ARCHAEOLOGICAL POTENTIAL MAPPING

IN LANDSCAPE UNIT K11

KOOTENAY LAKE FOREST DISTRICT

DRAFT REPORT

prepared for BC Timber Sales

by

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Credits

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Management Summary

The Provincial Forest lands encompassed within Landscape Unit K11 of the Kootenay Lake Forest District were assessed for archaeological potential via stereoscopic aerial photograph analysis. Sixty-three landform-based polygons were identified as having potential to contain significant archaeological sites via criteria derived from precontact land and resource use models developed for the upper Columbia River drainage. Numerical scoring of the criteria resulted in 62 polygons ranking Medium and 1 ranking High.

1. Introduction

This report accompanies the mapping of archaeological potential for Landscape Unit (LU) K11 in the Kootenay Lake Forest District. 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 discussion and evaluation of the results and recommendations for future management. The work was carried out for BC Timber Sales with funding from the Forest Investment Account.

2. Study Area Environmental Background

Landscape Unit K11 encompasses the north end of the Bonnington Range in the southern Selkirk Mountains. The study area is bounded on the east by Cottonwood Creek and the upper Salmo River and includes the valley of Hall Creek, a tributary of the latter. The LU extends westward to include watersheds tributary to the lower Kootenay River, including that of Rover Creek. This terrain was produced by several episodes of mountain building accompanied by the emplacement of granitic intrusions and the warping, fracture and uplift of sedimentary rocks. The bedrock underlying the LU consists primarily of Jurassic granite plutons with associated horneblende, biotite, granodiorite and, some flow lavas and bedded tuff, and minor intercalated and adjacent metamorphosed sedimentary rock.

This area was extensively and repeatedly glaciated during the Pleistocene Epoch of the last few million years. The most extensive advance comprised a coalescent ice sheet that covered all but the highest peaks in the general vicinity. Final deglaciation is suggested to have commenced about 15,000 years ago (Ryder 1981). Higher elevations apparently became ice-free first (Clague 1989), while melting ice blocks lingered at some places in the valley bottoms. Several terraces tributary to the lower Kootenay River appear to be remnants of small deltas graded to the elevation of a ca. 600 m a.m.s.l. stand of Glacial Lake Columbia that predates 10,000 years ago (Choquette 1996). As most of the LU is above this elevation, the implication is that most of it was ice-free prior to that date, and development of the drainage network would have been underway as well. The Salmo River has a relatively wide postglacial floodplain but most of the watercourses in the LU are relatively narrow and flanked by colluvium and alluvial fans. The surrounding terrain comprises moderate to steep glaciated mountainsides.

Most of the LU supports forests classified as ICHdw (Dry Warm Interior Western Hemlock subzone) and ICHmw2 (Columbia - Shuswap Moist Warm Interior Western Hemlock variant) at lower and middle elevations, respectively (Braumandl et al 1992) which, due to the widespread fires around the turn of the century, also contain stands of Douglas fir, birch, lodgepole pine, larch and ponderosa pine. At higher elevations are dense coniferous forests of the Wet Cold Engelmann Spruce – Subalpine Fir subzone (ESSFwc) (ibid.) which grade through krummholz to discontinuous areas of alpine tundra consisting of willows, mountain heathers, sedges, grasses and other herbs.

Low to middle elevation forested habitats in the southern Selkirks support whitetailed deer, elk, moose and grizzly and black bears. High elevation forests provide habitat for caribou, marten and wolverine in addition to summer deer and elk range in subalpine meadows. Caribou utilize mature high elevation forests and parkland ridges while the alpine tundra is habitat for mountain goats, golden eagles and rock ptarmigan. In precontact time, the Kootenay River supported large resident fish populations which included rainbow and bull trout, burbot, whitefish and sturgeon, and anadromous salmon ascended to falls above the Slocan River mouth.

A discussion of the postglacial palaeoecology of the study area requires extrapolation from palaeoenvironments of surrounding areas. The Columbia River drainage was apparently deglaciated relatively early when compared to equivalent latitudes in North America (Choquette 1996). Sheltered from the retreating Continental and Fraser ice domes by mountains, the region would have been under the influence of predominantly dry meridional airflow in late Pleistocene times. Pollen studies have identified a pioneer community of grass, sage, cattails and scattered conifers as the first widespread vegetation in much of the upper Columbia River drainage 12,000 or more years ago. This cold desert "steppe tundra" habitat was forced to higher elevations after about 10,500 years ago, giving way to coniferous forests as a warming climate permitted their invasion of the valley bottoms and mountainsides. Charred plant remains on an early floodplain of the Kootenai River in Montana (Mierendorf 1984) indicate that fire was already part of the regional ecology by 11,730 + 410 years ago, apparently increasing in frequency until the trend to aridity and high solar insolation peaked around 8000 years ago, when Douglas fir savannah grasslands were apparently widespread. Vegetal communities in the upper Columbia basin were relatively simple in composition between 10,000 and 7,000 years ago and were characterized by pronounced altitudinal and latitudinal zonation (Choquette 1987a).

By 6000 years ago, a major climatic change was underway as the Maritime westerlies began to exert a dominating climatic influence. The trend in vegetal configuration became longitudinal, and west-facing windward slopes became cloaked with dense forests. An increasingly varied and diverse vegetational mosaic evolved during a series of increasingly colder cycles within the last 6000 years. A global cooling trend known as the Neoglacial (Porter and Denton 1967) had begun to affect the region, resulting in the regrowth of cirque glaciers at higher elevations. The interval between ca. 6000 and 2500 years ago in the Kootenay drainage was characterized by high fluvial discharge and the region may have supported generally more extensive aquatic ecosystems, including larger resident fish and waterfowl populations as well as more productive riparian communities. Conditions between about 4000 and 2500 years ago were cooler than during subsequent millenia (Baker 1983, Hallet and Walker 1999) and were characterized by generally low forest fire frequency; forests expanded at the expense of grassland throughout the region. The maritime elements of the regional flora such as cedar and hemlock made their first appearances 4000-5000 years (eg. Hazell 1979) and became common after 3000 years ago (Hebda 1995). A second Neoglacial advance between ca. 3500 and 2500 years ago was followed by a globally recognized but relatively brief warm and dry interval ca. 1500-500 years ago, during which forest fire frequency and parkland-grassland habitats increased, while fluvial discharge notably decreased. The final glacial episode, the "Little Ice Age", reached its maximum expression between ca. AD 1630 and AD 1870 when it had become the most severe glacial episode in the upper Columbia drainage since the Pleistocene retreat more than 12,000 years ago.

At the present time, the paucity of palaeofaunal data from the study area limits our knowledge of the evolution of its wildlife populations. The continental conditions of droughtiness and high fire frequency between ca. 9000 and 7000 years ago probably supported greater ungulate populations in the Selkirk Mountains than were known historically, but this is hypothetical at present because of poor bone preservation and the limited amount of systematic archaeological investigatons. Fluctuations in deer, elk and caribou populations in response to climatic variation have been documented in the archaeological and ethnohistoric records further south (e.g. Choquette and Holstine 1982) that were probably reflected in the southern Selkirk Mountains as well. For example, the abundance of deer and elk seem to covary inversely during warm and cold intervals, respectively. Caribou would undoubtedly have been favoured during the colder portions of the climatic cycles. An expansion of the range of whitetail deer north of 50 North Latitude is apparent from reports of Schaeffer's Ktunaxa informants (Schaeffer 1940); this is probably related to European land use practices.

At the time of European contact, anadromous salmon ran up the Salmo River to the vicinity of the southeast corner of the LU and up the lower Kootenay River to where they were blocked by falls near the north boundary of the LU. The presence of landlocked salmon in Kootenay Lake indicates that salmon ran at least that far at some time in the precontact past as well. This resource was of great importance in the aboriginal economy and had a strong influence on human movement and settlement patterns. Regional palaeoenvironmental data has been synthesized into models of Holocene palaeoclimatology and palaeohydrology for the upper Columbia River drainage (Choquette 1985, 1987a) that have been used as a basis for predicting the Columbia's past salmon carrying capacity. The models define a series of climatic cycles during which climatically induced variations in fluvial discharge and sediment load would have affected salmon carrying capacity either positively or negatively. Periods of high fluvial discharge and relative stability from about 4500 to 2500 years ago and again between about 2000 and 500 years ago probably fostered large salmon runs up the Columbia and its tributaries that in turn would have supported large resident human populations and trading centres. At least some of the falls on the lower Kootenay River were probably presenting barriers to migration of salmon into Kootenay Lake by this time.

3. Archaeology

3.1 Previous Investigations

Eleven precontact sites on alluvial terraces and structural benches, including both open camps and sites with cultural depressions, were recorded by Diana French in a 1972 judgemental survey of the lower Kootenay River (French 1973). Additional sites have been added to the lower Kootenay River inventory by a number of small-scale judgemental surveys over the years (e.g. Choquette 1972, Turnbull 1977, Wilson 1989) and results of test excavations opposite the northwest end of the LU were incorporated into Turnbull's PhD dissertation (Turnbull 1977).

The only other archaeological work in the study area vicinity has been in response to proposed forestry developments, primarily Archaeological Impact Assessments by Kutenai West Heritage Consultants (e.g. 1998 - 2002) which have not resulted in the recording of any precontact archaeological sites in LU K11. Parts of LU K11 were included with the operating areas of several forest licencees for whom KWHC developed an archaeological predictive model (KWHC 2002). The KWHC model was reviewed as part of an upgrade of archaeological potential mapping in LUs K09 - K11 (Choquette 2008).

3.2 Culture History

The archaeological record of this part of the upper Columbia region was initially subdivided into four phases based primarily on diagnostic artifacts (Turnbull 1977 and Eldridge 1984 based on Mohs 1981). Emphasizing cultural depressions and certain other feature types, these were subsequently subsumed into a sequence of four "adaptive patterns" (Forager [6200 - 4200 BP] and Collector I, II and III [3799 - 2000, 1999 - 600 and 599 - 100 BP, respectively]) (Goodale et al 2004). An alternative approach places greater focus on stratigraphically and/or geomorphologically controlled assemblages equally weighted to all types of archaeological remains, emphasizing their palaeoenvironmental contexts. At Kettle Falls, a series of archaeological cultural-temporal periods was identified (Chance and Chance 1977-1985, Chance, Chance and Fagan 1977) while in the Canadian portion of the region, a series of archaeological complexes has been defined which are broader constellations of attributes explicitly related to patterns of precontact human land and resource use that covary over time and space (Choquette 1984, 1987b, 1993 and 1996). These traits include settlement pattern, lithic preference, feature types, subsistence base, artifact function and palaeoenvironmental context as extrapolated from the landform, palaeohydrological and soil/sediment associations of the cultural deposits. This approach facilitates construction of the hypothetical culture-historical framework that follows, which is testable and refinable by ongoing scientific archaeological investigation.

Within this framework, the archaeological record of the upper Columbia River drainage area includes evidence of two early postglacial archaeological complexes that appear to reflect discrete cultures. The earliest cultural components identified at present have been found on terraces, beaches, dunes and glaciofluvial bars associated with the drained basins of proglacial lakes. Numerous prominent terraces at 595 m (1950 ft) a.m.s.l. are present in the northern part of the Columbia River drainage which correlate with a stand of Glacial Lake Columbia, dammed at the Grand Coulee by the Okanagan ice lobe. Radiocarbon dating indicates that this lake had drained well before 10,000 radiocarbon years ago and was followed by a series of successively lowering terminal Pleistocene lakes. This lacustrine setting is common to early archaeological remains predating 10,000 years ago in immediately adjacent parts of northwestern North America (e.g. Ames et al 1980, Fedje et al 1995). These archaeological components demonstrate significant similarities to an archaeological trait constellation within the upper Columbia basin in addition to their early landform and sediment associations. These include assemblages dominated by microcrystalline stone such as siliceous metasiltite, quartzite and tourmalinite, quarried outcrop sources of which have been documented in the southern Purcell and central Selkirk mountains, and a technology based primarily on the production by percussion of large expanding flake blanks from large bifacial cores, edges of which were prepared by grinding. Large discoidal unifaces, large side scrapers, large stemmed weakly shouldered and lanceolate spearpoints and a variety of large marginally retouched flakes are typical tools. The name for the best defined representative of this archaeological trait complex in the upper Columbia, the Goatfell Complex, derives from the predominance of tourmalinite and tourmaline chert from Goatfell Quarry in the southern Purcell Mountains. Evidence of the biface core technology and large stemmed spearpoints of tourmalinite, Kootenay Argillite and quartzite have been found in upland and high terrace contexts in many areas surrounding LU K11. This indicates that humans were inhabiting the southern and central Columbia Mountains in early postglacial time, perhaps hunting in the steppe-tundra ecosystem in summer and wintering beside the huge early postglacial lakes. Initial occupation by Goatfell Complex people appears to have coincided with the northward shift in the mountain-steppe-lakeshore ecosystem out of what is now the Great Basin as the pluvial lakes there dried up at the end of the Pleistocene. At the present time, the Goatfell Complex is postulated to date between about 11,000 and 8000 years ago.

Cultural deposits of the second early archaeological manifestation have been found at Kettle Falls in cobble gravels, near Castlegar on a fluvial sand bar on a high terrace more than 120 m above the present confluence of the Kootenay and Columbia rivers, and in the basal deposits at the uppermost falls on the lower Kootenay River. The settings of these sites indicate that this culture had a riverine focus and suggest that the Columbia River was still actively downcutting through the glaciolacustrine valley fill during this time period, named Shonitkwu and dated 9800 - 8800 years ago. The use of rhyolite and coloured argillites as tool stock and certain distinctive Shonitkwu artifacts such as microblades radically differentiate Shonitkwu assemblages from Goatfell Complex implements and indicate the presence of a separate cultural group. The time slope on dated microblade assemblages indicates that this group arrived in the region from the north. The end of the Shonitkwu Period about 8800 years ago coincides with a marked decline in occupation at Kettle Falls which was followed by a virtual hiatus around 7500 before present. Coupled with evidence of aeolian deposition in a previously alluvial setting, this suggests a failure in the anadromous fish runs that may have been caused by the effects of the Hypsithermal drought.

In general, the lack of intensive archaeological investigation limits what can be inferred with regard to the middle Holocene human history of this part of the Columbia River drainage. Artifacts from collections in the Arrow Lakes and lower Kootenay River suggest that humans may have been present in the region between the end of Goatfell and Shonitkwu occupation and the beginning of the succeeding well documented Ksunku Period and Deer Park Phase (see below), but little is known of their activities. The focus of survey and excavation on pithouses may also be responsible for the dearth of documented evidence between about 8000 and 4000 years ago, as occupation may have been in open camps whose deposits were not extensively sampled. Such a settlement pattern is implied in Goodale et al's (2004) "Forager" adaptive pattern.

That the Columbia River's salmon runs had reached significant proportions is indicated by intensive re-utilization of the Kettle Falls fishery between about 4300 and 3400 years ago This archaeological manifestation was named Ksunku and is considered to have been a distinct culture as compared to the Shonitkwu. Although the ethnographic record indicates that Kettle Falls was the second most important aboriginal fishery in the entire Columbia drainage, Ksunku period occupations there were followed by a second occupational hiatus. This hiatus, and the period of relatively low use that followed it, coincide in time with the Deer Park Phase of the Arrow Lakes and lower Kootenay River (Turnbull 1977). The abundance and character of the Deer Park Phase archaeological evidence (especially the pithouses) indicate high human population density along the Columbia River and its tributaries north of Kettle Falls during the time period between about 3500 and 2500 years ago. This suggests that failure of the salmon runs was not responsible for the abandonment of Kettle Falls as a fishery during this period. Instead, it is postulated that high fluvial discharge was responsible for the upriver shift in the focus of the salmon fishery, both because the water volumes at Kettle Falls may have made the contemporary fishing technology unusable there and also because it contributed to larger salmon runs in the upper portions of the Columbia River drainage (Choquette 1985).

Following the period of high population density in the Canadian portion of the Selkirk Trench represented by the Deer Park Phase, significant changes again occurred in the human settlement pattern. Sites yielding evidence of occupation dating within the last two thousand years are less common in the Arrow Lakes and lower Kootenay River localities. During this same time period, the intensity of human use of the Kettle Falls fishery reached unprecedented proportions, and the lower falls there became the major fishery for the first time. Ecological factors relating to palaeohydrology and salmon carrying capacity again seem to have played a major role in influencing human settlement dynamics in this portion of the upper Columbia River drainage, reflected by somewhat of a southerly shift in the focus of human inhabitation in the Selkirk Trench. Interestingly, there is a similar downriver shift in occupational focus on the Thompson River over the same time span, there subsumed by the Shuswap, Thompson and Kamloops phases (Richards and Rousseau 1987). During subsequent millenia, human population appears to have begun increasing again, a trend which continued almost to the contact era. Although Turnbull found so little evidence of human occupation within the last 2000 years that he was not able to define a phase equivalent to the preceding Deer Park Phase, some sites dating to this time period are known in the Slocan, lower Kootenay and Pend d'Oreille valleys. Evidence of immediately pre-epidemic population decline may reflect the impact of the Little Ice Age of the last 400 years. The southward shift in the focus of the Sinixt, a group of Salish speakers who previously inhabited the Slocan and Arrow Lakes vicinities, took place during this period. The ethnohistory of the Sinixt has been extensively documented by Bouchard and Kennedy (1985, 2000) while the major ethnographic works on the Ktunaxa are Schaeffer (1940) and Turney-High (1941); Smith (1984) has compiled a recent synthesis.

Analysis of radiocarbon dates that accompany the presentation of the sequence proposed by Goodale et al (2004) provides a significant level of support for the model outlined above, especially when the early dates on large pithouses at the Slocan Narrows site are considered. Interestingly, Goodale et al identify the final centuries of the precontact era as a period of relative settlement disaggregation. However, from the perspective of upper Columbia palaeohydrology and salmon carrying capacity, this process may have actually begun earlier, after the downriver shift in focus of the major salmon fishery to Kettle Falls due to the effect of lower fluvial discharge on overall salmon populations as well as on their ability to ascend major falls and rapids blocking major tributaries. The increased focus on root resources may be a consequence of this reduction in the fishery (and furthermore, could even be a product of the different climatic conditions of the late Neoglacial). This hypothesis stands in contrast to the linear increase in resource intensification implied by Goodale et al.

4. **Study Methodology**

The predictive modelling approach employed in the present study is an extension of a scientific archaeological research design that has evolved specifically from archaeological investigation conducted within the upper Columbia River drainage area. As such, it employs an expert systems approach to development of hypothetical models of precontact human land and resource use and their testing via a deductive methodology. As noted in Section 3.1 above, parts of this LU have previously been mapped for archaeological potential by KWHC (2000). A comparison of the effectiveness of the KWHC product with that of the air photo / precontact land and resource use – based approach to predictive modelling as applied to K11 (and more than 132 others in the region) is included in Choquette (2008) and will not be repeated here. It will suffice instead to state that serious conceptual, methodological and technical problems with the inductive KWHC mapping prohibit improvement of its precision, rendering it both unreliable and unsuitable as an adjunct to the product obtained via the approach employed herein. It was thus necessary to analyze and remap the entirety of LU K11 as part of the present project, so the KWHC polygons should be deleted from the LU K11 AOA layers.

That being said, the present study comprises an assessment of the archaeological potential of Provincial Forest lands in Landscape Unit K11. The assessment takes the form of polygons drafted onto 1:20,000 scale TRIM contour maps, accompanied by a database 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. The individual polygons consist of landforms or landscapes identified via stereoscopic analysis of aerial photos. The criteria for polygon definition were derived from the geological and palaeoenvironmental background information summarized in Section 2 above. The criteria are linked with the prediction of potential occurrance of archaeological sites through the traits used to define the archaeological complexes and models discussed in Section 3.2, especially settlement pattern, lithic preference, subsistence base and palaeoenvironmental context as extrapolated from the soil and sediment associations of the cultural deposits. The archaeological complexes themselves are essentially models of past human land and resource use that have been synthesized from the existing heritage record and which are then applied to the terrain units defined from the air photo analysis. The result is a set of GIS compatible polygons that reflect the potential of various parts of the LUs to contain archaeological sites.

The criteria by which the polygons are assessed represent a bridge between the terrain units and the human land and resource use models. To achieve objectivity in defining the archaeological potential of the polygons and to promote broader understanding of the process amongst resource managers, 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 assessment or definition.

Each criterion is described below with specific reference to the biogeography and archaeology of LU K11. 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 as 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.

The limited extent of systematic archaeological investigation in the study area severely limits knowledge of the intensity of human habitation. The falls on the lower Kootenay River were developed for hydroelectric power before any archaeological work was done but the eroded shorelines have seen considerable attention from artifact collectors. The great abundance of artifacts in the local collections indicate that the lower Kootenay River valley including the West Arm of Kootenay Lake was very heavily utilized in precontact time. The falls and high terrace settings have been previously identified as loci for archaeological remains; at lower elevations, the beaches and river terraces form essentially one huge, continuous precontact archaeological site from Kootenay Lake to the mouth of the Kootenay River at Castlegar. However, the very limited amount of archaeological investigation in LU K11 has not resulted in the recording of any precontact archaeological sites within the LU itself.

A score of 3 for this criterion represents the presence of one or more known archaeological sites while a score of 2 is assigned to polygons in areas adjacent to known sites. A score of 1 reflects the location of a polygon between, but at some distance from, areas of known site occurrance. A score of 0 indicates a lack of known sites in a locality, but the very limited site inventory must always be kept in mind.

4.1.2 Corridor

The physiography of a region exerts a major influence on the movements of both animals and humans. The east-west corridor represented by the West Arm of Kootenay Lake and the lower Kootenay River was obviously the major precontact travel corridor, both on foot and by canoe. A second travel corridor connecting it with the upper Salmo River was extensively used during the post-contact era, but the time depth of pedestrian human use is not yet known. No precontact sites have been recorded in the corridor north of Salmo, however.

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. Twenty-three discrete sources of flakable stone have been identified in the upper Kootenay – Columbia over the past 30 years and the approximate locations of at least three 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 Ktunaxa territory. 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.

The southern Selkirk Mountains are composed primarily of granitic plutonic rock, with flanking zones of moderately to highly metamorphosed sedimentary rock. Where this metasedimentary stone is sufficiently siliceous, it could have served as tool stock in the precontact flaked stone industry. However, there are no known sources within the LU and, while some of the argillite and slate may have been workable, the occurrence of outcrops of suitable stone is not predictable at the present scale of geological mapping.

4.1.4 Ungulate Range

The study area is typical of much of the West Kootenay area in that its rugged mountainous topography and high precipitation values, particularly snowfall, do not favour large populations of ungulates, especially grazers. The palaeoenvironmental record indicates that ungulate range would have been significantly higher under conditions of more frequent wildfire such as prevailed ca. 9000 - 7000 and 2000 - 500 years ago.

Scoring for this criterion reflects the generally moderate quality of the ungulate range from a regional perspective, as extrapolated from present values and palaeoenvironmental reconstructions: the highest score is 2 out of 3.

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. In northerly latitudes, human habitation sites, especially late fall, winter and early spring 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 score accruing to south-facing landforms situated on or at the base of south-facing concave mountainsides.

4.2 Microsite Criteria

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

4.2.1 Terrace/Fan

Elevated terraces 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 the margins where vegetation tends to be more open.

4.2.2 Promontory

Bedrock prominences and ridges facilitated precontact movements across the landscape and many 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 that exists at a height of land that could have been used as a pass. Such areas typically contain archaeological deposits because they were used as temporary rest areas and overnight campsites.

4.2.4 Standing Water

Lakes and ponds attract wildlife and thus could have hunting grounds associated with them; those containing fish would have been obviously attractive for that reason. Lakeshores are also good camping areas, especially the north and east sides of smaller lakes and those parts of the Kootenay Lake shoreline that are sheltered from storms. When combined with scoring for relict watercourse, this criterion pertains to the previous existence of a water body, including proglacial lakes.

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, leaving discontinuous high terraces related to previous hydrological baselines. Although now considerably removed from water, landforms graded to previous watercourses or bodies of standing water are potential locations of early archaeological sites. The small number of sites recorded on the high terraces above the Kootenay River and the lower reaches of its tributaries is not indicative of the true potential of these landforms, given the very limited amount of archaeological investigation.

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.

4.2.8 Watercourse Node

This refers to specific portions of watercourses that could have served to attract and/or focus human activity. Examples of watercourse nodes include: nickpoints and rapids that could have served as fords); large eddies, pools and waterfalls which were good fishing locations; and springs. Some of these natural features can have sacred associations.

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. 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

Analysis of aerial photographs and background information of Landscape Unit K11 has resulted in the mapping of a total of 63 landform-based polygons where there is some likelihood that significant archaeological deposits and/or features are present (see maps and databases).

6. Evaluation and Discussion

As employed in this study, archaeological potential represents a relative measure of the likelihood of encountering precontact heritage 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. Within the resource management context, erring on the side of caution is a necessary element in 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 amount of previous research, including palaeoecology, is also a limitation of the capability and accuracy of predicting archaeological potential. It is fortunate that the direction of much of the archaeological research in the upper Columbia River drainage has been conducted within an explicit palaeoecological paradigm, as this 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 produces 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.

The level and nature of spatial sampling that has taken place previously in a landscape unit is also 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 negative and positive data (i.e. absence vs. presence 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 may have been expected) must be considered as well as locations where sites are actually present.

Given the above, 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. As such, 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 should be seen as part of the ongoing progress towards this objective in what was the Nelson Forest Region when this mapping was begun in 1993.

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, relationship to a particular resource such as stone or ungulates, solar aspect, etc. These macrosite criteria reflect the likelihood that an entire 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 intensity of previous investigation and the extent of the present archaeological inventory, 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. As such, the macrosite criteria 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. Sixty-one polygons are assessed as Medium archaeological potential and 1 is assessed as High.

Microsite variables, on the other hand, have determined 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 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. However, the microsite scores for the polygons do not provide useful information regarding archaeological potential as such, because terraces, promontories and saddles or watercourses, lakes and confluences do not have archaeological potential in themselves - their potential relates to the relationship between their settings and the precontact human land and resource use models. The 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 so that the results of such fieldwork 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.

Although they are grounded in a considerable depth of background research and experience, the scores placed on the macrosite criteria used in this study are still somewhat subjective and thus the ranks as sums of these scores are also subjective to some degree. It is to be hoped that this subjectivity will be steadily reduced as results of field investigations guided by the maps are factored back into the process. It must be noted that these field investigations should not be conducted in isolation from the information base that produced the polygons and those conducting the fieldwork must have adequate expertise to accurately record the requisite data. especially that pertaining to geomorphology and soils.

Since the archaeological inventory upon which this study draws does not represent the product of systematic investigation, the results thus 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 planning identifies 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 the locations of proposed forest industry activities 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. These areas of overlap represent potential conflicts which should be examined in the field via archaeological impact assessments and appropriate avoidance or mitigative measures identified if results warrant. Over time, the results of archaeological field investigations can be utilized to formally test and refine the models that served as the basis for polygon definition.

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 layout) 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 be based on proximity (e.g. within 50 m) of a polygon to a proposed road, landing or block as opposed to direct overlap.

Finally, a bias in this study must be noted here, that pertaining to prediction of archaeological potential related to use of plant resources. In part, this bias derives from the realities of past human subsistence practices in this region, where a huge diversity of economic plants occurs and harvesting was a constant activity during the growing season, carried out primarily in a dispersed fashion. The exception to this would be certain root crops (camas and bitterroot) which were the subject of focused extraction and processing by dedicated task groups, sometimes composed of many individuals. Culturally modified trees are an example of specific plant resource exploitation that could leave physical evidence but the fire and logging histories of much of the Kootenay River drainage area are such that trees of sufficient antiquity are rare. It can be stated generally that old growth stands have potential to include culturally modified trees and they should be identified prior to any proposed forestry actions. Otherwise, the great array of vegetal resources and their variability across time and space are such that It is not feasible to accurately predict specific patterning of archaeological remains related to plant use. A second component of the limitation in predicting archaeological potential based on plant exploitation lies in the nature of the archaeological record itself: the very large majority of implements and facilities related to this resource were of perishable organic materials which do not survive in the soils of this region to become part of the archaeological record. Nevertheless, criteria for predicting the specific locations of habitation sites would not be expected to differ greatly whether occupied in relation to exploitation of minerals, plants or animals, so these types of sites where more tangible remains typically occur are captured by the mapping. Furthermore, the existing ethnographic and archaeological records indicate that stone, ungulates and fish were the most significant determinants of the geographic orientation and timing of the seasonal subsistence round in this region. Given these considerations, it is not believed that this relative inability to delineate specific foci for exploitation of plants represents a serious bias in the predictive modelling employed in this study. That being said, the possibility of culturally modified trees must be borne in mind during any archaeological impact assessments in areas where the forest is of sufficient age.

7. Recommendations

A map of archaeological potential for Landscape Unit K11 has been developed on the basis of biogeographic criteria, precontact human land/resource use models and stereoscopic air photo analysis. Areas delineated by polygons have potential to contain pre-1846 archaeological deposits or features. As such, ***these 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.

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