ARCHAEOLOGICAL OVERVIEW ASSESSMENT
OF LANDSCAPE UNIT C20,
ROCKY MOUNTAIN FOREST DISTRICT

prepared for Tembec Enterprises Inc.

by

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Credits

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Management Summary

The Provincial Forest lands encompassed within Landscape Unit C20 of the Rocky Mountain Forest District were assessed for archaeological potential via aerial photograph analysis. A total of 106 landform-based polygons were delineated during the project as having potential to contain significant archaeological sites. The archaeological potential of these polygons was assessed via criteria derived from precontact land and resource use models developed for the upper Columbia River drainage. Numerical scoring of the criteria resulted in 30 polygons being assessed as having High archaeological potential and 76 polygons assessed as Medium.

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1. Introduction

Landscape Unit (LU) C20 of what was then the Cranbrook Forest District was orginally mapped for archaeological potential in 1999, but most of the maps were misplaced and only half of one TRIM sheet (82G0) was digitized. In 2004, the portion of the LU within Tembec's Managed Forest 27 was mapped and digitized. The present project represents the completion of the mapping of the Provincial Forest land in the LU, carried out for Tembec Enterprises Inc. under FIA contract number 07-RIP-FIA-105.

This report accompanies the mapping of archaeological potential carried out under that contract. It summarizes the background information that is the basis upon which the polygons were delineated and assessed, and describes the methodology employed. The report concludes with an evaluation and discussion of the results in the context of heritage resource management, and with recommendations.

2. Study Area Environment

LU C20 encompasses the drainage basins of Alexander and Line creeks in the southern Canadian Rocky Mountains. The LU is bounded on the east by the High Rock Range, which forms the Continental Divide; Alexander Valley and the southern two-thirds of the LU are bounded on the west by the summit of Erickson Ridge while the Wisukitsak Range is the boundary of the northern third and of the valley of Line Creek. Geologically, the two valleys are north-south trending troughs flanked by folded and faulted Palaeozoic rock of the Mississippian Rundle Group, the Pennsylvanian / Permian Rocky Mountain Supergroup and the Jurassic Fernie Formation (Grieve and Price n.d.). The resistant limestone and quartzite are expressed by steep topography characterized by castellate and serrate summits whereas the softer shales have been much more heavily eroded and form gentle saddles and rounded ridges and knolls. Concentrations of hard silica in the various strata served as the foundation for the precontact technology, which placed a great emphasis on sharp durable cutting edges (see also Section 4.1.3).

The landscape was significantly modified by glaciation during the Pleistocene Epoch, but the chronology of late Pleistocene glaciation and deglaciation has not been intensively studied. The deep U-shaped cross profiles of the major valleys and adjacent cirques demonstrate the erosive power of valley and alpine glaciation. It is obvious that the LU itself was never completely overridden by any coalescent ice mass, but evidence of only one episode of Pleistocene glaciation is readily visible. This last major glacial episode began some time after 20,000 years ago, and apparently consisted of the advance of valley glaciers originating in cirques on the faces of peaks adjacent to and at the heads of major valleys. Glacial erosion produced sharp summits and steep knife-edged arretes on most of the mountainous terrain, but a small ice cap apparently occupied the divide between Alexander and Line creeks. After the glacial ice withdrew, the lower portions of the major valley bottoms were filled with water ponded against stagnating ice or morainal debris further downriver. Local drainage was subsequently established and watercourses began eroding their way through the valley fills, carving terraces at various elevations above the valley bottoms. The freshly exposed sediments and surfaces resulting from these erosional processes were reworked by gravity and the wind to varying degrees before becoming stabilized by vegetation. At the lowest elevations, watercourses are flanked by alluvial floodplains.

The earliest vegetation in the adjacent Elk Valley was a birch-sagebrush tundra, with pine, spruce, and fir present downvalley (Fergusson 1978: 99). A date of 10,125 + 285 (GX5598) on beaver chewed wood corresponds to a change in vegetation from the shrub-herb tundra to a spruce dominant forest (ibid.). Subclimax pine and fir forest between about 9700 and 6800 years ago correlates with the warm dry Altithermal climatic interval. This time interval is represented in a pollen core from Crowsnest Lake by coniferous forest dominated by pine and spruce, proportions of the latter indicating slightly warmer and drier conditions in that locality as well (Driver 1978: 56). After 7000 years agon, the maritime westerlies began to exert a dominant climatic influence (Choquette 1987). Forests became denser on west-facing, windward slopes but grassland persisted and possibly even expanded in the rainshadows due to Chinook winds. It is likely that the influence of Chinooks was greatest between about 7000 and 5000 years ago, at which time the grasslands on the east slope of the Rocky Mountains to the east of LU C20 reached their maximum extent (e.g. Driver 1978: 61).

During the last 5000 years, the effects of a significant global cooling trend known as the Neoglacial (Porter and Denton 1967) become noticeable throughout the region. Glaciers began to grow in the high mountains, forest fire frequency declined and closed canopy forests expanded at the expense of grasslands and parkland. This cool, moist trend apparently reached its maximum sometime around 4000 and to the west was accompanied by significant compositional changes in the vegetation as the maritime cedar - hemlock associations made their appearance. While the ICH biogeoclimatic zone extends today up the Elk Valley to about 30 km southwest of LU C20 (Braumandl & Curran 1992), it is not known whether it ever characterized any part of the LU; it is not represented in pollen from Crowsnest Lake (Driver 1978: 55). The regional palaeoenvironmental data indicate that the last 5000 years have consisted of a series of alternatiing minor warm-dry and cool-moist intervals, in general becoming progressively colder. Conditions in the earlier half of this time seem to have been characterized by high snow packs, and alluvial floodplains commonly extended from valley wall to valley wall. A minor return to dry conditions between 2500 and 400 years ago resulted in the exposure of extensive gravel cored terraces that had previously comprised the alluvial floodplains of the Elk River and its tributaries. In addition to the lowering of the water table on these terraces, the increased aridity of the period was conducive to increased wildfires. In combination, west if the Contiental Divide, these environmental responses apparently resulted in a significant expansion of low elevation grasslands which in turn facilitated the expansion of bison into the Elk Valley. The Holocene cooling trend reached its peak during the last 400 years, an interval known as the "Little Ice Age", the most severe glacial episode since the Pleistocene.

The postglacial evolutionary trajectory gave rise to the modern vegetation, which today consists of coniferous forest of varying age classes, interspersed with grassy openings at various elevations. This is classified via the Biogeoclimatic classification (BEC) scheme (Braumandl et al 1992), which includes the Dry Cool Montane Spruce Subzone (MSdk) at lower elevations in Alexander and Line Creek valleys. Above it and in the northern parts of both valleys is the Dry Cool Engelmann Spruce – Subalpine Fir Subzone (ESSFdk). Besides the above zonal elements, riparian deciduous habitats are present in the lower elevation areas adjacent to watercourses and fire succession lodgepole pine stands are common throughout the area. The complexity of the vegetal mosaic is further illustrated by the presence of the lower elevation grasslands mentioned above. A diversity of non-arboreal plant communities occur above timberline. These are lumped together as AT - Alpine Tundra in the BEC scheme but also include high elevation grasslands.

The southern Rocky Mountains support a wide diversity of mammals including beaver, grizzly bear, black bear, cougar, Canada lynx, wolf, coyote, rabbit and hare, and porcupine. Ungulates in particular formed a major component of the subsistence economy of resident human populations and include deer, elk, mountain sheep and goats, and moose. Bison kill sites in the middle Elk River drainage (Choquette 1973) represent the only such sites known to occur west of the Continental Divide in Canada and indicate the expansion of this species into this area in response to the return to droughty conditions within the last two millenia (Choquette 1973 and 1984). Caribou were present in the mountains to the south at the time of contact and could have ranged into the study area during cooler Holocene intervals while fluctuations in deer and elk populations in response to climatic variation have been documented in the archaeological and ethnohistoric records further south (Choquette and Holstine 1982).

The Elk River drainage is noteworthy for its resident fish populations, bull trout likely being of especial importance in the aboriginal economy.

3. Cultural Context

3.1 Aboriginal Population

LU C20 is within the traditional territory of the Ktunaxa, a linguistically isolated cultural group who inhabited the drainage that now bears their anglicized name. The major ethnographic works on the Ktunaxa are Schaeffer (1940) and Turney-High (1941); Smith (1984) and Brunton (1998) have compiled recent syntheses.

Schaeffer (n.d. and summarized in Chalfant 1974: 47) identified a specific Ktunaxa band who “spent each summer west of the main ranges” in terrain encompassing LU C20. This group was known as the

> Gakawakam:tuk:n:k - `river running into, out again, and back into another river' (Michel Creek into Elk River). This was the Michelle Prairie band. ... They ranged between Crows Nest Lake and Waterton Lakes and crossed to Michelle Prairie by Crow's Nest Pass.

The Ktunaxa bands followed a nomadic seasonal subsistence round that resulted in extensive travels throughout the mountains and valleys of the upper Columbia River drainage. Scheduling of the Ktunaxa's seasonal round was determined by the location and timing of abundance and condition of a broad range of animal and plant resources.

Because of the disappearance of resident bison during the Little Ice Age, the ethnographic literature contains no references to the local hunting of these animals but does document trans-mountain treks, both equestrian and pedestrian, to hunt them east of the Rockies. Other big game species, particularly deer and elk, were taken singly with bows and traps and in communal hunts, mostly in the spring and fall. The latter provided the bulk of the meat that was dried and stored for winter consumption. From late spring through early fall, game, fish, waterfowl and plant foods such as roots and berries were acquired by dispersed task groups, for example, a group of women and children picking berries, accompanied by a few men who undertook casual hunting at the same time. After obtaining horses from the Flathead around A.D. 1730, the Ktunaxa began making the thrice yearly treks to the bison grounds east of the Rockies for which they are well known in the ethnohistoric literature.

Cooking by stone boiling was the preferred method of preparing food for immediate consumption, except for roots such as camas and bitterroot, which were baked in earth ovens. Foods not eaten directly were dried for winter storage; berries were important in this regard. The Ktunaxa employed a wide range of materials in their traditional technology. In addition to tourmalinite, chert and quartzite which were used for tools, the Ktunaxa also mined iron oxide for paint and soft argillite for making pipes. The main dwelling of the Upper Ktunaxa was the hide-covered tipi; there is some conjecture that prior to obtaining horses, a covering of mats and/or branches may also have been used.

Ktunaxa social organization was kinship-based and loosely organized into politically independent bands of related families. The hallmark of this social structure was its flexibility, a highly adaptive trait from the diachronic perspective. Band membership was voluntary and both size and composition varied from year to year. Chieftainship accrued to those with leadership qualities, although a tendancy towards hereditary chiefs is also apparent at least in latest precontact times. Treatment of the dead included both interment and exposure.

3.2 Previous Archaeological Investigation

This part of the southern Canadian Rocky Mountains has been subject to a relatively wide range of archaeological studies, although little work has been done within LU C20 itself. The route of the proposed expansion of the Alberta Natural Gas pipeline was surveyed in 1975 (Reeves and Head 1976), resulting in the recording of two clusters of precontact archaeological sites in the Rocky Mountains, one at the west end of the Crowsnest Pass. Excavations near the western entrance to both the Crownest and Phillips passes revealed evidence of 8000 or more years of occupation, which was most intensive prior to ca. 5000 years ago (Kennedy et al 1982). Included in the findings is significant evidence of bison hunting in montane grasslands as well as exploitation of an as yet unlocated but probably nearby source of quartzite.

The recorded sites within the part of LU C20 mapped in this project resulted from cursory surveys that were part of projects focussed in adjacent areas. The middle Elk River drainage area, consisting of the west end of Crowsnest Pass, the Elk Valley between Sparwood and Elkford, and the lower portions of tributary valleys, was the subject of a judgemental inventory in 1973 in anticipation of expansion of coal mines in the area (Choquette 1973). Sixty-seven precontact archaeological sites were found and three previously recorded sites were revisited. The nature and distribution of the middle Elk River drainage sites led to inferences regarding the area's past human inhabitation (see Section 3.3 below). However, the survey sample was judgemental, rendering the results potentially subject to sampling bias in that coverage was not exhaustive and there might have been a subjective concentration on the more visible (i.e. more recent) landforms and vegetal configurations. In 1976, the opportunity presented itself to explicitly test the hypothetical model developed from the 1973 survey results during the survey of the proposed Line Creek, Corbin and Hosmer-Wheeler coal mines (Choquette

1979). Arbitrary vector and random samples were employed in addition to judgemental sampling and 6 more precontact archaeological sites were found in the former two mine areas. The three sites in the valley bottom were characterized by relatively recent occupations, providing a positive test of the hypothesis. Three sites were also found at Ewin Pass at the head of Line Creek in a high elevation grassland setting.

A number of later heritage impact assessments also have been targetted to the development or expansion of coal mines and related facilities in the Elk drainage. In 1982 Aresco Ltd. conducted a heritage impact assessment of the expansion of the Balmer coal strip mine west of LU C20 (Warner 1983); no sites were found. Further north, a temporary encampment was discovered in Fording Coal Ltd.'s Henretta Pit mine area (Choquette 1990a). Evaluative excavations at this site yielded evidence of a long time depth of transient use and more intensive utilization as a hunting camp within the last 2000 years (Choquette 1993a). One precontact site was found on the divide between Brownie and McQuarrie creeks during a survey of the proposed Brownie spoil expansion (Choquette 2001). This large site consists of tool manufacturing debris of siliceous mudstone associated with a deflated exposure of the Fernie Formation in the saddle on the drainage divide. Excavations at EbPq-2 in the middle portion of the Henretta valley revealed deep, well stratified cultural deposits including tool manufacturing debris of chert from the High Rock Range and siliceous mudstone along with completed and utilized tools, butchered and cooked bone fragments, fire broken rock and abundant charcoal (Choquette and Wood 2005). Further localized surveys of proposed expansions of the Line Creek Mine were conducted in 1993 and 2004, resulting in the discovery of two more precontact archaeological sites. One small site, on a terrace cut into the toe of a recent landslide on Tornado Creek (Choquette 1993b) functioned as a workshop where a few nodules of siliceous mudstone were reduced; the recent landform association and the stratigraphic provenience within the upper 5 cm of sediment indicate a very recent precontact age. The 2004 field reconnaissance encountered a precontact archaeological site in the pass between Grace and Dry creeks (Choquette 2004a). The presence of fire broken rock concentrations and burnt bone indicates encampment and processing of the results of the hunt.

As part of Master’s thesis research, Russell Brulotte conducted an archaeological survey in the Racehorse Creek drainage immediately across the Continental Divide from LU C20 (Brulotte 1983). Twelve precontact sites, a possible quarry and two isolated finds were recorded and two sites were test excavated on the Alberta side; in addition, a site consisting of unworked stone flakes was recorded on the west side of Racehorse Pass in LU C20. A radiocarbon date of 3050 + 130 BP was obtained from a tested rockshelter while temporally diagnostic projectile points indicate a time depth of as much as 7000 years for the sampled occupations in Racehorse Creek valley. The main focus of the research was on bone assemblages, however, and the results yielded little definitive information regarding specific patterns of precontact human land and resource use. The lithic assemblages suggest a relatively strong geographic orientation southward along the Rocky Mountain east slope and secondarily important east-west movements.

The Crowsnest Pass itself was the subject of more than 10 years of systematic archaeological research including surveys and major excavations under the general direction of Dr. Brian Reeves of the University of Calgary. Some of these data formed the basis for a doctoral dissertation by Jonathan Driver (1978).

More recently, archaeological assessments have begun to be conducted in advance of proposed logging. As noted in Section 1, an AOA was done of the Crown land in 1999, followed by an AOA of the Managed Forest 27 portion in 2004 (Choquette 2004b). No precontact archaeological sites have been recorded within LU C20 itself as a result of the small number of impact assessments that have been conducted thus far, but one precontact archaeological site consisting of chipped stone artifacts was recorded on a high terrace above Grave Creek to the west of the LU.

3.3 Models of Culture History

The limited amount of archaeological work is inadequate to support the development of a formal culture history sequence for LU C20 itself. However, archaeological investigations in the immediately adjacent middle Elk River drainage and Crowsnest Pass localities have yielded data that contributes to the development of several precontact human land and resource use models that are applicable to the LU.

The known precontact archaeological sites in the middle Elk River drainage area are of two general types: those related to resource exploitation and those more directly associated with trans-mountain travel. The resource exploitation sites can be further subdivided. One group consists of the camps, kills, butchering areas, workshops and lookouts associated with natural grasslands on middle and low elevation terraces in the Elk Valley between present-day Sparwood and Elkford. Some of these sites yielded abundant bison bone that included all skeletal elements, indicating that hunting of resident bison was an important activity. A stone sinker and part of an antler harpoon are evidence that fishing was practiced at the mouth of Michel Creek. Temporally sensitive artifacts (predominantly arrow points) from these resource-oriented sites suggest occupation within the last 2000 years. Other indications of the relatively limited time depth of these sites include their associations with presently existing grassland openings and geologically recent landforms, limited soil development in the shallow stratigraphic contexts of the cultural deposits, and the well preserved bone. The second group of resource exploitation sites includes small hunting camps and workshops in valleys and passes in immediate proximity to the Continental Divide. The present data sample from these sites, which includes stratified excavated features and bone and artifact assemblages, consists of discrete occupations of late precontact age as well as those possibly as much as 6000 years old.

The second type of sites also can be subdivided into two groups, but on the basis of geographic location instead of function. In contrast to the sites discussed previously, which are widely scattered in the southern Elk Valley and situated in many valleys tributary io the middle Elk River, the second type of sites are much more spatially restricted and correlate with major travel corridors. They occur as two linear series of campsites, one on the west side of the Crowsnest Pass and the other along the Fording River. The former group is basically an extension of the well documented Crowsnest Pass site concentration which has been interpreted to represent a longstanding adaptation to the seasonal distributions of ungulates in the montane grasslands of this transmountain corridor (Driver 1978, Kennedy et al 1982). Of the second group of linear sites, all but one occur along the north side of the Fording River near its confluence with the Elk. This site concentration extends from the low terraces immediately adjacent to the Fording River mouth up onto and along a high loess-mantled glaciolacustrine terrace. Based on this range of landform ages and on the morphology of the projectile point sample, the occupational sequence at these sites spans the entire Holocene - the only such time span known for any locality in the entire Elk Valley. The other site in this group, EbPr-2. is situated on a series of intermediate terraces near the Fording River – Henretta Creek confluence; stratigraphic and lithic technological data likewise indicate occupation spanning the entire Holocene. Taken as a whole, the second site type is characterized by linear distribution in primary association with major travel corridors. Another attribute of this site type is the only evidence of early postglacial human occupation in the middle Elk River drainage. This evidence consists of early palaeohydrological and sedimentary settings and the occurrence of several time diagnostic artifact types that have been radiocarbon dated to 9000-11,000 years in adjacent parts of the Northern Rocky Mountains. This time depth stands in striking contrast to the more recent resource exploitation sites.

These results were synthesized into a model of precontact human land and resource use which postulated that prior to about 2000 years ago, human presence in the Elk Valley was related to travel via the Fording Trail between areas of higher population in the Rocky Mountain Trench and the foothills of the Rockies. Within the last 2000 years, however, a semi-resident human population had become established and was systematically exploiting the biological and geological resources of the middle Elk drainage area itself. Hunting of resident bison on the enlarged grasslands was apparently a significant component of the post-2000 b.p. land/resource use pattern.

By its explicit linkage to discrete attributes of the natural landscape, this precontact land/resource use model can serve as an hypothetical culture history construct that is testable by further archaeological inquiry. The results of the 1976 southeast coal block survey (Choquette 1979), the heritage impact assessments of Norcen Energy Resources Coal Bed Methane test well in the upper Elk Valley (Choquette 1992), the Chauncey Creek gravel pit (Choquette 1990b) and the excavations at EbPr-2 in the Fording - Henretta confluence (Choquette 1993b) constitute explicit field tests of this construct.

The more recent investigations associated with the Fording and Line Creek mines also added additional detail to the archaeological record of the later precontact inhabitants. In addition, they have shed light on another component of the land/resource model that is not represented in the Elk Valley itself, and that is the exploitation of the terrain in the immediate vicinity of the Continental Divide north of Crowsnest Pass. It is postulated that the pre-2000 b.p. assemblages from upper Henretta, Brownie and Grace creeks, along with those from Ewin Pass, represent the evidence of hunting by groups resident east of the Continental Divide during the early Neoglacial Period. It is further speculated that this pattern may reflect the strong influence of the Maritime westerlies when Chinook winds made the East Slope of the Rockies much more habitable than the correlatively much cooler and wetter conditions of the Elk Valley itself.

The Crowsnest Pass, on the other hand, has yielded evidence of some 10,000 years of continuous human inhabitation. This is due to the presence of extensive ungulate resources, particularly bison, that were accessible year round from various parts of the pass. Driver identified a relatively stable settlement pattern that he named the “herd hunter” model, an adaptation that

> “concentrated primarily on exploitation of bison, particularly at those
> times of year (late fall, winter, spring) when bison were the most

> accessible ungulate in Crowsnest. At other times of year, other ungulates, notably elk and sheep, were hunted. The reliance upon other ungulates during the summer can be explained by changes in the seasonal distribution and behaviour of all ungulates in the Pass." (Driver 1978: 172)

Based on this model, Driver (ibid.: 166) indicates that "sites were located seasonally to take advantage of the distribution of ungulate herds, and the changing behaviour of these herds throughout the year influenced hunting patterns". Following Reeves (1972), Driver (1978: 166) identified a settlement pattern that consists of winter valley bottom camps when bison were the main ungulates hunted, with deer and sheep as subsidiary, while in summer, groups moved to higher elevations where bison were still the dominant ungulate hunted but other species were also important. In this pattern, precontact human settlement was concentrated along the main pass while subsidiary occupation took place in creek valleys with the greatest areas of microtopographic/microclimatic grasslands (ibid.: 138).

The Crowsnest Pass grasslands extend continuously across the Continental Divide into the southern part of LU C20 and the lower Alexander Creek valley. However, the upper part of this valley is narrower and a broad band of subalpine coniferous forest extends across an area of relatively subdued topography at the divide between Alexander and Line creeks. This forest separates the grasslands in the lower Alexander Valley from those in the Line Creek drainage, which are connected with the adjacent parts of the Elk River drainage. It is likely that the former valley can be considered to be part of the Crowsnest Pass and thus contains archaeological components of the herd hunter model that could encompass the entirety of postglacial time. On the other hand, the more episodic models of precontact human land and resource use developed for the middle Elk River drainage would likely be applicable to the Line Creek watershed that comprises the northern portion of the LU.

4. Study Methodology

This study comprises an assessment of the archaeological potential of the previously unmapped Provincial Forest land in Landscape Unit C20. The assessment takes the form of polygons drafted onto 1:20,000 scale TRIM contour maps, accompanied by a data base containing the criteria upon which the definition of the polygons is based and the scoring that supports the ranking of the polygons into Medium or High archaeological potential. Private land of Tembec's MF 27 overlaps the south end and part of the centrai part of LU C20; this was previously mapped for archaeological potential by the present writer utilizing the same methodology as applied in this project.

The individual mapped polygons consist of landforms or landscapes identified via stereoscopic analysis of aerial photos. The criteria for polygon definition were derived from the geological, palaeoenvironmental and archaeological background information summarized in Sections 2 and 3 above. The criteria are linked with the prediction of potential occurrence of archaeological sites on the basis of the models of past human land and resource use derived from the archaeological record summarized in Section 3.3. The result is a set of GIS compatible polygons that reflect the potential of various parts of the LU to contain archaeological sites.

The criteria by which the polygons are assessed are described below with reference to the biogeography and archaeology of the study area. To achieve objectivity in defining the archaeological potential of the polygons, each criterion is numerically scored relative to its contribution to the delineation and evaluation of the polygon in question. A four part scoring system has been used: "0" indicates that the criterion in question has not contributed to the definition of a given polygon, "1" indicates a minor contribution, "2" a more significant contribution and "3" indicates that the criterion is a major determinant of the polygon's definition or assessment. The criteria are subdivided into two categories that reflect the regional perspective (macrosite criteria) and the local perspective (microsite criteria). The distinction between the two is discussed in more detail in Section 6 below.

4.1 Macrosite Criteria

The following attributes are considered to be the primary determinants of archaeological potential within the regional context.

4.1.1 Known Sites

Where the level of previous investigation has been sufficient to support it, the distributions of known sites can provide a relatively reliable measure of the intensity of precontact human utilization within the given study area in which they occur, and also some indication of the types of past human activities that might have taken place.

For example, focussed occupation, particularly that of a winter settlement or base camp characterized by a significant duration and continuity of human presence, would have had a range of other activities associated with it. Besides those related to procurement and processing of subsistence resources, such ancillary activities would have included a range of social and ceremonial practices that could be represented by archaeological sites. Thus the vicinity of a habitation focus would be characterized by a higher site density than would other parts of the landscape even if they were characterized by similar topography.

Eight precontact archaeological sites have been recorded in LU C20, all of them lithic scatters. Three are in Alexander Creek valley and one is in the valley of Tornado Creek a short distance above the junction with Line Creek. The other sites are associated with passes: one in Racehorse, two in North Fork and one in Ewin. The sites are thus scattered throughout the LU and none have been intensively investigated. However, as discussed in Section 3 above, the archaeological survey work conducted thus far in adjacent portions of the Rocky Mountains has documented numerous precontact habitation and resource exploitation sites. The models that have been developed incorporate the types, locations and settings of all of the known sites and enable the prediction of site occurrence utilizing the palaeogeographic information obtained from air photo analysis.

A score of 3 for this criterion represents the presence within a mapped polygon of one or more known archaeological sites, while a score of 2 is assigned to polygons adjacent to known sites. A score of 1 reflects the location of a polygon between, but at some distance from, areas of known site occurrence. A score of 0 indicates a lack of known sites in a locality.

4.1.2 Corridor

The physiography of a region exerts a major influence on the movements of both animals and humans. The north-south troughs represented by the valleys of Alexander and Line creeks naturally made them travel corridors because they connected with the major corridors of the Crowsnest Pass and Elk Valley, respectively, and because of the relatively low divides at their heads. In addition, both valleys are bounded on the east by the Continental Divide, breached by Racehorse, Deadman, North Fork and Tornado passes which connected with the foothills and plains to the east.

The score assigned to this criterion reflects the relative importance of a travel route based on what is known about past movement patterns.

4.1.3 Bedrock Geology

As discussed in Choquette (1981), stone suitable for tool manufacture is neither ubiquitous in the region nor restricted to a single source. Instead, certain aspects of the geological history have resulted in discrete spatial distributions for the bedrock formations that underlie the region. Twenty-three sources of flakable stone have been identified in the upper Columbia drainage over the past 30 years and the approximate locations of at least four more are known. Because of the non-biodegradable nature of this material and the capability to use stone to track movements of people across the landscape relative to the location of the discrete sources, this criterion is of great importance to the archaeology of this region. Since workable stone was an essential underpinning of the precontact economy, stone sources were sufficiently strong attractions that they appear to have been significant determinants of the foci for subsistence resource exploitation as well as of routes of transmountain travel. They are thus extremely valuable tools for predicting archaeological potential.

In addition to tools and flakage removed during the more advanced stages of tool manufacture and repair, the artifact assemblages of many of the archaeological sites in the LU C20 vicinity contain worked fragments of siliceous nodules. Some of these nodules have water-smoothed or glacially striated cortex, indicating that they were picked out of fluvial or glaciofluvial gravels and till exposures. Certain distinctive characteristics of other blocks and nodule fragments allow for them to be assigned to specific bedrock formations, the majority of which outcrop in the southern Rockies. Quarries and lag exposures of Banff siliceous siltstone occur in the Bow and Kananaskis drainages and bedrock quarries of Etherington Chert are present at Fording Pass and in the Livingstone Range. A discrete bedrock source of siliceous mudstone nodules was identified in a deflated Fernie Formation outcrop on a divide in the Fording drainage while evidence from DjPq-1 and 2 strongly suggests that a quarried outcrop of Rocky Mountain quartzite is present near the west end of the Crowsnest Pass, probably in the MF 27 portion of LU C20.

The bedrock geology of LU C20 itself consists of a series of upturned and steeply dipping Palaeozoic sedimentary strata striking north-northwest south-southeast parallelling the predominant strike of the Rocky Mountains. Included among these strata are the Rocky Mountain, Banff, Etherington and Fernie formations, all of which have documented precontact quarries as noted above. While no quarries are known within the parts of the LU mapped during this project and there is nothing in the sparse recorded data from the LU that suggests the presence of an intensively exploited outcrop, there are extensive exposures of bedrock and talus of these formations on the mountainsides, tributary valley walls and saddles. Therefore, scattered lithic resources were readily available throughout the LU.

Scoring for this criterion reflects proximity to and accessibility of outcrops of these formations and the talus slopes below them.

4.1.4 Ungulate Range

LU C20 contains high quality deer, elk and moose habitat along the valley bottoms and southerly aspects of the lower valley walls. It is not known whether the bison that had expanded into the middle Elk River drainage area were mountain bison (Bison bison athabascae) or an extension of herds of plains bison (Bison bison bison); this is one of the more intriguing problems in regional palaeoecology. Driver (1978: 37-38) identified indigenous herds in Crowsnest Pass as discrete from plains herds that moved westward to winter in the Chinook zone. In summer, the indigenous herds split into smaller groups and moved into tributary valleys, particularly those with micro-topographic/climatic grasslands. Such grasslands would have been more extensive during the early Holocene and as noted previously evidence of intensive exploitation of bison during this time period was excavated from DjPq-1 in the south part of LU C20. In addition to summer utilization of the montane grasslands by all of the above ungulate species, they is also important mountain sheep habitat. It is likely that the high elevation grasslands would have been more extensive during the early Holocene, both because of the warmer drier climate and because of the presence of more soil prior to Neoglacial erosion. Evidence of the latter, especially the most recent effects of the Little Ice Age, is widespread in the high elevations of the LU where mechanical weathering and runoff have notiiceably removed significant tracts of previous alpine vegetation. On the other hand, portions of the LU exhibit avalanche chutes and subalpine meadows which support seasonal populations of elk in particular; these would have fluctuated during the Holocene as well but in response to increases in snow accumulation. Finally, the extensive mosaic of fire succession montane forests evident in the LU today indicate a further component of fluctuating ungulate habitat.

Scoring for this criterion reflects the relative value of ungulate range based on present values and extrapolated from palaeoenvironmental reconstructions that include palynology as well as fire history in terms of succession and fire climax.

4.1.5 Solar Aspect

Southerly exposures tend to support a more open vegetal cover than other aspects, making them the preferred locations of trails for both animals and humans. Human habitation sites, especially fall and winter settlements, tend to be situated to take advantage of solar heating.

Scoring for this criterion is based both on micro- and macrotopography, with the highest scores accruing to south-facing landforms situated on or at the base of extensive south-facing slopes.

4.2 Microsite Criteria

Scoring for each of these criteria reflects its relative importance in determining the specific location, size and shape of individual polygons.

4.2.1 Grassland Association

As discussed previously, natural grasslands are present in various parts of LU C20. Some, such as those at high elevations, are apparently relics of more extensive earlier Holocene communities. Others, in particular those which occupy Neoglacial floodplain terraces, are more recent by definition of the age of the landforms upon which they are situated. The emergence of these level expanses of previously non-existent grazing range is hypothesized to have been instrumental in the expansion of bison into the middle Elk River drainage area during the late Holocene arid interval.

Enlargement of the grassland “tiles” in the vegetal mosaic also took place at middle elevations during this minor return to aridity and high wildfire frequency, providing increased forage on southerly aspects along the valley walls for mountain sheep as well as bison, deer and elk. This far east in the Rocky Mountains, the Chinook effect is also worthy of consideration with regard to maintenance or even expansion of grasslands. This process, whereby adiabatic heating of westerlies as they decline after dropping their moisture on windward slopes, can create arid microenvironments downwind of significant mountain peaks and massifs. In the case of LU C20, this influence is apparent in the lee of the higher parts of Erickson Ridge. As discussed in Section 2 above, this process would have been most influential between about 7000 and 5000 years ago when the climate was still warm but the westerlies began to exert their influence on regional climate. However, its true impact is masked somewhat by the subsequent loss of the substrate which supported grasslands at higher elevations. As discussed in Section 4.1.5, another aspect of the grassland association criterion as mapped in LU C20 relates to Neoglacial disruption of previously more extensive high elevation grasslands. The expression of Neoglaciation in LU C20 as identifiable on air photos is not as expanded cirque glaciation as such. Rather, the overwhelming late Holocene terrain manifestation at high elevations is increased mechanical weathering which, combined with the effects of gravity, resulted in the growth of extensive talus accumulations and occasional rock glaciers. The colluvial influence of mechanical weathering becomes very apparent on a northward cline along the Continental Divide in the eastern part of the LU, where grassy slopes have been removed by downslope soil movements or buried beneath expanses of rock debris.

Scoring for this criterion takes the above palaeoecological factors into account and facilitates the testing of the middle Elk drainage land and resource use models described in previous sections of this report. A score of 3 denotes a direct association with the natural grasslands of the later Holocene floodplain terraces while a score of 2 is accorded to polygons in immediate proximity to these biogeographical features. Polygons associated with natural grassland openings at middle and high elevations are scored as 1 in the subalpine forest to capture episodic intervals of higher fire frequencies and 2 in the vicinities of previously more extensive alpine grasslands in the broader mountain valleys. The relatively higher score attached to the valley bottom grasslands as opposed to those at higher elevations reflects the limiting influence of the steep topography at high elevations, as it is apparent that while low elevation grasslands could have encompassed very large areas of level or moderately sloping terrain at times in the past, the steepness of the mountains would not have varied and would always have represented a constraint on the extent of available grassland habitat. A score of 0 indicates no grassland association.

4.2.2 Terrace/Fan

Deglaciation and the subsequent effects of glacial meltwater runoff and slope stabilization were responsible for the creation of a set of landforms upon which very early sites may be situated. These include level areas adjacent to kettle lakes, fluvial bars and colluvial/alluvial fans and aprons. Entrenchment of watercourses left elevated terraces which are favourable camping areas because they tend to be better drained with regard to soil moisture and also avoid the effect of cold air drainage, an important consideration in late fall, winter and early spring. Level, typically well-drained landforms, terraces have also been selected as travel corridors, especially along their margins where vegetation tends to be more open.

In the adjacent Crowsnest Pass, Driver (1978: 145) observed a strong tendancy for sites to be located on valley terraces.

4.2.3 Promontory

Prominences and ridges remaining after dissection of the valley fill as well as drumlins, eskers, and linear bedrock outcrops would have facilitated or channelled precontact human and animal movements across the landscape. In addition, some of these landforms are vantage points where localized ad hoc activities such as tool production and maintenance may have taken place.

4.2.3 "Saddle"

At the heads of some valleys are constrictions that are lower than the surrounding heights of land, making them the preferred routes for traversing drainage divides. The term "saddle" refers to the lower, more level terrain which exists at a height of land that could have been used as a pass. Such areas typically contain archaeological deposits both because they were used as temporary rest areas and overnight campsites and because the terrain served to spatially concentrate human activity. In addition, as noted in Section 4.1.3, the soft shales of the Fernie Formation are often expressed as saddles between more resistent strata – these heavily eroded saddles are known to yield lag deposits of siliceous mudstone nodules suitable as tool stock.

4.2.4 Standing Water

Lakes and ponds attract wildlife and thus could have hunting sites associated with them. Those containing fish would have been obviously attractive for that reason - the inlet and outlet streams of lakes were often selected as sites for fish weirs. Lakeshores are also good camping areas, especially the north and east sides which have favourable solar aspects.

4.2.5 Watercourse

Rivers and streams and the associated riparian ecosystem support a diversity and abundance of subsistence resources as well as being sources of vital fresh water.

4.2.6 Relict Watercourse

The establishment of the postglacial drainage system was accompanied by significant changes in hydrology. Valley fills of glacial drift and glaciolacustrine silt were partially dissected by meltwater, leaving high terraces now well above the present valley bottoms. These relict drainage features are potential settings of early archaeological sites.

4.2.7 Confluence

Confluences of watercourses are significant predictors of archaeological site locations for several reasons. Most importantly, they usually correspond with confluences of valleys and thus represent junctions of travel corridors where temporary stopovers and activities would likely have been repeated frequently enough to produce archaeologically detectable cultural deposits. A second consideration is that the quality of water from tributaries is often better than that in the main stream, particularly during the freshet. Also, confluences often are good fishing locations.

In the Crowsnest Pass, Driver (1978: 145) noted that the highest site density observed on valley terraces was where the linear pattern of terraces is interrupted by small stream valleys with a different set of terraces.

4.2.8 Watercourse Node

This refers to specific portions of watercourses that could have served to attract and/or focus human activity. Examples include rapids and narrows that could have served as fords; large eddies, pools and waterfalls which were good fishing locations; and springs. Some mineral springs attracted animals, making them potential ambush hunting locations and in addition, some of these natural features can have sacred associations.

POLYGON	WATERCOURSE NODE ATTRIBUTES
C20-58	falls on unnamed creek
C20-136	spring, mineral lick on upper Line Creek

Table 1. Polygon watercourse node attributes.

4.3 Confidence

The need for this measure was expressed by Oliver Thomae of the Cranbrook Forest District in the context of future emergency situations such as fires or pest outbreaks. It is desirable to be able to separate out those polygons where archaeological values are sufficiently well known that measures such as field investigation or mitigation are clearly necessary from other polygons whose definition is based on limited data or large extrapolative leaps in predictive modelling. As employed in this study, Confidence is a subjective measure that should be considered within the context of 'risk management'.

This criterion is a subjective combination of the predicted presence and density of archaeological sites along with an estimate of the potential significance of the archaeological values contained within a given polygon. It is scored high, medium or limited confidence as 3, 2, or 1, respectively. A score of 1 equates with a lower level of confidence commensurate with data limitations or greater level of speculation and while it certainly speaks to a need for further investigation, this level of confidence reflects acceptance of the risk of losing data in the polygon if extenuating circumstances should arise that require rapid response.

5. Results

One hundred and six landform-based polygons were identified as having potential to contain archaeological sites in the portion of Landscape Unit C20 mapped during the present project (see maps).

6. Evaluation and Discussion

As employed in this study, archaeological potential represents a relative measure of the likelihood of encountering precontact archaeological resources in a given locality. A number of factors are reflected by this relative measure, including probability of site occurrance, possible density of sites and/or cultural deposits, and significance. At its most basic level, the definition of archaeological potential depends upon an adequate data base to support accurate predictions of the presence of sites. The ideal situation would consist of an inventory of all sites within the study area and information regarding the nature of past human use in terms of activities, seasonality, duration of occupation and nature of social unit(s), and the time span(s) of such use.

The concept of potential arises when this ideal is not met, leading to the compromise of attempting to identify areas where sites might be located. The level and nature of spatial sampling that has taken place previously in a landscape unit is obviously an important consideration in this regard. A large enough proportion of the target land base must have been examined to support correlations between the known inventory and the actual distribution of sites over the landscape. Both positive and negative data (i.e. presence vs. absence of archaeological sites) must be taken into account and places where sites have not been found at a sufficiently intensive level of sampling (especially where sites were expected) must be considered as well as locations where sites are actually present. Unfortunately, very little archaeological work has been done in LU C20 and none of it in a sufficiently systematic manner that would support extrapolations of site distributions.

Within the resource management context, erring on the side of caution is a necessary element of this “compromise”, since archaeological heritage is a precious, unique non-renewable resource that represents a significant component of the cultural identity of living groups, their ancestors and their future generations. Thus, where a lack of systematic archaeological investigation is reflected by the absence of hard data in an inventory, it must be assumed until proven otherwise that all or most human land and resource use patterns are represented in a given landscape unit, subject to the constraints of the past environmental conditions.

The orientation of previous research, including palaeoecological, is also a factor influencing the capability and accuracy of predictions of archaeological potential. The direction of the writer’s archaeological research in the upper Columbia River drainage has been conducted within an explicit palaeoecological paradigm, which expands the supporting data base to incorporate such aspects of the environment as geomorphology and palaeohydrology. As discussed in Section 4, analysis of aerial photographs produced a data set that includes landform and hydrological associations. These provide a scientifically objective definition of at least some past environmental constraints, thereby partially delimiting the range of potentially applicable patterns of past human land and resource use that could be projected onto a given landscape.

Both macrosite and microsite criteria were considered during the analytic process but only the former were used to rank the archaeological potential of the polygons. This is because archaeological potential derives from the characteristics of a broad environmental context, i.e. the combination of attributes such as location within a corridor, solar aspect, relationship to a particular resource such as stone or ungulates, etc. These macrosite criteria reflect the likelihood that a valley or even an entire landscape unit would have supported precontact human occupation or use and thus could contain archaeological sites. As discussed in Section 4, the values assigned to these criteria take into consideration such general characteristics as the relative location of the study area in the upper Columbia River drainage as a whole, the geologic history with regard to physiography and relative accessibility of mineral resources, local palaeocology, etc. The intensity of previous investigation and the extent of the present archaeological inventory are also considered so that, where the inventory is adequate, it serves to indicate localities that were apparently more or less intensively occupied by humans and thus the degree to which additional sites are expectable. The macrosite criteria therefore are conceived of as components of the overall ecological synergy that in total gives potential archaeological value to polygons defined at the 1:20,000 scale. The archaeological potential of each polygon is thus a composite of its macrosite criteria. It is derived by totalling the numerical scores for Confidence and Macrosite Variables. The totals are then grouped into two modal classes (high and medium) within the ranked universes.

Microsite variables, on the other hand, determine the placement of polygon boundaries and the sizes of the individual polygons. As such, they are specific to each polygon in relationship to the components of the immediately surrounding landscape, which either has low archaeological potential (and thus is not delineated with polygons at all) or which is delineated by separate polygons because of differences in microenvironmental characteristics such as landform or relationship to water. The archaeological significance of the microsite criteria, therefore, is that they are responsible for the definition of a given polygon relative to its immediate surroundings. These criteria are best conceived of as independent descriptors of each polygon. They do not, however, provide useful information regarding archaeological potential as such, because grasslands, terraces, promontories and saddles or watercourses, lakes and confluences do not have archaeological potential in themselves - their potential relates to the relationships between their settings and precontact human land and resource use patterns (the relationships captured by the macrosite criteria). Therefore, scores for each microsite criterion represent a measure of the contribution each has made to the delineation of a given polygon. This information is provided primarily for future use when a sufficiently large number of polygons has been examined in the field. At such time, the fieldwork results can be utilized as tests of the relative value of these criteria as predictors of archaeological site locations in a given landscape unit and, by extension, of the applicability of the various precontact land and resource use models to the landscape unit in question.

Those areas that have not been mapped as polygons are considered to have ***low archaeological potential***, that is, areas where sites are not likely to be present. It must be emphasized, however, that this ***does not imply the absence of sites and certainly does not imply a lack of heritage significance for those sites that may be present***. Indeed, the very scarcity and isolation of sites can convey upon them a relatively greater significance than for sites in denser zones because they may contain unique information.

7. Recommendations

The assessment of archaeological potential in the present context of GIS mapping and large-scale and spatially extensive field investigations (via impact assessments) can be viewed as a means of incorporating science into resource management. Results of field investigations can be tracked and fed back into the predictive models as represented by the mapped polygons. An ultimate scientific objective would be for multivariate spatial analyses to identify archaeological patterns on the basis of attributes whose predictive capability has been objectively confirmed. The present study can be seen as part of the ongoing progress towards this objective in the Kootenay Region. The geographic distinctiveness of the landscape of LU C20 and the explicitly deductive paradigm within which some of the previous archaeological work has been conducted lend themselves especially well to such an endeavour. The archaeological record of this part of the Northern Rocky Mountains has been interpreted in terms of precontact land and resource use models which are reflected by the palaeogeographic attributes of archaeological deposits. As with the other archaeological potential mapping in the Rocky Mountain Forest District, this study represents an opportunity to put the locally intensive spatial sampling of the mandated archaeological impact assessments to the service of science in the testing of overarching hypotheses, enabling the progress of archaeological research without incurring additional cost. This will only be possible, of course, if such investigations are conducted by adequately trained archaeologists within the context of suitably informed sampling designs that are conceptually linked with the data and models identified in the AOA.

Since the archaeological inventory upon which this study draws does not represent the product of systematic investigation of the entire LU C20, the results must be considered as preliminary and largely hypothetical. Furthermore, the maps are conservative in nature, given the non-renewable nature of the resource. Nevertheless, the assessment is based on considerable background material and experience and it represents a valuable planning tool to facilitate the integration of archaeological site conservation with other types of future land use, especially that related to forest industry activities. Forest development plans identify areas where road and landing construction, harvesting and site preparation are proposed. Since all of these activities involve some degree of ground disturbance, they represent significant threats to the integrity of archaeological sites and features. By comparing proposed forest industry activities as depicted on the development plans with mapped polygons of archaeological potential, it is possible to identify potential resource conflicts that could result in the destruction of non-renewable archaeological resources. Therefore, ***the archaeological potential polygons can be used to identify areas where more detailed investigations via preliminary archaeological field reconnaissance (PFR) or archaeological impact assessments (AIAs) should be undertaken***. The intensity of such investigation will depend upon the extent and location of previous disturbance, and appropriate avoidance or mitigative measures identified if results warrant.

In this context, it must be emphasized that the accuracy of polygon location is limited by the precision of the TRIM map base and also by the degree to which forest canopy closure allows for the delineation of landform boundaries. Therefore, the locations of the polygon boundaries on the maps should not be viewed as exact, and landform context as determined in the field (for example, during reconnaissance, cruising or preparation of silvicultural prescriptions) is desirable as an adjunct to the mapping if avoidance is chosen in the planning stages. With regard to using the archaeological potential maps to determine the need for archaeological impact assessments, the assessment of potential impact should include proximity (e.g. within 50 m) of a polygon to a proposed road or block as opposed to being based solely on direct overlap.

As noted previously, over time, the results of archaeological field investigations can be utilized to formally test and refine the models that serve as the basis for polygon definition. If this process is carried out in its entirety, determining the need for field investigation of a given forest industry activity can be cost-effective and efficient, and the results can be meaningful in furthering our understanding of past human behaviour. An achievable ideal would be the incorporation of the mapped polygons and database into the planning process to the extent that avoidance or appropriate activity is designed at the outset, thus significantly reducing the need for, and expense of, archaeological impact assessments and facilitating the stewardship of significant archaeological values.

A useful mechanism for accomplishing this has been applied in parts of the Rocky Mountain Forest District (c.f. Choquette 2002a-c, 2003 a-c). Although it has been termed "Archaeological Inventory Survey" for the purposes of FRBC/FIA contracts, this process as applied in the RMFD is more appropriately considered to be ground truthing of archaeological potential polygons, As such, it focusses on examination of the lands mapped as polygons from air photos and has a primary intent to confirm, reject or modify them based on field information. This improves the precision of the mapping by overcoming the inherent limitations due to forest canopy closure, landform boundaries not being captured by 20 m TRIM contour intervals, and inaccurate locations of watercourses, roads, etc. which guide the placement of many polygon boundaries in the mapping process.

Of equal importance to the ground truthing is the addition to this process of what has been termed a "management database" which records information about the polygons that has direct bearing on potential land uses with regard to conservation of archaeological values. This management database includes data on the geomorphology and Holocene stratigraphy as well as current land uses and disturbances. These attributes in combination serve to identify constraints and opportunities for development activities on the lands encompassed by the archaeological potential polygons. This would allow for more informed decision-making with regard to such planning considerations as cutblock layout, season and technological system for timber harvesting, and site preparation techniques. In addition to purely archaeological concerns, this type of data also has bearing on terrain stability, flood history and ecological sensitivity. Such information obviously can allow for even more efficient forestry planning in the context of integrated sustainable resource management.

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