PREDICTIVE MODELLING AND THE EXISTING ARCHAEOLOGICAL INVENTORY IN BRITISH COLUMBIA

Non-permit report prepared for

Archaeology Task Group of
Geology, Soils, and Archaeology Task Force
Resources Inventory Committee

By

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PREAMBLE

The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments. First Nations peoples are represented in the Committee. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report The Future of Our Forests.

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For additional copies, and/or further information about the Resources Inventory Committee and its various Task Forces, please contact:

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MANAGEMENT SUMMARY

The present study addresses concerns which have originated in the Resources Inventory Committee (RIC), an initiative undertaken by Provincial and Federal Governments to integrate program design and set standards for resource inventory. This study was done under the Earth Sciences Task Force, one of six task forces. The Earth Sciences Task Force has four Task Groups, including Landslide/Slope Stability; Seismic; Aquifer/Hydrogeology; and Archaeology.

A previous study has discussed the state of the existing inventory in British Columbia (Eldridge and Moon 1992). The present study examines the quality and coverage of archaeological surveys in British Columbia and the feasibility of incorporating the existing data into predictive models; identifies areas requiring additional survey; discusses appropriate scales, sampling strategies, and environmental parameters for potential mapping (predictive modelling); determines a preferred methodology for inventory; and selects an area and techniques for testing the preferred methodology.

Overview studies are found to be lacking in specific statements which enable potential mapping. Several recent overviews, two of which included potential maps, are examined in detail. Maps at 1:250,000 scale from one report are found to be useful for regional planning but lacking the precision necessary for archaeological resource management.

All twenty one probabilistic surveys conducted in British Columbia are examined in detail. Summary tables of their methods and results are presented. These reports are found to be mostly of high quality and useful for predictive modeling.

A large selection of intensive non-probabilistic surveys was also examined. Methods and results are tabulated and mapped together with those of probabilistic surveys. Many of these reports were found to have some Utility for predictive modelling.

Areas requiring additional survey are discussed. Large parts of the province have never been surveyed or survey has been so limited that the inventory is not useful for management or modelling. Survey methods and reporting standards are discussed. A major recommendation is that survey study areas be mapped on the same base as used for the B.C. Archaeological Site Inventory, whether maintained on a Geographic Information System (GIS) or on hardcopy maps.

It is conservatively estimated that 16,000 prehistoric archaeological sites occur along the coastline of the province of which about 5,000 have been recorded. In the interior of the province, probably at least 70,000 archaeological sites exist, of which only 9,000 are recorded. The numbers for the interior could be underestimated by an order of magnitude.

A recommendation is made to conduct two predictive modelling experiments. These would test appropriate methods for producing potential maps to cover unsurveyed areas. One is recommended for the southern Strait of Georgia, where a good archaeological inventory is already available in a GIS along with over 50 environmental and land use inventories. The second test is recommended for the Dean River Valley in the Chilcotin region. Environmental resource folio maps have been generated for this area, including a 1:50,000 archaeological potential map derived from probabilistic data. It is recommended that the most powerful GIS predictive modelling tool, logistic regression analysis, be tested against the judgemental method, which appears to outperform the GIS modelling. Field truthing would be an important component of both experiments.

CREDITS

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INTRODUCTION

The present study addresses concerns which have originated in the Resources Inventory Committee (RIC), an initiative undertaken by Provincial and Federal Governments to integrate program design and set standards for resource inventory. This study was done under the Earth Sciences Task Force, one of six task forces. The Earth Sciences Task Force has four Task Groups, including Landslide/slope stability; Seismic; Aquifer/Hydrogeology; and Archaeology.

A previous study has discussed the state of the existing inventory in British Columbia (Eldridge and Moon 1992). The present study examines the quality and coverage of archaeological surveys in British Columbia; the feasibility of incorporating existing data into predictive models; identifies areas requiring additional survey; discusses appropriate scales, sampling strategies, and environmental parameters for potential mapping (predictive modelling); determines a preferred methodology for inventory; and selects an area and techniques for testing the preferred methodology.

OVERVIEW ASSESSMENTS

A sample of recent Overview Assessments were examined but it was found that generally they do not present data in a manner Usefu1 for direct application to predictive modelling/potential mapping. Most were development specific and make statements which are confined to small proportions of a region. The single most important use of overviews appears to be that they usually provide a summary of regional or local archaeology and ethnography. Very few studies follow through with a map incorporating identified potential areas on the landscape.

Two exceptions found were both linear overviews which combine potential mapping with sensitivity and significance indices to evaluate alternate routes for linear developments (Eldridge 1982; Stryd, Bouchard and Kennedy 1990) Both models appeared to have predictive value, although neither has been followed up by full-scale impact assessment and ground truthing. A similar method, but using GIS, was implemented to select preferred powerline routes in the U.S. Southwest (Moreno 1991:30). A more common method for linear surveys is to determine judgementally the potential from ethnography, prior experience, and with the aid of a helicopter over-flight.

Given their deficiencies, a detailed examination of overview assessments was not undertaken. Three recent large scale overviews consulted by this study all encountered serious limitations to their abilities to provide potential mapping. There follows a brief discussion of three recent overviews of very large areas to illustrate their general utility for potential mapping or model building.

Bussey and Alexander (1992) have recently completed a preliminary overview of the Cariboo Forest Region, an area which encompasses many of the best probabilistic surveys and freshwater shoreline surveys conducted in the province. Their report succeeds in integrating archaeological, ethnographic, and environmental data to produce a simple but apparently effective predictive model. Their report includes maps of areas with archaeological sensitivity or potential. The potential criteria are based on environmental units defined in accordance with traditional Native values. They note that this approach is applicable only within the last 4500 years of relatively unchanged environment. They avoided plotting known sites in order to "prevent biased interpretation of unsurveyed areas." (Ibid: 1).

They mapped only two potential classes, "with potential" and "without potential". In addition, each environmental unit has a written evaluation of relative potential. Potential maps are provided on a 1:250,000 map base in accordance with CORE requirements. The authors note that use of 1:250,000 scale maps resulted in "poorer definition of archaeological potential zones than is possible at the more commonly used 1:50,000 (or less) scale." (Ibid:12), and that "Future investigations should involve the use of 1:50,000 topographic maps and/or aerial photographs for interpretation." (Ibid: 134).

Bussey and Alexander's product, although coarse grained due to the scale, does have utility for regional planning. Approximately 75% of the area has been excluded from archaeological "potential". Bussey and Alexander tested the map by overlaying all 2155 known site locations. Only two small sites fell within the "without" potential class. Despite the apparent accuracy, there is some concern that the low potential rating is based on surveys which did not use subsurface testing in forested environments (see our discussion of probabilistic survey results below) because much of the "without" potential is forested. Nevertheless, if all areas which have mapped potential are submitted for review by Archaeology Branch officials then very positive benefits will accrue from the mapping exercise.

Another recent overview for CORE encompasses Vancouver Island (Wilson et al 1992). Vancouver Island has a large number of well documented systematic surveys and most of the probabilistic culturally modified tree (CMT) studies in the Province. However, the interior of the island further than a few hundred metres from the coast is virtually unknown archaeologically.

"Predictive modelling" of site potential is confined solely to mapping an indicator of density of sites along the shoreline, high "potential" being greater than 1 site/km of shoreline, low "potential" less than 1 site. Some known ethnographic resource exploitation areas and trails are plotted on the map.

> Because the present map is archaeological, only ethnographic information which would suggest the possible presence of physical remains was used for mapping purposes (Ibid:47)

hence excluding sites of mythological significance and other similar sensitive areas.

> Areas comparable in topography were deleted from potential if no reference to their use could be found. This was done simply because no archaeological evidence to confirm potential areas is known (Ibid:47).

The authors also find that the 1:250,000 and even 1:50,000 scale maps are

> far from perfect in terms of predicting the location of sites and sometimes even the general density of archaeological resources (Ibid:47).

This report contains no apparent attempt to analyze or integrate existing archaeological and ethnographic data in such a way as to generate variables useful for modelling site location. Environmental variables do not appear to have been incorporated into the map.

An overview of heritage resources for the Kalum South Resource Management area was conducted by Mackie and Eldridge (1992b). This area is poorly known archaeologically, with only a few high-quality riverbank corridor surveys. In addition, published ethnographic sources provide little hard data regarding settlement pattern or resource use. This study also fails to integrate ethnographic, historic and archaeological data to generate statements or maps of heritage potential. As with Bussey and Alexander, Mackie and Eldridge were constrained by concerns expressed regarding the use of data pertaining to Native peoples (Ibid:76-81, Appendix 1). A considerable body of information was collected concerning previously unrecorded heritage places, and these reinforce the general impression of insufficient data to allow potential mapping. Although no overall potential mapping was attempted, the potential statements of previous researchers were extracted and organised on a watershed management unit basis. The authors recommend that "Potential mapping should be supported by ground truth probabilistic sampling, and utilize an operational GIS." (Ibid: 90).

SURVEYS

The present study concentrates on locating and compiling data from the two types of inventory survey which provide useful data for management purposes: probabilistic sample surveys and "complete" intensive/systematic surveys. These survey types provide a reliable indicator of where sites are not located - a data type critical to both predictive modelling and informed land management. This data was almost always missing from the large, regional inventory surveys of the 1970's, when over half the current inventory was recorded (Eldridge and Moon 1992:2-3). Of the two groups, the probabilistic surveys are the most useful from a modelling perspective, as these normally included low potential areas in their survey. The systematic surveys are generally confined to narrow shoreline margins along coastlines or rivers, and their results cannot be extrapolated inland; however, they can be extrapolated to similar shorelines elsewhere. Eldridge and Moon (1992:10) found that of most existing surveys:

> Few gave detailed accounts [of survey methodologies] and, in many cases, it was very difficult to determine exactly how survey was accomplished, let alone any overall research design. This tends to be particularly true of older reports. Another endemic problem is the lack of information on areas which were surveyed but lacked sites altogether.

Research Methods

In order to find the examples of systematic or probabilistic surveys the Annotated Bibliography (Archaeology Branch, 1992) published on diskette was searched for key words with a word processor. These words included "potentia"[1], "systema"[tic], "predicti"[ctive], "random", "probabi"llistic], "probaba"pistic (sic)], "quadrat", "transect", "intensi"[sive], and "shoreline". Any reports which included these words in their annotations were found by this method. After the search was completed, searches were made for the names of specific authors whose work had looked particularly useful during the key word search. A few author's names were searched whose work was known to ;be potentially useful but which had not shown up in key word searches.

When a suitable report was found it was appended to a new file containing all the desired reports. Numerous duplications resulting from the Annotated Bibliography's repetitions in different map zones were removed. This resulted in a short list of more than 290 titles. These reports were examined and unsuitable candidates eliminated. A subset of explicitly random or probabilistic reports was then generated and eventually was combined with selected intensive/systematic surveys. A number was assigned to a project or major part of a project and this REF number was applied to all relevant reports on the list and all tables and figures as well as in the text below. The order of the numbers reflects only the order in which projects were processed. The resulting list is attached as Appendix 1 which also includes a few additional sources found during research. This research method does not pretend-to produce an exhaustive coverage, but it was felt to the majority of available B.C. literature, including the "grey literature".

The entire process was made unnecessarily difficult due to the manner of data entry in the Annotated Bibliography. Particularly disabling are irregular formatting, spelling errors, and the frequent substitution of lower case alphabetic "l"'s for numeric "l"'s (which precludes searches for permit and map unit numbers or sorting by date!. Ordinarily, such information would be better entered in a database with error checking capabilities and then reported to a text file for publication or left as a database file for those with the capability to use it. An effective database design could reduce the size of the 1 MByte file by 90% or more. The reports on the final list were examined in detail. Information about survey methodology, sampling methods, and results were obtained. Differences between the studies in methods of defining study areas, defining sites, and in providing data on methods and results led to a considerable amount of interpretation and reanalysis. Some site types were excluded from calculations since there were such wide variations on how (or even if) these sites were included in the original studies. The principal two exclusions were for historic sites and culturally modified tree sites. Many shoreline lengths had to be determined with a map wheel, often from the less than ideal report maps. Some statistics were recalculated or checked by other means. A few report figures concerning site numbers and locations were checked against 1:50,000 maps in the B.C. Archaeological Inventory and even against original site maps. The data were entered into a spreadsheet, which calculated various statistics concerning sampling fractions, site densities, and so on. The spreadsheets are presented as Tables 1 and 2, located at the end of the main report.

Probabilistic Surveys

Twenty-one probabilistic surveys have occurred in British Columbia, not including specialized surveys for culturally modified trees. The twenty-one surveys have all occurred in the British Columbia interior, but are spread over much of this part of the province. The greatest number have been conducted in the Chilcotin region, west of the Fraser River (Figure 1). In the following discussion, standard references are supplemented by the reference code number used in the tables and map. Appendix 1 contains more details on these REF's and provides the identifying numbers not found in the references cited section.

The quality of probabilistic surveys is, with a few exceptions, good. Almost all have some weaknesses in terms of their data presentation or utility for predictive modelling. Many are confined to certain geographic zones. As an example, many of the probabilistic surveys were conducted for B.C. Hydro in areas of proposed hydroelectric developments. These projects almost always were confined to pondage areas within valley bottoms. In two cases in northern British Columbia, the valley bottoms were rated as having much lower potential than the nearby subalpine and alpine biogeoclimatic zones-(e.g., Apland 1980b, 1993 personal communication, REF 3; Mitchell and Eldridge 1981, REF 16). Some studies dealt only with specific site types, such as cultural depressions (Blacklaws 1978).

Many projects did not use subsurface testing. These projects, while providing relatively reliable data for open grassland communities, all show a much lower site density for the higher elevation forested zones (e.g., Eldridge 1975, REF 12; Matson and Ham 1974, Ham 1975, REF 14; Matson, Matson and Ludowitz 1979, Matson et al 1980, Magne and Matson 1984, REF 13; Beirne and Pokotylo 1979, Pokotylo 1976, 1979, REF 7; Pokotylo 1975, REF 17). Each of the projects recognised that the forested zone data were not comparable to the grassland data, but none rectified the situation by subsurface testing. Projects where subsurface testing played a large role in the survey strategy (e.g., Eldridge and Eldridge 1979 REF 10; Spurling 1979, 1980, Alexander 1982, 1983, REF 2; Mitchell and Eldridge 1981, REF 16) did not occur in the bunchgrass/Cariboo aspen biogeoclimatic zones. The Peace River project provides figures for the number of sites found purely by shovel testing. In total "54 undisturbed sites with no surface indications were located using this technique" (Spurling 1980:140). If one adjusts the overall Peace River figures to remove these 54 sites then the total sites found drops from 112 to 58, the sites per square kilometre falls from 5.05 to 3.54, and the predicted number of sites drops from 763 to 533. The effect would be even greater if it were possible to apply these figures just to forested strata. A detailed analysis of the biases introduced without subsurface testing is given in Alexander (1983).

A similar bias affects the best reported example of a probabilistic survey of the alpine/subalpine zones. Alexander and Matson (Alexander and Matson 1986, Alexander et al 1985, REF 1) note that site density is very low in the Alpine zone, but that: (1) sites resulting from brief encampments would not be expected in the areas of bare gravels and rocks where visibility is good; and, (2) sites occurring in the lush meadows and small groves of trees would not be found due to vegetation cover, in the absence of subsurface testing. Most of Alexander's sites in the very high density subalpine zone were cultural depression features, which can be easily identified without subsurface testing. This suggests that the extreme differences in site density between the alpine and subalpine zones may be overstated, and that many more sites could occur in the more sheltered parts of the alpine.

Survey in the Lytton to Botanie Lake area found a high site density in the sub-alpine, but little of the alpine was surveyed due to logistical considerations (Baker 1974, Table 1 this report, REF 4). Judgemental surveys in alpine and subalpine zones have confirmed Alexander's assessment of the relative site density differences (Alexander 1992, no REF). Other alpine studies have found extraordinary densities of archaeological deposits in areas of alpine lithic quarries (e.g. Fladmark 1985; Apland 1977; Choquette and Pickard 1989:133-137). For instance, Fladmark notes that in the Central Plateau region of Mount Edziza

> every non-vertical area not covered by snow seems to possess some scatter of obsidian. For instance, obsidian flakes were observed essentially continuously in the course of a 4-S km walk across the Central Plateau (1985:48). [recorded sites] are part of a continuous scatter of obsidian items that rarely diminishes to a density of less than 1 piece per 4 m2 over the entire observed area of the Central Plateau. In the actual EP 8 and 21 site areas, however, the surface is basically pure obsidian, with densities of 1000-4000 obsidian items per m2. (Ibid:61).

The quality of the reporting (as opposed to the research in general) varies greatly. Some reports are written with vague discussions of research design or methods, and the impression is given of inexperience (e.g., Blacklaws 1978, REF 22; Richards 1981, REF 19; McIntyre and McIntyre 1983, REF 15), while another consists only of a six page interim report (Baker 1974, REF 4). In one report, there were major discrepancies between the text and maps in terms of number and size of sample units surveyed, the number of units in the sampling frame, the map scale, and the number of sites located (Ball 1978, REF 6). However, this work is also the only example of a probabilistic survey in which a simple model was created correlating archaeological site location with environmental data and the data were then extrapolated throughout the study area to obtain zones where similar archaeological site locational patterning would be expected. Some reports failed to present data critical to evaluating site density, such as number of previously recorded sites which lay within sampling units, and these data had to be obtained from the B.C. Archaeological Inventory (Burley 1975, REF 9). Many reports only gave statistics related to sampling units: while this is mathematically sound, a conversion to standard density values and population estimates in terms of number of predicted sites in the study area would have been much more useful (e.g. Matson et al 1980, REF 13).

Of peripheral interest are the ubiquitous minor errors, ranging from use of sample sizes for sampling without replacement when actually sampling with replacement (Matson, Ham and Bunyan 1979, REF 14), to miscounting the number of quadrats surveyed (e.g, Mitchell and Eldridge 1982, REF 16), and many simple minor errors of calculation. Most of these minor errors were revealed in the spreadsheet when calculated values were slightly different to those presented in the Originals.

A discussion of the site density values of the probabilistic surveys is presented following the discussion of the intensive surveys.

Intensive Surveys

No probabilistic surveys for archaeological sites have taken place on the coast of British Columbia, with the exception of specialised CMT surveys which did not explicitly search for buried archaeological sites (e.g., Eldridge and Eldridge 1988; Arcas Associates 1986). A major factor which led to the rejection of probabilistic surveys by coastal archaeologists is the dense coastal vegetation. This can make foot travel extremely difficult and restricts the amount of mineral soil which is visible. The low potential for finding sites in these environments using visual foot sweeping techniques led to the development of subsurface testing. In the interior, the subsurface testing often was combined with probabilistic survey methods. On the coast shoreline inventories were stressed, probably because of the ease of boat access and the heavy pressure of development and modern use of this zone.

Relatively systematic coastal survey began in the southern Strait of Georgia (e.g., Acheson, Cassidy and Claxton 1975 REF 48), where a long term Provincial government inventory program concentrated on shorelines. At much the same time intensive surveys of interior lakes and rivers were starting as part of the same movement to build up the inventory (e.g. Mohs 1974, 1975 REF 39). In much of the Strait of Georgia, erosion from subsidence is combined with a relatively dry environment to make many shore zone sites highly visible. Systematic intensive surveys of the uplifting outer coasts, where many sites are completely vegetated and stranded, created the need for subsurface testing. This need was met with the use of subsurface soil probes which could detect anthropogenic soils (e.g. Hobler 1976:46). Probe testing was eventually combined with explicit standardized survey methods to ensure even coverage of the study area (Haggarty and Inglis 1983, 1984 REF 30). The methodology has become a standard followed for many inventories throughout the B. C. coast (e. g., Archer 1984, 1990a, 1990b, 1991, REF 35; Mackie 1982, REF 28, 1986b, REF 23; Acheson and Zacharias 1985, REF 25; Zacharias and Wanagun 1992, REF 26; Eldridge, Mackie, and Wilson in preparation, REF 27; Marshall 1992, REF 24; McMillan and St. Claire 1991, 1992, REF 34; Eldridge et al 1988, REF 53), and the data resulting from these projects are generally comparable.

An analysis of old and new coastal survey results by Maclcie (1986b:3-5) reveals a wide range of biases generated by older survey methods on the westcoast of Vancouver Island. He notes (Ibid:3) an increase in sites found (excluding CMT's) in resurveyed areas of 140% for the early phase of Archer's work in Prince Rupert, 270% on the Ohiaht Project, 350-600% on the Pacific Rim Project and 560% from the 1982 Meares Island Survey. Recently Wilson, Kennedy and Bouchard (1992:46) have discussed similar increases in site density on Quadra Island in an area thought to be well surveyed. Mackie analyses the Ohiaht Project in more detail and finds that:

> Of the 22 previously recorded sites 73% [N=16] were larger than 2,OOO m2; (23% [N=6] larger than 10,000 m2). Ninety two percent (N=55) of those 160] newly recorded were smaller than 2,000 m2. In fact, 47% (N=23) were smaller than 200m2. (Ibid:3).

The complexity of midden deposits was also found to vary, with previously recorded sites being predominantly more complex, and the newer discoveries more frequently simple. There were also differences in some of the locational data associated with sites. A very important point for predictive model building relates to the applicability of ethnographic data to the archaeological record. It was found that a very high proportion (82%) of older recorded sites were still associated with an ethnographic place name, while the inverse proportion (86%) of newly recorded sites were without a remembered name. Mackie concludes that a researcher using the older data would find that the archaeological data "correlated well with ethnographic knowledge" (Ibid:5).

Using ethnographic place-name data would obviously contribute to a model which predicts the larger, more complex sites, but equally would do little to predict the large majority of sites.

> It is clear that the older survey results are of little use for applications such as settlement pattern or population reconstructions, resource management, ecological analyses, and so on. However, they will be of some use in finding out more about the nature of ethnographically known places. They may be helpful too in locating the focal points of regional activities.
> Unfortunately, if soil probes have not been used to determine site boundaries, the sites will be so inadequately mapped and the dimensions so poorly known, that the records will prove of little use for more than locational data.
> It is a good bet that similar biases, modified slightly for local cultural differences, will be found in most areas of coastal British Columbia. (One exception may be the Gulf of Georgia where sites are eroding and thus more visible.) (Ibid:5)

In other parts of the province, many surveys of varying degrees of systematization and intensity have taken place, predominantly along river valleys. This report includes those systematic surveys with data which appeared to have a reasonable degree of reliability, especially those in which areas without sites were identified. Many other surveys may have contained equivalent data quality without it being apparent in the *Annotated Bibliography*.

Prehistoric Site Densities

The values in Table 1 and Figure 1 reveal some clear patterns in the data. Both the map and the tables need to be used together to properly assess the data: the map has summary data averaged over entire study areas, whereas the tables include values for various strata or environmental units. The smaller strata tend to show closer values between projects than do the project averages. In the discussion below, references are generally omitted, but can be derived from the table and references cited. Figure 2 provides an additional view of recorded site densities; each recorded site in the B.C. Archaeological Inventory (as current March 1992) is plotted as an open circle.

Open Grasslands

To begin, many of the projects surveyed in open grasslands of the B.C. Interior, classed generally in the ponderosa pine-bunchgrass or the Cariboo aspen biogeoclimatic zones (Krajina 1973), have remarkably similar values of sites per square kilometre: 14.84 (Hat Creek 1), 14.07 (Hat Creek 2) [separate survey areas], 12.86 (Clinton Ashcroft), 18.75 (Mouth of the Chilcotin), and 10.51 (Eagle Lake 1984). Values from intensive surveys are more variable, and are not directly comparable to probabilistic surveys (or each other) because a narrow strip of high potential land is often surveyed, and the width of the strip is seldom rigorously reported or evenly surveyed. This usually results in an inflated value for sites per square kilometre. Sites per linear kilometre is generally a more accurate reflection of density for the systematic surveys. Nevertheless, the square kilometre indices tend to the same central values as those in the grassland: 16.82 (Okanagan Lake), 7.13 (South Thompson, north bank), 10.00 (Pritchard - South Thompson, north bank), 3.74 (South Thompson, south bank), 2.14 (Princeton), 17.14 (Ashnola River), 3.12 (Seton/Shalath). The South Thompson and Seton values are based on wide surveys and are most comparable with the probabilistic survey data.

Subalpine

Subalpine areas have even higher average densities: 17.00 (Lytton/Botanie),
24.31 (Potato Mountain) and 11.25 (Cornwall Hills).

River Canyons with Salmon

Canyon values along salmon rivers tend to be have the highest values of all: 32.7 (Ashcroft section of Valemount-Vancouver CN line, which is mainly in the Fraser and Thompson canyons), 55.33 (Kitselas Canyon), 30.00 (Chileotin Canyon). The Mouth of the Chilcotin, with 18.75, is also largely within the Fraser Canyon.

Southeast B.C.

In the Kootenay region, two projects have values of 0.8 sites per linear kilometre, the same as Okanagan Lake. These densities are similar to coastal values. Values for the Slocan Valley are low, with 0.6 sites per square kilometre, and 0.33 per linear kilometre on Slocan Lake (the latter is not included on the tables or map).

Northeast and Northwest B.C.

Within the most northern parts of B.C., values tend to be very low, at least along areas probabilistically surveyed. The massive Liard River survey area has an average of only 0.05 sites per square kilometre, while the Stikine-Iskut has 0.02. However, downstream on the Stikine a high site density has been found near Telegraph Creek but the values cannot be calculated with the available data. The high density of this area is evident from the coalescing circles on Figure 2. A survey along a northwest trail resulted in a value of 39.36 per square kilometre (Nakina River), although this works out to "only" 1.18 sites per linear kilometre, still a high value by comparison to any coastal shoreline. The 210 km long Highland Post Trail in the upper Stikine/Spatsizi area found a density of 0.63 sites per square kilometre, but only 0.02 sites per linear kilometre. Some 16 prehistoric sites were found in the remote 15 x 7 km Metsantan-Caribou Hide study area in the Spatzizi area. Although only a density of 0. 15 sites per square kilometer, these sites create a small dark cluster on the map of all recorded sites (Figure 2).

Local Variations

There are often systematic differences in values between east vs. west and north vs. south shores of valleys. For example, within the interesting Okanagan probabilistic survey (which is the only survey of minor tributary streams of a major southern valley), west drainage strata have an average of 0.45 sites per kilometre square, while the east drainage is 0.20. On the Okanagan Lake systematic survey, the west shore is 0.91 sites per linear kilometre, while the east is 0.76. A very great difference between east and west shores was noted on the Slocan Lake intensive survey (Eldridge 1981), and Atlin Lake had a difference of 0.37 on the east and 0.18 on the west. In this case, the west shores are close to glaciers and may not have been preferred for camping. The north side of the South Thompson River has almost double the site density of the south, at 2.14 vs. 1.12 sites per linear kilometre. Some of this difference may be due to heavier modern development on the south side, which has destroyed many sites, but much of the difference may be the preferred siting of winter house pit villages to catch the sun. Similarly, on the Peace, the north intermediate terraces have a value of 8.38 vs 1.50 for the southern equivalent, while the safeline to valley rim is 11.67 on the north vs. 0.67 on the south .

Lakeshores and Lake Islands

Many interior lakes have high site densities, and islands in lakes always have higher densities, although sometimes the differences may not be significant. For example, Babine Lake has 0.39 sites per linear kilometre of regular lakeshore, vs. 0.99 for island shores, Tchesinkut Lake has respective values of 0.18 vs. 1.00, and Nazko 2 has 1.24 and 2.29.

Cumulative Effects of Long Term Use of the Landscape

The difference in values between different areas of the provincial Interior would be even more pronounced if isolated finds had been treated equally in each project. In areas of relatively sparse finds, such as the Dean and Liard Rivers, isolated finds of lithics were recorded as archaeological sites. On the Clinton Ashcroft project, isolated lithic finds (often projectile points on steep slopes [Pokotylo 1977:21]) were noted but not recorded as sites. If they had been, the sites per square kilometre would rise to 220.71, an astonishing figure based on a very reliable sample. It would extrapolate to some 17,657 sites in this valley, compared to, for instance, the 87 predicted in the entire Liard River pondage area. This undoubtedly reflects intensive aboriginal use of this grassland valley, but it also reflects the relatively high surface exposure and good visibility in the dry interior. It may also be related to its proximity to a major source of basalt which might make stone artifacts locally more disposable. It may merely be a good reflection of the cumulative effect of aboriginal use which is often overlooked in more challenging (from an archaeological survey point of view) environments.

Coastal B. C.

This brings us to the B.C. outer coast, where intensive shoreline surveys in a challenging environment range from about 3 to 1S sites per square kilometre, a value generally similar to densities in the southern Interior. These sites exclude CMT's but there is a strong similarity between the Interior isolated find sites and CMTs. CMTs, like lithics on exposed soil, are highly visible, since most are standing trees. Values for CMT densities in areas of old growth forest near coastlines or rivers often translate to hundreds, and even thousands, per square kilometre (e.g., Arcas Associates 1986; Eldridge and Eldridge 1988; Eldridge, Kennedy and Bouchard 1989), even higher than the isolated lithics and perhaps more impressive, since all the cultural scars and stumps date to the last few hundred years, whereas the lithics could span thousands of years.

Along the coast, non-CMT site densities are best described as sites per kilometre, since virtually all the surveys have been linear shoreline traverses of narrow width. Almost all vary between 0.4 and 1.4 sites per kilometre, with higher values generally in the south. The lowest value, 0.2, occurs on the central coast near Bella Bella, but this survey concentrated on intertidal beaches and may not be comparable. Inter-observer variability may also be a problem: on the 1992 Gwaii Haanas project, the two most experienced crew leaders had 0.92 and 0.78 sites per kilometre respectively, but the least experienced crew leader had an average of only 0.22, bringing the project average down to 0.26.

PREDICTIVE MODELLING

Predictive modelling for archaeological site locations has been a topic of concern to managers for over a decade (e.g., Darsie, Keyser and Hackenberger 1985). The subject is extremely complex and will only be dealt with briefly here. Originally, predictive models generally used univariate statistics to correlate site locations with multiple environmental variables. These models were used to help select areas for survey when total survey was impossible or impractical (Hollenbeck 1985). This form of analysis has been used, at least by a few archaeologists, since the early 1970s (Plog and Hill 1971, referenced by Judge et al 1975:94).

Geographical Information Systems (GIS)

The advent of geographic information systems (GIS) has revolutionized the ability to analyze spatial relationships and produce predictive models. The ability to transform a map layer to a new data type (for instance, converting contours into slope and aspect algorithms) and to combine different data sets into new map covers allows for much more sophisticated mathematical models to be generated. A typical example might begin with dividing the study area into small (often about 25 m squares) cells and applying a univariate statistical test to determine if there are significant correlations between archaeological site locations and environmental variables. It would then move to the very sophisticated logistic regression analysis on variables selected to give the best fit with archaeological sites. Each cell is evaluated for its overall probability of containing a site given its position on the regression line correlating the presence of a site to the presence or distance to an environmental variable. A probability surface is produced. A "cutoff point", usually about 50%, is chosed as a decision boundary to determine if a cell contains a site. Finally, a map is produced predicting site presence or absence (e.g, Warren 1 99o).

It is perhaps fair to say that the products of GIS predictive modelling have not lived up to their promise. Some attempts at predictive models have achieved a predictive accuracy only slightly better than chance. For instance, Warren (1990) provides an example of correctly predicting 67% of the sites occurring on 61 % of the land base. This result is not impressive when it is remembered that the sites occur over only a small part of the land and that any model can be 100% accurate by predicting site potential in 100% of the land area. In a better case, Carmichael (1990:221) creates a model that correctly identifies 72% of the sites using approximately 45% of the landbase in a large area in Colorado. The first successful application of GIS in archaeological predictive modelling using logistic regression achieved a correct classification of 76% of the sites using 40% of the land base (Kvamme 1984 referenced in Carmichael 1990). It should be noted that many of these models are handicapped by poor, 1:250,000 scale maps for their base environmental data and local features critical to site location may not be mapped. Even so, as Altschul (1990:227) comments in a stimulating article:

A model is judged to be successful if it correctly predicts where sites will and will not be located 80 to 90% of the time. While accuracy is important, it is not necessarily a very useful measure. Predictive models in CRM have generally been based on the observation that in most regions sites tend to cluster around certain environmental features. This observation is not new; indeed, it has been part of most field archaeologists' baggage for over a century. Sophisticated models that capitalize on this fact may be accurate, but by and large do not tell us anything we did not already know.

While acknowledging Alschulis comments, the situation in B.C. is that we do not know where the sites are even likely to be in many parts of the province, simply because of inadequate survey coverage. It is worth while to compare the GIS accuracy with predictive models/potential maps produced by other means. As previously discussed, the 1:250,000 scale map of the Cariboo Forest Region predicted almost I00% of the known sites would occur in about 25% of the land base (13ussey and Alexander 1992). This map is based on a model which correlates mapped but ethnically significant environmental zones with ethnographic patterns of activity. It would appear to be much more accurate than the GIS models. Another model (also untested by later ground-truth survey) was based on some simple correlations with distance to permanent water (derived from probabilistic survey), terrain classes, quality of fish habitat, and soils/forest cover (derived from Canadian Land Inventory 1:50,000 maps). This model predicted 75% of the estimated 900-1200 sites in the Dean River valley would occur in only 6% of the land area (Eldridge and Eldridge 1979). It is worthwhile to note that nearly all the Dean River study area has been assigned as having "potential" in the Bussey and Alexander 1:250,000 map, illustrating the difference in accuracy introduced by scale. Although the site distribution patterns may be easier to predict in the Chilcotin region than in the Plains or Southwest, the difference in accuracy is marked. It would be instructive to produce a predictive model, using similar techniques as those commonly used in the United States, on the Dean River data.

Part of the difference between the GIS and simple predictive models may be due to the use of a small cell sizes in logistic regression. One of the strengths of logistic regression is the non-assumption of a normal distribution for variables and the potential to fit polynomial interaction terms into the model (Warren 1990:212) but models fully using this power have yet to be developed, especially at fine resolution. Archaeological sites tend to have strong negative binomial distributions - that is, they tend to be rare events that cluster rather than be randomly or evenly distributed (Mitchell and Eldridge 1981: 18). For predictive purposes, it means that a single large (500 m) cell in a high potential area will have a good chance of containing several sites, while adjacent but peripheral cells have none. The smallest cell size possible is normally chosen for logistic regression in order to maximize the accuracy and resolution of the encoded information (Warren 1992:96). It is considered undesireable for any cell to have more than one parameter for any variable. However, if a small cell size (e.g., 25 x 25 m) is used, a large number of cells in the high potential zone will still be empty, because of the small size of the individual sites. This may result in an apparent reduction in site density. For instance if a hypothetical 5 quadrats contain 10 small sites in an area encompassing 100 quadrats, then 5% of the 500 m cells contain sites. Using 25 m cells, perhaps 40 cells could contain the same 10 sites but now, instead of 100 cells, there are 40,000 cells, and the proportion containing sites is only 0.1 %0. The sites appear to have become much more rare and difficult to precisely predict. In order to include most sites, a very high number of "false positive" errors must be accepted, and the predictive model appears to be less powerful. More experimentation with real data would be necessary to test the relative advantages of each approach as no study of these factors could be found in the recent literature.

Utility of Existing Data for Predictive Modelling

Many of the inventory studies examined in this study have data useful for predictive modelling. This is particularly true of the probabilistic surveys, but also holds for many of the systematic intensive surveys. All the studies that made detailed, systematic observations are particularly useful for predictive modelling. Many of the large-area probabilistic surveys, such as Dean River, Clinton Ashcroft, or Eagle (Choelquoit) Lake have data which could be used with little or no additional work in sophisticated modelling approaches. The limitations to predictive modelling in British Columbia will come, not from a lack of good archaeological data, but from a lack of mapped environmental data at the appropriate scale.

Many of the British Columbia probabilistic surveys produced simple models of environmental correlates. They often systematically field recorded environmental data such as vegetation cover and topographic features (e.g., Eldridge and Eldridge 1979; Magne 1984). Some reports analyzed this data in relation to site locations, to varying standards of formal analysis (e.g., Beirne and Pokotylo 1979, Pokotylo 1979, REF 7). The Magne (1984) study used cluster and principal components analysis to group quadrats scored for a large number of environmental variables. The cluster analysis grouped all the quadrats containing archaeological sites on the basis of environmental characteristics alone. This cluster analysis effectively produced a predictive model for the study area. However, the environmental data coded in the field has not been mapped for the rest of the study area or adjacent areas, precluding "as is" use of the model.

One of the strengths of the logistic regression technique mentioned earlier is that a probabilistic sample of an area is not strictly necessary. What is needed are enough cells that are known to have sites and enough that are known to not have sites, covering a cross-section of the area to be mapped. Obviously, data that are skewed by biased survey methods will produce a skewed model, but good judgemental surveys can produce reasonably representative samples.

Coastline intensive survey results can be used to produce predictive models which can be extrapolated to unsurveyed or reconnaissance-level surveyed coastlines. The Gulf of Georgia data is a prime candidate for this treatment, not only because the quality of survey is relatively good, but because up to 50 environmental map layers are already digitized and available in the Environmental Emergencies Services Branch's OSRIS system (oil spill response information system) .

One problem with using existing data for predictive modelling is that sites are entered in CHIN as point data. If a relatively small cell size is used and the scale of mapping is large, it would be necessary to map sites as polygons. Indeed, it would be advantageous for current management techniques to map larger sites as polygons at 1:50,000 scale. Sites less than 100 m in maximum diameter can be plotted as point data because a manager is likely to flag any project as having potential conflict if it comes within 200 m or so of a known site. A CHIN search for large sites finds 3670 over 99 m in maximum dimension, and only 1292 over 200 m. It would represent only a modest effort to map these sites as polygons on a GIS system or on paper hardcopy maps.

Predicting numbers of Sites in B.C.

The compilation of data during this study has produced density values which allow predictions of the number of sites in the Province (Tables 1 and 2). The coastline of B.C. is about 30,000 km long (Chan 1993, personal communication). Assuming that half of the coastline is basically unsuitable for archaeological sites with an average of 0.4 sites per linear kilometre, then this predicts 6,000 sites. If the other half has higher potential, with an average of 0.8 sites per kilometre, this predicts 12,000 sites, for a total of 18,000 prehistoric sites along the B.C. coastal strip. Many more must be located inland of the coast, although most are probably at or near the modern shore. probably considerably less. A search in CHIN for all prehistoric sites less than 20 m in elevation and more than 123 degrees longitude (to exclude large numbers of recorded sites in the lower Fraser River) produced a total of 5,070 prehistoric sites, of which nearly 1,500 are in the southern Strait of Georgia. It would appear, therefore, that 1/4 of the sites along the coastline of B.C. could already be recorded. Predictive modelling would be a valuable tool in aiding management of the unsurveyed, or non-systematically surveyed, areas.

In the interior, site numbers are more difficult to predict. The probabilistic surveys cumulative predictions of sites within their study areas total 6,336. There are 16,000 prehistoric sites recorded in B.C., so the interior has about 9,000 recorded archaeological sites, not many more than the number predicted just for the probabilistically surveyed areas. For just the Cariboo Forest District, there are 2,155 recorded sites, including historic sites (Bussey and Alexander 1992) but the probabilistic study areas alone are estimated to have 2,783 prehistoric sites. Comparing the total area of red shading on the British Columbia map (Figure 1) to the total area of the interior, it is likely that the study areas represent much less than 1/10 of the total area, so there must be at least ten times the 6,336 sites in the predictive study areas, and perhaps many more. The number of prehistoric sites in British Columbia as a whole is almost certainly more than 100,000. The state of Arkansas, a much smaller area than British Columbia, has almost 20,000 recorded archaeological sites (Farley et al 1990:144).

AREAS REQUIRING ADDITIONAL SURVEY

Many areas in British Columbia require additional inventory before accurate predictive models of site location can be produced. Certain regions of the province have had no or very little survey, including areas expected to have high site densities. Even in areas of expected low densities, systematic surveys have found significant numbers of sites. The areas requiring additional survey are identified on Figure 3, but the map does not indicate all areas in which additional survey is needed. Some of the areas where data is critically short include:

> all areas further than 100 m from the coastline west of the Coast Mountains, especially known high potential areas such as lakes and subalpine parklands;
>
> the north and west coasts of Haida Gwaii;
>
> the north coast excluding areas surveyed around Prince Rupert-Port Simpson and the mouth of the Skeena;
>
> the entire Nass River drainage;
>
> the Rocky Mountains and foothills northwest of the Peace River, and the northeast corner of the province;
>
> the Fraser Plateau outside the immediate areas of the Blackwater, Dean, and Chilcotin rivers, south to the Bridge River (although much of this area could be mapped extrapolating from existing data);
>
> the highland and subalpine area between the Okanagan and Arrow Lakes

In order to check quality of existing surveys there is a need for systematic survey of areas of Interior Douglas-fir zones using subsurface testing, to determine if the density of archaeological sites in these areas is really as low compared to the grassland regions as is currently indicated. Ideally, this survey would resurvey a few quadrats previously systematically surveyed and would include some survey of grassland areas, only counting sites found in subsurface tests to control for the difference in surface visibility.

Culturally modified tree studies need to be undertaken in the Interior. Many of the early instances of recording tree modification took place in interior locations (e.g., Borden 1952b; May 1977; Eldridge 1982; Mobley and Eldridge 1992), but there has never been studies of their distribution comparable to those on the Coast where red cedar is a major component. Studies could profitably be conducted in lodgepole pine and hemlock forests, both species of which were extensively used for food. These environments are much easier to survey in than the coastal rainforests, due to a comparative lack of understory. Logging is rapidly removing older stands.

More diverse areas of subalpine parkland need to be surveyed throughout the province to test whether the high density of sites in these locations holds over large areas, or is the result of conducting survey in areas used particularly heavily by Native peoples, such as Botanie Valley or Potato Mountain. No high altitude survey has occurred on Vancouver Island, despite various indications that these areas were used. For instance Sproat (1868) mentions that the Nuu-chah-nulth built stone huts in the alpine areas while hunting, and there has been recent evidence for intensive exploitation of marmots in the interior of Vancouver Island (MacNab 1993, personal communication).

In much of the Northwest, survey is almost exclusively concentrated along riverine valley corridors. The resulting apparent site distribution is in marked contrast to the Native view of the same landscape. As one leader asked us: "Culturally the entire landscape up to the mountain peaks was used and occupied. What can be done to connect the riparian with the mountain peaks?" (Loring 1992).

Very few of the trading trails, such as the grease trails of central British Columbia have been surveyed. The location and routes of these surveys is generally well known (e.g, Bussey and Alexander 1992: Figure 13; Mackie and Eldridge 1992: 18-19). These areas have a high potential for archaeological sites although, as such, they can be mapped as having high potential without specific surveys.

SCALE FOR POTENTIAL MAPPING

The scale of maps useful for predictive modelling and potential mapping depends on the degree of accuracy required by the end user. Regional planners may be happy with a 1 :250,000 scale map that provides very general information regarding whether areas have archaeological potential or not. A research officer at the Archaeology Branch, on the other hand, requires a map at 1 :50,000 or larger scale that provides more information and accuracy regarding potential than what their experience alone can provide. The potential maps at 1 :250,000 created by Bussey and Alexander (1992) appear, in the absence of field testing, to be quite powerful in that nearly 100% of the known sites are predicted in about 25% of the total area. However, these maps could not have been produced without the extensive and intensive probabilistic field inventory work which has taken place in the area, and the correlation of archaeological and ethnographic information with environmental parameters at finer scales. The 1:250,000 maps are useful for regional overviews, but their use is limited to alerting non-archaeological planners of potential archaeological concerns. For archaeological resource managers, there may by a problem with large areas of low potential having many unmapped pockets of very high potential (e.g. lesser known quarries, pockets of grasslands or subalpine parklands and other concentrated resource locales), and of many areas with low or nil potential mapped as having potential. Comparing the 1:250,000 map portion mapped at 1:50,000 by Eldridge and Eldridge (1979), virtually all the smaller Dean River study area was mapped by Bussey and Alexander as having "potential", whereas 94% of this area was classed as low to very low potential by Eldridge and Eldridge. Many of the predictive modelling projects in the United States have found that using a 1:250,000 scale of data produces information that is of little utility. The archaeological model will tend to have poor accuracy, especially if the quality of environmental data available at 1:250,000 is not at maximum resolution for the scale.

To increase the accuracy and sophistication of the models it is recommended that, whenever possible, predictive modelling and potential mapping be carried out at 1 :20,000 scale and the results exported to the smaller scale when required. The operations associated with changing scale in a GIS - rectification of feature placement through rubbersheeting and manual shifting - would be a major problem even if just the archaeological potential cover was exported. Since the coarser grained maps would probably lump finer resolution potential classifications in any case, and relatively few polygons would be mapped, it is probably more cost effective to manually transfer the combined polygons onto a clean hardcopy 1 :250,000 map and then re-digitize. In the interim, while electronic 1 :20,000 maps are unavailable to the Archaeology Branch, it will be useful to continue low resolution modelling at 1:250,000 scale following the example of Bussey and Alexander (1992). The 1:250,000 scale has the advantage of relatively low cost for the map base and also integrates with the CORE initiative standard.

METHODS AND AREAS FOR PREDICTIVE MODEL TESTING

Predictive modelling using logistic regression should be tested against "judgemental" type potential mapping. Essentially, a predictive model must be better than an expert examining a 1:50,000 topographic map and predicting site potential. The Dean River example would be an excellent test of modern modelling, since hardcopy 1:50,000 Canada Land Inventory standard resource mapping is available for the study area. The map layers include terrains, soils, forest cover, ungulate habitat, and fisheries values as well as archaeological potential. These could be digitized if they are not presently available in this form. The quadrat data could form the "training model", which could then be tested against the judgementally collected site locations. This same technique, if successful, could be extended to test other probabilistically surveyed areas, in slightly different environments, and then, as the model is refined, applied to much of the Fraser Plateau.

Another good area to test predictive modelling is the southern Strait of Georgia, using the OSRIS GIS of the Environmental Emergencies Service Branch. This system contains about 1400 archaeological sites as one map layer, together with environmental data for over 50 other variables. An archaeological predictive model would be relatively easy to produce as the quality of data is generally very good. A early example of a potential map is available for a small part of the area (Cassidy 1979). The Emergencies Service Branch is willing to work with the Archaeology Branch to conduct a modelling experiment, subject to system availability and personnel replacement (Howes 1992, personal communication).

If a GIS useful for archaeological resource management is developed, it would be very advantageous to include SPOT and LANDSAT satellite images with the system. Demonstrations of the OSRIS, which includes these images, have shown them to be extremely valuable in assessing current land uses, development boundaries, and unmapped local topographical and cultural features. Although the cost of a 60 x 60 km block is $1,800, it would be worthwhile to obtain coverage of areas of rapid development. In fact, for most internal Archaeology Branch uses, the satellite images by themselves combined with an overlay of known archaeological sites would be much more useful than a TRIM map base, which would cost at least $2,400 for the same area (16 maps @ $150). However, modelling or exploratory data analysis could not be done on the satellite imagery by itself.

PREFERRED METHODOLOGY

Many of the problems identified while assessing early survey reports have been rectified by Archaeology Branch policy and the formal Guidelines for *Archaeological Impact Assessment*. Permit applications are now rigorously examined for methodological precision, and flawed survey methods will normally be queried and rectified prior to fieldwork. Systematic bias towards finding certain site types in certain locations will often be addressed during this consultation. However, there are still some areas where improvements can be made, and other initiatives can be taken.

Much of the field work now conducted in British Columbia is done as a result of impact assessments. Whether a development request is ever subject to the archaeological referral process is often decided by local planners or other officials, who may have little idea of archaeological potential. For instance, Mackie and Eldridge (1992b:86-87) have recently identified a breakdown of the referral process at various levels of government within an area of northwestern B.C. In this case, non-professional, non-technical support staff from other ministries were making archaeological resource management decisions. Of development requests that do get referred to the Archaeology Branch, impact assessments are only required for those that the research officer feels have archaeological potential. This is, in the absence of recorded sites in the development area, an example of ad hoc predictive modelling. However, these models are generated without hard data except for information available on NTS 1:50,000 topographic maps (often seriously out of date), combined with personal experience of the area, if any.

Recommended Survey Methods.

Probabilistic methods for surveying coastlines should be assessed through field trials. CMT research has shown it is possible to rchaeologically survey large inland areas and it should only require the addition of subsurface testing to combine these surveys with traditional site surveys to produce some data on inland and intertidal site densities along the B.C. coast. However, the survey intensity would have to be increased compared to CMT surveys because small buried sites are not visible from a distance the way standing CMTs are. Transects may be better suited to this survey than quadrats, given the logistics of locating survey areas in rainforests. Surveys need to be undertaken in different environmental zones and areas with different Quaternary and Recent history, as sea level curves are hugely varied.

Probabilistic surveys of CMTs, common during the mid to late 1980s, have largely been replaced by judgemental traverse surveys. While the latter may be sufficient to characterize CMT distributions and quickly collect suitably large samples of particular data, they are not as reliable as probability samples for assessing density and distribution. Interval transect surveys produce good results for estimating population parameters; they are not very good for defining the boundaries of CMT "sites". These have not been well defined in the past. If an interval transect method is used, it should be regular and be spaced close enough to interpolate site boundaries.

Surveys of coastal areas should include survey of mid and lower intertidal areas, with subsurface testing, in order to find inundated supertidal archaeological sites. These may often contain highly significant "wet" sites with plant preservation. Apland recommended nearly 20 years ago ',the intertidal zones of beaches should be examined for evidence of cultural activity even in the absence of such diagnostic features as middens, fish traps, house remains, etc." (Apland 1974:7). Although it is often not clear from coastal survey reports, it seems that this was not a standard coastal surveying practice until quite recently. It was only very recently that surveys and site assessments included subsurface testing of beaches, with the subsequent discovery of subsided and/or waterlogged cultural deposits (e.g., Easton 1991; Eldridge 1989, 1991; Eldridge, Bouchard, and Kennedy 1992; Mackie and Eldridge 1992a).

In the interior, there is a great need for additional probabilistic surveys in previously unsurveyed areas. The surveys need to employ subsurface testing. Supplementary survey with subsurface testing in forested zones near known high potential grasslands is also required, as this has never occurred. Even if prehistoric behaviour was strongly correlated with grasslands, there is a strong likelihood of the distribution of grassland and forest being drastically different in the past, not only due to climactic changes, but due to the abandonment of traditional Native burning techniques.

> A point of interest concerning the prehistoric vegetation zones was the annual burning of the upper level growth by the Indians to encourage more range for the propagation [sic] of deer (V. Adrian, pers. com.). Chief Adrian states that until recent time the meadow land was 1000' lower than present due to this forest control (Wales 1974:2).

The situation is analogous to the changing sea levels and the distribution of coastal sites through time.

Reporting

Several improvements to the reporting requirements should be made. A clear presentation of methods is vital. Of foremost importance is the delivery of explicit large-scale maps of areas covered by foot (and subsurface tested if applicable), areas covered by other techniques and areas not covered. A useful example is the 1982 Meares Island survey intensity map (Mackie 1983:15-17). Summary statistics of accurate size of study area and surveyed area should be reported. The length of shoreline (if applicable) broken down by different survey techniques is valuable information, but is seldom presented. Subsets of the survey area used in analysis should also be measured.

The Archaeology Branch needs to input survey coverage on 1:50,000 NTS map base and on GIS when it effectively replaces the hardcopy maps. It is critical to include surveys which found nothing. The survey coverage should be colour coded by survey intensity, use of subsurface testing, etc. The boundaries of areas where detailed potential maps have been produced should also be indicated on the maps. Large sites should be plotted as polygons.

There should be a tighter standard for site definition - that is, for deciding at what point the distance between two cultural deposits becomes great enough to determine that the deposits should be called two sites. There are instances of splitting to absurd levels - for instance, of describing petroglyph panels 7 m apart as two sites - and also of lumping with equal absurdity - for instance, of a railway construction camp, a discrete traditional Native village, and a shipwreck in the nearby river all with a single Borden number. There is often better quality information from split data than from lumped data. For instance, treating a large area with diverse features and components as a single entity may result in important data for one component not being recorded. Splitting is, in general, preferable to lumping, and the development of relational databases allows for detailed splitting without unnecessary data duplication. At present, the different site definitions make estimating site densities very difficult. Entry of field data into the CHIN database can control some of these problems, especially unnecessary splitting. However, published guidelines could address this problem, and a set of standards could be developed and universally applied. The effective use of GIS will impose new standards and will also encourage creative solutions. For instance, a single site with diverse components - such as a small shell midden with an associated area of CMTs which covers many hectares - can under the present system have only one set of dimensions and a single-point georeference. However, under a GIS running from a relational database, a "many to many" relationship can be defined, and the shell midden can be associated with one set of attributes and dimensions while the CMTs can have their own data set and georeferencing, while the two components share a single Borden number and set of common management fields.

CONCLUSIONS

The existing archaeological site inventory contains a large amount of data which would have utility for predictive modelling. The most useful and, often, the highest quality data occurs in the 21 probabilistic sample surveys from the B.C. Interior. Most of these surveys provide precise details on survey methods and intensity and on areas which can be relied upon to have no sites present. Systematic-intensive surveys of the British Columbia coastline and Interior lakes, rivers, and trails also have some utility. Many lack precise data on surveyed areas where no sites occur, which is the major weakness of the present provincial database.

Standards of survey in British Columbia are controlled adequately for the most part. A major change to the B.C. Archaeological Site Inventory is recommended. It should become a requirement to precisely map actually surveyed areas in reports, and that these plots be transferred to the Inventory maps that show the location of known sites.

The locations of new surveys are not providing data critical to the assessment of archaeological potential in previously unsurveyed areas or environments. Probabilistic surveys no longer seem to be conducted. In the past, these have often been carried out by B.C. Hydro in areas proposed for electrical generation, or by academics for research. Re-survey of some areas, but using sub-surface testing, is recommended to confirm low site potential presently assigned to some low visibility environments. Survey in select unknown areas is recommended in order to acquire the data necessary for predictive modelling. Existing data suggests that the highest archaeological site densities occur in canyons with salmon runs, subalpine areas, and grasslands near water in the ponderosa pine-bunchgrass and Cariboo aspen biogeoclimatic zones. It is estimated that at least 100,000 prehistoric archaeological sites occur in British Columbia.

Predictive modelling and potential mapping should occur at 1:20,000 scale. Potential mapping at 1:250,000 scale should be conducted to alert regional planners and land managers to general areas which have archaeological potential. A recent example of 1:250,000 potential mapping assessed approximately 25% of a very large area as having potential. An older example of potential mapping at 1:50,000 scale within one of these potential areas predicted that 75% of the sites would occur in only 6% of the study area, thus showing the increased power available at the larger scale.

Predictive modelling using logistic regression analysis has been shown to be the most powerful computerized modelling tool in the United States. The normal results obtained through this technique appear to be less accurate than those obtained by the "judgemental" model used to formulate the older potential map described above, which used manual overlays of various environmental variables combined with a probabilistic survey to assign sophisticated potential ratings. Logistic regression should be used to analyse the same data set as that used for the "judgemental" model, and the two maps field tested to determine which is more accurate.

Logistic regression analysis should also be tested to model site distribution using archaeological data gathered during systematic shoreline survey in the Gulf of Georgia combined with a large number of environmental variables, all of which are already stored in OSRIS. The combination of specific environmental variables which best predict archaeological site location are identified during analysis.

Predictive Modelling and Archaeological Inventory in British Columbia

Table 1: Summary of all probabilistic surveys in British Columbia.

PROJECT NAME	REF	DATE	AREA TYPE	TYPE	LNGTH	WIDTH	SUBSURF	TOT QUAD	TOT KM²	# SAMPL QUAD	% SAMPLE	# SITES FOUND	SITES/ KM²	# SITES PREDIC	PRED MIN	PRED MAX	CON - FIDENCE
SLOCAN VALLEY	11	1981	VALLEY BOTTOM	QUAD	500	500	NONE	303	75.75	20	6.60%	3	0.60	45	12	115	95.00%
OKANAGAN	5	1975	CREEK/SM. LAKE	QUAD	1000	1000	NONE	379	379.00	76	20.05%	26	0.34	130	105	156	66.67%
Peachland Cr.					1000	1000		40	40.00	8	20.00%	0	0.00	0	0	0	66.67%
Eneas Cr.					1000	1000		26	26.00	6	23.08%	2	0.33	9	2	22	66.67%
Trout Cr.					1000	1000		114	114.00	23	20.18%	11	0.48	55	16	145	66.67%
Shingle Cr.					1000	1000		41	41.00	8	19.51%	7	0.88	36	8	70	66.67%
Chute Cr.					1000	1000		12	12.00	2	16.67%	2	1.00	12	2	29	66.67%
Robinson Cr.					1000	1000		12	12.00	2	16.67%	0	0.00	0	0	0	66.67%
Naramata Cr.					1000	1000		11	11.00	2	18.18%	1	0.50	6	1	13	66.67%
Penticton Cr.					1000	1000		40	40.00	8	20.00%	0	0.00	0	0	0	66.67%
Ellis Cr.					1000	1000		29	29.00	6	20.69%	0	0.00	0	0	0	66.67%
Shuttleworth Cr.					1000	1000		32	32.00	7	21.88%	3	0.43	14	4	38	66.67%
McLean Cr.					1000	1000		22	22.00	4	18.18%	0	0.00	0	2	n/a	66.67%
West Drainage Strata					1000	1000		221	221.00	45	20.36%	20	0.45	99	76	122	66.67%
East Drainage Strata					1000	1000		158	158.00	31	19.62%	6	0.20	31	20	42	66.67%
LYTTON - BOTANIE	4	1974	ALPINE-VALLEY	QUAD	500	500	NONE	28	7.00	28	100.00%	31	4.43	31	NOT APPLICABLE		
Grassland					500	500		6	1.50	6	100.00%	11	7.33	11			
Forest					500	500		16	4.00	16	100.00%	3	0.75	3			
Subalpine					500	500		4	1.00	4	100.00%	17	17.00	17			
Alpine					500	500		2	0.50	2	100.00%	0	0.00	0			
HAT CREEK I	7	1976	HIGH VALLEY	QUAD	400	400	NONE	565	90.40	44	7.79%	85	10.64	962			
Grassland					400	400		331	52.96	32	9.67%	76	14.84	786			
Forest					400	400		234	37.44	12	5.13%	9	4.69	176			
HAT CREEK II	7	1978	HIGH VALLEY	QUAD	400	400	NONE	289	46.24	77	26.64%	101	7.18	332			
Medicine-Harry Cks					400	400		168	26.88	34	20.24%	21	3.86	104			
Open Pit Mine					400	400		77	12.32	24	31.17%	48	12.50	154			
Houth Meadows Waste Embankment					400	400		41	6.56	16	39.02%	27	10.55	69			
Headworks Resevoir					400	400		3	0.48	3	100.00%	5	10.42	5			
Grassland Strata					400	400		126	20.16	33	26.09%	74	14.07	284			
Open Forest Strata					400	400		61	9.76	16	26.08%	12	4.72	46			
Closed Forest Strata					400	400		102	16.32	27	26.10%	15	3.52	57			
HAT CREEK ALL	7				400	400		854	136.64	121	14.17%	186	9.47	1294			

Predictive Modelling and Archaeological Inventory in British Columbia

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CLINTON-ASHCROFT - All	17	1975	VALLEY BOTTOM	TRAN-SECT	2000	100	NONE	400	80.00	14	3.50%	618	220.71	17657	NOT GIVEN		
"Sites"					2000	100	NONE	400	80.00	14	3.50%	36	12.86	1029			
"Isolated Lithics"					2000	100	NONE	400	80.00	14	3.50%	582	207.86	16629			
FRASER PLATEAU	12	1976	HIGH PLATEAU	QUAD	500	500	NONE	400	100.00	20	5.00%	7	1.40	140	"NOT POSSIBLE"		
CHILCOTIN MOUTH	14	1974	RIVER VALLEY	QUAD	400	400	NONE	181	28.96	20	11.05%	41	9.10	263			
Grasslands			GRASS VALLEY		400	400		78	12.48	13	16.67%	39	18.75	234	78	468	98.00%
Forest			FOREST VALLEY		400	400		103	16.48	7	6.80%	2	1.79	29	3	46	71.60%
HOMATHKO	8	1982	LAKESHORE	QUAD	400	200	SHOVEL	120	9.60	24	20.00%	5	2.60	25	NOT GIVEN		
TASEKO LAKES	20	1984	HIGH VALLEY	QUAD	500	500	NONE	110	27.50	11	10.00%	16	5.82	160	48	270	95.00%
POTATO MOUNTAIN	1	1985	MONTANE	QUAD	400	400	NONE	203	32.48	18	8.87%	36	8.60	279	NOT GIVEN		
Alpine			ALPINE		400	400		135	21.60	9	6.67%	1	0.69	15			
Parkland			ALPINE/SUBALPINE		400	400		68	10.88	9	13.24%	35	24.31	264			
EAGLE LAKE 1979	13	1979	PLATEAU	QUAD	400	400	NONE	471	75.36	35	7.43%	46	8.21	619	NOT GIVEN		
EAGLE LAKE 1984	13	1983		QUAD	400	400	NONE	471	75.36	43	9.13%	57	9.11	686			
Grasslands					400	400		326	52.16	22	6.75%	37	10.51	548			
Forest					400	400		145	23.20	21	14.48%	20	5.95	138			
DEAN RIVER	10	1979	HIGH VALLEY	QUAD	500	500	SHOVEL	2968	742.00	36	1.21%	34	1.26	932			
Lakes & River			RIVER/LAKE SHORE		500	500		380	95.00	20	5.26%	32	6.40	608	380	836	80.00%
Residual			AWAY FROM WATER		500	500		2588	647.00	16	0.62%	2	0.50	324	0	763	80.00%

Predictive Modelling and Archaeological Inventory in British Columbia

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QUESNEL	18	1979	PLATEAU		500	500	TROWEL	2422	605.50	19	0.78%	7	0.39	233	233	872	JUDG'L
Immediate Riverbank					500	500		128	32.00	2	1.56%	2	4.00	128	3	NOT POSS	JUDG'L
Riverbank					500	500		178	44.50	3	1.69%	1	1.33	59	5	NOT POSS	JUDG'L
River-Creek Conflnc					500	500		29	7.25	2	6.90%	0	0.00	0	2	NOT POSS	JUDG'L
Lakeshore					500	500		52	13.00	4	7.69%	2	2.00	26	3	NOT POSS	JUDG'L
Lake-Creek Conflnc					500	500		20	5.00	2	10.00%	2	4.00	20	1	NOT POSS	JUDG'L
Creeks with Lakes					500	500		127	31.75	2	1.57%	0	0.00	0	1	NOT POSS	JUDG'L
Creeks w/o Lakes					500	500		301	75.25	2	0.66%	0	0.00	0	4	NOT POSS	JUDG'L
Intercreek Areas					500	500		1587	396.75	2	0.13%	0	0.00	0	0	NOT POSS	JUDG'L
Innaccessible					500	500		124	31.00	0	0.00%	0	0.00	0	EXCL'D FROM SAMPLE		
NAZKO	22	1978							1.76		20.00%	13	36.88	65	NOT GIVEN		
Kluskus Middle					200	200	NONE	30	1.20	6	20.00%	8	33.33	40			
Kluskus East					150	150	NONE	25	0.56	5	20.00%	5	44.44	25			
UNCHA LAKE	19	1981	PLATEAU	QUAD	500	500	NONE?	1541	385.25	40	2.60%	10	0.28	106	NOT GIVEN		
Lakeshores					500	500		265	66.25	25	9.43%	10	1.60	106			
Non-lakeshore					500	500		1276	319.00	15	1.18%	0	0.00	0			
MORICE LAKE	9	1975	LAKESHORE	TRAN-SECT	500	100		80	4.00	20	25.00%	5	5.00	20	NOT GIVEN		
NORTHEAST COAL	6	1977		QUAD	500	500		104	26.00	12	11.54%	5	1.72	45			
Stratum 1					500	500		26	6.50	3	11.54%	1	1.33	9			
Stratum 2					500	500		60	15.00	7	11.67%	0	0.00	0			
Stratum 3					500	500		18	4.50	2	11.11%	4	8.00	36			

Predictive Modelling and Archaeological Inventory in British Columbia

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SITE C - PEACE TOTAL	2	1980	VALLEY TOTAL	QUAD			SHOVEL	717	150.75	78	10.88%	112	5.05	762	429	1165	<90.00%
North Flood Plain			FLOOD PLAIN		500	500		86	21.50	17	19.77%	19	4.47	96	73	149	90.00%
N.Intermed. Terraces			TERRACES		500	500		103	25.75	21	20.39%	44	8.38	216	142	290	90.00%
N.Valley Rim-Safeline			VALLEY RIM/TABLELANDS		500	500		117	29.25	12	10.26%	35	11.67	341	191	491	90.00%
Islands			RIVER ISLANDS		250	250		152	9.50	3	1.97%	0	0.00	0	0	0	90.00%
South Floodplain			FLOOD PLAIN		500	500		72	18.00	11	15.28%	10	3.64	65	15	122	90.00%
S. Inter. Terraces			TERRACES		500	500		57	14.25	8	14.04%	3	1.50	21	6	47	90.00%
S.Valley Rim-Safeline			VALLEY RIM/TABLELANDS		500	500		130	32.50	6	4.62%	1	0.67	22	2	65	90.00%
SITE C DAMSITE	2	1981	VALLEY TOTAL	QUAD	500	500	SHOVEL	39	9.75	16	41.03%	3	0.75	7	"NOT POSSIBLE"		
FINDLAY RIVER	15	1983	HI STRM VALLEY	QUAD	100	100	SHOVEL	850	8.50	90	10.59%	0	0.00	0			
STIKINE-ISKUT	3	1980	VALLEY BOTTOM	QUAD	1000	1000	SHOVEL	204	204.00	51	25.00%	1	0.02	4	NOT GIVEN		
LIARD RIVER - Cluster	16	1981	VALLEY BOTTOM	QUAD	250	250	SHOVEL	14224	889.00	165	1.16%	6	0.05	43	57.0	121.0	<95.0%
Major Strm Confl					250	250		411	25.69	57	13.87%	6	1.68	43	40	80	<95.00%
Mnr Strm Confl/Lakes					250	250		419	26.19	56	13.37%	0	0.00	0	17	41	<95.00%
All other areas					250	250		13394	837.13	52	0.39%	0	0.00	0	"A FEW"		
LIARD RIVER - Total	16	1981	VALLEY BOTTOM	QUAD	250	250	SHOVEL	28448	1778.00	165	0.58%	6	0.05	87	114	242	<95.00%

Predictive Modelling and Archaeological Inventory in British Columbia

Table 2: Summary of a selection of intensive, systematic surveys in British Columbia.

PROJECT NAME	REF	DATE	AREA TYPE	TYPE	SUBSURF	LENGTH	WIDTH	TOT KM2	#SITES LOC	SITES/ KM	SITES / KM2	COMMENTS
MOACHAHT / MUCHULAT PROJECT	24	1991	COASTLINE	INTERVAL	PROBE	404000	30	12.12	150	0.37	12.38	CA 100M INTERVALS PROBE BEHIND BEACH, WALKED ALL BEACHES, LENGTH FROM SITE REPORT MAP WHICH IS POOR SCALE, UNDERESTIMATE?
MEARES ISLAND ARCH. SURVEY	28	1982	COASTLINE	TRAVERSE	PROBE	132000	100	13.20	110	0.83	8.33	DISTANCE FROM REPORT MAPS AND OF WHOLE SURVEY AREA. MAPS VERY CLEAR ABOUT BOAT SURVEY VS. FOOT SURVEY. SUBSEQUENT WORK HAS REVEALED MORE SITES WHICH COULD BE INCLUDED, SOME SITE TYPES REDEFINED AND LUMPED AND FORMS OFTEN DO NOT AGREE WITH REPORT
TOQUAHT ARCH. PROJECT	34	1992	COASTLINE	TRAVERSE	PROBE	106000	100	10.60	49	0.46	4.62	SHORELINE CALCULATED FROM REPORT MAP
OHIAHT ETHNOARCH. PROJECT	23	1984	COASTLINE	TRAVERSE	PROBE	58846	100	5.88	82	1.39	13.93	DISTANCE FROM CHART, WHOLE SURVEY AREA. MAPS AVAILABLE TO SHOW BOAT VS. FOOT SURVEY. SUBSEQUENT WORK HAS REVEALED ADDITIONAL SITES WHICH COULD BE INCLUDED.
PACIFIC RIM PROJECT	30	1983	COASTLINE	TRAVERSE	PROBE	342616	100	34.26	237	0.69	6.92	EXCLUDING CMT'S, NO INDICATION OF BOAT VS. FOOT SURVEY. SUBSEQUENT WORK INDICATES QUITE A FEW MORE SITES TO BE FOUND IN SOME AREAS. THESE NEW SITES HELD UP IN PARKS SERVICE SITEFORM BOTTLENECK.
West Coast Trail Unit			COASTLINE	TRAVERSE	PROBE	111000	100	11.10	53	0.48	4.77	SHORELINE CALCULATED FROM REPORT MAP
Broken Group I. Unit			COASTLINE	TRAVERSE	PROBE	144616	100	14.46	145	1.00	10.03	SHORELINE CALCULATED FROM CHART
Long Beach Unit			COASTLINE	TRAVERSE	PROBE	87000	100	8.70	39	0.45	4.48	SHORELINE CALCULATED FROM REPORT MAP
S. STRAIT OF GEORGIA	48	1992	COASTLINE	MIXED	MIXED	1610000	N/A	N/A	1449	0.90	N/A	GIS DERIVED DATA, MAY INCLUDE SOME HISTORIC SITES. ALL SITES KNOWN IN AREA, MANY DERIVED FROM EARLY SURVEYS AS REFERENCED BUT MORE FROM RECENT SMALL PROJECTS. RELATIVELY HIGH VISIBILITY OF SITES MAY MAKE THIS DATA QUITE USEFUL.
NORTHEAST GULF OF GEORGIA	29	1977	COASTLINE	TRAVERSE	NONE	156000	30	4.68	186	1.19	39.74	DISTANCE INLAND NOT SPECIFIED, 30m ESTIMATED.
ROBSON BIGHT ECO. RESERVE	53	1988	COASTLINE	TRAVERSE	PROBE	10700	30	0.32	5	0.47	15.58	COASTLINE MAY BE LONGER, NOT MAP WHEELED

Predictive Modelling and Archaeological Inventory in British Columbia

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PROJECT NAME	REF	DATE	AREA TYPE	TYPE	SUBSURF	LENGTH	WIDTH	TOT KM2	#SITES LOC	SITES/ KM	SITES / KM2	COMMENTS
BELLA BELLA	49	1974	COASTLINE	SYSTEMATIC	NONE	1118790	15	16.78	194	0.17	11.56	COAST DISTANCE FROM REPORT MAPS, WITH INAPPROPRIATE SCALE. SURVEY WIDTH PERS. COMM B. APLAND. HEAVY CONCENTRATION OF EFFORT ON BEACHES. MAP DOES NOT INDICATE FOOT VS. BOAT DISTINCTION.
KUNGHIT CULT. HIST. PROJECT	25	1985	COASTLINE	TRAVERSE	PROBE	245000	30	7.35	133	0.54	18.10	WIDTH IS PERS. COMM. WITH S.ACHESON, MAPS DO NOT INDICATE FOOT VS. BOAT DISTINCTION.
GWAII HAANAS ARCH. INVENTORY	26	1991	COASTLINE	TRAVERSE	PROBE	160000	50	8.00	75	0.47	9.38	MAPS DO NOT INDICATE FOOT VS. BOAT
GWAII HAANAS ARCH. INVENTORY	27	1992	COASTLINE	TRAVERSE	PROBE	319500	100	31.95	83	0.26	2.60	MAPS INDICATE BOAT VS. FOOT SURVEY, SITE FORMS IN PARKS SERVICE BOTTLENECK, REPORT IN PROGRESS. LOW DENSITY MAY BE RELATED TO EXPERIENCE OF SUPERVISORS. THE MOST EXPERIENCED COASTAL SURVEY SUPERVISOR ACHIEVED 0.92 SITES/KM, THE LEAST EXPERIENCED 0.22 SITES/KM.
PRINCE RUPERT ARCH. PROJECT	35		COASTLINE AVG.	TRAVERSE	PROBE	229600	100	22.96	157	0.68	6.84	AMALGAMATED FROM VARIOUS, BUT NOT ALL ARCHER REPORTS. EXCLUDES CMT'S.
Kitkatla Area		1989	COASTLINE	TRAVERSE	PROBE	69000	100	6.90	68	0.99	9.86	
Kitson/Smith/DeHorsey I.		1990	COASTLINE	TRAVERSE	PROBE	34500	100	3.45	0	0.00	0.00	
Ridley/Lelu Islands		1983	COASTLINE	TRAVERSE	PROBE	34500	100	3.45	1	0.03	0.29	
Kaien Island		1983	COASTLINE	TRAVERSE	PROBE	42310	100	4.23	26	0.61	6.15	
Venn Pass/ Tugwell Is.		1983	COASTLINE	TRAVERSE	PROBE	36290	100	3.63	42	1.16	11.57	
W.Side Tsimpsean Penin.		1990	COASTLINE	TRAVERSE	PROBE	13000	100	1.30	20	1.54	15.38	
Tsimpsean IR 2 Corridor		1983	INLAND	CORRIDOR	PROBE	14550	30	0.44	0	0.00	0.00	
Georgetown Lake		1983	LAKESHORE	TRAVERSE	PROBE	4360	30	0.13	1	0.23	7.65	
Terrace-Pt. Edward / CNR		1983	RIVERBANK	CORRIDOR	PROBE	140000	200	28.00	25	0.18	0.89	
KITSELAS CANYON	38	1981	RIVERBANK	INTENSIVE	NONE	4820	150	0.72	40	8.30	55.33	MANY SITES NOT IN INVENTORY DUE TO OVERSIGHT BY PROJECT DIRECTOR.
KITSUMKALUM RIVER	32	1986	MIXED	TRAVERSE	SHOVEL	43500	40	1.74	22	0.51	12.64	SHORELINE FROM 1:20000 MAPS WITH REPORT MAP AS GUIDE
River			RIVERBANK	TRAVERSE	SHOVEL	35000	40	1.40	19	0.54	13.57	
Lakes			LAKESHORE	TRAVERSE	SHOVEL	8500	40	0.34	3	0.35	8.82	

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TELEGRAPH CR.-STIKINE	46	1978	RIVERBANK	NOT GIVEN	NOT GIVEN	NOT GIVEN	NOT GIVEN		130			EXAMINATION OF FIELD NOTES SHOULD MAKE THIS DATA USEFUL FOR PREDICTIVE PURPOSES. THIS IS AN EXAMPLE OF WHICH THERE ARE PROBABLY QUITE A FEW OTHERS OF INADEQUATE REPORTS WHICH MIGHT BE SAVED BY REFERENCE TO FIELD NOTES IF THEY SURVIVE.
UPPER STIKINE/SPATSIZI	52	1982	MIXED	TRAVERSE	MIXED	N/A	N/A	111.30	20	N/A	0.18	
Metsantan-Caribou Hide			MIXED	TRAVERSE	SHOVEL	15000	7000	105.00	16	N/A	0.15	
Hyland Post Trail			TRAIL	TRAVERSE	NONE	210000	30	6.30	4	0.02	0.63	WIDTH IS ESTIMATED
KUTHAI L.-NAKINA R.	57	1974	TRAIL	TRAVERSE	NONE	40225	30	1.21	23	0.57	19.06	WIDTH IS ESTIMATED
Silver Salmon R. Trail			TRAIL	TRAVERSE	NONE	24135	30	0.72	4	0.17	5.52	
Nakina River Trail			RIVERBANK	TRAVERSE	NONE	16090	30	0.48	19	1.18	39.36	
ATLIN LAKE	33		LAKESHORE AVG.	INTENSIVE	NONE?	279100	N/A	34.41	71	0.25	2.06	NOT CLEAR IF HISTORIC SITES INCLUDED
Atlin Area Lakeshore		1975	LAKESHORE	INTENSIVE	NONE?	65000	200	13.00	24	0.37	1.85	DISTANCES/AREAS CONVERTED FROM MILES
Designated Homesite Area		1975	INLAND	INTENSIVE	NONE?	NOT GIVEN	N/A	12.95	5	N/A	0.39	INCLUDES "RANDOM ARTIFACT"
Southwest Lakeshores		1976	LAKESHORE	INTENSIVE	NONE	106500	100	10.65	19	0.18	1.78	DISTANCES FROM REPORT MAP
Southwest Islands		1976	LAKE ISLANDS	INTENSIVE	NONE	107600	100	10.76	23	0.21	2.14	
CARP LAKE	44		LAKESHORE	INTENSIVE	NONE	55400	150	8.31	117	2.11	14.08	
1974 Lakeshore		1974	LAKESHORE	INTENSIVE	NONE	17900	200	3.58	41	2.29	11.45	LENGTH DERIVED FROM MAY'S MAPS
1975 Lakeshore		1975	LAKESHORE	SYSTEMATIC	NONE	24200	100	2.42	39	1.61	16.12	DISTANCES FROM MAY'S MAPS/ EXCLUDES ONE CMT SITE
1974/75 Islands			LAKE ISLANDS	SYSTEMATIC	NONE	13300	100	1.33	37	2.78	27.82	
BABINE LAKE	39	1976	LAKESHORE	SYSTEMATIC	NONE	499000	75	37.43	231	0.46	6.17	NO MAPS, VERBAL DESCRIPTION DOES NOT ALLOW SEPARATION OF BOAT SURVEY FROM FOOT SURVEY. FIRST YEAR OF WORK MORE SYSTEMATIC AND INTENSIVE AND MAY BE THE MOST USEFUL FOR PREDICTIVE PURPOSES.
Lakeshore			LAKESHORE	SYSTEMATIC	NONE	441500	75	33.11	174	0.39	5.25	
Islands Shore			LAKE ISLANDS	SYSTEMATIC	NONE	57500	75	4.31	57	0.99	13.22	

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TCHESINKUT LAKE	58	1975	LAKESHORE	TRAVERSE	NONE	46052	400	18.06	9	0.20	0.50	100m SPACING OF TRAVERSES PROBABLY INFLUENCE DATA RECOVERY
Lakeshore			LAKESHORE	TRAVERSE	NONE	45052	400	18.02	8	0.18	0.44	
Islands			LAKE ISLANDS	TRAVERSE	NONE	1000	N/A	0.04	1	1.00	25.00	
NECHAKO RESERVOIR	40	1952	LAKESHORE / RIVERBANK	UNCLEAR	NONE	643600	30	19.31	130	0.20	6.73	MOST SITES NOT IN CHIN BECAUSE OF LACK OF MAPS, DETAILS FROM REF 19 WIDTH ESTIMATED
NAZKO 2	22	1978	LAKESHORE	TRAVERSE	NONE	91000	30	2.73	109	1.64	39.93	SHORELINE CALCULATED FROM REPORT MAPS, NOT ALL RESULTS ARE USEFUL
Lakeshore			LAKESHORE	TRAVERSE	NONE	86000	30	2.58	107	1.24	41.47	
Riverbank			RIVERBANK	TRAVERSE	NONE	5000	30	0.15	2	0.40	13.33	
Lakeshore Islands			LAKE ISLANDS	TRAVERSE	NONE	3500	30	0.11	8	2.29	76.19	
CHILCOTIN PROJECT	31	1972	RIVERBANK / VALLEY	INTENSIVE	NONE	34000	N/A	14.80	117	3.44	7.91	
Fraser W. Bank			RIVERBANK / VALLEY	INTENSIVE	NONE	6000	2000	12.00	93	15.50	7.75	
Chilcotin Canyon			RIVERBANK	INTENSIVE	NONE	2000	100	0.20	6	3.00	30.00	ca. 100m INLAND SURVEY AREA?, NOT SPECIFIED
Farwell Creek			RIVERBANK	INTENSIVE	NONE	26000	100	2.60	18	0.69	6.92	ca. 100m INLAND SURVEY AREA?, NOT SPECIFIED
NORTH THOMPSON	55	1983	RIVERBANK / FLOOD PLAIN	NOT GIVEN	NONE	86400	1500	129.60	45	0.52	0.35	
SOUTH THOMPSON	36	1978	RIVERBANK	INTENSIVE	NONE	116000	300	34.80	191	1.65	5.49	REPORT SAYS FLOODPLAIN, BUT SURVEY WIDTH 200-300
North Side			RIVERBANK	INTENSIVE	NONE	58000	300	17.40	124	2.14	7.13	
South Side			RIVERBANK	INTENSIVE	NONE	58000	300	17.40	65	1.12	3.74	
PRITCHARD / SOUTH THOMPSON	37	1972	RIVERBANK	TRAVERSE	NONE	5000	300	1.50	15	3.00	10.00	REPORT SAYS LENGTH IS 3 MI IN LENGTH
ADAMS RIVER	56	1977	RIVERBANK	MIXED	NONE	32000	500	16.00	59.00	1.84	3.69	
Intensive			RIVERBANK	TRAVERSE	NONE	1000	500	0.50	7	7.00	14.00	100% COVERAGE, NOT CLEAR IF THE INTENSIVE METHOD IS RESPONSIBLE FOR THE HIGH VALUES
Selective River			RIVERBANK	SYSTEMATIC	NONE	31000	500	15.50	52	1.68	3.35	"LIKELY" AREAS
STEIN VALLEY HAULROAD	41	1988	RIVERBANK	CORRIDOR	NONE	21000	100	2.10	11	0.52	5.24	EXCLUDING CMT'S/HISTORIC
CORNWALL HILLS SUMMIT	42	1987	SUBALPINE	INTENSIVE	NONE	NOT GIVEN		0.80	9	N/A	11.25	

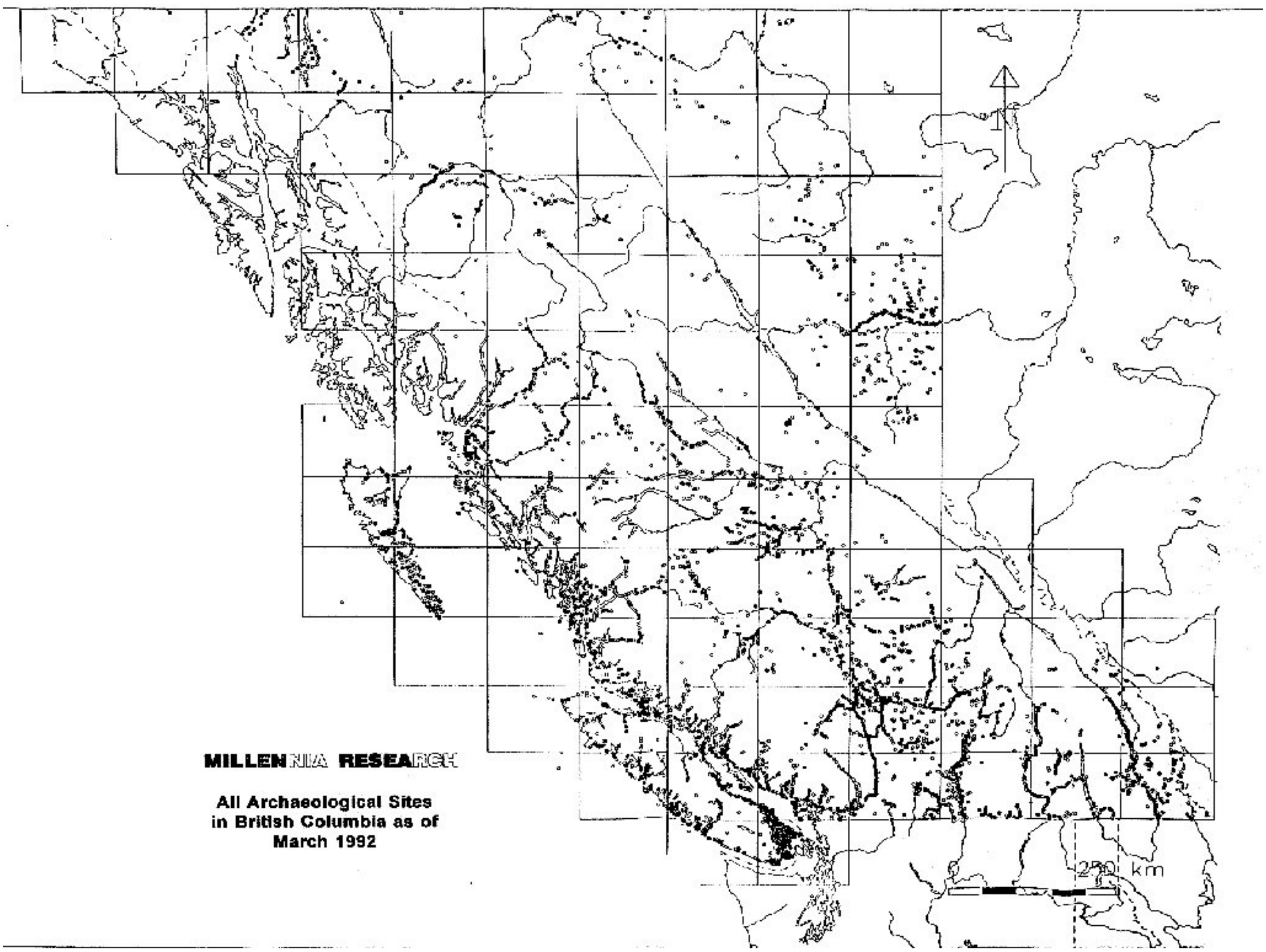
Predictive Modelling and Archaeological Inventory in British Columbia

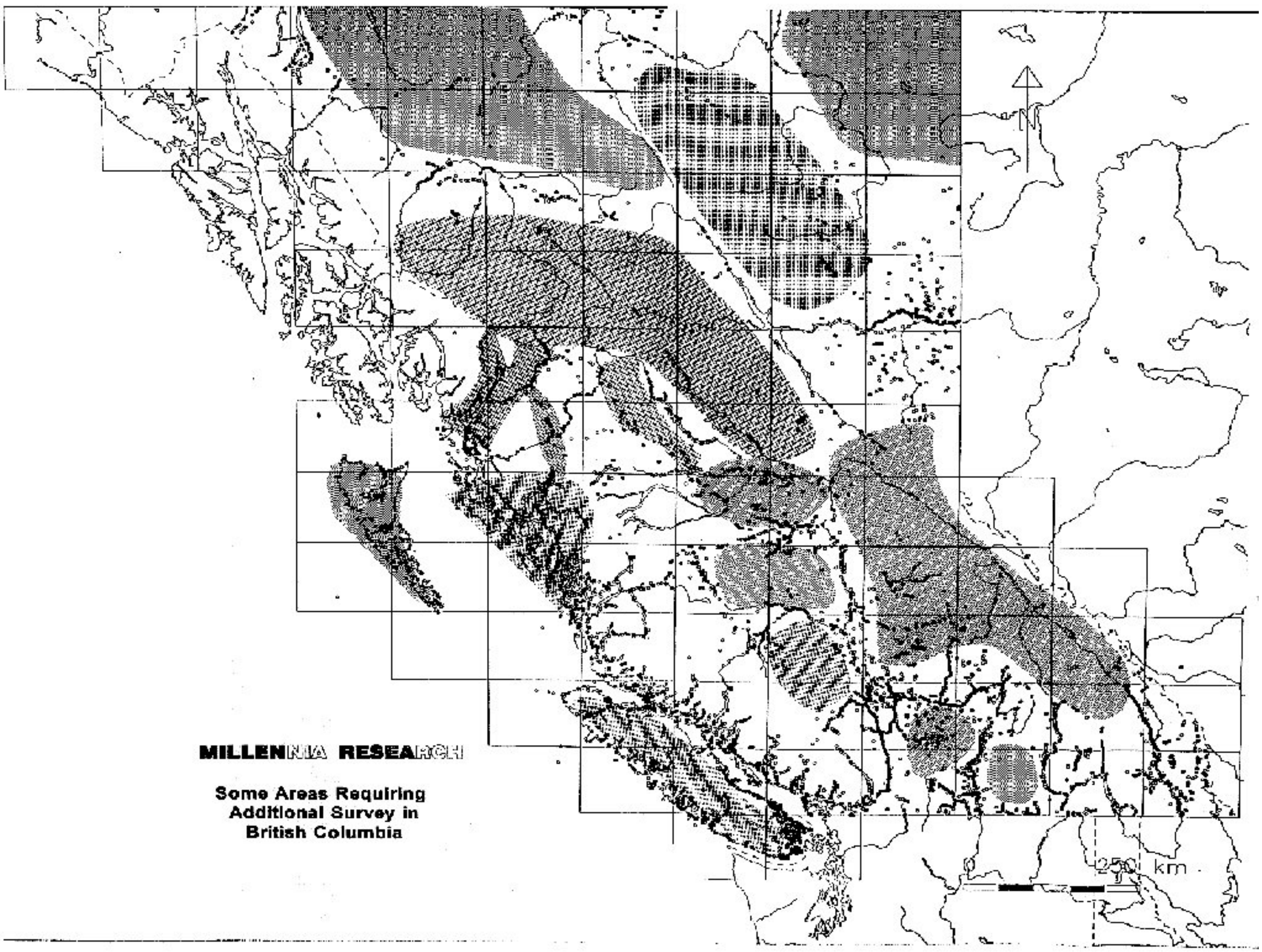
Table 2: Summary of a selection of intensive, systematic surveys in British Columbia.

PROJECT NAME	REF	DATE	AREA TYPE	TYPE	SUBSURF	LENGTH	WIDTH	TOT KM2	#SITES LOC	SITES/ KM	SITES / KM2	COMMENTS
SETON PORTAGE / SHALALTH	21	1974	LAKESHORE	QUADS	NONE	52000	500	26	81	1.56	3.12	VERY INTENSIVE 100% COVERAGE UNLESS UNSAFE.
Lakeshore			LAKESHORE	QUADS	NONE	48000	500	24.00	69	1.44	2.88	
River			RIVERBANK	QUADS	NONE	4000	500	2.00	12	3.00	6.00	
VALEMONT TO VANCOUVER / CNR	43	1984	RIVERBANK	INTENSIVE	PROBE	154625	70	10.82	174	1.13	16.08	HIGH AND MODERATE POTENTIAL ONLY HERE, LOW POTENT. RESULTS TO COME
Clearwater			RIVERBANK	INTENSIVE	PROBE	49235	70	3.45	17	0.35	4.93	
Ashcroft			RIVERBANK	INTENSIVE	PROBE	42478	70	2.97	90	2.12	30.27	
Yale			RIVERBANK	INTENSIVE	PROBE	62912	70	4.40	67	1.06	15.21	
PRINCETON BASIN - Partial	51	1987	GRASSLAND	TRAVERSE	SHOVEL	N/A	N/A	42.00	90	N/A	2.14	POOR MAPS/DESC. MAKE USE DIFFICULT, CANNOT USE ALL. SHOVEL LARGELY ABANDONED EARLY IN PROJECT DUE TO HIGH VISIBILITY OF GROUND SURFACE AND VERY THIN SOILS.
CATHEDRAL PARK	50	1988	MIXED	INTENSIVE	SHOVEL	34290		7.41	36	1.05	4.86	POOR MAPS/DESCRIPTION REDUCE VALUE FOR PREDICTION. FIELD NOTES MAY RECTIFY. SHOVEL USED INTERMITTENTLY.
Ashnola River			RIVERBANK	TRAVERSE	SHOVEL	31500	50	1.58	27	0.86	17.14	
Cathedral Lakes			SUBALPINE	SYSTEMATIC	SHOVEL	2790	2093	5.84	9	N/A	1.54	
OKANAGAN LAKE	54	1977	LAKESHORE	TRAVERSE	NONE	176000	50	8.80	148	0.84	16.82	ALL INFO FROM 1977 REPORT
West Shore			LAKESHORE	TRAVERSE	NONE	96000	50	4.80	87	0.91	18.13	SURVEY WIDTH APPROXIMATE
East Shore			LAKESHORE	TRAVERSE	NONE	80000	50	4.00	61	0.76	15.25	
ARROW LAKES POST-INUNDATION	45	1977	LAKESHORE	INTENSIVE	N/A	114078	250	28.52	85	0.75	2.98	WIDTH ESTIMATE FROM 2 SITE FORMS ONLY, MAY BE MUCH WIDER.
Upper Arrow			LAKESHORE	INTENSIVE	N/A	34915	250	8.73	15	0.43	1.72	
Lower Arrow			LAKESHORE	INTENSIVE	N/A	79163	250	19.79	70	0.88	3.54	
KOOTENAY RIVER	47	1977	MIXED	SYSTEMATIC	NONE	257945	N/A	43	218	0.85	5.01	ARBITRARY SECTORS. NO EXPLANATION GIVEN FOR DIFFERENCE IN DENSITY BETWEEN SECTORS 2 AND 3.
Sector 1 Predom. Lakes			LAKESHORE	SYSTEMATIC	NONE	93523	305	28.51	119	1.27	4.17	
Sector 2 Predom. River			RIVERBANK	SYSTEMATIC	NONE	101068	91	9.20	93	0.92	10.11	
Sector 3 River			RIVERBANK	SYSTEMATIC	NONE	63354	91	5.79	6	0.09	1.04	50% OF INUNDATION ZONE ONLY

Maps


MILLENNIA RESEARCH
Archaeological Site Survey in British Columbia
Probabilistic Survey
12 Reference Code
9.2/163 Sites Per km²/Predicted Sites
Intensive/Selective Survey
49 Reference Code
0.2/6.3 Sites Per Linear km/Sites Per km²
PACIFIC OCEAN


MILLENNIA RESEARCH
All Archaeological Sites
in British Columbia as of
March 1992
N
250 km


MILLENNIA RESEARCH
Some Areas Requiring
Additional Survey in
British Columbia
0
250 km
N

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1992 Gwaia Haanas 91 Archaeology. 1991 Archaeological Resource Inventory of Southeastem Moresby Island within the Gwaia HaanastSouth Moresby National Park Reserve. Draft Version May 1992. Prepared for and of file with Canadian Parks Service, Westem Region, Calgary.

APPENDIX 1

REFERENCES
ORDERED BY NUMBER
WITH
ANNOTATION

References used in compiling Tables I and 2, organised by REF number as on the tables. There are occasionally other references for the same projects which were not consulted due to factors such as useful summaries in later works or the need to sub-sample for this project. The majority of these references are cut and pasted from several Archaeology Branch text files which comprise the most up to date edition of their Annotated Bibliography (Archaeology Branch 1992). The majority of reports were selected using key word searches as described in the main body of this report. The formatting is rearranged in some places, and some of the annotations are edited to reflect the use made of the reports in this project. Otherwise, it is primarily a re-organised version of selections from the published diskette.

I Probabilistic survey, high altitude
Alexander, Diana and R.G. Matson

1986 Preliminary report onPotato MountainArchaeological Project. Permit 1985-11. HCB. 98pp. Map 92 N.

Funding: Social Sciences and Humanities Research Council of Canada. (research).
A probabilistic survey of alpine tundra and parkland environments found sites limited to the parkland area.
Numerous cache pits and smaller numbers of roasting pits were found. Findings point to a model of intensive summer use of parkland for mountain potato harvesting by very large groups of people from different wintering bands. An analysis of lithic scatters with an ethnoarchaeological model of site use considers the influence of site function on interassemblage variability. Cultural depressions (roasting and cache pits; house pit) and lithic scatters were excavated. Interpretation of pit function and construction was tested, awaiting C14 dates.

I Probabilistic survey, high altitude
Alexander, Diana and R.G. Matson

1987 Report on the Potato Mountain archaeological project (1985). Permit 1985-11. HCB. 105pp. + appendix. Map 92 N.

Funding: SSHRC (research).
Sites in alpine and subalpine environments were recorded and collected. Large lithic scatters were collected in the Potato Mountain and adjacent Eagle Lake areas; a preliminary analysis is presented. Test excavations were conducted at a variety of sites with C14 dates ranging from 100 +/-60 to 2220 +/- 80. A large stemmed point suggests use of the area as early as 7 to 8000 years BP.

I Probabilistic survey, high altitude

Alexander, Diana, R. Tyhurst, L. Bumard-Hogarth and R.G. Matson

1985 A preliminary ethnoarchaeological investigation of the Potato Mountain Range and the Eagle Lake area. Pemnit 1984-14. HCB. 137pp. Map 92 N.

Funding: Canadian Ethnic Studies program (research). The study was designed to research traditional Chilcotin land use pattems and material culture and interpret local prehistory. Archaeological survey yielded 31 sites. Traditional use and construction of Chilcotin features is discussed.

2 Probabilistic - river valley

Alexander, Diana

1982 An inventory and assessment of heritage resources at the Peace River - site C damsite. M.O. 1981-18. HCB. 234pp. Map 94 A.

Funding: B.C. Hydro (EIA). The purpose of the study was to locate, evaluate and test excavate archaeological resources near the proposed site C damsite. Probabilistic and judgemental survey yielded 6 new sites. Sixteen sites were evaluated. HbRf 62 is considered significant and represents a large undisturbed multicomponent site on the south bank of the Peace River.

2 Probabilistic - river valley

Alexander, Diana

1983 The limitations of traditional surveying techniques in a forested environment. Journal of Field Arehaeology 10:177-186.

2 Probabilistic - river valley

Spurling, Brian E.

1979 A status report on the activities of the Peace River archaeological project. Pemmit 1978-14. HCB. 65pp. Map 94 A.

Funding: B. C. Hydro (EIA).
Field studies were directed at increasing the survey sample size of the proposed Site C reservoir area and assessing the value of heritage sites in the region. Stratified random survey resulted in location of 74 sites bringing the total to 315 sites in the study area based on about 12% coverage. (An estimation of 729 sites for the entire study area is made). Two systematic surface collections were made, 2 sites (HaRk I and HaRk 14) were test excavated and 6 sites were tested using a new method for detemmining site size and content.

3 Probabilistic - river valley
Apland, Brian C.

1980 Stikine-Iskut Hydroelectric Project Stage 2 detailed heritage impact assessment, 1980 end of season summation. Pemmit n/a. IOpp. Map 104 B, G, H, I, J.

Funding: B.C. Hydro.

This letter report describes the results of a systematic survey of the potential reservoir areas of the proposed Stikine and Iskut hydroelectric dams. A random quadrat approach was employed using I km2 quadrats and designed to survey 25% of the reservoir area, to test observations and predictions resulting from a 1979 study. Six heritage sites were recorded, 2 of which were prehistoric (IaTm 1, IaT1 2). IaTm I was interpreted as a kill site located at a cariboo crossing while IaT1 2 was interpreted as a temporary camp site. This report contains the clearest methodological statement for the probabilistic aspects of this project.

3 Probabilistic - river valley

Apland, Brian C.

1980 Preliminary archaeological study of the proposed Stikine Iskut hydroelectric development. Pemnit 1979-29. HCB 59pp + appendices. Map 104 H, I.

Funding: B.C. Hydro (EIA).

A variety of probabilistic and judgemental sampling techniques were employed in an area proposed for hydroelectric development to determine appropriate future survey techniques and evaluate resource potential. Four sites were found and judgemental survey was recommended for later project stages.

3 Probabilistic - river valley

Wilson, Ian R. (I.R. Wilson Consultants)

1984 Stikine-Iskut development heritage resources impact assessment summary volurne. Permit 1983-35. HCB. 190 pp. + appendices. Map 104 H, I, J.

Funding: B.C. Hydro (EIA).

This volume represents a summary report on four seasons of research on a large proposed hydroelectric project. 39 sites, several recent use sites and seven heritage buildings are identified. Prehistoric sites are small, briefly occupied and probably related to winter hunting. One stratified site is an exception.

Apland, Brian

1993 Personal communication with Alexander Mackie

4 Probabilistic, high altitude to valley bottom

Baker, James

1974 Report on the archaeological research done in the Lytton Region, May to August 1974. Permit 1974-27. HCB. 6pp + maps. Map 92 I.

Funding: Canada Council Grant (research).

Designed to determine the site density and resource utilization patterns within the three ecological zones defined for the region and to determine the season of occupation and the activities conducted at sites in the highest ecological zones. Thirty-one sites were located. Excavation of an area containing mat lodge, earth oven, and open sites was conducted on the basis of stratified random sampling units. Research design and excavation supervision by Morley Eldridge who has added his personal knowledge to the coding of these data for this report.

5 Probabilistic, stream/creek shores

Baker, James

1975 Okanagan College archaeological research project. Report of the first stages of a multi-stage research project including report of Okanagan Valley random quadrat survey by Steven Lawhead. Pennit 1975-14. HCB. 28pp + appendices. Map 82 E, 92 H.

Funding: ASAB (research).

Designed to consolidate and co-ordinate archaeological research in the Okanagan Valley, and to initiate systematic survey employing ethnographic leads, private knowledge and probabilistic survey techniques to totally delineate the resource area of the Okanagan Indian bands north of the 49th parallel. Forty-three sites were located.

5 Probabilistic, stream/creek shores

Lawhead, Steven

1975 Okanagan Valley Random Quadrat Survey 1975. Report in partial fulfilment of the requirements under permit 1975-14 issued to James Baker at Okanagan College, Kelowna, B.C. Bound with Baker 1975 in Archaeology Branch Library. Permit 1975-14. 35pp. Map 82 E, 92 H.

6 Probabilistic - lakeshore/ rivershore

Ball, Bruce, F.

I978 Heritage resources of the Northeast Coal Study: the NEC heritage project 1977- 1978. Permit 1977-7. HCB. 184pp. Map 93 P.

Funding: ? (EIA).

Designed to assess the nature and extent of heritage resources in the region threatened with destruction by development. Twenty-six historic sites were recorded through stratified random sampling procedures. Excavation at GiRi 4 revealed a lack of diagnostic artifacts and few non- diagnostic artifacts. A paleocultural sequence for the NEC Core area is tentatively presented.

6 Probabilistic lakeshore/ rivershore

Ball. Bruce F.

1980 Regional sampling in a forested situation: archaeology and the Northeast Coal study. M.A. thesis. Dept. of Archaeology SFU. Map 93 P.

7 Probabilistic, high altitude to valley bottom

Beirne, Patricia D., and David L. Pokotylo

1979 Hat Creek project: inventory, assessment and evaluation of the cultural heritage resources. Permit 1978-12. HCB. 285pp. Map 92 I.

Funding: B.C. Hydro (EIA).

Prior to development of a thermal generation project, archaeological studies were conducted in the areas likely to be affected by construction. Random quadrat study was used; a 7.8% sample in the first year (Phase 1) and "more than" 7.8% during Phase 2. Phase I resulted in 85 sites; Phase 2 year I in 101 sites and Phase 2 year 2 in 13 sites (all prehistoric). Different predictions of site numbers in study areas are also made (each year encompasses a different study area). Considerable effort was made to geographically separate site types and as a result, 29 "archaeological zones" are identified. Nineteen historic sites were recorded. Test excavations yielded large numbers of artifacts and a sequence of C-14 dates. It is estimated that 200-300 sites may be adversely affected by the project. A site assessment scheme is applied to heritage resources found during the project.

7 Probabilistic high valley

Pokotylo, David L.

1976 Preliminary archaeological impact assessment of the proposed Upper Hat Creek development. Permit 1976-1. HCB. 43pp + appendices. Map 92 I.

Funding: B. C. Hydro (EIA).

Designed to survey and test localities in conflict with potential development. A probability sample survey of the area located 68 sites, and on the basis of this, it was estimated that the area contained a minimum of 777 sites. The dominant category of material culture is the chipped-stone industry, while the researcher concludes that the main prehistoric occupation appears to be conoentrated in the Early Nesikep cultural period of 7000 to 2800 years ago.

7 Probabilistic high valley

Pokotylo, David L.

1979 An archaeological impact assessment of the proposed Hat Creek thermal electric development Phase 1. In: Annual Report for the year 1976: activities of the Provincial Archaeologist's Office of British Columbia and selected research reports. pplOO-156. Map 92 I.

Funding: B. C. Hydro (EIA).
An initial probability sample of part of a project area potentially affected by a thermal generation project yielded 85 sites predominated by a chipped stone industry. The main prehistoric occupation is concentrated in the "Early Nesikep" period (7000-2800 B.P.)

8 Probabilistic lakeshore

Blacklaws, R., S. Fuller and C. Trauman

1984 B.C. Hydro Homathko development generation preliminary heritage inventory and assessment. Permit 1982-28. HCB. 95pp. Map 92 N.

Funding: B.C. Hydro (EIA).

Survey using judgemental and random sampling techniques yielded 29 sites (9 historic) and identified areas of heritage potential. Sites are briefly evaluated and future programs are outlined.

9 Probabilistic shoreline - lakeshore

Burley, David V.
1975 Skeena III preliminary report: the archaeology of Morice Lake. Permit 1975-4. HCB. l 5pp. Map 93 E, L.

Funding: ASAB (research).

Designed to locate sites around the shores of Morice and McBride Lakes, a shoreline survey and random transect survey was undertaken. Twenty-six sites were recorded, all within lOOm of water bodies. The maps and descriptions in this report were supplemented by reference to the inventory data in order to determine numbers of previously recorded sites included in survey transects.

10 Probabilistic valley bottom

Eldridge, Morley and Ann Eldridge

1980 An evaluation of the Heritage resource potential of the Dean River Valley. Permit 1979-21. HCB. 156pp. + Appendix. Map 93 C.

Funding: HCB (research).

The study was undertaken to provide a regional data base. Judgemental and statistically based survey yielded 17 sites bringing the regional data base to 91. Detailed background is provided and a potential rating of the region is provided.

11 Probabilistic valley bottom, intensive shoreline, lakeshore

Eldridge, Morley

1981 The heritage resources of the Slocan Valley: an inventory and evaluation. Non-permit. HCB. p. Map 82 F.

Funding: HCB (research).

Simple random quadrat survey as well as judgemental and systematic lakeshore survey was conducted to estimatQ the density and variety of heritage sites in the Slocan Valley. Three sites were recorded in quadrat survey, 21 in judgemental survey. Thirty historic sites were found as well.

12 Probabilistic - plateau

Eldridge, Morley

1976 Survey sampling on the Fraser Plateau. Permit 1975-4. HCB. p. Map 92 O.

Funding: B.C. Forest Service (research).
A random sampling survey using m quadrats was employed to compare results against judgemental survey. Thirty-five sites were found, 7 in quadrats. The researcher feels that area site density using quadrat survey grossly underestimates true site density. This finding is credited to forest cover obscuring sites.

13 Probabilistic - lakeshore to high altitude

Magne, Martin P.R. and R.G. Matson

1984 Athapascan and earlier archaeology at Big Eagle Lake, British Columbia. Permit 1983-7. HCB. p. + appendices. Map 92 O.

Funding: Social Sciences and Humanities Research Council.

The report is a synthesis of a major regional inventory and site testing program with a number of separate chapters prepared by different researchers. The project resulted in several methodological advances in ethnic group identification, settlement pattem analysis, lithic technological analysis and dendrochronology. Culture historical data is also provided.

13 Probabilistic - lakeshore to high altitude

Matson, R. G., M. Magne, and D. Ludowicz

1979 The Eagle Lake archaeological project; the 1979 field season. pemmit 1979-14. HCB. p. Map 92 N, O.

Funding: Canada Council (research).

Both random quadrat survey and traditional survey techniques were used to locate 46 sites and 105 sites respectively. The aims of the project are the identification and description of Chilcotin Athapascan settlement and artifact pattems and to contrast these with adjacent Salishan pattems. The objectives are at least partly to be realized through an innovative technique of lithic analysis.

13 Probabilistic - lakeshore and plateau to high altitude

Matson, R. G., M. Magne, D. Ludowicz, and D. L. Pokotylo

1980 The Eagle Lake project: report on the 1979 season. Pemmit 1979- 14. HCB. p. Map 92 N, O.

Funding: S. S. H. R. C. (research).

This volume represents the fmal report on the above pemmit number and presents fmdings in more detail than an earlier paper. Detailed settlement pattem analysis, an experimental lithic reduction study, and analyses and comparisons of lithic debitaye and tools are presented in context of the study's broad objectives of defining and explicating Chilcotin settlement pattems and lithic artifact pattems.

14 Probabilistic - riverbank and benches, canyon

Matson, R. G., and Leonard C. Ham

1974 Report to ASAB Shuswap settlement pattem project. Pemmit 1974- 10. HCB. 9pp + appendices. Map 92 O.

Funding: ? (research).

In order to predict site density and explicate settlement pattem, "regional quadrat sampling" by use of 400m quadrats was employed at the confluence of the Fraser and Chilcotin. General site density estimates are made and locational infommation regarding cache pits is inferred.

14 Probabilistic riverbank and benches, canyon

Ham, Leonard (SFU)

1975 Shuswap settlement pattems. M.A. thesis, Dept. of Archaeology, SFU. 259pp. Map 92 O.

Funding: Canada Council; SFU (research).

Designed to describe and summarize the results of archaeological survey in the area occupied by the Shuswap native groups in order to fommulate a reconstruction of prehistoric settlement pattems in the area. 40 sites, comprised of 163 cache pits and 32 housepit features, were located and recorded. Researcher concludes that the data supports the ethnographically reported settlement pattem - winter house pit villages located on the beaches above the Fraser River and summer river fishing camps. Limited activity food storage sites were also used.

14 Probabilistic riverbank and benches

Matson, R.G., Leonard Ham and Donald Bunyan

1979 Prehistoric Settlement Pattems at the Mouth of the Chilcotin River, B.C. University of B.C. Report. Continuation and summary of work presented in Matson and Ham 1974 and Ham 1979.

15 Probabilistic higher valley bottom

McIntyre, Kenneth G., and Marion C. Mclntyre

1983 The Gataga project an overview assessment report of heritage resource investigations conducted in the Finlay River Valley and eastward into the Muskwa Range of the Rocky Mountains in north central B.C. M.O. 1981-24. HCB. Vol. 1. 197pp, Vol. 2 appendices. Map 94 F.

Funding: Cyprus Anvil Mining Corporation (EIA).

The purpose of the investigation was to locate and assess heritage resources in conflict with a proposed mining project. A "stratified unaligned systematic sample investigation. by "helicopter ovemight, foot traverse, close visual inspection and shovel hole testing" was conducted. Judgemental survey was also conducted. No sites were found in the development area, though about 18 new sites were found.

16 Probabilistic valley floor and walls

Mitchell, Donald H., and Morley Eldridge

1981 An overview of Liard River valley heritage resources. M.O. 1981- 13. HCB. 93pp. Map 94 M, N, 104 P.

Funding: B. C. Hydro (EIA).

The object of the study was to identify the density, distribution, and type of heritage resources found in a large area proposed for a hydro-electric project. A variety of survey techniques were used to locate 12 prehistoric sites and 17 historic sites. Judgemental survey was considered more effective in temms of site location, but random survey was recommended to continue to assess site density.

16 Probabilistic valley floor and walls

Mitchell, Donald H., and Thomas Loy

1981 An overview of Liard River Valley heritage resources. Pemmit 1979-30. HCB. 93pp. Map 94 M.

Funding: B.C. Hydro (EIA).

A variety of probabilistic and judgemental survey was conducted in areas potentially affected by a proposed hydroelectric development to detemmine appropriate survey strategies and assess heritage potential. Twelve prehistoric and 17 historic sites were found. Judgemental survey was rated as the most productive strategy in the study area. This report largely eclipsed by the 1981 Mitchell and Eldridge report.

17 Probabilistic dry valley floor and lower walls

Pokotylo, David L.

1975 Archaeological resources in the Clinton-Ashcroft study area - an initial evaluation. Pemmit 1975-5. HCB. 38pp. Map 92 I.

Funding: ASAB (research).

The study was undertaken as an initial evaluation of the distribution of archaeological resources of the Semelin and Bonaparte Valley areas in advance of possible rail development. A stratified random transect survey yielded 62 surface sites. It is estimated the valley systems contain 1065 sites.

18 Probabilistic, Potential methods, valleys and higher plateaus

Montgomery, Pamela

1979 The Blackwater drainage study: a heritage inventory project in the vicinity of Quesnel, B.C. Pemmit 1979-22. HCB. 143pp. Map 93 B, C.

Funding: HCB (research).

Both quadrat survey and judgemental survey were undertaken in the vicinity of Quesnel to revise the regional heritage potential map. Two sites were tested (FeRo I and FeRo 4). Seven sites were found in quadrat survey, 15 using a judgemental approach and an additional 8 sites were recorded on the basis of informant infommation. A revised potential map was produced.

19 Probabilistic - Lake and river shore, plateau

Richards, Thomas

1981 Heritage resource assessment of the Uncha Lake area of the Nechako Plateau of West Central British Columbia. Non-permit. HCB. p. Map 93 F.

Funding: HCB. (research).

Stratified random survey yielded 9 previously unrecorded and I known site and limited judgemental survey yielded 6 unrecorded sites. The heritage potential of the area was considered relatively low.

20 Probabilistic - valley bottom at higher altitude

Magne, Martin

1984 Taseko Lakes prehistory project: report on a preliminary survey. Permit 1983-7. HCB. 89pp. + appendices. Map 92 O.

Funding: B.C. Heritage Trust (research).

A preliminary sample survey in the Taseko Lakes region yielded 16 sites with between 48 and 270 sites expected in the area. Site density was consistent with other surveys in the region (one sitelO.17 km squared). Seven site types were identified with the majority representing small sites.

21 intensive 100% shoreline using quadrats - lakeshores

Wales, W. Derek

1974 Site survey and excavation: Seton Ponage - Shalalth, a preliminary report. Permit 1974-31. Cariboo College Papers in Archaeology, Number 3. p + maps. Map 92 I.

Funding: Seton Ponage Indian Band (research).

Designed to compile a complete inventory of sites in the study area, a "Ruppe type 4" survey (intensive) was conducted, yielding 61 new sites, added to the 20 previously known from the area. Housepits were located near the lake and near running water. One site was test excavated.

22 intensive, valley bottom, lake and rivershore and Probabilistic, lakeshore

Blacklaws, R. W.

1978 Final report of the Nazko #2 archaeological survey. Permit 1978-7. HCB. 34pp. Map 93 B, C, F, G.

Funding: Nazko-Kluskus bands? (research).

Judgemental and probabilistic survey was undertaken in the Kluskus Lakes area and several linear projects were also inventoried and about 150 sites were recorded. It is stated that this area of the province probably contains the most dense distribution of sites in the province. Simple random survey is judged to be an effective predictive strategy. A preponderance of sites with surface features was recorded.

22

Montgomery, Pamela

1979 A heritage resource management program for the Nazko-Kluskus region. Non-permit. HCB. 47pp. Map 93 F, G.

Funding: HCB (research).

A management plan for the Nazko-Kluskus area is offered along with review of previous work done in the area. On the basis of this review of the various parts of the project, it was decided to sample only a small portion of the study as it appears to have some flaws which are probably not easily rectified using the reports alone.

23 Intensive shoreline - coastal

Mackie, A.P.

1986 A Closer Look at Coastal Survey Results, The Midden Vol.xviii, No. I :3-5.

24 intensive shoreline - coastal

Marshall, Yvonne

1990 The Mowachaht Archaeology Project, Phase I, 1989. Pemmit 1989- 84. 128pp. Ministry Library. Map 102 E.

Funding: B.C. Heritage Trust.

The 1989 investigations represent the first phase of a project designed to document change in native political organizations in Nootka Sound during the period AD 1750-1950. Systematic inventory of the area resulted in the recording or revisiting of 64 sites.

24

Moon, Heather

1993 Personal communication with Alexander Mackie

25 Intensive Shoreline - coastal

Acheson, Steven and Sandra Zacharias

1985 The Khungit Haida Culture History Project. Results of Phase I. Heritage Conservation Branch.

26 Intensive shoreline - coastal

Zacharias, Sandra K. and Wanagun (Richard S. Wilson)

1992 Gwaia Haanas 91 Archaeology. 1991 Archaeological Resource Inventory of Southeastem Moresby Island within the Gwaia Hasnas/South Moresby National Park Reserve. Draft Version May 1992. Prepared for Canadian Parks Service, Westem Region.

27 Intensive shoreline - coastal

Eldridge, Morley, Alexander Mackie and Bert Wilson

1993 Gwaia Haanas 92 Archaeology. 1992 Archaeological Resource Inventory of Eastem Moresby island within the Gwaia Haanas/South Moresby National Park. Report in preparation at time of writing for Canadian Parks Service, Westem Region.

28 Intensive shoreline - coastal

Mackie, Alexander P.

1983 The 1982 Meares island archaeological survey: an inventory and evaluation of heritage resources. Non-pemmit. HCB. 151pp. Map 92 F.

Funding: HCB (EIA).

Survey of Meares Island located, recorded or re-recorded and assessed 190 heritage sites in the shoreline fringe of the study area. 73 modified tree areas with 781 modified trees and 1257 modifications of different types were recorded. Sixty-five shell middens, 32 fish traps, 10 canoe skids, 8 historic sites, a waterlogged site and a reported burial area are documented. Impacts of logging are assessed.

29 Intensive shoreline - coastal

Acheson, S and S. Riley.

1977 An Archaeological Resource Inventory of The Northeast Gulf of Georgia Region. In the Annual Report 1977Aetivities of the Provincial Archaeologist Office of British Columbia and Selected Research Reports. pp 39-70. Heritage Conservation Branch of British Columbia.

30 Intensive shoreline - Coastal

Haggarty, James C. and Richard 1. Inglis

1984 Interim progress report historical resources site survey and assessment. Pacific Rim National Park. Pemmit 1983-8. HCB. 78 pp. Map 92 C, E.

Funding: Parks Canada (research).

Intensive archaeological site survey of the Broken Group Islands, Long Beach and West Coast Trail units of Pacific Rim National Park yielded 307 sites, including 56 known sites. Sites are divided by type including shell middens, fish traps, burial places, tree resource utilization areas, isolated fmds, rock art places, and (presurnably) historic sites. Detailed methodology is presented and summary of results are presented. A more detailed final report is anticipated.

31 Intensive survey - river and stream bank

Keddie, Grant

1972 The Chilcotin archaeological and ecological survey project. Pemqit 1972-18. HCB. p + appendices. Map 92 O.

Funding; OFY (research).

Designed to delineate, describe and study recent and prehistoric environTnental zones, human utilization of the zones and changes in human ecology, systematic survey was undertaken in three distinct zones. The project was the first in B. C. to employ systematic surface collection as a recording procedure. One hundred seven new sites were recorded. Results are described but interpretation is not presented.
Appendix 1 Cont.
32 Intensive shoreline - riverbank

Archer, David J.W.

1987 The Kitsumkalum heritage survey project: a report on the 1986 field season. Pemmit 1986-17. HCB. 72pp. + Appendix. Map 103 I.

Funding: B.C. Heritage Trust (research).

A heritage inventory, with limited subsurface testing, of the Kitsumkalum River valley added 27 sites to the known 13 in the region. The new sites include a greater variety than previously known, with 5 separate clusters of prehistoric sites. Preliminary examinations show differences between clusters.

32 Intensive shoreline - riverbank

Archer, David J.W.

1988 Kitsumkalum Survey Initial Results. The Midden XX, 2:6-10.

33 Intensive shoreline - lakeshore

French, Diana E. (ASAB)

1975 Atlin Lake heritage resources inventory 1975: preliminary report. Pemnit 1975-4. HCB 9pp + appendices. Map 104 N.

Funding: ASAB; Dept. of Labour (research).

Designed to identify heritage resources and their distribution, judgemental survey and infommant interview yielded 35 new sites. Three archaeological horizons were identified, including a supposed early microblade component.

33 Intensive shoreline - lakeshore

French, Diana E. (ASAB)

1976 Atlin Lake heritage resources inventory - 1976 preliminary report. Pemnit 1976-5. HCB 6pp + appendix. Map 104 N.

Funding: ASAB (?) (research).

Designed to continue a systematic survey and inventory of heritage resources on Atlin Lake. Survey resulted in location of 42 additional sites.

34 Intensive shoreline - coastal

McMillan, Alan D. and Denis E. St. Claire.

1991 The Toqusht Archaeological Project: Report on the 1991 Field Season. Report prepared for the British Columbia Heritage Trust, The Archaeology Branch, and the Toquaht Band. Pemmit 1991 -31.

34 Intensive shoreline - coastal

McMillan, Alan D. and Denis E. St. Claire.

1992 The Toquaht Archaeological Project: Report on the 1992 Field Season. Report prepared for the British Columbia Heritage Trust, The Archaeology Branch, and the Toqusht Band. Pemmit 1992-46. This report contains some additional survey infommation the bulk of which is in their 1991 report.

35 Intensive shoreline - river bank and coastal

Archer, David J.W. (Museum of Northem British Columbia)

1984 Prince Rupert Harbour project heritage site evaluation and impact assessment. Pemmit 1983-35. HCB. p. Map 103 I, J.

Funding: HMM (EIA).

A number of projects in the Prince Rupert harbour and region were conducted and some minor test excavation conducted. A road corridor between Prince Rupert and Grassy Point yielded one site; Ridley and Lelu Island yielded 11 sites (all modified trees); a rail route between Terrace and Port Edward yielded 39 new sites and 9 previously recorded sites; survey of Kaien Island yielded 12 new sites and 17 known sites; and survey of Metlakatla reserve lands resulted in 17 new sites and 30 previously known sites.

35 Intensive shoreline - coastal

Archer, David J.W. (University of Calgary)

1990 The Kitkatla heritage inventory project: an interim report on the 1989 field season. Pemmit 1989-50. 100pp. Ministry Library. Map 103 G.

Funding: B.C. Heritage Trust; Employment Development Branch.

Coastal survey of traditional Kitkatla (Coast Tsimshian) territory covering southeast portion of Porcher Island, north half of Dolphin Island and northeast portion of Spicer Island. Forty new sites were located and mapped and a number of artifacts were recovered from the intertidal zone. Survey is the first part of a two year study of the area.

35 Intensive shoreline - coastal

Archer, David J. W. (Tsimshian Tribal Council)

1990 The North Coast heritage inventory project: a report on the 1989 field season. Permit 1989-47. 64pp. Ministry Library. Map 103 J.

Funding: B.C. Heritage Trust; Employment and Immigration Canada; Metlakatla Band; University of Calgary.

During the summer of 1989 a small scale archaeological survey was conducted near the city of Prince Rupert on the north coast of British Columbia. The survey covered Carr Islet, Tsimpsean Peninsula from Observation Point to Ryan Point, Tuck Inlet and the north shore of Prince Rupert Harbour. Nine new sites were found: six small shell middens, one medium sized shell midden, and two large shell middens. Some time was also devoted to upgrading the infommation on sites recorded before 1980. In all, eight sites were mapped and described. Some of these results incorporated into this study, others not intensive or systematic enough to warrant inclusion.

35 Intensive shoreline - coastal

Archer, D.J.W.

1991 The north coast heritage inventory project: a report on the 1990 field season. Pemqit 1990-66. 278pp including site fomms. Ministry Library. Map 103 J.

Funding: Ministries of Tourism and Social Services and Housing.

During the summer and fall of 1990 an archaeological survey was conducted near the city of Prince Rupert on the north coast of British Columbia. The survey covered Kitson Island, the south sides of Smith Island and DeHorsey Island, and the west side of Tsimpsean Peninsula from Ryan Point to Jap Point. Three new sites were found, all of them shell middens and all located on the west side of Tsimpsean Peninsula. The rest of the field season was devoted to recording sites found at the end of the previous season and to updating sites recorded before 1980. In all, 38 sites were mapped and described.

36 Intensive shoreline - riverbanks, river valleys

Mohs, Gordon

1979 Heritage resources of the South Thompson River Valley: inventory, interpretation and evaluation. Pemmit 1978-8. HCB. 168pp. Map 82 L, 92 1.

Funding: HCB (research).

The South Thompson River Valley was systematically surveyed between Kamloops and Chase (116 km) resulting in the location of 192 sites. 75% of these are in the floodplain; the remainder on river terraces. 65% are on the river's north side. The majority of sites represent habitations, with pit houses being the most common. Damage from land development is considered extensive. Significance criteria are applied to sites to detemmine their importance and a conservation management plan is proposed.

37 intensive riverbank and floodplain surves,

Eldridge, Morley

1974 Recent archaeological investigations near Chase B. C. Pemmit 1972-28 and Pemmit 1972-38. HCB. 177pp. Map 82 L.

Funding: ? (research).

Designed to survey 3 sq. miles, map 5 sites, and salvage excavate 2 sites, (EeQx 14 and EeQx 5) on the Thompson River. Survey revealed 118 sites, indicating heavy utilization of the flood plain in aboriginal times. As a result, the possibility of year-round habitation of sites is suggested. With regard to excavation, research suggests that the Nesikep Tradition was not present in the south Thompson area until after 2800 B.P. and that before this time, an exploitative system with a toolkit similar to that of the Old Cordilleran culture existed.

38 intensive riverbank/canyon survey

MacDonald, George F. and Gary Coupland.

1982 Ethnohistorical and Archaeological investigations at Kitselas Canyon. Report on file with Parks Canada, Calgary Albena and Kitselas Band Council, Terrace, B.C. Report on f le with Canadian Parks Service, Calgary. This is the only report of sites on the west side of Kitselas Canyon which do not appear in any subsequent Kitselas reports or publications and which never made it into the B.C. Inventory.

38 intensive riverbank/canyon survey

Mackie, Alexander P.

1986 Aboriginal Site Distributions Along the Lower Skeena River Within Coast Tsimshian Territory. Paper presented at the Annual Meeting, of the Canadian Archaeological Association, Toronto 1986. Copy on file with the Archaeology Branch, Victoria B.C. This paper analyses site distributions along the lower Skeena River and includes original data about sites which are not in the B.C. Inventory due to an oversight by the Kitselas Project directors.

39 intensive shoreline - lakeshores

Mohs, Gordon

1974 Babine Lake archaeological survey project. Permit 1974-1. HCB. 13pp + appendix. Map 93 K, L.

Funding: ASAB (research).

The study was designed to locate all sites on the Babine Lake shoreline, resulting in recording of 45 prehistoric sites and I historic site. Only one site was found associated with a creek, of which 77 drain into the lake.

39 Intensive shoreline - lakeshores

Mohs, Gordon

1975 Babine Lake archaeological survey project 1975. Permit 1975-4. HCB. 10pp. Map 93 K, L.

Funding: ASAB (research).

Inventory was continued around Babine Lake, resulting in location of an additional 86 sites along 40 miles of lakeshore, raising the lakeshore site count to 130. Site concentration is greatest on Babine Arm. Every Island has yielded sites, typically major occupation sites.

40 intensive shore and river bank

Borden, Charles E.

1952a Results of a preliminary survey of the Nechako reservoir in west central B. C. Non-permit. HCB. 23pp. Map 93 E, F.

Funding: ? (EIA).

In response to an Alcan proposal to inundate the Nechako Reservoir, brief judgemental survey located 115 sites, mostly in the more accessible eastern end of the study area.

40 Intensive survey lake and river shore

Borden, C.

1952b Results of Archaeological Investigations in Central British Columbia. Anthropology in British Columbia, Vol. 3:31-43.

40

Borden, C.

1952c A Uniform Site Designation Scheme for Canada. Anthropology in 8ritish Columbia, Vol. 3:44-48. Many sites on project REF 40 not in CHIN due to inexact information on old site fonns. However, this reference has one Borden area map plotting sites in FiSi area and indicating the quality of information which probably resides in Borden's notes at UBC.

41 Intensive survey, riverbank corridor

Wilson, Ian R. and Morley Eldridge

1988 Stein River haulroad route rehmements, heritage resources inventory and impact assessment. Permit 1988-39. 46pp. Map 92 I.

Funding: British Columbia Forest Products Ltd.

The road aligntnent was re-examined to include route rehmements in the western part of the road and to include culturally modified trees (CMT's) along the route. No "new" archaeological sites were located in the project area but a pictograph site (EbR1 6) and an arborgraph (EbRk 11) were recorded in areas away from the proposed development. Four CMT localities were recorded which contain examples of both rectangular and tapered scars. Collection of stem round samples from scarred trees and 40 cm + cedars within the right of way is recommended mitigation.

42 Intensive survey, high altitude

Rousseau, Mike K. and Rob H. Gargett.

1987 Prehistoric Resource Use on Cornwall Hills Summit. The Midden XLX, 5:6-9.

43 intensive shoreline - river valley

Stryd, Arnoud H. and Stephen Lawhead

1984 CN Rail twin tracking project: final statement heritage inventory and preliminary impact assessment. Non-permit. HCB. 301 pp. (limited survey)

Funding: CN Rail (EIA).

This report details the results of a heritage resource inventory and preliminary impact assessment on CN's twin tracking project between Valemount and Vancouver. 174 heritage sites were identified in areas ranked as "high" and moderate to high" potential. Sites were evaluated and significance rankings provided. Detailed impact assessment at 24 of 28 sites in conflict with development is proposed.

43 Intensive shoreline - river valley

Stryd, Arnoud H. and Stephen Lawhead

1984 C.N. Rail twin tracking project. Valemount to Vancouver fmal statement heritage inventory and preliminary impact assessment. Non-permit. HCB. 30 pp. + Appendices.

Funding: C.N. Rail (EIA).

Site survey of the high and moderate potential areas along the proposed B.C. segment of the C.N. twin tracking program yielded 174 heritage sites. Sites located were assessed as to size, stratification, content and condition. 28 sites were found to be in conflict with development and detailed impact assessment is recommended at 24 of these.

43 Intensive shoreline - river

Stryd, Arnoud H.

1993 Personal communication with Morley Eldridge.

44 Intensive lakeshore

Sneed, Paul G., and B. Brown

1975 Archaeological reconnaissance in Carp Lake Provincial Park: the 1974 season. Permit 1974- 1. HCB. 7pp + appendices. Map 93 J.

Funding: ? (EIA).

Designed to conduct a survey of an area that received provincial park status and would be subject to development. Forty-five sites were recorded. Researcher concludes that Carp Lake was used primarily for the extraction of one or a few resources.

44 Intensive lakeshore

May, Joyce

1977 Archaeological Reconnaissance in Carp Lake Provincial Park 1977 season. Permit 1977-18. ASAB. IOpp + appendices. Map 83 J.

Continuation of Sneed and Brown's work of 1975.

45 Intensive shoreline

Mohs, Gordon

1977 Arrow Lakes Reservoir Region post inundation studies of the archaeological resource. Permit 1977-11. HCB. 72pp + appendices. Map 82 E, F, K, L.

Funding: ASAB (?) (EIA).

Designed to re-assess and re-evaluate previously recorded archaeological sites impacted by the construction of a dam and to inventory archaeological sites in the area not previously examined or recorded. Thirty-seven new sites were located and 108 recorded sites were re-examined. The majority of sites along the foreshore were seriously damaged.

46 Intensive shoreline

French, Diana E.

1980 Preliminary assessment of heritage resources in the Telegraph Creek land management area of northwestem B. C. Permit 1978-7. 84pp. Map 104 G, J.

Funding: HCB (EIA).

Systematic survey was conducted in response to a variety of possible developments and resulted in the recovery of 132 sites. Site density was high particularly at and below the Stikine/Tahltan River confluence. Sites are primarily related to fishing and fish storage activities. Dating was uncertain.

47 Intensive shoreline, lake shore and riverbank

Sneed, Paul G.

1978 Kootenay River diversion cultural heritage resources: phase I impact statement. Perrnit 1977-36. HCB. p + appendices. Map 82 J, K.

Funding: B.C. Hydro (EIA).

Systematic inventory of 50% of the study area subject to inundation resulted in the discovery of 180 heritage sites and re-evaluation of 51 previously known sites. Of the 231 sites, 94°/0 were prehistoric which were divided into five basic site types based on surface observations. The large majority of sites are relatively undisturbed and are considered to represent a signiEcant resource.

Appendix 1 Cont.

47

Wilson, Ian R.

1981 Kootenay River diversion environmental impact assessment heritage studies. Permit 1979-23. HCB. 155pp. Map 82 G, J, K, O.

Funding: B. C. Hydro (EIA).

Prior to development of a proposed hydroelectric project, areas threatened by inundation were systematically surveyed. Two hundred fifty two sites in the Upper Columbia Valley and 32 sites along the Kootenay River were located and/or revisited and rerecorded. Eighteen sites were preliminarily tested by shovel testing. Not consulted for this report.

48

Acheson, S., S. Cassidy and C. Claxton Intensive survey, coastal shoreline

1975 Report: of the archaeological survey of the southwestern Gulf of Georgia. Permit 1975-6. HCB. 15pp + appendices. Map 92 B.

Funding: ASAB (research).

Over two field seasons, over 1000 sites were recorded in a regional inventory of the southern Gulf of Georgia. Survey was coastally oriented and judgemental. It is estimated that the majority of sites in the area were recorded.

48

Wainwright, Peter

1993 Personal communication with Morley Eldridge.

49

Apland, Brian C.

1974 The 1974 survey of portions of the Bella Bella region. Permit 1974-8. HCB. 7pp + appendices. Map 92 M, 102 P.

Funding: SFU; ASAB (research).

Designed to examine intertidal zones, raised beach features and generally record site types not previously recorded as part of a settlement pattem study, 110 sites were found. Intertidal zones revealed sigruficant numbers of sites. Details of exact areas of survey and sites found in each area very hard to recover. Only part of this report was used.

50 Intensive survey, high altitude to high valley bottom

Vivian, Brian

1989 A survey and assessment of the cultural resources in Cathedral Provincial Park, B.C. Permit 1988-80. 61pp. Map 92 H.

Funding: Ministry of Parks.

The report presents the results of a good judgemental survey of Cathedral Park. Most but not all of the high potential areas are covered. A total of 20 new sites were recorded and 10 previously recorded sites were reported on. The report includes some discussion on the significance of high elevation interior sites. It also gives an assessment of each site in terms of which ones may be expected to yield further information and which ones require monitoring, etc.

51 Intensive survey, valley bottom

Vivian, Brian

1989 A Survey and assessment of the prehistoric cultural resources of the Similkameen Basin, Upper Similkameen Valley, B.C. Permit 1987-9. 127pp (volume 1). Map 92 H.

Funding: University of Calgary, Mascot Mines, Challenge, B.C., S.E. E.D. Program.

In the summer of 1987, an archaeological survey of the Princeton Basin was conducted to compile an inventory of prehistoric heritage resources present in the region. It was the first systematic survey ever conducted within the Similkameen Valley. Over the course of 4 months, a total of 116 sites were found, 10 previously recorded sites were revisited, private artifact collections were viewed. Information was collected on site location and size, and the nature of surface artifact assemblages. Sites found represented a wide range of activities including large campsites returned to year after year, smaller campsites used only for several months, lithic quarries, isolated lithic reduction locations and animal kill sites. The results of the survey confirm the archaeological importance of the Similkameen Valley and the value of the heritage resources contained within the Valley. The report is in two volumes. Volume I is the main report, and Volume 2 contains site forms only.

52

Friesen, David E. Intensive survey, trail and large block, high altitude to valley bottom

1983 Archaeological investigations of the upper Stikine River basin and Spatsizi Plateau region, northwestern B. C. Permit 1982-10. HCB 78pp. Map 94 E, 104 H.

Funding: Arctic Institute of North America; Explorer's Club (research)

Objectives were to provide inventory and evaluation of heritage resources and assess the potential of the region for investigating prehistoric trade and transportation. Thirty-four sites were recorded related to historic and late prehistoric times. Tahltan and Sekani settlement patterns in the area are discussed.

53

Eldridge, Morley and Sandra K. Zacharias, Dorothy Kennedy and Randy Bouchard

1989 Robson Bight archaeological resource inventory. Permit 1988-85. 137pp + plates, maps. Map 92

Funding: Archaeology and Outdoor Recreation Branch.

An archaeological inventory was conducted for an ecological reserve and a proposed reserve addition. Ethnologists also researched the Indian history of the Robson Bight area. Five prehistoric archaeological sites (4 shell middens and a fsh trap) were recorded in addition to numerous bark stripped trees and some aboriginally logged trees. Yellow cedar appears to have been utilized most heavily. Two shell middens are small and are interpreted as short term camps. One midden is thought to be the remains of a winter village or long-temm fishing camp - almost certainly a named place of origin for two kin groups of the Komkintis people.

54 Intensive shoreline

Rousseau, Mike K. and D. Wales

1977 Interior lakes archaeological inventory Okanagan Lake survey 1977. HCB. Map 82 E, L.

Funding: ASAB (research).

Judgemental survey primarily oriented to lakeshores was undertaken to compile a regional inventory. Seventy-three sites were recorded, mostly very small lithic scatters.

55 Intensive shoreline

Wilson, Robert L.

1983 Heritage resource investigations of the mid-North Thompson River region, B.C. Permit 1982-24. HCB. 71pp. Map 92 I.

Funding: B.C. Heritage Trust; Canada Manpower; North Thompson Indian Band: (EIA, research).

Designed to inventory and document sites on the North Thompson I.R. to assess agricultural impacts and to investigate the status of heritage resources in the area., systematic survey of selected areas was undertaken. Three sites were test excavated and 42 sites were recorded. An oral history program was conducted.

56

Brown, B. and G. Lundborg

1977 Archaeological resources of the Lower Adams River. Permit 1977-19. HCB. 38pp. Map 82 M.

Funding: (?) (EIA).

Designed to locate and record sites endangered by park development. Sixty-six sites were recorded, the majority of which were small habitation sites located on the river.

57

French, Diana E.

1974 Survey of the Silver Salmon River between Kuthai Lake and the Nakina River, northwestem B. C. Pemmit 1974-16. HCB 9pp. Map 104 N.

Funding: ?

Designed to survey and locate archaeological sites along the Old Indian trail between Atlin Lake and Nakina River (a trail used extensively during historic times by Inland Tlingit). Ten sites were located.

58 Intensive shoreline

Rafferty, Pauline

1975 Archaeological reconnaissance of the Bulkley-Nechako area - summer 1975. Pemmit 1975-4. HCB. 8pp + appendices. Map 93 K, L.

Funding: ASAB (research).

The westem Nechako drainage and eastem Bulkley Valley were systematically surveyed as part of a regional inventory program, recording 23 sites including one historical site. Pithouse sites were recorded, the most northerly of this site type recorded to date.