whole seed was counted as 1.0 and each fragment as 0.5. The weights of charcoal, bone (both burnt and unburnt) and shell and counts of other remains, including lithics, fish scales, fungal sclerotia, and flatworm cocoons were also recorded. Data from subsampled fractions were adjusted using a correction factor (initial sample weight/subsample weight).

Density per litre was determined by dividing quantity or weight by the sample volume. For each variable, the mean, standard deviation, range and coefficient of variation was calculated and histograms arranged in descending order of concentration were generated.

Charcoal, burnt bone and charred seed concentrations were correlated in bi-variate plots. Three additional graphs were drawn; one of uncharred seeds by depth as an indicator of recent contamination, the other two plotted charcoal and charred seeds by soil colour value.

Environment and Plant Resources

Vegetation Survey Results

Description of the Present Forest -- The forest on the west bank of the Red River consists of Manitoba maple (*Acer negundo*) [nomenclature follows Scoggan (1979)], ash (*Fraxinus pennsylvanica* var. *subintegerrima*), cottonwood (*Populus deltoides*), peach-leaved willow (*Salix amygdaloides*) and white elm (*Ulmus americana*)(Table 1). Of these, maple is clearly the most abundant (with a relative density of 71.8%) and widely distributed, occurring in over one-half of the quadrats sampled. The density of ash is only one quarter that of maple, while cottonwood, willow and elm combined make up the remainder. Although the density of cottonwood is only 6.1%, some of these are massive trees with diameters up to 110 cm. In terms of overall importance maple receives a value greater than all other species combined (Table 1).

The underbrush consists of various shrubs and vines with maple, ash and willow saplings and a variety of herbs (Tables 2, 3 and 4). Among these, maple saplings occur most frequently, showing vigorous rejuvenation relative to other tree species. The shrubs include dogwood (*Cornus stolonifera*), gooseberry (*Ribes* sp.), snowberry (*Symphoricarpos* sp.) and a single Tartarian honeysuckle (*Lonicera tatarica*), an introduced species. Gooseberry and Virginia creeper vine (*Parthenocissus*) are the most widely distributed shrub and vine species. Although the October 5 sampling differs little in terms of the importance of such species as maple and gooseberry, its limited findings especially with regard to vines probably reflect the smaller sample size and the autumn season (Table 3). In August, an estimated 50 to 75% of the lower slope quadrat area and 6 to 25% of the upper slope quadrat area consisted of bare ground. In October, an estimated 72% of the ground was bare.

Comparisons -- Floodplain forests in the Winnipeg area along the Red River and its tributaries vary in structure and composition (Fig.2). Maple, ash and elm appear at all sites, while willow, oak and cottonwood are absent at some locations (Table 5). This variation may be attributed in part to elevation, as elevation affects the frequency and duration of flooding and thus the distribution of species. Other factors such as the history of disturbance may also be involved. In general, oak and aspen are largely restricted to upland zones with well-drained soils, willow thrives on lower terraces near the river, and maple, ash and elm are widely distributed.

Comparison of The Forks with six other floodplain forests reveals a few important distinctions (Table 5). The Forks has more maple and willow and less elm than most of the other sites. Only at La Barrière Park does maple receive a higher value. The high importance value of maple at The Forks is due to the large number of young trees which may reflect recent disturbance. The lack of elm at The Forks may be attributed to early cutting or perhaps loss to disease.

Apart from such disturbances, the present-day riverbottom forests are probably similar to those that existed prior to 19th century European land clearance. An account provided by Henry Youle Hind in his 1858 Red River exploration narratives describes the presence of elm, maple, ash, oak and aspen along the banks of the Red River downstream from the Red River Settlement (Hind 1971). Much of the forest within the immediate vicinity of the Settlement was cut by the mid-19th century for use as construction material and fuel. This denudation is clearly revealed by photographs taken in 1858 by the explorer H.L. Hime (Huyda 1975), as well as by photographs of Upper Fort Garry taken in 1878 (Manitoba Archives Upper Fort Garry 4). The trees on the banks of the Red River today represent a relatively young forest, probably less than 100 years old. Further evidence of disturbance is reflected in the presence of herbs such as burdock, couchgrass, Canada thistle and clover which were either intentionally introduced from Europe as forage plants or accidentally as weeds (Table 4).

Climate

Southern Manitoba has a semi-arid climate with short, hot summers and long, cold winters. Weather records have been kept at Winnipeg only since 1872. Earlier patterns must either be extrapolated from weather records or reconstructed from indirect evidence. Break-up and freeze-up dates of the Red River (Rannie 1983) and observations made by early settlers suggest that both spring and fall temperatures were approximately 2.5°C cooler during the 19th century. For earlier periods, only general trends in climate interpreted from pollen evidence are available (Ritchie 1983). For the period of record (1872-1980), precipitation averaged about 522 mm annually with a range of about 410 mm (Ehrlich *et al*. 1953; Anonymous 1982).

Table 1: Forks vegetation survey (August 9 and October 5, 1989); forested area on west bank of Red River

Taxon	# of quadrats of occurrence	# of tree stems	Total basal area (cm²)	Relative frequency (%)	Relative density (%)	Relative dominance (%)	Importance value
Acer negundo	26	117	13843.75	54.17	71.78	31.55	157.5
Fraxinus pennsylvanica	9	26	3334.58	18.75	15.95	7.60	42.3
Populus deltoides	5	10	19181.49	10.42	6.13	43.72	60.27
Salix amygdaloides	6	8	7254.98	12.50	4.91	16.53	33.94
Ulmus americana	2	2	261.25	4.17	1.23	0.60	6.00
Total:	48	163	43876.05	100.01	100.00	100.00	300.01

n=30 quadrats, 5 X 5m
Total basal area = 43,876.05 cm²
Average basal area per tree = (43,876.05/163)=269.18 cm²

Table 2: Shrubs, saplings and vines (August 9, 1989)

Taxon	# of quadrats of occurrence	Relative frequency (%)	Average cover (%)
Shrubs and Tree Saplings			
Acer negundo	8	28.6	7.9
Fraxinus pennsylvanica	4	14.3	1.8
Ribes sp.	5	17.9	6.2
Symphoricarpos sp.	1	3.6	0.8
Vines			
Parthenocissus inserta	5	17.9	12.2
Smilax herbacea	1	3.6	0.1
Solanum dulcamara	4	14.3	0.5
Total:	28	100.2	29.5

n=20 2x2 m quadrats

Table 3: Shrubs and Saplings (October 5, 1989)

Taxon	No. of quadrats of occurrence	Relative frequency (%)	Average cover (%)
Tree Saplings			
Acer negundo	4	44.4	3.6
Salix amygdaloides	1	11.1	1.6
Shrubs			
Ribes sp.	2	22.2	1.8
Cornus stolonifera	1	11.1	0.3
Lonicera tartarica	1	11.1	6.3
Total:	9	99.9	13.5

n=10 2x2 m quadrats

Table 4: Relative abundance of herbs not found in quadrats (August 9, 1989)

Common Name	Taxon	Relative Abundance[1]
Couch Grass	*Agropyron repens*	O to F
Smooth Brome	*Bromus inermis*	O to F
Burdock	*Arctium minus*	F to A
Absinthe	*Artemisia absinthium*	O
Canada Thistle	*Cirsium arvense*	O
Wild Cucumber	*Echinocystis lobata*	X
Clover	*Melilotus sp.*	O
Dock	*Rumex sp.*	R
Graceful Goldenrod	*Solidago canadensis*	O
Sow Thistle	*Sonchus sp.*	F
Meadow-Rue	*Thalictrum sp.*	R
Stinkweed	*Thlaspi sp.*	O
Stinging Nettle	*Urtica dioica*	O

[1] A=abundant, F=frequent, O=occasional, R=rare, X=present

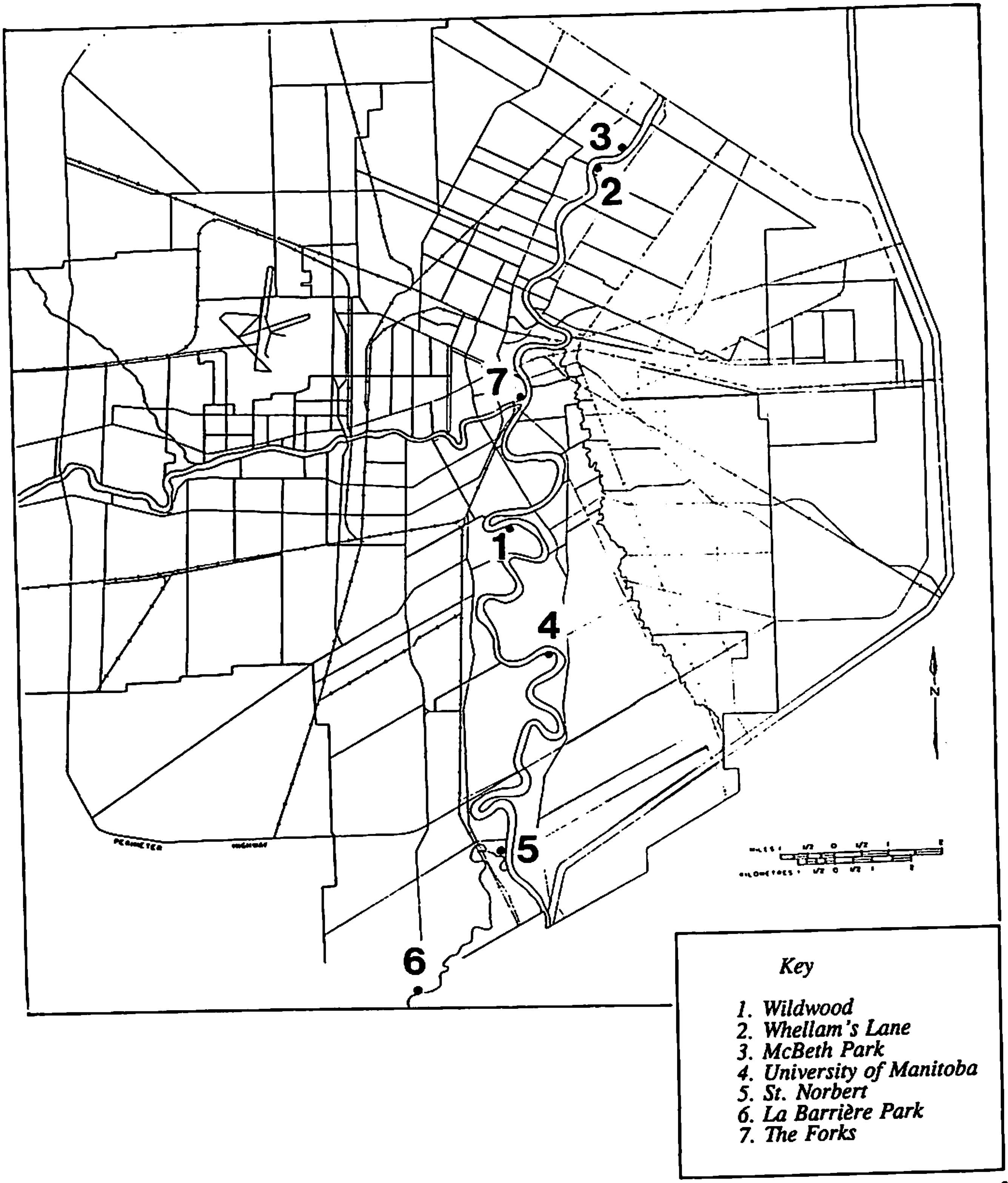

Figure 2: Riverbottom forest sites in the Winnipeg area used in comparisons. Map courtesy of Department of Geography, University of Manitoba.

Temperatures are also variable. Mean January temperatures from 1874 to 1949 (Ehrlich *et al.* 1953) were -18.9°C (-2°F) with a range of 13.3°C (29.2°F). July temperatures averaged 19.6°C (67.2°F) with a range of 6.4°C (14.1°F). The frost-free season presently averages about 120 days from May 25 to September 20 (Donlop and Shaykewich 1982), although one year in four is likely to have a season of only 95 days. The current climatic variability was as characteristic of the 19th century as it is of the 20th century, judging by historic accounts of droughts and floods (Anonymous 1958).

Landforms and Hydrology

The Forks area lies within the Red River Plain (Ehrlich *et al.* 1953), a landscape which includes flat upland plains underlain by glacial lake clays dissected, in turn, by river flood plains and levees composed of alluvial deposits. The plain is essentially flat but long, low clay ridges over much of its area make it appear undulating. Elevations in the area vary from 221 m near Lake Winnipeg to over 259 m at the top of Birds Hill. Most of the land, however, is about 228.7 m in elevation, which makes it prone to flooding during high water periods.

The Red River rises in west-central Minnesota and flows northward to Lake Winnipeg. The Assiniboine River rises in eastern Saskatchewan and flows eastward to meet the Red at The Forks in Winnipeg. Near the junction of these two major rivers there are several important tributaries, including the La Salle, the Seine and Cooks Creek (Fedoruk 1970). These tributaries usually experience high flows during spring runoff but have little or no flow during late summer (Ehrlich *et al.* 1953). The Red and Assiniboine also peak in spring, usually in April or May. Major floods on the Red River have been recorded for the years 1826, 1852, 1861 and 1950. The 1826 flood was by far the most devastating. Estimates suggest that in that year, flood waters in late May reached an elevation of 233.0 m, over 11 m above the modern Winnipeg datum (Anonymous 1958). The estimated maximum discharge was over twice the maximum flow of the Red River during the celebrated flood of 1950. The 1852 and 1861 floods were also greater than that of 1950. Unfortunately, little is known about historic floods on the Assiniboine, although a large flood was experienced in 1882.

Soils

The soils near the junction of the Red and Assiniboine rivers have developed on fine-textured sediments, predominately clays but also alluvial deposits of silty clay loams (Michalyna *et al.* 1975). A combination of fine soil textures that are relatively impermeable to water seepage and low-lying topography renders many of the Red River Plain soils poorly- to imperfectly- drained. Poorly-drained soils remain wet for most of the growing season, while imperfectly-drained soils are not wet but remain at their moisture-holding capacity for much of the growing season.

The Red River Plain contains representatives of four soil orders: Chernozemic, Luvisolic, Regosolic and Gleysolic. Most upland soils belong to the Chernozemic order. These are deeply-developed with a humus-enriched upper horizon and have formed under a cover of prairie grasses, aspen parkland, or in prairie-forest transition areas (Clayton *et al.* 1977). One series, Birch Point, belongs to the Luvisolic order. These soils have light-coloured upper horizons and are formed under forest (Clayton *et al.* 1977). Regosolic soils are immature and, unlike other orders, have not developed distinctive horizons. Regosols occur along rivers and streams where repeated accumulations of riverine silts and clays have inhibited soil development. The Gleysolic order includes soils that are poorly or imperfectly-drained and

Table 5: Comparisons of six floodplain forests with The Forks (continued next page)

	Relative Frequency	Relative Density	Relative Dominance	Importance Value
Acer negundo				
Site Name:				
Wildwood	31.1	26.6	27.1	84.8
Whellam's Lane	17.7	12.5	4.2	34.4
McBeth Park	29.2	25	10	64.2
University of Manitoba	15.9	9.6	11.8	37.3
St. Norbert	16.7	13.8	12.6	43.1
La Barrière	54	73.8	33.9	161.7
The Forks	54.2	71.8	31.6	157.6
Average Importance Value:				83.3
Fraxinus pennsylvanica				
Site Name:				
Wildwood	10.8	7	3.3	21.1
Whellam's Lane	2.9	1.3	1.6	5.8
McBeth Park	8.3	5	3.5	16.8
University of Manitoba	38.6	42.3	39.2	120.1
St. Norbert	25.6	18.1	22.9	66.6
La Barrière	18.9	10	13.6	42.5
The Forks	18.7	16	7.6	42.3
Average Importance Value:				45
Ulmus americana				
Site Name:				
Wildwood	33.8	39.8	23.1	96.7
Whellam's Lane	57.4	71.9	65.5	194.8
McBeth Park	41.7	57.5	49.7	148.9
University of Manitoba	34.1	40.4	42.3	116.8
St. Norbert	38.9	48.1	32.3	119.3
La Barrière	27	16.2	52.5	95.7
The Forks	4.2	1.2	0.6	6
Average Importance Value:				111.2

Table 5 (cont.): Comparisons of six floodplain forests with The Forks.

Sources of information: Shay and Shay, 1985b (Wildwood, McBeth Park); J.M. Shay, personal communication (Whellam's Lane, St. Norbert, La Barrière); C.T. Shay, personal observation (University of Manitoba); The Forks, this report.

	Relative Frequency	Relative Density	Relative Dominance	Importance Value
Salix amygdaloides				
Site Name:				
Wildwood	24.3	26.6	46.5	97.4
Whellam's Lane	1.5	1.3	1.2	4.0
McBeth Park	--	--	--	--
University of Manitoba	--	--	--	--
St. Norbert	--	--	--	--
La Barrière	--	--	--	--
The Forks	12.5	4.9	16.5	33.9
Average Importance Value:				19.3
Populus deltoides				
Site Name:				
Wildwood	--	--	--	--
Whellam's Lane	20.6	13.1	27.5	61.2
McBeth Park	20.8	12.5	36.8	70.1
University of Manitoba	--	--	--	--
St. Norbert	3.3	1.9	8.3	13.5
La Barrière	--	--	--	--
The Forks	10.4	6.1	43.7	60.2
Average Importance Value:				29.3
Quercus macrocarpa				
Site Name:				
Wildwood	--	--	--	--
Whellam's Lane	--	--	--	--
McBeth Park	--	--	--	--
University of Manitoba	10.2	7.1	6.7	24.0
St. Norbert	14.4	17.5	23.8	55.7
La Barrière	--	--	--	--
The Forks	--	--	--	--
Average Importance Value:				17.0

consequently are waterlogged for much of the season. Because of waterlogging, reducing conditions lead to horizons that are greyish with mottled rust-coloured iron deposits.

Natural Habitats and the Distribution of Plants in Early Historic Times

Landforms, drainage and soils combine to create a variety of natural habitats in The Forks area. These can be grouped, according to the amount of soil moisture or permanency of flooding, into three general types: aquatic, lowland (including marshes, stream margins and floodplains) and upland. The composition of the plant communities belonging to these types is reconstructed for the early 19th century based upon modern studies and historical records.

Aquatic -- These habitats are the most restricted because, apart from the rivers themselves, there are few permanent water bodies on the flat Red River Plain. Species of submerged and floating aquatic plants which one might find growing in shallow, slow-moving parts of the river are pondweeds (*Potamogeton* spp.) and hornwort (*Ceratophyllum demersum*).

Lowland Marshes, Stream Margins and Floodplains -- Permanent marshes, which do not dry up even in severe droughts (as do semi-permanent marshes), include some of the same aquatic species (Bossenmaier and Vogel 1974) as those found in aquatic habitats. There would have been permanent and semi-permanent marshes east of the junction of the Red and Assiniboine rivers in what is now St. Boniface. Early maps (e.g., Hind 1858, reprinted 1971) show a large crescent-shaped marsh, the remnant of a former oxbow lake of the Red River, just east of the junction. Temporary wetlands, those that are wet only during spring runoff, were widespread due to the relatively poor drainage in parts of the flat Red River Plain.

A number of emergent marsh species such as cat-tail (*Typha latifolia*), common reed (*Phragmites australis*), bulrush (*Scirpus* spp.) and bur-reed (*Sparganium* spp.) would have grown around the margins of these wetlands. As in more recent times, wet meadows would probably have been dominated by sedges (*Carex* spp.), white-top grass (*Scolochloa festucacea*), and reed grass (*Calamagrostis* spp.), and also manna grass (*Glyceria* spp.) and slough grass (*Beckmannia syzigachne*) in some areas. Typical shrubs of marsh and river margins would have included willow (*Salix* spp.), red osier dogwood and, to the east of the Red River, alder (*Alnus* spp.).

Along the two rivers and their main tributaries, aquatic and marsh habitats grade into low-lying floodplains which are characterized by periodic spring flooding. Even the slightly higher low terraces of the main rivers are occasionally flooded. As noted earlier, the most common trees of the frequently-flooded zone include Manitoba maple, elm, ash, peach-leaved willow, cottonwood and, in the most favourable habitats, basswood.

Because these riverbottom forests are periodically flooded and are composed mainly of mature trees which cast dense shade, they have relatively little ground cover of shrubs and herbs. Scattered shrubs in these low-lying forests include red osier dogwood, gooseberry and poison ivy (*Rhus radicans*) on slightly higher ground. Climbing vines such as the Virginia creeper, moonseed (*Menispermum canadense*) and, occasionally, wild hops (*Humulus lupulus*) and wild grape (*Vitis* spp.) would also be found. Today, meadow-rue (*Thalictrum* spp.), false Solomon's-seal (*Smilacina stellata*), wood-nettle

(*Laportea canadensis*) and ostrich fern (*Matteuccia struthiopteris*) are common constituents of the scattered ground cover.

Upland Forest and Prairie -- On the higher and rarely-flooded parts of the river floodplains and toward the upland plains, today's forest stands consist of bur oak (*Quercus macrocarpa*) and aspen (*Populus tremuloides*) with shrubby margins and an under-story or shrub stratum of saskatoon berry (*Amelanchier alnifolia*), hazel (*Corylus* spp.), red-osier dogwood, wild red raspberry (*Rubus idaeus*), chokecherry (*Prunus virginiana*), wild plum (*P. americana, P. nigra*), wild rose (*Rosa* spp.), snowberry (*Symphoricarpos* spp.), hawthorn (*Crataegus* spp.), high-bush cranberry (*Viburnum* spp.) and wild currants and gooseberries. According to early maps (Warkentin and Ruggles 1970), more or less continuous forests of oak and aspen were found mainly on the east side of the Red River in the 19th century. For example, Aaron Arrowsmith's 1816 map of the Red River Settlement (Warkentin and Ruggles 1970:187) shows a belt of woodland extending about a mile on the east side of the Red River and north and south of the junction. Around the junction is the notation "Woods interspersed with small prairies extending for several miles." Narrow bands of forest are shown along the west side of the Red, along the Assiniboine, and along several tributaries. Henry Youle Hind's map of 1858 (Hind 1971:172) bears a number of notations suggesting that upland woods were composed mainly of aspen.

Beyond a mile from the Red River on the east side, Arrowsmith's map shows "Plains interspersed with tufts (groves) of wood," while Hind's map illustrates "aspen thickets" in patches. Both maps show that most of the upland was covered with prairie or marsh. Judging by its remnants today, the prairie was composed of tall grasses such as big bluestem (*Andropogon gerardi*) and speargrass (*Stipa comata*), with herbs such as brown-eyed susan (*Rudbeckia serotina*), milk vetch (*Astragalus* spp.) and wild onion (*Allium stellatum*). There probably would also have been scattered clumps of shrubs such as the wolf willow (*Elaeagnus commutata*), western snowberry and wild rose. Important herbs of the deciduous forests and aspen groves probably included sarsaparilla (*Aralia nudicaulis*), false Solomon's seal, pale vetchling (*Lathyrus ochroleucus*) and wild strawberries (*Fragaria* spp.).

Plant Resources

Southern Manitoba prairies, parklands and forests are rich in useful plants and animals. Plant foods, for example, include a number of leafy greens, seeds and nuts, roots and tubers, berries and fleshy fruits and plants that can be harvested for their sap and inner bark or cambium (Table 6). In addition, there are many species that can be used for fuel, building materials, crafts and other purposes.

Environmental History Over the Past 1500 Years

There is little geologic or fossil evidence available to reconstruct the environmental history of the junction of the Red and Assiniboine rivers. This summary is based upon studies of other areas in southern Manitoba.

A recent study of the history of the Assiniboine River (Rannie *et al.* 1989) coupled with earlier works on the history of Lake Manitoba (Teller and Last 1981, 1983) suggest that about 3000 years ago the Assiniboine shifted its course from flowing northward into Lake Manitoba to flowing eastward. This early eastward flow was along the LaSalle River channel, but it is not known when the Assiniboine changed to enter the Red River at the junction.

Table 6: Geographical distribution of food plants in southern Manitoba. Numbers refer to the number of species in each vegetation zone. (Modified from Shay 1980).

Type of Plant Food	*Vegetation Zone* Deciduous Forest	Aspen Parkland	Prairie
Roots and Tubers	26	38	32
Sap and Cambium	3	4	2
Greens	35	56	42
Berries and Fleshy Fruits	19	26	11
Seeds and Nuts	17	30	30
Totals	100	154	117

Pollen evidence from cores taken in southern Manitoba (e.g., near Tiger Hills, 70 km southwest of the junction) show a general increase in the pollen of deciduous trees such as oak, beginning about 3500 years ago (Ritchie 1983). The past 1500 years appear to have been more or less stable in terms of pollen composition. This implies no major change in vegetation over this time, and it is probably safe to assume that the distribution and composition of plant communities over the past 1500 years around The Forks resembled that of today.

Predicted Plant Use at The Forks

The probability of a plant food becoming charred depends upon how it is processed. Seeds that are parched or roasted over a fire are more likely to become charred than those used without such treatment. Fruits such as chokecherry may be pounded but the resulting fragments, even if charred, are not easily identified. The small seeds of other fleshy fruits such as strawberry most likely would be ingested and later passed in feces (Bryant 1974). Plants sought for their sap, leaves, flowers or underground parts would have had little chance of becoming charred. Even if charred, these soft tissues would be easily fragmented and difficult to recover and identify. In contrast, the remains of seeds, nuts, berries and fleshy fruits may be preserved (Table 7). Some remains will be more frequently found than others. For example, there are about four times the number of seeds of goosefoot (*Chenopodium*) in an edible portion compared with knotweed (*Polygonum*). Similarly, an edible portion contains only several hundred seeds of chokecherry, but many thousands of strawberry.

Human activities are not the only source of seeds. The natural seed rain from vegetation may become concentrated in the soil. For example, seed concentrations in upland prairie, pasture and fallow fields in Saskatchewan ranged up to 180 seeds per litre (Archibold 1981; Archibold and Hume 1983). Those seeds accidentally charred might mistakenly be attributed to human use. Another complication is that, once deposited, seeds may be moved within the soil by frost action and burrowing animals (Miksicek 1987).

Charcoal found in an archaeological site may also derive from human and natural sources. Being easily fragmented and buoyant, charcoal can be scattered by human trampling as well as transported by water (Blong and Gillespie 1978). Conversely, charcoal produced by natural fires can become incorporated into archaeological deposits through erosion and deposition. Fragmentation of pieces may also lead to biases in representation (Zalucha 1981; Deck 1989).

In order to determine the importance of human versus natural sources for seeds and charcoal, it is vital to analyze samples from a wide variety of contexts and evaluate evidence bearing upon their deposition.

Table 7: Plant remains expected in 100 grams edible portion of various common plant foods found in The Forks area.

Plant food	Estimated no. seeds per 100g edible portion	Reference(s)
Seeds		
Goosefoot (*Chenopodium*)	150,000-200,000	Barclay and Earle (1974)
Knotweed (*Polygonum*)	53,000	Barclay and Earle (1974)
Marsh elder (*Iva*)	125,000-200,000	Barclay and Earle (1974)
Berries and fleshy fruits		
A. Small-seeded berries		
Saskatoon (*Amelanchier*)	400	Schopmeyer (1974)
Strawberry (*Fragaria*)	3500	Personal observation
Raspberry (*Rubus*)	2000	Schopmeyer (1974)
Currant/gooseberry (*Ribes*)	3000	Schopmeyer (1974)
Wild grape (*Vitis*)	100	Schopmeyer (1974) and personal observation
B. Large-seeded fruits		
Chokecherry (*Prunus virginiana*)	200	Schopmeyer (1974)
Wild plum (*Prunus americana*)	40	Schopmeyer (1974)
High-bush cranberry (*Viburnum*)	400	Schopmeyer (1974)
Nuts		
Bur oak (*Quercus macrocarpa*)	25	Schopmeyer (1974)
American hazel (*Corylus americana*)	100	Schopmeyer (1974)

Table 8: Chronological placement and seed concentrations of samples from the 1988 excavations at The Forks by the Canadian Parks Service.

	Historic III	Late Prehistoric	Blackduck I-II	Blackduck III-V	Other
Approximate Age (AD)	1810-1826	1450	700-730	390-660	--
Sample Numbers	1, 4, 10, 23, 24 (n=5)	2, 7, 21, 25, 26, 27, 28 (n=7)	3, 12, 14, 15, 18, 31, 32 (n=7)	5, 6, 8, 11, 16, 17, 19, 20, 33, 34, 35 (n=11)	9, 13, 22, 29, 30 (n=5)
Mean Seed Concentration	55.4	5.3	7.7	5	--
Concentration Range	1.3-252	0-13.1	0.3-17.7	0-29.4	--

Past Environments and Ethnobotany

The Samples

The 35 sorted samples represent most of the occupation layers recognized at the site (Table 8). Five samples were from the Historic II period (*ca*. AD 1810-1826), seven from the Late Prehistoric (*ca*. AD 1450), seven from Blackduck I-II (*ca*. AD 700-730) and 11 from Blackduck III-V (*ca*. AD 390-660) (chronology courtesy of M.A. Tisdale). Fifteen sediment samples came from hearths and the balance from pits, living floors and other contexts.

The 35 samples contain nearly 1500 charred and uncharred seeds. The latter are considered recent intrusions, because charring is virtually the only way plant remains can survive for long in most soils. The density of charred seeds in the samples was relatively high but variable, ranging from 0 to 252 seeds per litre. The highest concentration was from a hearth (sample 24) dating to the Historic III period. Average density was 12.5 seeds per litre, but with sample 24 omitted, the average density was reduced to 5.4 seeds. Six samples contained no charred seeds. Overall, densities were high compared with other sites in the region and across eastern North America. For example, at two late prehistoric sites in the Illinois River valley, densities ranged from 0 to 18 seeds per litre (Asch and Asch 1985).

There were differences in the density of charred seeds over time and from one type of feature to another. When arranged by chronological period, the samples showed a dramatic increase in seed density during the Historic period compared with Late Prehistoric or Blackduck levels (Table 8). However, when the exceedingly rich sample 24 is removed, the resulting average of 6.2 seeds per litre is similar to the other periods. There were also differences in seed density among the archaeological contexts. For example, the density of 13 hearths was 28.3 (7.8 without sample 24) compared with 0.6 seeds per litre for seven samples from organic occupation layers.

Eighteen plant families and 25 genera were represented among the charred seeds recovered (Table 9). Four seed types made up 91% of the seeds. In order of abundance these included goosefoot, willow, wild rose and raspberry.

A Reconstruction of Past Soils, Vegetation and Ethnobotany

The seeds, charcoal, bone, shell, lithic flakes and small (less than 0.5 mm) organic remains tentatively identified as fungal sclerotia, flatworm cocoons and snail eggs can be used to reconstruct some of the environmental conditions and plant uses over the past 1500 years. The charcoal and charred seeds probably represent either the remains of plants growing on the site or brought to the site by humans for food, fuel or other purposes. A few could have been carried by the river from upstream. Bone fragments and fish scales may represent the remains of food preparation, especially if they have been burned or calcined. Other animal and fish remains may have been deposited naturally. Shells of clams and aquatic snails would have been introduced with flood deposits whereas land snails probably lived at the site. The flatworm cocoons would have derived from leaf litter and the snail eggs would have been laid in the upper few centimetres of the soil. Finally, the fungal sclerotia would have been parasitic on local trees, shrubs and/or herbs.

The combined evidence of the land snails, most of which prefer damp, shaded woodland habitats, the snail eggs, flatworm cocoons and sclerotia imply the existence of accumulated plant litter. Decomposition of this litter together with the addition of charcoal fragments could account for the dark colour of the occupation layers. The charcoal and seeds also suggest a woodland habitat at the site although adjacent habitats are also represented. Charcoal from the various hearths and organic layers includes a mixture of typical riverbottom forest species such as ash, poplar/cottonwood/willow, elm and maple. Oak, typical of the higher ground on floodplain margins, is also represented.

According to their habitat preference, all of the 20 charred seed types could have come from the riverbottom forest (Table 10). Wormwood (*Artemisia*), a typical plant of the upland prairie, was found growing in an open area in our vegetation survey (Table 4). Most of the seed types also occur in habitats such as the marsh along the river's edge as well as upland forest and prairie. Roughly half represent shrubs, although the willow seeds could have come from either a shrub or the peach-leaved willow. Other shrubs represented in varying amounts include buckthorn (*Rhamnus*), American hazel, wild rose, wild cherry (*Prunus* spp.), wild plum, hawthorn, saskatoon, raspberry and mooseberry (*Viburnum edule*). The latter eight shrubs are known to have been food plants of the Native groups that inhabited the region in Historic times (Shay 1980). Plant foods among the herbs may have included goosefoot and knotweed.

Of the 13 plant foods listed in Table 7, eight were identified in our analysis. (In addition, an acorn of oak was collected by Canadian Parks Service excavators and identified by the Historic Resource Conservation Branch - M.A. Tisdale, personal communication, 1989). The food plants listed in Table 7 and not recovered from the site include marsh elder (*Iva*), strawberry, currant/gooseberry and wild grape. Their absence is puzzling. Either they were not used or their use did not result in charred remains. This may have been the case (as suggested earlier) for the strawberry, whose small seeds may have been ingested and passed in feces elsewhere.

The most obvious trend in plant use over time is the increase in the percent occurrence of goosefoot from being less than 15% of the samples recovered from Blackduck layers to 60% in Historic

III (Table 11). Another change is the absence of raspberry seeds in the Blackduck horizons but their occurrence (40%) in samples of the Late Prehistoric and Historic periods.

We have begun to evaluate the conditions under which the samples were deposited by investigating the concentration of seeds, charcoal, bone, shell, lithic flakes from stone tool making and other remains (Appendix 2). The distribution of all these items is skewed; most samples have low densities per litre while a few are rich in remains. This uneven distribution is typical of archaeological deposits in general, which tend to be clustered rather than uniformly distributed. Bivariate plots of charred *vs*. uncharred seeds show a number of samples with either many charred and few uncharred seeds or vice versa. A few samples have roughly equal concentrations of both. The same pattern is true of burnt *vs*. unburnt bone.

Comparison With Seed Remains Found at Other Northeastern Plains Sites

Seeds of selected wild plants found at seven other late Prehistoric sites in the Northeastern Plains (Fig.3) were compared with those recovered from The Forks. Included in the comparison are weedy annuals, fruits, berries and nuts. The comparison of seeds is complicated by factors of differential deposition and preservation and by the different ways in which the seeds were collected and reported (Wegner 1979:56).

Comparisons of ubiquity (relative frequency) is used to minimize the differences in absolute counts of seeds between sites (Pearsall 1989:215). It indicates how common a seed type is at a site (Pearsall 1989:213) and may suggest how important that plant food may have been.

Seeds of weedy annuals were found at all eight sites. Goosefoot was the most common seed found at all sites except Naze. Amaranth may have been collected where it was locally abundant, particularily in the southeastern part of the study region. Sunflower (*Helianthus*) was recovered from only three sites in the southern part of the region, where it was fairly common. Other weedy annuals, such as marsh elder, dock (*Rumex*) and knotweed are uncommon.

Charred seeds of fruits and berries were relatively rare. Wild plum occurred in a few samples from all eight sites. Chokecherry and/or pincherry (*P. virginiana/P. pensylvanica*) was found at five sites. Only two sites contained wild grape and raspberry. Strawberry was recovered only at The Forks. The paucity of fruits and berries may be because they were not being processed and consumed in such a way that their seeds could fall into a fire and become charred. Thus, fruits and berries were probably more important than their low numbers indicate. The few nut remains include hazel, oak and walnut (*Juglans*).

Summary

The Forks North Point Site was occupied over at least six centuries, perhaps on a seasonal basis. Hearths, pits and organic layers yielded a variety of artifacts and other materials. This preliminary report covers a vegetation survey and the analysis of seeds and other remains from 35 sediment samples. Our research shows:

(1) The riverbottom forest at The Forks (composed of maple, cottonwood, willow, ash and elm) probably existed prior to 19th century deforestation. Earlier forests may have had the same species but differed in the proportion of each.

(2) A number of plant families are represented among the charred seeds. These include typical food plants such as goosefoot, useful for its seeds, and members of the rose family, sought for their fruit.

(3) Wood charcoal remains represent the trees typical of river bottom forests in the Winnipeg area.

(4) The distribution of seeds, bone and charcoal in the 35 samples is uneven and may result from a variety of factors.

Acknowledgments

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Table 9: Charred seed types identified from The Forks 1988 excavations, Canadian Parks Service.

Common Name	Scientific Name	No. of seeds	%	No. of samples	%
Spruce	*cf. Picea*	1.0	0.1	1	2.9
Grass	Gramineae	11.5	1.0	3	8.6
cf. Grass	*cf.* Gramineae	20.0	1.8	9	25.7
cf. Wild Rice	*cf. Zizania aquatica*	1.0	0.1	1	2.9
cf. Alkali Grass	*cf. Distichlis stricta*	6.0	0.5	2	5.7
cf. Sedge	*cf.* Cyperaceae	2.0	0.2	2	5.7
Lily	*cf.* Liliaceae	1.0	0.1	1	2.9
Wild Lily-of-the-Valley	*Maianthemum canadense*	2.5	0.2	2	5.7
cf. Lily	*cf. Maianthemum*	1.0	0.1	2	5.7
Willow	*Salix*	154.0	13.7	9	25.7
American Hazel	*Corylus americana*	0.5[1]	<0.1	1	2.9
Stinging Nettle	*Urtica dioica*	6.5	0.6	6	17.1
Knotweed	*Polygonum*	2.5	0.2	3	8.6
cf. Dock	*cf. Rumex*	1.0	0.1	1	2.9
Goosefoot	*Chenopodium*	592.0	52.7	9	25.7
Crowfoot	*Ranunculus*	2.0	0.2	2	5.7
Peppergrass	*Lelpidium densiflorum*	1.5	0.1	1	2.9
cf. Rose	*cf.* Rosaceae	0.5	<0.1	1	2.9
Rose	*Rosa*	159.0	14.2	5	14.3
Cinquefoil	*Potentilla*	6.0	0.5	3	8.6
Raspberry, Bramble	*Rubus*	45.5	10.3	6	17.1
Pincherry	*Prunus pennsylvanica*	0.5	<0.1	1	2.9
Wild Plum	*Prunus americana*	1.5	0.1	1	2.9
Hawthorne	*Crataegus chrysocarpa*	1.0	0.1	1	2.9
Saskatoon	*Amelanchier*	1.0	0.1	1	2.9
cf. Saskatoon	*cf. Amelanchier*	1.0	0.1	1	2.9
Buckthorn	*Rhamnus alnifolia*	0.5	<0.1	1	2.9
Dogbane	*cf. Apocynum*	1.0	0.1	2	5.7
Bindweed	*Convolvulus*	1.0	0.1	1	2.9
Dragonhead	*Moldavica parviflora*	1.5	0.1	2	5.7
Mooseberry	*Viburnum edule*	1.0	0.1	1	2.9
Composite	Compositae	14.5	1.3	7	20.0
cf. Composite	*cf.* Compositae	9.5	0.8	5	14.3
Wormwood	*Artemesia*	1.0	0.1	1	2.9
Cocklebur	*cf. Xanthium*	0.5	<0.1	1	2.9
	Total =	**1122.5**			

[1] Seed fragments count as 0.5

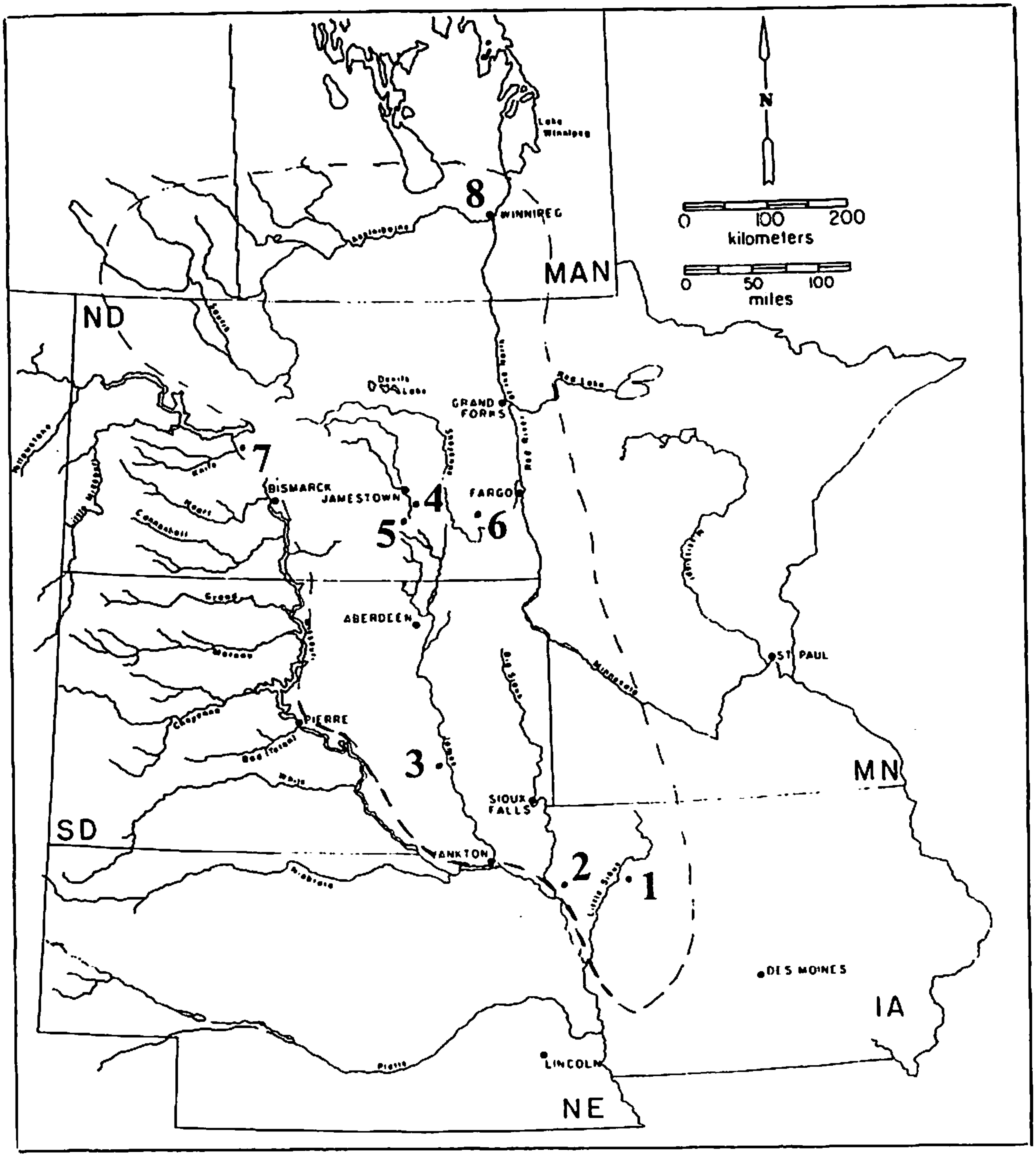

Figure 3: Locations of the eight Northeastern Plains sites used in comparison of seed remains: 1) Chan-Ya-Ta, Iowa; 2) Rainbow, Iowa; 3) Mitchell, South Dakota; 4) Hendrickson III, North Dakota; 5) Naze, North Dakota; 6) Shea, North Dakota; 7) White Buffalo Robe, North Dakota; 8) The Forks (North Point), Manitoba. Map adapted from Gregg, 1987:28.

Table 10: Habitats represented by charred seed types identified from The Forks 1988 excavations, Canadian Parks Service (potential food plants are also noted). Ubiquity (frequency) is the percent occurrence of each seed type in the 35 samples.

		Habitat				
Seed Type	Frequency % (n=35)	Marsh	Riverbottom Forest	Upland Forest	Prairie	Food Plant
Wild Lily-of-the-Valley	5.7		x	x		
Willow	25.7	x	x			
American hazel	2.9		x	x		x
Stinging nettle	17.1	x	x	x		
Knotweed	8.6	x				x
Goosefoot	25.7	x	x			x
Crowfoot	5.7	x	x	x		
Peppergrass	2.9		x			
Rose	14.3		x	x	x	x
Cinquefoil	8.6	x	x	x		
Raspberry	17.1		x	x		x
Pincherry	2.9		x	x		x
Wild plum	2.9		x	x		x
Hawthorn	2.9		x	x		x
Saskatoon	2.9		x	x	x	x
Buckthorn	2.9		x			
Bindweed	2.9		x	x	x	
Dragonhead	5.7	x	x			
Mooseberry	2.9		x	x		x
Wormwood	2.9				x	
Cocklebur	2.9		x			

Table 11: Percent ubiquity (frequency) of charred seed types by chronological period, Canadian Parks Service excavations at The Forks, 1988.

	Chronological Period			
Seed Type	Historic III % (n=5)	Late Prehistoric % (n=7)	Blackduck I-II % (n=7)	Blackduck III-IV % (n=11)
Goosefoot	60.0	57.1	14.3	9.1
Willow	40.0	28.6	14.3	36.4
Raspberry	40.0	57.1	0.0	0.0
Stinging nettle	60.0	14.3	28.6	0.0
Rose	40.0	0.0	28.6	9.1
Cinquefoil	40.0	0.0	14.3	0.0
Knotweed	0.0	0.0	28.6	9.1
Wild Lily-of-the-Valley	20.0	14.3	0.0	0.0
Crowfoot	0.0	0.0	28.6	0.0
Dragonhead	20.0	0.0	0.0	9.1
American hazel	20.0	0.0	0.0	0.0
Peppergrass	20.0	0.0	0.0	0.0
Pincherry	20.0	0.0	0.0	0.0
Wild plum	0.0	14.3	0.0	0.0
Hawthorn	0.0	0.0	0.0	9.1
Saskatoon	0.0	0.0	14.3	0.0
Buckthorn	20.0	0.0	0.0	0.0
Bindweed	0.0	0.0	14.3	0.0
Mooseberry	0.0	0.0	14.3	0.0
Wormwood	20.0	0.0	0.0	0.0
Cocklebur	20.0	0.0	0.0	0.0

****** *Note: Appendix 3, Appendix Figures 1 to 18 and Appendix Tables 1 to 16 are not included in this report. For copies of these, please contact C.T. Shay, St. Paul's College, University of Manitoba, Winnipeg, Manitoba R3T 2M6.*

APPENDIX 1

FLOTATION, PROCESSING AND ANALYSIS

Soil samples are processed in a greenhouse at the University of Manitoba. The flotation device was built from designs similar to those described by Jarman *et al.* (1972) and Crawford (1983). It consists of a 220-litre polyethylene drum (100 cm tall x 50 cm in diameter) which has been modified by inserting, halfway down the drum, a sheet metal funnel that narrows to an outlet pipe. Above the funnel are three rings that supply air and water. The first is a ring of 2.5 cm copper pipe fitted with 12 sintered bronze air filters. Air supplied by a small compressor bubbles out of the filters and through the sample to the surface. The second ring, of 1.25 cm copper pipe with nozzles, provides a water spray. The third ring is a perforated rubber hose through which air from a second compressor bubbles.

Samples are catalogued noting site, provenience, processing details, etc. A subsample of approximately 500 g is removed for soil analysis and the remaining volume is measured and transferred to 10-litre buckets. Samples greater than 10 litres are divided with a sample splitter. The buckets are filled with water. To samples rich in clay, 0.5 grams per litre of a dispersant, sodium hexametaphosphate (commercial 'Calgon'), is added. After agitation, suspended and floating organic material is poured through six soil sieves (mesh sizes 4, 2, 1, 0.5, 0.42 or 0.35 and 0.25 mm). This step is repeated until most of the floating organic matter has been removed. The residue is then poured into the water-filled flotation drum to which has been added 5 to 10 ml frothing agent (Commercial "J Foam"), and 5 to 10 ml kerosene (a collector). A metal sieve (46 cm diameter with a mesh size of 1.6 mm) is suspended below the water to catch coarse material or the "heavy" fraction. The combined effect of the air bubbles and water spray carries light organic particles to the surface foam and through a spout to the stack of soil sieves.

When flotation is complete, the material accumulated on the sieves is transferred to paper towels and packed in plastic bags prior to drying in the laboratory. After drying, the residue is re-sieved and each sieve fraction weighed. Fractions with large amounts of residue are subsampled with a sample splitter and weighed.

A Wild-Heerbrugg M4 binocular microscope (magnifications up to 50x) is used to sort material into seeds, charcoal, bone, shell, insects and artifacts. Seeds and charcoal are identified using reference collections; the other organic materials are sent to specialists for identification. The weights of charcoal, bone and shell from the heavy, 2.0 mm and 4.0 mm fractions are recorded.

Approximate densities of seeds and other remains were estimated by totalling the densities for each of the five light size grades and the heavy portion and dividing by the volume of the original sample. For each size grade the following formula was used:

$$\text{Density} = \frac{\text{number of seeds}}{\text{sub-sample fraction}}$$

For example, for a 10-litre sample that was split in half three times (sampling fraction 1/8th) and contained one seed in each of the six size grades, the total density would be

$$\frac{1 \times 6}{0.125} \text{ or } 6 \times 8 = 48 \text{ seeds per sample}$$

The density per litre would then be 48/10 or 4.8 seeds per litre.

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APPENDIX 2

NOTES ON THE DISTRIBUTION AND INTERPRETATION OF PLANT AND OTHER REMAINS

Introduction

In the analysis of remains from an archaeological excavation there are questions such as: did these remains arrive here by cultural or natural means or some combination of each? Such questions bear upon the interpretation of activities at the site, which plants and animals were used and how the remains were subsequently modified by human and natural agencies. In this section we explore the distribution, association and interpretation of selected types of remains in an attempt to address the above questions.

Judging by the stratigraphic profiles of the excavation trenches at The Forks, the structure of the site is complex (M.A. Tisdale, personal communication, 1989). Multiple thin dark lenses appear to merge and divide over short horizontal distances, and there is abundant evidence of animal burrowing throughout. Given this complexity, it would not be surprising to find cultural and other remains scattered, mixed and/or redeposited.

Description of the Remains

The nine types of remains that may help us understand how materials came to be deposited are described below in terms of their distribution among 35 flotation samples, possible origin and the association with other categories.

Uncharred seeds

As noted in the text, uncharred seeds are usually considered to be intrusive although the likelihood that they have been preserved since the time of deposition depends upon how long they have been in the soil, the preserving conditions and the qualities of the seed involved. For example, the hard thick stones of chokecherry (*Prunus virginiana*) would be expected to last much longer than the seeds of legumes (Leguminosae) with thin seed coats. Uncharred seeds can become buried through the action of burrowing rodents, earthworms and by other means. It is not uncommon to find naturally deposited seeds in the soil to depths of 5 to 10 cm.

At this stage in our research we assume that uncharred seeds represent contamination and disturbance and that the higher the concentration, the greater the degree of contamination.

Charred seeds and charcoal

These may have been either culturally or naturally derived, although high concentrations probably represent cultural deposition.

Unburnt bone

Most of the fragments found appear to be from medium and large mammals, making it likely that they were culturally deposited.

Calcined and burnt bone

This category is most likely culturally deposited.

Lithic flakes

These probably derive from stone tool making or sharpening.

Small black spheroidal objects less than .5 mm in diameter

Some of these have been identified by Dr. J. Reid (personal communication) as fungal sclerotia. Their occurrence suggests an association with higher plants because sclerotia are formed by fungi that are parasitic on trees, shrubs and herbs. They are usually dispersed by water. Concentrations of sclerotia would suggest association with plants that were either growing on or brought to the site.

Small white spheroidal objects less than .5 mm in diameter

These have been tentatively identified by Dr. D. Schwert (personal communication) as the cocoons of minute soil-living worms belonging to the family Enchytraeidae. They feed on organic litter and are present in temperate deciduous forest soils in numbers up to 30,000 per m^2 (Swift *et al.* 1979).

Fish scales

These could have been naturally deposited, although if found in large numbers are probably cultural.

Distribution, Association and Interpretation of Remains

The nine types of remains are unevenly distributed. For each type, several samples contain high concentrations while most have few remains or none. Some types appear to be positively associated with each other. For example, there appears to be an association between fungal sclerotia and that worm cocoons and between charred seeds and burnt bone. Based in part on these associations, the nine types can be grouped into five general indices.

1) contamination and disturbance - uncharred seeds
2) organic debris either on a soil surface or in a pit - sclerotia and worm cocoons

3) food processing - charred seeds, bone and fish scales
4) residue of heating, cooking or other tasks involving fire - charcoal
5) stone tool making or resharpening - lithic flakes

Two other points should be noted. First, there is crude relationship between uncharred seeds and depth. Secondly, the concentrations of charred seeds and charcoal are not closely related to soil colour, although light soils tend to have few seeds.

Snail Shells and Remains Tentatively Identified as Snail Eggs

Four samples were analyzed for snail shells by Drs. Brian McKillop and Richard Carter. One sample (no. 31) from a hearth area in the Blackduck I horizon contained a number of shells and fragments of aquatic molluscs while the other samples (nos. 17, 19 and 22) were from an organic layer (Blackduck V), a surface hearth (Blackduck III) and the fill of a small pit associated with Layer 125. These three samples all contained land snails characteristic of moist habitats and typical of riverbottom forests.

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