A Domesticated Landscape: Native American Plant Cultivation on the Northwest Coast of North America.

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A DOMESTICATED LANDSCAPE:
NATIVE AMERICAN PLANT CULTIVATION ON THE
NORTHWEST COAST OF NORTH AMERICA

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Geography and Anthropology

by

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# TABLE OF CONTENTS

Acknowledgments ................................................................. iii  
List of Tables ........................................................................ viii  
List of Figures ........................................................................ ix  
Abstract ................................................................................ x  

Chapter  
1 Cultivation on the Northwest Coast: An Introduction ................. 2  
2 The Origins of Plant Cultivation and Agriculture: An Overview and Assessment .............................................. 16  
   Infrastructure-Driven Models of the Origins of Agriculture .......... 18  
   Structure-Driven Models of the Origins of Agriculture ............. 21  
   Superstructure-Driven Models of the Origins of Agriculture ...... 23  
   Complex Models of the Origins of Agriculture ....................... 25  
3 Reconsidering Non-Western Agriculture ..................................... 33  
   Tending, Cultivation, and Domestication ............................... 36  
   Agroecosystems .................................................................. 39  
   Wetland Cultivation ............................................................ 41  
4 Patterns of Plant Cultivation on the Northwest Coast .................... 47  
   Ownership ......................................................................... 50  
   Soil Tilling and Weeding .................................................. 55  
   Transplanting and *In situ* Replanting of Propagules ............. 57  
   Selective Harvesting ......................................................... 60  
   Fire ................................................................................... 61  
   Pruning ............................................................................... 63  
   Fertilization ......................................................................... 65  
   Seed Cultivation ................................................................. 66  
   Domestication ...................................................................... 67  
5 Ethnographic Accounts of Estuarine Cultivation .............................. 69  
   Rhizomes in Economic, Ceremonial, and Cosmological Life ...... 71  
   Methods of Plant Cultivation .............................................. 77  
      Ownership ....................................................................... 80  
      Site Preparation and Soil Modification ............................ 82  
      Vegetative Transplanting, Replanting, and Selective Harvesting . 91  
      Weeding and Garden Hunting ....................................... 96  
      Harvest .......................................................................... 98  

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<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale and Distribution</td>
<td>102</td>
</tr>
<tr>
<td>Ethnography and the Question of Antiquity</td>
<td>107</td>
</tr>
<tr>
<td>Domesticates</td>
<td>111</td>
</tr>
<tr>
<td>6 A Non-Agricultural Northwest Coast: Retracing the History of an Idea</td>
<td>114</td>
</tr>
<tr>
<td>Explorers</td>
<td>116</td>
</tr>
<tr>
<td>Boas</td>
<td>122</td>
</tr>
<tr>
<td>Boas' Students and Allies: Kroeber, Lowie, and Sauer</td>
<td>128</td>
</tr>
<tr>
<td>Other Schools of Thought</td>
<td>131</td>
</tr>
<tr>
<td>Reconsiderations</td>
<td>137</td>
</tr>
<tr>
<td>7 A Context for Cultivation: Cultural Intensification and Resource</td>
<td>141</td>
</tr>
<tr>
<td>Intensification on the Pre-European Northwest Coast</td>
<td></td>
</tr>
<tr>
<td>The Northwest Coast: Environments and Resources</td>
<td>143</td>
</tr>
<tr>
<td>The Move Toward Sedentism</td>
<td>146</td>
</tr>
<tr>
<td>Circumstances of Resource Intensification after 4000 B.P.</td>
<td>151</td>
</tr>
<tr>
<td>Precarious Polities, Prestige, and Resource Production</td>
<td>153</td>
</tr>
<tr>
<td>The Intensification of Finite Resource Sites</td>
<td>161</td>
</tr>
<tr>
<td>8 The Ecology of Estuarine Root Cultivation</td>
<td>165</td>
</tr>
<tr>
<td>Ecology of the High Salt Marsh</td>
<td>166</td>
</tr>
<tr>
<td>Rockworks, Mounds, and the Expansion of the Upper Marsh</td>
<td>169</td>
</tr>
<tr>
<td>Rockworks, Mounds, and the Properties of Marsh Soils</td>
<td>175</td>
</tr>
<tr>
<td>9 Estuarine Garden Sites in Archaeological Contexts</td>
<td>182</td>
</tr>
<tr>
<td>The Destruction and Preservation of Garden Rockworks</td>
<td>187</td>
</tr>
<tr>
<td>Archaeological Surveys</td>
<td>191</td>
</tr>
<tr>
<td>Quatsino Sound</td>
<td>195</td>
</tr>
<tr>
<td>Nootka Sound</td>
<td>202</td>
</tr>
<tr>
<td>Clayoquot Sound</td>
<td>208</td>
</tr>
<tr>
<td>Site Surveys at Documented Low-Gradient Gardens</td>
<td>211</td>
</tr>
<tr>
<td>General Observations and Conclusions of Archaeological Surveys</td>
<td>220</td>
</tr>
<tr>
<td>10 Excavations at Ts'isakis: DhSk12</td>
<td>228</td>
</tr>
<tr>
<td>Site Description</td>
<td>232</td>
</tr>
<tr>
<td>Oxidizable Carbon Ratio Dating Methods</td>
<td>236</td>
</tr>
<tr>
<td>Excavation Units</td>
<td>238</td>
</tr>
<tr>
<td>Unit A</td>
<td>239</td>
</tr>
<tr>
<td>Unit B</td>
<td>242</td>
</tr>
<tr>
<td>Unit C</td>
<td>243</td>
</tr>
<tr>
<td>Soil Processing</td>
<td>245</td>
</tr>
<tr>
<td>Expected Findings</td>
<td>246</td>
</tr>
<tr>
<td>Findings</td>
<td>247</td>
</tr>
<tr>
<td>Interpretation of Findings</td>
<td>249</td>
</tr>
</tbody>
</table>
LIST OF TABLES

1. Kwak'wala Grammatical Categories for Plant Resource Sites ................. 92

2. Potential Distribution of Certain Northwest Coast Salt Marsh Plants within the Tidal Column. ................................................................. 171

3. Plants Identified at Garden Sites, Somass River Estuary ...................... 218
LIST OF FIGURES

1. Primary Ethnolinguistic Groups of the Northwest Coast ..................... 1

2. Nimpkish River Tidal Flats ................................................................. 7

3. Garden Sites Identified by Indigenous Consultants
   a. Nuu-chah-nulth ................................................................. 104
   b. Kwakwaka'wakw .............................................................. 113

4. Idealized Marsh Cross Section .......................................................... 173
   a. Prior to Garden Rockwork Construction
   b. With Intact Garden Rockwork

5. Damaged Garden Rockworks ............................................................... 190
   a. Low Gradient Shoreline
   b. High Gradient Shoreline

6. Quatsino Sound Archaeological Survey Areas .................................... 197

7. Hathaway Creek Tidal Flats, EdSw4 .................................................. 199

8. Nootka Sound Archaeological Survey Area ....................................... 203

9. Boco del Infierno Bay, DjSp8 ............................................................ 205

10. Clayoquot Sound Archaeological Survey Areas ................................. 210

11. Idealized Rhizome Garden Complex ............................................... 226

12. Excavation Units at DhSk12 ............................................................. 229

13. Unit Stratigraphy and OCR Dates: DhSk12 ....................................... 241
ABSTRACT

By all accounts, the peoples of the Northwest Coast of North America did not cultivate plants at the time of European contact. This dissertation provides an interdisciplinary assessment of evidence to the contrary, and presents a critique of the literature from which this orthodoxy has been derived. As a primary line of evidence, this thesis describes estuarine gardens found on this coast during the contact period. Northwest Coast peoples created gardens of Pacific silverweed (*Potentilla anserina* ssp. *pacific*a), springbank clover (*Trifolium wormsksjoldii*) and other plants with edible, starchy roots within estuarine plots. Ethnographic sources suggest that these gardens were maintained through transplanting, weeding, selective harvesting, and a host of other management methods. Such sites were termed “gardens” by Franz Boas and others, but were dismissed as “non-agricultural” in part due to the restrictive definition of agriculture which prevailed in Boas’ time.

Indigenous motives for plant resource intensification paralleled the post-Pleistocene intensification of other resources, as sedentary villages developed around productive estuaries where salmon and other resources were concentrated. Ethnographic evidence suggests that Northwest Coast peoples had strong economic, dietary, and ceremonial motives to enhance rhizome output, which evolved alongside these long-term trends in dietary and settlement patterns. Gardens represented an elegant response to these motives. With mounded soils, often encircled by rock enclosures, these gardens dramatically expanded the narrow zone where these edible plants grow. Anomalously porous and nutrient-rich garden soils further enhanced
rhizome output. Linguistic evidence suggests that indigenous peoples recognized gardens as a product of human agency, and as "places of manufactured soil." Gardens recorded during the colonial period can be found archaeologically, and probable garden sites with similar structural characteristics can be found dotting this coastline. Archaeological evidence conducted for this dissertation demonstrates that these gardens were being intensively managed prior to European contact. Similar wetland gardening methods from the American tropics are explored, as is the demise of Northwest Coast wetland gardening in the colonial period. Cumulatively, this dissertation concludes that Northwest Coast estuarine gardening constitutes a tradition of "plant cultivation," by current definitions of that term.
Figure 1: Primary Ethnolinguistic Groups of the Northwest Coast
CHAPTER 1
CULTIVATION ON THE NORTHWEST COAST: AN INTRODUCTION

Since the beginnings of anthropological research on the Northwest Coast of North America, there has been little debate as to whether the peoples of this region practiced agriculture. Most scholars have accepted that they did not. Indeed, these peoples' presumed lack of agriculture, their large, sedentary villages of highly stratified foragers, could be described as one of American anthropology's most prominent anomalies. As Alfred Kroeber (1962:61) claimed, the Northwest Coast peoples seemed to represent an entirely exceptional case, "a wholly non-planting and non-breeding culture - perhaps the most elaborate such culture in the world." As beneficiaries of vast salmon runs living far from the agricultural centers of the Americas, the orthodox argument went, these people fed themselves with minimal effort and without apparent need for plant cultivation. This aspect of Northwest Coast subsistence was among a larger suite of ethnographic exceptions enthusiastically advertised by Franz Boas and his students in their rebuttal of both evolutionary and environmentalist models of cultural development. As such, the truism of a Northwest Coast without cultivation became a part of most American anthropologists' early training and a prominent factoid within many textbooks in the fields of geography, anthropology, and archaeology (e.g. Ames and Maschner 1999:13-14; Netting 1986: 27-40; Harris 1977; Harris 1968; Sauer 1952,1936; Kroeber 1939; Linton 1934; Benedict 1934; Lowie 1920; Spinden 1917).

Since Boas' time, however, there has been a dramatic change in the prevailing view of what constitutes "plant cultivation." Today, most authors question the
European biases of past depictions of non-Western plant management. Plant cultivation, they suggest, was neither invented and then diffused from a small number of "civilized" hearths, as many Eurocentric anthropologists suggested, nor did its emergence always eclipse efficient and pre-existing modes of hunter-gatherer subsistence (Harlan 1996, 1975; MacNeish 1992; Cowan and Watson 1992).

"Cultivation," it is now countered, represents a broad continuum of practices. Many of these practices differ materially from European agriculture, but all involve the manipulation of both plants and their environments as a means toward the anticipated ends of quantitatively and qualitatively enhanced plant production. And, as Boas himself recognized, such practices were widespread within Northwest Coast societies. This broad reevaluation of the very nature of plant cultivation provides us with an opportunity to revisit the puzzling case of the non-cultivating Northwest Coast.

To be sure, there are many puzzles. Not only have scholars found the sedentism, social stratification, complex ceremonialism, and patterns of resource ownership found among Northwest Coast "foragers" somewhat bewildering, but these foragers also seemed to fit most of the preconditions for the development of plant cultivation and domestication posited by some of the leading theorists on agricultural origins. The Northwest Coast was a land of sedentary fisherfolk, with both leisure time and a diversity of plants at their disposal. As such, few regions of the world seem so well suited to the "sedentary fisherfolk" hypothesis advanced by Sauer (1952) and adopted by such authors as Anderson (1969) and Moseley (1975), or the "affluent foragers" model of agricultural genesis as summarized by MacNeish (1992). In each case, the Northwest Coast has presented a curious exception to these hypotheses. Certainly, if
pre-agricultural sedentism, abundant vegetation, and opportunities for experimentation
serve as prerequisites for the development of plant cultivation, few places would seem
as likely a candidate for the development of plant cultivation – even by conventional
criteria – than the Northwest Coast. This exception, arguably, has refueled some
authors’ faith in models that presume scarcity as a precondition for agricultural
development. Repeatedly, the Northwest Coast has been cited as a curious exception,
and theorists have been compelled to defend their models with claims that the region
presents a highly exceptional case (e.g., Sauer 1952, 1936). Several explanations have
been advanced, in turn, to explain why Northwest Coast peoples did not cultivate plants:
the superabundance of salmon eclipsed all other means of subsistence; the region was
isolated from paths of American agricultural diffusion and the idea of plant cultivation
never occurred to its inhabitants; Mesoamerican crops failed to diffuse across numerous
inhospitable climate zones; or the Northwest Coast lacked a pool of suitably cultivatable
plants. Yet few of these assertions are necessarily true, and – in light of what is now
known regarding both the region and the nature of cultivation – none serve as a
particularly convincing explanation.

This presumed lack of plant cultivation is additionally puzzling because the
archaeologically detectable development of human-environmental relations along the
Northwest Coast followed a sequence which appears to have been particularly
conducive to the development of agriculture elsewhere in the world (Deur 1999). On
this point, even the scarcity-driven materialist models of authors such as Binford (1968),
Boserup (1965), and Cohen (1977) seem to suggest that the Northwest Coast might be a
particularly conducive environment for the development of plant cultivation. Following
the stabilization of post-Pleistocene sea levels, a larger and more predictable salmon population appears to have facilitated the heightened geographic concentration of hunter-fisher-gatherers in sedentary villages at estuarine sites (Fladmark 1975).

Subsequent developments within both the social organization of these peoples and in their technologies for harvesting and storing marine animals facilitated secondary population growth; in turn, this fostered the emergence of large, sedentary villages of extended family houses, as seen and described by Europeans at the time of contact. As village populations continued to grow, resource harvesting methods continued to intensify: a profusion of fish weirs, intertidal stone fish traps, and fish net technologies persist in the archaeological record as witness to these events. Why, then, was there no corresponding intensification of plant resources?

The answer is that there was a corresponding intensification of plant resources. What differs is the fact that explorers and early anthropologists alike largely overlooked or misdiagnosed evidence of plant resource intensification. Tobacco was the only plant which European explorers saw as evidence of plant cultivation on the Northwest Coast. At the time of first European contact, this familiar cultivar was planted by seed into plots of ground that were cleared of forest vegetation and fertilized with rotting piles of organic detritus, on both the northern and far southern ends of the region (Vancouver 1801). When first seen by Europeans, these tobaccos, including the “Haida tobacco” (Nicotiana quadrivavlis) were growing on the moist outer coast, far outside of their ancestral ranges in the dry Western interior. Diverse evidence suggests that the seeds had been transported to the outer coast at some distant time through trade networks (Turner and Taylor 1972). There was a tradition of transporting, transplanting, and
tending endemic food plants, however, which surpassed both the scale and significance of tobacco cultivation. Each seems to have served to bring desirable food plants close to home, within the defensible control of individual villages and households (Kuhlken 1994). The edible bulbs of camas (*Camassia quamash* and *Camassia leichtlinii*) were transported and transplanted from the dry interior to burned, anthropogenic clearings on the moist outer coast. Similar, inter-zonal transplanting seems to have occurred on a smaller scale with some liliaceous plants, such as the tiger lily (*Lilium columbianum*). These plots of desirable plants were owned by clans, families, or individuals, and were often weeded, pruned, or burned; their soils were turned, while their seeds and rootlets were sometimes returned to the soil, all to enhance localized productivity. As this dissertation shall demonstrate, the indigenous peoples of this coast consistently employed a wide variety of such methods to enhance the productivity of many plants.

However, some of the most compelling evidence for the presence of Northwest Coast cultivation can be found in the case of the root-cropping of certain native estuarine plants, including, most notably, the Springbank clover (*Trifolium wormskjoldii*) and the Pacific Silverweed (*Potentilla anserina. ssp. pacifica*). Along much of the coast, particularly from Vancouver Island northward to southeast Alaska, plots of these plants were manufactured or modified to become what were termed “gardens” (of the sort seen in Figure 2) by a number of early writers. Boas (1966, 1934: 37, 1921: 186-94, 1909, n.d.), in particular, described widespread Kwakiutl “gardens” of these two estuarine plants. Boas (1934) provided a particularly detailed map of one of these gardens, at the mouth of the Nimpkish River, and Figure 2 has been based, in large part, on this map. Most of these *Potentilla* and *Trifolium* gardens occupied
Figure 2: Nimpkish River Tidal Flats
estuarine gravel beds where the mouths of rivers and streams met saltwater bays and inlets. These two plants were ordinarily grown together; both possess edible, starchy rhizomes that grow in dense clusters and range from roughly three to 10 mm in width. In some cases, additional estuarine plants with edible root segments, most notably the ricercot lily (*Fritillaria camschatcensis*) and the Nootka lupine (*Lupinus nootkatensis*) were grown within these plots as well.

Garden design varied considerably along the coast, but in each case, gardens appear to have been the product of a labor-intensive construction process. Soils were regularly worked and often mounded in garden plots. On rocky shorelines, garden beds were created by the removal of rocks and small boulders down to a level rock and soil surface. Often, these rocks were piled along the boundaries of each plot (in a manner somewhat similar to the intertidal rock fish traps of the region) and were sometimes lined with split boards placed on edge and held between stakes placed in the ground (Boas 1934; Figure 2). In parts of the coast without accumulations of glacial rock, such as on low-gradient deltaic deposits or along the southern Northwest Coast, gardens often appear to have been marked with cedar posts or encircled with short walls of sticks, mud, or small rocks. Undesirable plants were regularly weeded out of these plots. In many cases, the ends of the rhizomes were taken from desirable specimens of these plants. from within or outside of the plots, and “placed back in the ground so they would grow the following year” (Turner and Efrat 1982: 68, 73). On the central portion of this coast, these gardens were owned through a lineage-based system of tenure, and, in some instances, appear to have been guarded and defended from unauthorized harvests (Turner et al. 1983).
These practices resemble the plant cultivation methods and low-intensity “agriculture” described by contemporary researchers working elsewhere in the Americas (Anderson 1993; Bean and Lawton 1993; Doolittle 1992; Denevan 1992b; Wilken 1987: 70-95; Bryan 1929; Steward 1930). Like the planting mounds, rock impoundments, and other agricultural features found elsewhere in the Americas, the cultivation features of the Northwest Coast served to alter local hydrology and to produce and retain a rich anthropogenic soil. Functioning somewhat like terraces or raised garden beds, Northwest Coast rockworks also appear to have facilitated the considerable expansion of level, nutrient-rich planting surfaces (which were extremely rare as natural features on this sheer, glacial topography). This was achieved as these rockworks retained nutrient-rich estuarine detritus, deposited during floods and peak tides and worked into the plots by human cultivators, and allowed the expansion of the narrow band of high salt marsh where these two plants can grow (Eilers 1979). Together, these factors appear to have enhanced the output of these starchy rhizomes tremendously, allowing them to become the primary starchy food in the diet of many (perhaps most) Northwest Coast peoples (Turner and Kuhnlein 1982). And, importantly, these gardens allowed the peoples of the Northwest Coast to bring dense plantings of edible rhizomes – totaling, it would appear, several acres of cultivated land – within each of the territories surrounding individual villages. The cumulative significance of these rhizomes in the Northwest Coast diet appears to have been substantial.

Garden sites, matching those described in the ethnographic literature, are detectable through field observation and archaeological methods. In some formerly
cultivated locations, atypical plant communities or plot markers are evident. In high-gradient marshes, rockworks are often visible in the *Potentilla-Trifolium* zone; their shape ranges from singular rectangles or ovals, to crescent-shaped rock terraces, to complex, subdivided plots. These features are situated in the high marsh, meters above the elevation of stone fish traps and weirs, and are of very different design. Like fish traps and other labor-intensive resource harvesting strategies, these gardens were largely abandoned following the diseases, dislocation, and dietary changes of the early colonial period. Many remnant stone features can still be found along the coast in association with garden sites, as shall be described in subsequent chapters, although most of these features have been eroded or damaged. Though in poor repair, some are still available for inspection and archaeological testing. And, on the basis of absolute dating methods employed in the course of this dissertation research, it is apparent that these features were being constructed and maintained well before European contact.

More often than not, garden sites encountered in past archaeological surveys have been overlooked. Rockworks are known garden sites have been automatically and erroneously categorized as dysfunctional fish traps: the gardens sit far too high in the tidal column and their design is unsuited to the task of catching fish. These oversights may be attributed to Northwest Coast archaeologists' wide and uncritical acceptance of the ethnographers' contention that "Northwest Coast peoples did not rely heavily on plant foods" (Huelsbeck 1988: 166). As a result, few archaeologists have given the question of plant use or plant management serious consideration. While marine animals may have been the predominant staples of most Northwest Coast diets, there seems is little ethnographic support for claims as brazen as those of Huelsbeck — moreover, there
is little convincing evidence of minimal plant food consumption within the region’s skeletal record (Deur 1998). With few exceptions (see Gill 1983), such *a priori* assumptions about plant use have assured that archaeological research programs have not been designed in such a way as to identify the location or character of rhizome gardens.

In light of all of the evidence presented so far, why do scholars still commonly depict the region as devoid of plant cultivation? The answer to this question provides a telling perspective on the ways in which scholarly orthodoxy emerges and is perpetuated. To be sure, the non-cultivator orthodoxy was already taking shape well before the arrival of anthropologists on the Northwest Coast. The European explorers and fur traders that flooded into the Northwest Coast of North America in the late 18th and early 19th centuries commonly arrived assuming that the entire region represented uncultivated wilderness. Early explorers sometimes described aspects of the cultivation practices discussed here – the regular digging of rhizomes from individual plots of rich soils, or the presence of clearings with abundant food plants – but wrongly assumed that these abundant plant resource sites were natural features of the landscape. Curiously, while acknowledging some evidence of indigenous plant cultivation, even the region’s earliest European explorers ascribed the practices to influences emanating from Europe.

In 1789, during one of the first Euro-American fur trading expeditions on the northern Northwest Coast, members of John Meares’ crew saw evidence of cultivated plots – probably of tobacco – among the Haida on British Columbia’s northern coast. In his official log, Meares’ assistant, William Douglas (1790: 369), asserted that “In all probability Captain Gray, in the Sloop *Washington*, had fallen in with this tribe, and
employed his considerable friendship in forming this garden,” though Douglas admitted 
that there was no evidence to support this claim. Indeed, Gray does not appear to have 
visited this village and Meares was probably the first European to pull ashore there. 
Today, few would ascribe Haida tobacco cultivation to the “considerable friendship” of 
early fur traders and explorers. The pre-contact antiquity of Haida tobacco cultivation is 
widely accepted (Turner and Taylor 1972). Other plant management practices 
encountered by these early explorers were poorly documented, and were likewise 
ascribed to European influences. However, unlike tobacco cultivation, they remained 
largely misunderstood today and are still commonly attributed to European influence, 
due in part to a host of similar a priori assumptions about Northwest Coast peoples’ 
lack of plant cultivation.

Even as the 19th century continued and European recolonization of the 
Northwest Coast proceeded apace, most chroniclers continued to interpret indigenous 
plant use as a recent development, based on a sense of this place and its inhabitants that 
was often superficial and based on brief encounters and biased expectations. Colonialist 
tracts described the Northwest Coast’s indigenous peoples as if they used the land 
minimally, deviating from their maritime pursuits only infrequently to hunt or to 
randomly pluck a few shoots and berries. “Of agriculture they are quite ignorant,” 19th 
century writers would assert, “they have no aboriginal plant which they cultivate” 
(Brown 1873: 50). This view, in turn, would be used to justify the displacement of 
indigenous peoples from their lands during the colonial period. In 1868, Land 
Commissioner Gilbert Sproat would characterize Northwest Coast indigenous land use 
practices in quite typical terms:
We often talked about our rights as strangers to take possession of the district... [observing that] any right in the soil which these natives had as occupiers was partial and imperfect as, with the exception of hunting animals in the forest, plucking wild fruits, and cutting a few trees...the natives did not in any civilized sense, occupy the land (Sproat 1987: 8).

Subsequently, this image of Northwest Coast plant use and management was reasserted by anthropologists, most notably Franz Boas, who thoughts on the matter were much influenced by the restrictive definition of cultivation which prevailed in his time (Denevan 1992; Doolittle 1992; Norton 1981). With diffusionist zeal, Boas (and his contemporaries, such as Spinden [1917]) viewed Mesoamerica as the hearth of American plant cultivation, and a dependence upon Mesoamerican seed-bearing domesticates as being diagnostic of agriculture throughout North America.1 Clearly, Boas was aware of aspects of the endemic cultivation practices on the Northwest Coast described here - his empirical, ethnographie writings are among the most authoritative early written sources on the topic. But seeing no evidence of introduced domesticates, seed planting, or overall dependence upon agricultural products, Boas opted to define these peoples as foragers. Moreover, as highly anomalous foragers, these peoples served Boas' need for exceptional cases with which to 'falsify' the prevailing anthropological wisdom of his day, a point that will receive more attention in subsequent chapters.

1 Yet, as Sauer (1952) suggests, seed agriculture was not characteristic of fisherfolk, whose diet was already rich in the proteins supplied by seed crops. More often, such peoples required no additional protein source, but instead, encouraged the vegetative reproduction of starchy and carbohydrate-rich roots.
Since Boas' time, ethnographers and ethnobotanists have described the cultivation of endemic plants, but, in large part because of the inertia of the "non-agricultural" label, have not openly challenged this designation (Turner et al. 1983; Turner and Efrat 1982: 68, 73; Turner and Kuhnlein 1982; Kuhnlein et al. 1982; Norton 1979; Turner pers. com.). Northwest Coast food gathering was depicted as a simple, even leisurely affair in the anthropological and geographic literatures. Salmon was the staple, and, as these fish were available in seemingly limitless quantities, there was simply no need for the peoples of this coast to modify their environment or utilize plants. "Their civilization was built upon an ample supply of goods, inexhaustible, and obtained without excessive expenditure of labour" (Benedict 1934: 174). The only hint of human proprietorship was to be found in "small plots of problematical tobacco" (Murdock 1934: 223). "The plants just grew by themselves. The only agriculture was of European introduction" (Drucker 1953: 81). Consistently, the region would be labeled as a place of non-cultivators in early ethnological surveys and, in turn, these surveys would influence the thinking of subsequent generations of scholars (Spinden 1917; Sauer 1936; Kroeber 1939).

In this dissertation, however, I make an alternative claim. The region's natural abundance was overstated, I contend, while the role of humans in modifying Northwestern environments was much understated and misunderstood. Moreover, the abundant evidence of transplanting, and often intensive management of camas, tobacco, Potentilla, Trifolium, and other plants by the indigenous peoples of the region indicates that "plant cultivation," as that term is now commonly defined, was an integral part of Northwest Coast resource management. Thus, in the course of this dissertation, I
conduct an overdue reevaluation of Northwest Coast plant use, not only in light of changing definitions of indigenous cultivation made since Boas' time, but also in light of plant management practices that have been largely overlooked. Toward this end, I emphasize the practices associated with estuarine root cultivation.
CHAPTER 2
THE ORIGINS OF PLANT CULTIVATION AND AGRICULTURE:
AN OVERVIEW AND ASSESSMENT

If the peoples of the Northwest Coast did, in fact, cultivate plants, then the study of Northwest Coast cultivation should at once inform, and be informed by existing theory on the nature and origins of agriculture. Among cultural ecologists, environmental anthropologists, and archaeologists, few topics have been the focus of such persistent speculation as the origins of agriculture. Indeed, recent decades have witnessed many book-length treatments of the topic (e.g., Anderson 1999; Lie 1999; Piperno and Pearsall 1998; Harris 1996; Thorpe 1996; Smith 1995; Mannion 1995; MacNeish 1992; Cowan and Watson 1992; Rindos 1984; Clark and Brandt 1984; Reed 1977a; Cohen 1977; Sauer 1952). Theories of the origins of agriculture have been both numerous and diverse. Their proponents have attributed causality to a host of different factors, both within and outside of the realm of human agency. Almost all have posited some causal interplay between environmental change at various scales (usually during the period immediately following the Pleistocene epoch), human sedentism, human population growth, technological development, human experimentation with plants, and phenotypic or genetic changes within plant populations. What differentiates these theories is their attribution of causality to different factors or combinations of the factors included in this list.

The archaeological record, however, has yet to yield unambiguous evidence demonstrating that any one of these factors consistently played the foremost causal role in agricultural development worldwide. Thus, arguably, theories of agricultural origins
often have served to reveal as much about the *a priori* theoretical and ideological presuppositions of their respective authors as they have served to reveal the genesis of cultivation and domestication in past societies. In order to summarize these diverse theoretical positions parsimoniously, I have borrowed the conceptual distinctions proposed by Marvin Harris (1979) for the analysis of human-environmental relations. While I do not attempt to substantiate Harris' hypothesis for the origins of agriculture, I do employ his theoretical framework, which serves as a particularly appropriate heuristic device in this case.

When examining the character and genesis of particular cultural traits, Harris (1979) distinguishes between each society’s “infrastructure,” “structure,” and “superstructure.” Under the heading “infrastructure,” Harris includes those factors that constitute “modes of production,” such as environmental pressures or the technologies used in food procurement; under the category of infrastructure he also includes “modes of reproduction,” including those factors affecting human demographics, fertility, and demographically significant medical practices. Under the heading “structure,” Harris includes the organizational frameworks that structure human societies and economies. This includes all facets of a people’s “domestic economy” (e.g., their family structure, division of domestic labor, education, gender roles, and domestic sanctions) and all facets of a people’s “political economy” (e.g., their political organization, division of non-domestic labor, patterns of taxation or tribute, class or caste structure, and the organization of military and policing). Under the heading “superstructure,” Harris includes belief systems and modes of expression - these include art, literature, ritual, sport, and science. In Harris’ view, infrastructural factors are the causal drivers within
cultures, directing — in turn — all developments within the other two categories, directly or indirectly. Structural factors, in Harris' view, can shape superstructural factors, while superstructural factors have little causative role in the development of cultural practices overall. Informed by his broader critique of Boasian "historical particularism," Harris' materialist model of cultural genesis is largely at odds with the models that shaped the early conceptual development of Northwest Coast studies, including Boas' possibilism and Kroeber's superorganic view of culture. However, Harris' infrastructural-determinism is compatible with many of the prevalent models of the development of agriculture.

**Infrastructure-Driven Models of the Origins of Agriculture**

Infrastructure-driven models have long dominated the literature addressing theories of agriculture origins. This is due in no small part to the fact that materialist modes of analysis, often advanced in reaction to Boasian particularism, have traditionally provided the theoretical foundation for cultural ecology, that subfield most involved in the search for agricultural origins. A series of interconnected assumptions, nominally rooted in Darwinian evolutionary theory, underlie these models: that cultures evolve in some systematic manner, that cultures face certain biological threats to their perpetuation, and that those cultures that endure have done so through the development of successful survival strategies (Stoddart 1966). Cultural traits, then, tend to be interpreted as adaptive responses to environmental pressures, on the basis of the observation that they have persisted into the ethnographic present. Most models of agricultural origins thus suggest that — by and large — food resource intensification, including the development of plant cultivation, represents a response to certain
environmental and demographic pressures on food availability. More specifically, such models suggest that the development of cultivation results from societies' attempts to secure or improve the productivity and predictability of foodstuffs in the face of scarcity, real or potential.

Spinden (1917) was among the first scholars directing systematic attention to the question of agricultural development as a response to resource scarcity. In Spinden's model, the agricultural practices of the Americas originated in highland Mesoamerica, when efficient hunting-gathering bands' populations exceeded the carrying capacity of the local environment, motivating foragers to search for ways to enhance plant output. While sharing Spinden's emphasis on scarcity as a formative factor, Childe's (1936) model of agricultural development was more comprehensive and somewhat more influential. Childe suggested that, at the close of the Pleistocene epoch, the desiccation of marginal environments had brought about a period of population pressure in multiple remnant, species-rich "oases." In turn, this fostered increased hunter-gatherer experimentation with the enhancement of plant and animal resources. Many of these oases, Childe suggested, ultimately became the hearths of agricultural development in various environmental and geographical contexts. It could be argued that, since Childe's time, there have been few substantive departures from this general formula among infrastructural-determinists: environmental change, atypical environments, and food scarcity have all been fundamental to most subsequent models, though these variables have been weighted and conceptualized in different ways.

In an effort to operationalize these infrastructural frameworks, Ester Boserup provided one of the most explicit articulations of the theoretical assumptions regarding
resource pressure that had remained latent or implicit in Childe's model. Boserup's work shared fundamental compatibilities with Childe's model, and together these two authors set the tone for much of the subsequent literature on the origins of agriculture. Much of this literature manifested, explicitly or implicitly, Boserup's (1965) suggestion that rapidly growing human populations developed agriculture as a means of circumventing Malthusian environmental limits on human population growth. In effect, Boserup suggested that successive periods of plant resource intensification increased food production in proto-agricultural regions, repeatedly expanding the human carrying capacity in an otherwise limiting natural resource base. Echoing both Childe and Boserup, Cohen (1977) speaks of agricultural development as a response to a "food crisis" resulting from a gradual overcrowding of productive hunting and gathering sites. He suggests that this crowding and resource intensification happened at different rates in different locations, and does not necessarily link this development to a singular moment in human history. In contrast, Binford (1968) depicted agriculture as an adaptive response to food crises brought about by post-Pleistocene environmental change and in situ demographic pressures associated with greater sedentism. As such, he characterized agricultural development as a process that would take place in environmental and demographic margins (somewhat reminiscent in genesis and functions to Childe's "oases") during the end of the Pleistocene epoch. In part because of Binford's centrality within American archaeology, models of agricultural origins

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1 These models might demand revision on the basis of the observation that paleopathologies tend to increase in the archaeological record at a pace that parallels periods of agricultural adoption and intensification. Food scarcity – quantitative and qualitative – may contribute to agricultural intensification, therefore, but ironically may be exacerbated for a large portion of a society's population. This hints that agricultural intensification may parallel other salient social and dietary developments, such as the reduction in dietary breadth associated with more sedentary modes of production, as well as heightened levels of social stratification. See the papers in Cohen and Armelagos (1984).
within the context of post-Pleistocene scarcity and sedentism drawn from Binford’s work have been widely adopted by a number of prominent authors, such as David Harris (1977b) and Marvin Harris (1979: 85-88).

Evolutionary theorists such as Rindos (1984), Dunnell (1971), and Bettinger (1991) provide an unusual twist on infrastructure-driven models. In these evolutionary models, agriculture is depicted as an outcome of behavioral patterns deeply rooted in primate behavior antecedent to the development of modern Homo sapiens sapiens, but motivated by fundamental subsistence requirements. By Rindos’ model, for example, weeding, tending, the defense of plant resource sites, and the storing of plant foods are all ancient practices of the genus Homo. As culture-bearing humans elaborated these practices, this model suggests, demographic and cultural changes made humans increasingly dependent upon cultivation for subsistence. Domesticates are thus the byproducts of innate primate behavior, and may have been longer in the making than many conventional theorists speculate.

**Structure-Driven Models of the Origins of Agriculture**

Structural models of the origins of agriculture have been less common; indeed, strictly structural models are rare, and most models that accommodate structural factors also commonly incorporate infrastructural causative variables. Marxist scholars have been perhaps the most prolific sources of structural models of agricultural origins. Broadly speaking, Marx and Engels attributed the emergence of agriculture to population pressures on resources, in a simplistic causal relationship that foreshadowed some of the later, infrastructural theories of agricultural origins. However, while population pressures appear outwardly to be an infrastructural influence, and

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infrastructural variables may represent the proximate cause of resource intensification, Marx and Engels ultimately attributed this germinal population increase to largely structural changes within human societies and economies (Engels 1942). As such, structural changes were the primary drivers of agricultural development.

Following this line of reasoning, several authors have endorsed and refined models stating that growing efficiency in food procurement, due to structural changes, created the population pressures which, in turn, led to the emergence of agriculture and a host of subsequent structural changes. Appropriately, many advocates of structural models of agricultural origins had training in, or strong sympathies with, Marxist theory, including such authors as Grahame Clark (1953, 1952) and Vavilov (1950). Such structural models also underlie Childe’s (1936) interpretation of post-Pleistocene agricultural origins, which emphasized the causative role of social and economic responses to environmental change, as much as they emphasized the causative significance of environmental change itself. Indeed, structuralist underpinnings may be found supporting such works as Cohen (1977) and Boserup (1965) too, though these authors, along with Childe, emphasized environmental and demographic stresses as the primary causative agents of agriculture, and are more appropriately left in the “infrastructural” category. Flannery (1973) has also attributed agricultural innovation to infrastructural pressures that have resulted originally from changes in social and economic structures within societies.

Structural models of the origins of agriculture also appear in reference to those regions which Harlan (1975) termed “non-centers.” Non-centers are regions where
cultivation was practiced, but where peoples were ostensibly late recipients of crops and cultivation technologies imported from elsewhere. Non-centers, as such, represent agricultural regions, but were not “agricultural hearths” in the traditional sense. These non-centers include places such as the eastern woodlands of North America, Europe, or the fringes of the Incan empire; some (e.g. MacNeish 1992: 19) also depict the Caribbean lowlands of South America as a non-center (cf. Sauer 1952). In such places, it is likely that the acquisition of agricultural crops and technologies was often driven by social and economic motives, rather than strictly dietary motives. As agricultural civilizations emerged, those nonagricultural peoples on the periphery found themselves enticed into trade and coerced into tribute. Certainly, under such circumstances, the incentives for individuals and groups to become cultivators were in no small part structural, serving to restructure or reinforce economic relations within and between individual societies (MacNeish 1992; papers in Cowan and Watson 1992).

**Superstructure-Driven Models of the Origins of Agriculture**

Responding to prevailing models of agricultural origins, a small number of scholars have advanced models in which a culture’s superstructure provides the primary incentives for the cultivation and domestication of plants and animals. Most of these authors share a general skepticism of both evolutionary and environmental models of cultural development. As an alternative, most promote historicist explanations of cultural change, and attribute causality to emic cultural phenomena.

Eduard Hahn presented an early and formidable challenge to the environmentalist perspectives (and then-prevalent teleological views) of agricultural

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2 One might argue that – despite his infrastructural emphases – Leslie White (1959) might also be
origins during the late 19\textsuperscript{th} and early 20\textsuperscript{th} centuries. Hahn (1896) suggested that many of the desirable qualities of domesticates would not have arisen until their ancestral plants and animals had experienced a very long period of human manipulation and selection. As a result, he concluded, there must have been non-utilitarian motives for the onset of many forms of plant and animal husbandry. In light of this observation, and abundant archaeological evidence of the past ceremonial functions of contemporary domesticates, Hahn promoted the notion that agricultural practices originated, in part, for ceremonial purposes. In his most widely cited example, Hahn noted that wild cattle were dangerous animals, which were cautiously captured and kept by proto-herders as a source of milk for early Neolithic fertility rituals. Once tamed, cattle were bred selectively over long periods, reflecting the longstanding activities of Neolithic fertility cults and resulting in both long-term selection for crescent-shaped horns (reminiscent of the crescent moon) and heightened milk production. Only later and as a byproduct of this ceremonial domestication, by Hahn’s argument, did milk production become an important component of human economies and diets. Hahn’s interpretations of plant cultivation paralleled this overall line of reasoning, with the sowing of plants also originating as a ceremonialized, reproductive act.

Until comparatively recently, Hahn largely stood alone in his central emphasis upon superstructural causes. However, some of the more strict diffusionists, including Boas (1938) and Carter (1977) have recognized superstructural imperatives in the diffusion of agriculture. These authors depict agriculture as a practice that was invented in a very small number of contexts, possibly as a result of experimentation motivated by included in this list of scholars inspired by structuralist models emanating from Marxist literatures.
superstructural factors. From a singular or finite number of centers, agriculture thus diffused around the world, motivated strongly (though not exclusively) by the superstructural qualities of agriculture - its novelty, as well as its symbolic, ceremonial, or religious functions. As many of these diffusionist models often emerged as a critique of infrastructural models, they have tended to deny the importance of infrastructural factors explicitly. More recently, authors such as Hayden (1990) have attributed forms of resource intensification, including the development of agriculture, to competitive feasting within chiefdom-level societies including those found on the Northwest Coast; feasting served both ceremonial and socio-economic ends, and therefore heightened food production was driven by both structural and superstructural motives.

Complex Models of the Origins of Agriculture

In their distilled forms, each of the models described above may seem somewhat heavy-handed. Certainly, each of these models accounts in some minor way for the influences of multiple causes, infrastructural, structural, and superstructural. There are, however, a number of complex models of agricultural origins that unambiguously attribute causality to more than one category of cultural influences: here, I term these the “complex” models of agricultural origins.

Many models that identified superstructural roots to the origins of agriculture have also attributed intensification secondarily to structural and superstructural factors. For example, many members of the “Berkeley school” of cultural geographers tended to view structural and superstructural facets of cultures as being essentially indivisible in the emergence of plant cultivation and domestication (Wagner 1977, 1996; Johannessen 1987, 1984). By this logic, ceremony might be the proximate cause of agricultural
innovation, but ceremony was motivated by a host of social and economic motives that served, in essence, as the “ultimate” causes of agricultural experimentation. Further, these models tend to situate the process of agricultural experimentation within the distinctive environmental and social contexts of individual agricultural hearths. For example, like Cohen (1977), Binford (1968) and other authors who accentuated infrastructural cultural drivers, Carl Sauer (1952: 22) viewed some degree of pre-agricultural sedentism as being fundamental to the development of agriculture. However, contrary to these other writers, Sauer argued that the role of sedentism was not in that it produced localized demographic stress on a finite resource base. Rather, Sauer (1952: 21-22) suggested that pre-agricultural sedentism was diagnostic of localized resource abundance and provided the geographical fixedness and social continuity required for agricultural development:

“Agiculture did not originate from a growing or chronic shortage of food. People living in the shadow of famine do not have the means or time to undertake the slow and leisurely experimental steps out of which a better and different food supply is to develop in a somewhat distant future...The improvement of plants by selection for better utility to man was accomplished only by a people who lived at a comfortable margin above the level of want.”

Sedentism was thus necessary to provide the social and spatial context in which experimentation could be carried out on the long-term, but the primary motives for experimentation are at once superstructural and structural. Environmental factors—essentially infrastructural variables—provided the material abundance that was a precondition for sedentism, thus fostering agricultural experimentation, according to this model. Abundance, rather than scarcity, was key. In the resource-rich, sedentary
fisherfolk of Southeast Asia and South America's Caribbean lowlands, Sauer found his ideal conditions for agricultural development. However, when addressing the precise origins of domesticates, Sauer (1952) largely agreed with Hahn's superstructural hypotheses.

Other authors, such as Hassan (1977) and Redman (1978) have generated more systematized models of agricultural origins, which posit positive feedback loops in which structural and infrastructural variables exhibit mutual causation. In Hassan's model, population size, sedentism, advances in harvest and storage technologies, environmental changes, and the natural availability of cultivatable plants and sites all play crucial roles. If any one set of factors has overriding causal significance in these models, it is the structural factors that influence settlement size and sedentism, the organizational capacity of a society, and the availability of technologies that facilitate agricultural intensification.

One of the most comprehensive models of the origins of agriculture has been provided in the comparatively recent work of MacNeish (1992). Integrating the published models and evidence of agricultural origins accumulated over the last century, MacNeish advances a model that accounts for multiple pathways toward agriculture, accounting for both environmental and cultural causation. MacNeish identifies three common paths toward agriculture: the "destitute foragers" model, the "efficient foragers" model, and the "affluent" or "village foragers" model. Much evidence suggests that each of the paths outlined in this "trilinear theory" has been followed by emergent agriculturalists at some time in human history. I briefly summarize each here...
(recognizing fully that the routes, as I summarize them here, do not exhaust the full range of possible, complex paths towards agriculture that MacNeish [1992] identifies).

Destitute foragers, according to this model, existed in populated areas which experienced adverse post-Pleistocene environmental change, resulting in increased resource scarcity and increasingly "patchy" environments. Assuming the presence of cultivable lands and plants, this change encouraged a revolutionary increase in human experimentation with the intensification and relocation of plants. If successful, these early cultivators fostered mutant domesticates of augmented food value, allowing heightened sedentism and, in turn, greater agricultural intensification. This model incorporates many of the infrastructural models advanced by such authors as Childe, Binford, Boserup, Flannery, and Cohen.

Efficient foragers, by MacNeish's trilinear model, lived in less stressful or geographically differentiated environments. According to this model, successful foraging strategies brought about a gradual increase in population or a gradual decline in the natural availability of exploited species. Over time, per capita food yields steadily decreased, bringing gradual pressures to intensify the output of naturally occurring or cultivated plants. Change in these societies was evolutionary rather than revolutionary. Geographically discrete intensified plant communities would then facilitate sedentism which, in turn, encouraged "agricultural intensification," a growing dependence upon the output of selectively propagated, genetically distinct crops. This model manifests infrastructural theories that are more moderate than those that influenced MacNeish's "destitute foragers" model, relying less on dietary stress as a causal variable and more heavily upon structural changes. In this respect, the "efficient foragers" model is
reminiscent of the more recent theories of Harlan, Flannery, and MacNeish himself, which posit a causative interplay of structural and infrastructural forces.

The affluent foragers or village foragers model posits that, following the emergence of discrete, biologically productive environments at the end of the Pleistocene epoch, some human societies concentrated around productive resource sites, such as riverine or estuarine areas. This demographic concentration at resource-rich sites facilitated the emergence of highly productive foraging strategies and the appearance of what were essentially pre-agricultural, sedentary villages. Experimental manipulation of naturally occurring food plants in the vicinity of these villages facilitated the emergence of supplementary horticulture. Over time, these peoples often became dependent upon the enhanced and predictable output of cultivation, thereby making the transition to agriculture. This growing agricultural dependence resulted from population growth and the exhaustion or unpredictably of productive hunting, fishing, and gathering sites. Other authors, most notably Sauer (1952), have advanced similar models.

This last line of MacNeish’s trilinear theory – the affluent forager model – fits the Northwest Coast data quite well on multiple counts. Indeed, in his explication of the affluent forager model, MacNeish (1992) was puzzled by the absence of agriculture on the Northwest Coast. He suggested that the region was compatible with the affluent forager model on all counts except the presence of agriculture. Like Boas and Sauer, he suggested that this anomaly was attributable to the fact that the region was remote from routes of agricultural diffusion. He also suggested – wrongly, I think – that the region lacked sufficiently circumscribed micro-environments between which plants could be moved, or a pool of potential domesticates among the region’s wild plants; it is unclear
on what evidence MacNeish based this claim. Still, together, both Sauer’s (1952) sedentary fisherfolk hypothesis, and MacNeish’s (1992) affluent foragers hypothesis provide clear theoretical foundations for a discussion of Northwest Coast cultivation.

Here, I advance a hybrid model of agricultural development that is informed by the writings of Sauer and MacNeish, a model that exceeds the causal complexity of most of those models described above. I contend that, without an appreciation of all three levels of resolution — including infrastructural, structural, and superstructural motives for plant intensification — any model of the origins of cultivation on the Northwest Coast will present, at best, an incomplete picture. With its distinctive environments, highly stratified indigenous societies, and elaborate “ceremonial economies,” the Northwest Coast demands a “complex” model of agricultural origins. A more thorough treatment of these issues in the Northwest Coast context must be postponed, however, until subsequent chapters.

Still, the case for a multi-causal model of agricultural development may be made for reasons that have little to do with the precise character of Northwest Coast environments and peoples. Those who search for singular causes of agricultural origins (including most of the infrastructural-determinists addressed above) are, by their own admission, informed by evolutionary theory. Yet much of the literature regarding human-land interaction in geography, anthropology and cognate fields exhibits a particularly Lamarckian interpretation of evolutionary theory, too often becoming crudely functionalist in tone and emphasis (see overviews in Stocking 1982; Livingstone 1992). In these mono-causal metanarratives, each cultural practice is
construed as possessing an inherent ecological "function" simply because it exists - because, in evolutionary terms, it has survived the selective pressures that emanate from environmental stresses on human populations. An "agricultural complex" is thus depicted as the cumulative outcome of a progression of incremental and singularly adaptive strategies.

I contend that evolutionary theory does provide an analogue model for agricultural development, but that many theorists have overlooked or misapplied some of the fundamental lessons of evolutionary theory. As with changes in DNA, culture composes and environmental selection edits. By this evolutionary logic, any number of changes can occur in a culture's subsistence practices that are not inherently adaptive from a dietary or environmental perspective, so long as they do not ultimately prove lethal to the people and practices of a social group. Infrastructural factors may ultimately have "veto power" over cultural changes fueled by structural and superstructural factors; nonetheless, humans are free to experiment and to adapt their lifeways in response to structural and superstructural motives so long as it does not prove lethal (cf. Harris 1979). In this light, the "possibilism" of the sort promoted by Vidal de la Blache (1926) provides a perspective on cultural 'evolution' that is more true to the assumptions of Darwinian evolutionary theory than models that strictly attribute causality to environmental phenomena. Admittedly, the possibilist critique runs counter to the stated evolutionary foundations of both infrastructural and structural theories of agricultural origins. However, I would counter that this critique should inform the analysis of agricultural development. Moreover, different sorts of pressures

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3 To be sure, there is a valuable lesson in Hayden's (1990) discussion of the ceremonial foundations of
emerge at different stages in a people’s transition from foraging to cultivating.

Certainly, at one time a culture group may be more strongly motivated by infrastructural factors, and at another time, by structural or superstructural motives. However, there is no reason to assume that a single category of motivations will play an overriding causal role at every successive step in this transition. By embracing a possibilist, multi-causal approach to agricultural origins – wherein one recognizes the potential, but by no means omnipresent, influences of infrastructural factors – each of these variables might be accommodated in turn.

Northwest Coast plant intensification, though the role of infrastructural factors on the Northwest Coast cannot be fully discounted.
CHAPTER 3
RECONSIDERING NON-WESTERN AGRICULTURE

If prevailing views of the origins of agriculture have changed significantly in recent decades, so too have prevailing views of the nature of indigenous agriculture in the Americas and elsewhere. Formerly, authors tended to depict plant cultivation as an innovation that had been invented within, and diffused from, a finite number of agricultural hearths. Writers generally equated agriculture with the familiar and orderly patterns of cultivation generated within the civilizations of Europe. Likewise, they tended to dismiss as “non-agricultural” the unfamiliar cultivars and seemingly chaotic anthropogenic plant communities, often intercropped and non-geometric, encountered in portions of Africa, the Americas, and elsewhere during the colonial period (Blaut 1993; Doolittle 1992; Butzer 1990; cf. Carter 1977; Spinden 1917). This scholarly bias persisted, largely unchallenged, well into the 20th century. Only a subset of domesticated plants were viewed as diagnostic of plant cultivation in non-European contexts; maize, beans, and squash, for example, were employed as the litmus test of “cultivation” within North America by Kroeber (1939) and others. Peoples lacking these crops were commonly designated as non-cultivators, despite occasional (and sometimes well-documented) cultivation practices involving endemic plants. This scholarly effort to narrowly categorize agricultural modes of production greatly influenced the ways in which subsequent generations of geographers, anthropologists, and archaeologists discussed and viewed the peoples whom they studied. However, a growing body of evidence has clearly demonstrated that the modification of plant
communities has been an integral component of the broader range of subsistence practices among most human populations. "Agriculture," as such, is not a novel trait, found within a finite range of cultures, but has originated from diverse and innumerable origins, and cultivators have employed a number of crops, both domesticated and undomesticated, both native and introduced (D. Harris 1977).

Since authors such as Sahlins (1972) demonstrated that chronic resource scarcity and enervating labor requirements were not ubiquitous among hunter-gatherer societies, the concept of "agricultural revolutions" has required substantial revision. Significantly, not all hunter-gatherers experienced intense deprivation, nor were they uniformly motivated to alter their subsistence practices on the basis of regular or intermittent scarcity. Researchers thus cannot assume that once cultivation was "discovered" by, or diffused to, a hunter-gatherer population, these peoples were motivated to abandon successful resource strategies in favor of this innovation. And certainly, there are many foreseeable factors that would restrict the "revolutionary" abruptness of agricultural adoption as posited by Childe and his adherents, including technological barriers, dietary preferences, the efficiency of preexisting modes of hunting or gathering, enduring social structures, and many others. Rather, one of the important lessons of Sahlin's critique is that the intensification of plant cultivation was often, by necessity, a gradual and evolutionary process, rather than a revolutionary transformation of hunter-gatherer societies (MacNeish 1992; Harris and Hillman 1989; Doolittle 1984).

These revelations underscore the fact that foraging, hunting, low-intensity plant tending, and intensive cultivation are not mutually exclusive activities. Cultivation may
persist alongside other subsistence strategies for millennia without, in itself, inciting a society’s transition to agricultural dependence, despite evolutionary models that have suggested the contrary. Instead, these modes of subsistence tend to blur, one into the other, and diverse cultivation strategies have been found to be commonplace among most ethnographically known aboriginal populations, including many so-called “hunter-gatherers.” Emergent plant cultivation practices may not noticeably diminish, then, but merely augment the dietary benefits of hunting and gathering, thus contributing to the overall temporal stability and spatial concentration of food resources (Griffin 1989). In many societies, past and present, hunter-gatherer subsistence strategies and even intensive cultivation appear to be “overlapping, interdependent, contemporaneous, coequal, and complementary” within both the diet and the seasonal schedule of subsistence activities (Sponsel 1989: 45).

Still, in some cases, aboriginal dependence upon modified plant communities appears to have intensified when other dietary sources have become less available or predictable, fostering the emergence of truly “agricultural” modes of subsistence (Caldwell 1976). Alternatively, as Flannery (1968: 77) has suggested, some cultivators might be said to have undergone an “agricultural transformation” once scheduling conflicts emerged between plant and animal resource harvests, and the societies responded by privileging cultivating tasks over traditional hunting and gathering activities. The initial emergence of cultivation may therefore not be a sign of population stresses upon resources within a particular society, but agricultural intensification may have often been motivated by scarcity—of time or of resources—

Tending, Cultivation, and Domestication

Definitions of what constitutes "plant cultivation" have also changed in recent decades. In light of the critique of uniform agricultural revolutions and diffusions, authors now commonly propose a continuum of cultivation, in an attempt to codify the broad range of methods and intensities of plant modification that have been documented (Ford 1985; Wilke et al. 1972; Lévi-Strauss 1950). Following Harlan (1975), many authors now draw the distinction between plant "tending," plant "cultivation," and plant "domestication." Plant tending, by these definitions, involves the minor modification of environments to encourage the growth of naturally occurring plants in situ. In contrast, plant "cultivation" involves a more extensive pattern of environmental modification in anticipation of qualitatively and quantitatively enhanced plants. By this definition, cultivation involves the seeding or transplanting of propagules, the intentional fertilization or modification of soils, improvements of irrigation or drainage, or the clearing or "weeding" of competing plants.

Plant "domestication" is generally depicted as a process that emerges from the act of cultivation, and therefore appears subsequent to the development of cultivation. Domestication involves the intentional or unintentional genetic modification of plants through the selective tending and reproduction that accompanies long-term patterns of cultivation. While most scholars tend to view cultivation as a precondition for domestication, cultivation does not necessarily lead to the emergence of domesticates; thus, hypothetically, cultivation could continue for millennia without the emergence of
domesticated plant forms. Only if domesticates are propagated vegetatively or are isolated from their wild progenitors will they persist as genetically distinctive populations, due to the effects of cross-pollination with wild progenitors among seed crops (Vavilov 1950). (Significantly for the Northwest Coast case, agricultural innovators who did not adopt crops from remote regions have often been mistaken as non-cultivators, as there have been limited opportunities for genetic isolation of cultivars from wild plant communities. Moreover, the visible distinction between their plantings and wild populations of culturally significant plants often remains slight). Often, when isolated from their ancestral populations, domesticates gradually become dependent upon human intervention for their continued survival, as they lose their ability to reproduce by seed, or to cope with the soils, water budget, pests, or competing natural vegetation, inside or outside of their ancestral ranges. In many cases, the cessation of human maintenance of domesticated plants appears to have resulted in the extinction of domesticated varieties or species. This was particularly true in the post-contact Americas, wherein abrupt demographic collapse and relocation resulted in the abandonment of many agricultural practices, which soon resulted in the extinction of associated crops (Sauer 1952: 46).

While there is little disagreement about what constitutes a domesticated plant, the origins of domesticates is a contested issue. Disagreements between domestication theorists mirror larger schisms within evolutionary theory. Some authors (e.g. Ames 1939) provide a “punctuated equilibrium” model of domestication. According to these models, domesticates are the product of a very small number of mutational events: human-modified landscapes facilitate the emergence or survival of mutant plant
genotypes, some of which are desirable to humans, and are thus selected out by cultivators for subsequent reproduction. Other authors (e.g. Johannessen 1987, 1976, 1970) provide a more classically Darwinian model of domestication, in which humans gradually exert directional selection on a plant community, consistently selecting for reproduction those plants with marginally desirable characteristics. By this model, gradual selective propagation by cultivators represents an incremental process, occurring over the course of several human generations, with the cumulative, unanticipated effect of major changes in the genotype. These divisions among theorists of domestication, however, only center on the question of the tempo of mutational events. Despite this, most authors do agree that cultivators tend to observe improvements in yield or other desirable qualities among a concentrated population of plants, that they select these outstanding plants for subsequent use and replication, and that this has some effect upon a plant's genetic distinctions from its wild progenitors. In some cases, cultivators also learn to replicate site conditions that augment these desirable traits, a fact that may facilitate further genetic drift from wild ancestral plant populations (Kimber 1978; Wilke et al. 1972; Johannessen 1976, 1970, 1966).

Arguably, regardless of the tempo of plant mutation, early domesticators would not foresee the long-term, cumulative, qualitative and quantitative effects of their actions among the plants they manipulate in these ways. Therefore, pre-industrial domesticates probably did not represent the anticipated creations of past cultivators, but instead manifested the multiple outcomes of longstanding, intentional, short-term plant enhancement traditions (Johannessen 1976; Hahn 1896).
In light of these definitions, it is clear that each general stage within Harlan’s scheme of “tending,” “cultivation,” and “domestication” might be considered a precondition for the next within the process of plant intensification. However, the specific motives, timing, and trajectories of agricultural growth almost certainly did not follow uniform paths. Harlan’s categories, therefore, can only provide a heuristic device for analyzing the development of cultivation, rather than providing an unambiguous “stage theory” of agricultural evolution (MacNeish 1992; Pearsall 1992).

**Agroecosystems**

Hypotheses for the origins of plant cultivation and domestication generally posit that the emergence of these practices has emerged – in different ways, in different contexts – from the environmental modifications that accompanied plant tending. As the intensity of environmental modification has increased, so too have the genetic and phenotypic differences that separate culturally significant plants from their wild progenitors. Accordingly, researchers have directed increasing attention to the presence of “agroecosystems” as diagnostic of cultivation (or “incipient cultivation”) practices among aboriginal populations. These agroecosystems represent human-constructed environments, designed to enhance the output of culturally significant plants by replicating or enhancing certain naturally occurring conditions. Such environments are characterized by anthropogenic modifications of site hydrology, soils, insolation, plant community structure, and the like. These changes often serve to replicate or enhance

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1 Certainly, some models of agricultural stages conflict with Harlan on minor points. Harlan (1975) designates a wide range of cultivators as “agricultural,” whereas MacNeish (1992: 10-11) does not. MacNeish (1992: 10) suggests that cultivators who plant individual domesticates (plants of altered genotypes) or cultivars (plants of altered phenotypes only) in “relatively limited plots” are “horticulturists” or “incipient agriculturalists.” To be “agricultural” by MacNeish’s standards, a people must be seed cultivators, planting on “relatively large plots or fields.” MacNeish does not clearly articulate the standards by which “relatively limited plots” and “relatively large plots” are to be discerned.
those site conditions to which a plant is native and allow culturally valued plants to occupy sites that are substandard or beyond the plant’s natural range. In addition, agroecosystems generally are characterized by some degree of change in the species mix and species diversity within these human modified sites. Cumulatively then, authors such as David Harris (1972) have suggested that agroecosystems are characterized by reduced species diversity, heightened productivity of culturally preferred species, and the stability or “homeostasis” of early successional species as a result of repeated human intervention.

Within the Americas, few agroecosystems have received as much recent attention as the cultivation of burned clearings (or “swiddens”) and wetland cultivation practices that are often associated with raised, mounded or drained fields. In recent years, scholars have begun to recognize that anthropogenic clearings, usually created by fire, have been fundamental components of the overall practice of plant cultivation and in the process of plant domestication (Boyd 1999; Carneiro 1974, 1964; Stewart 1956; Anderson 1956). Lewis (1972), for example, has proposed that the use of fire allowed the spatial concentration and selective control of plants and animals that were essential to the emergence of agriculture and domesticates in South Asia. In the Americas, the absence of metal axes prior to European contact appears to have inhibited the emergence of swidden cultivation as it is now known. Denevan (1992b) has thus suggested that much of the cultivation in the pre-contact tropical forests of the Americas took place in burned clearings along riverine waterways at the forest’s edge. Such clearings, he argues, would have improved sunlight penetration of the forest canopy and improved soil fertility in a way similar to that of contemporary swiddens, and would
have been the closest analogue to contemporary agricultural plots within much of the American tropics. Burned areas at the forest's edge appear to have served as sites of significant experimentation with the inter- and intra-regional relocation and selective reproduction of desired plants (Gómez-Pompa et al. 1987). Importantly, the environments fostered by burned clearings likely replicate, in some part, the ancestral habitats of many domesticates; perennial domesticates, in particular, often appear to have been originally derived from successional plant communities but do not grow naturally, for example, within the understory of mature and undisturbed forests. In addition to replicating a cultivar's native habitats, such cleared sites concentrated plant resources, reducing the labor previously required by foraging. Indeed, burned clearings of transplanted and successional vegetation appear to have concentrated resources in such a way that some of the earliest systems of land tenure may have emerged in association with anthropogenic clearings in dense forest settings (Pyke, et al. 1977; Griffin 1989).

Wetland Cultivation

Wetland agricultural sites represent another category of agroecosystem that was common in the Americas, and one that is particularly relevant to the discussion of Northwest Coast plant cultivation methods. Wetland cultivation received little recognition by past generations of scholars, in part due to the absence of wetland cultivation within European agricultural traditions (Denevan 1992a; Doolittle 1992; Denevan and Turner 1974; Netting 1968). In the Americas, Asia, Africa and Oceania, however, such agricultural practices were widespread, particularly within tropical environments. Wetland cultivation took a wide variety of forms, and often involved the
production of “agricultural landforms,” earthworks such as raised or drained fields, that leave a distinct and archaeologically detectable imprint on the land, even long after cultivation has ceased. Modified to accommodate distinctive local soils and hydrology, wetland agricultural landforms allowed the expansion of natural or planted plant communities into new or environmentally marginal locations (Mathewson 1985; Denevan 1970).

These features received limited attention in the early literatures of geography, anthropology, or archaeology. The late 20th century, however, was characterized by a widespread revision of Western academic thought on the role of wetland cultivation in the Americas. William Denevan (1970, 1966, 1963, 1962) initiated much of this revisionism, after identifying and documenting elaborate raised fields in wetland environments in the Bolivian savannahs. Soon, this revisionary gaze was turned to other locations in the American tropics where agricultural development had not been previously documented, in part or in whole. Lathrap (1970) examined the long overlooked significance of wetland root cropping in Amazonia, and Smith et al. (1968) recorded unexamined wetland agricultural landforms on the margins of Lake Titicaca; numerous researchers recorded overlooked practices of wetland cultivation along the coastline of tropical South America (Parsons 1969; Parsons 1968).

Soon, similar wetland cultivation methods and landforms were identified through much of the American tropics, as well as within certain subtropical and temperate zone locations within North and South America (e.g., Siemens 1989, 1983a, 1983b; Denvan et al. 1987; Turner and Denevan 1985; Mathewson 1985, 1984; Turner and Harrison 1983; B.L. Turner 1983, 1974; Denevan 1982; Denevan and Turner 1974).
This research was carried on in no small part by Denevan, James Parsons, and their respective students. Increasingly, archaeological and historic sources made it clear that wetland cultivation was among the most widespread agricultural practices within the pre-Columbian Americas, and it had facilitated the emergence of sedentary populations within both humid and arid environments (Doolittle 1990; Wilken 1987; Mathewson 1984; Siemens 1983; J.R. Parsons 1976; Turner 1974; J.J. Parsons 1969). Within the fields of geography, anthropology, and archaeology, the theoretical implications of this revisionary movement were profound. Most notably, B.L. Turner (1983, 1974) documented elaborate and long overlooked wetland agricultural practices and landforms in the Maya lowlands. On the basis of these observations, Turner effectively toppled the prevailing view of the Maya as an advanced, urbanized ancient society with no hint of intensive agriculture (Turner and Harrison 1983; Turner 1978; Mathewson 1977).

Among the numerous wetland cultivation methods found in the Americas at the time of European contact, systems of raised bed farming were particularly widespread. These practices involved the relocation of naturally occurring silts and organic debris that had accumulated in waterborne environments, either riparian or lacustrine. Highly intensive wetland cultivation, including raised fields and related features, appear to have been used extensively in coastal riverine areas in such places as Columbia, Belize, Suriname, and Ecuador. Organic and mineral debris accumulated in these riverine and lacustrine environments was placed upon nearby terraces or raised fields to enhance soil fertility and physically expand the planting surface (Mathewson 1985, 1984; Denevan 1970). These features were often, as Mathewson (1985) notes, "physiomimetic," mirroring the desirable biophysical environments of naturally occurring nearshore...
cultivation sites. Using digging sticks or wooden spades, soil was mounded above the mean water level of adjacent lakes or rivers to produce level planting surfaces. When built in wetland environments, terraces and raised fields often served to raise planting surfaces from lands that were too saturated or submerged to allow cultivation under ordinary circumstances. While still well watered from naturally occurring groundwater or from naturally occurring seeps, such raised beds sat above the level of wetland saturation, resulting in hydrological and soil characteristics that were particularly amenable to crop growth. In other cases, nutrient rich nearshore environments were drained to similar effect. These technologies were employed in numerous different ways throughout the Americas to produce chinampas, tablones, camellones, montones, mojos, “lazybeds,” and other agricultural features. (Similar agricultural landforms were widespread in the Pacific islands, often serving to expand cultivable areas by raising planting surfaces above saturation level within freshwater or brackish coastal wetlands [Kuhlken 1994, in press; Barrau 1961]).

The soils augmented within raised bed or terraced agricultural landforms were sometimes reinforced with stone or wooden structures, but they commonly consisted solely of relocated and mounded soils. Cultivated plants were planted directly into the accumulated soil within these lake- or river-edge plots. Numerous crops were grown on these plots, and were often cultivated in mixed “intercropped” plantings of complementary cultivars. The repeated augmentation of planting surfaces with such waterborne materials served to expand terraces or raised fields, thereby increasing the total cultivable area within shoreline wetland environments. As such, they have often been interpreted as evidence of intensified population pressure on cultivated nearshore
regions. The plots produced by this practice are characterized by particularly high soil fertility, with regular “energy subsidies” from external sources, including the primary productivity of riverine, lacustrine, or terrestrial ecosystems. They were among the most productive agricultural features in the Americas, characterized by atypically rich and workable soils; even when cultivated intensively, they seldom required fallow periods to regain their fertility (Mathewson 1987; Wilken 1987). Accumulations of mineral and organic soils within such wetland cultivation systems result in distinctive anthrosols, usually distinguishable from natural wetland soils by anomalies in texture and composition resulting from manual soil translocation and post-depositional soilurbation. Such soils are diagnostic of wetland agriculture, and can generally be detected in archaeological contexts (Sandor, et al. 1986; Turner and Harrison 1983; Turner 1974).

Past researchers have noted that waterfront cultivation methods afforded the additional benefits of access to nearby aquatic animal resources, such as fish and game, as well as access to waterborne transportation. Indeed, in such places as the tropical lowlands of South America, the presence of sedentary populations of hunter-fisher-gatherers at highly productive natural resource sites, in coastal or riverine areas, appears to have been an important a priori precondition for the emergence of wetland cultivation in some contexts. Within the lowland tropics, this “dual economy” of wetland cultivation and aquatic hunting and fishing appears to have provided a more productive and stable source of subsistence than would have been possible in any subsistence strategy tied solely to terrestrial plant cultivation. These dietary and scheduling complementarities of wetland gardening and marine exploitation has been
widely noted as a crucial step in the development of agriculture within productive coastal environments throughout the American tropics (Cohen 1981, 1977; Mosley 1975; Parsons and Denevan 1967; Coe and Flannery 1967; Coe 1961)

The pre-European Northwest Coast was not unlike these tropical contexts, and to be sure, plant management strategies of the sort I describe here – involving both the cultivation of wetlands and the burning of vegetation – were widespread in this region. As was true elsewhere in the Americas, these practices commonly were overlooked by early explorers and scholars, and, when they were documented, were often dismissed as “non-agricultural” (Sluyter 1999; Siemens 1990). However, as has been demonstrated in this chapter, there has been a recent sea-change in scholarly opinion regarding what constitutes cultivation, and a growing appreciation of the distinctive indigenous cultivation practices of the Americas. In light of this, contemporary researchers are compelled to critically reexamine those peoples that have traditionally been designated as “non-cultivators” within the ethnographic literature, particularly in those cases in which the absence of cultivation seems counterintuitive. Few ethnographic contexts fit this description better than the Northwest Coast of North America. In the chapters that follow, I provide an overview and assessment of plant management practices once found in this region that mirror those of the American tropics, and which warrant the designation as “plant cultivation,” as this term is now commonly used.
CHAPTER 4
PATTERNS OF PLANT CULTIVATION ON THE NORTHWEST COAST

While this dissertation emphasizes Northwest Coast peoples’ cultivation of estuarine root grounds, such practices were by no means the sole form of plant cultivation to be found in the region. In order to set the foundation for a more detailed discussion of estuarine root cultivation methods in the chapters that follow, this chapter will address general patterns of plant management, other than estuarine gardening, that appear to have been widespread among the Northwest Coast peoples. As this chapter shall demonstrate, the observation that Northwest Coast peoples were in some manner cultivating plants is not entirely a new one, even if the implications of this observation have yet to diffuse throughout the broader literature on human-environment interaction.

Certainly, tobacco cultivation was widely recognized by early explorers and scholars alike. Such early explorers as Vancouver (1984:1359) noted that tobacco seed pods were placed in mounded soils, within tilled sites that “were deeply cultivated and kept clear of weeds,” while in the fall, “rotten wood was mixed into the soil to enrich it for the next year” (Turner and Taylor 1972:250-251). Many of these

Tobacco seed pods were placed in mounded soils, within tilled sites that “were deeply cultivated and kept clear of weeds,” while in the fall, “rotten wood was mixed into the soil to enrich it for the next year” (Turner and Taylor 1972:250-251). Many of these
gardens appear to have been abandoned prior to the first arrival of anthropologists in the region, due in part to the arrival of introduced tobaccos through trade networks.

Though commonly overlooked by explorers and scholars, the cultivation of other plants — food plants in particular — was widespread, employing methods similar to those employed in tobacco cultivation. Numerous authors have mentioned the cultivation-like qualities of traditional camas management (Turner 1995; Turner and Kuhnlein 1983). Numerous ethnographic consultants have used the term “gardens” to describe their tended patches of crabapple, wapato, and other managed plant communities.1 Smith (1950: 336-337) suggested that the contact period Nooksack (Coast Salish) management of camas and other plants “already foreshadowed simple agricultural procedures.” Collins (1974:55) refers to the Upper Skagits’ “semidomestication” of tiger lilies and “wild carrots” which they cultivated in individually owned plots, while White (1980:20) suggests that the Skagit “cared for the nettle in a manner closely resembling cultivation.” All the plants managed in these ways represented not only important sources of foods, materials, and medicines, but also served as significant items of trade; prior to European contact, Northwest Coast peoples had developed effective and specialized storage and shipping methods for most of their perishable plant products. Together, these plant management practices allowed Northwest Coast peoples to maintain the production of camas, berries, and other staple plant foods at the levels described ethnographically (e.g., Jenness 1934-35:7). I do not intend to exhaustively summarize the full range of plant management practices that were found on the Northwest Coast in the sections that follow. Rather, I conduct a survey of known plant management methods in order to demonstrate

1 Archaeologically detectable settlement patterns often parallel the apparent distribution of managed plant communities as much as they reflect fishing and animal harvesting sites (Boyd and Hadja 1987:321).
that certain cultivation practices appear to have recurred throughout the region - that there was, in essence, a "cultivation complex" on the Northwest Coast into which I might contextualize my more focussed discussion of estuarine rhizome garden cultivation.

Many cultivation methods described as "traditional" by indigenous consultants over the last century and a half, despite the fact that their languages are often mutually unintelligible, their territories often separated by hundred of kilometers. Taken together, these accounts attest to cultivation practices along the full length of the ethnographic Northwest Coast. The methods described represent multifaceted cultural solutions to regionally distinctive environmental obstacles to enhanced plant output, solutions that differ from European cultivation methods in significant and consistent ways. Likewise, it is apparent that certain physical traces of the cultivation methods described by ethnographic consultants, such as anthropogenic prairies or monocultural root beds, were viewed and recorded by the region's first European explorers. Finally, and importantly, references to these cultivation practices can be gleaned from parenthetical comments within some of the most venerable anthropological accounts of Northwest Coast peoples. In light of this evidence, it is clear: if the peoples of the Northwest Coast were not uniformly cultivating plants, they were engaging en masse, in much discussion of, and "leisure time experimentation" with, the potentials of plant cultivation. As discussed before, such experimentation is widely viewed as fundamental within the development of agriculture among sedentary hunter-fisher-gatherers (MacNeish 1992; Sauer 1952).

Certainly, there were many differences between Northwest Coast plant management and introduced European agriculture, though both plausibly represent alternative forms of "cultivation." In the course of an ethnographic interview, Kwakwaka'wakw elder Adam Dick (pers. comm. 1998), provided an equivalent
traditional term for “plant cultivation” in his language that he hoped might help clarify these differences. This term was used among the Kwakwaka’wakw to summarize their full suite of plant management practices — “q’waq’wala7owkw” — which literally translates as “keeping it living” (Deur and Turner 1999; Turner and Deur 1999). This term is a revealing indicator of the emic perspective of peoples who sought to create and maintain productive plots of productive plants near their home villages and within their home territories, through repeated and purposeful human intervention. What follows is a discussion of the methods that were part of this overall strategy of “keeping it living.”

Ownership

More than most aspects of traditional Northwest Coast plant management, there is abundant ethnographic evidence of the ownership and demarcation of plots of culturally significant plants. Ownership of root grounds and berry plots appears to have been ubiquitous along most of the Northwest Coast; this fact has not been disputed, even by most 20th century anthropologists (Barnett 1955: 252; Boas 1921). However, the rigidity of traditional land tenure was greater, and the full range of plants that were owned and inherited was considerably broader, than is commonly recognized. Suttles (1997, 1955, 1951a) noted that his Central Coast Salish consultants consistently identified ten species of native plants that were grown in plots that were owned by individuals or families, and inherited through longstanding systems of land tenure. These included blue camas (Camassia quamash), giant camas (Camassia leichtlinii), nodding onion (Allium cernuum), Hooker’s onion (Allium acuminatum), rice-root lily (Fritillaria lanceolata or Fritillaria camschatcensis), tiger lily (Lilium columbianum); bracken fern (Pteridium aquilinum); wapato (Sagittaria latifolia), bog cranberry (Vaccinium oxycoccus), and an unidentified “wild carrot” (possibly Potentilla anserina ssp. pacifica or Conioselinum...
Of these plants, all but the bog cranberry were valued and maintained for their edible roots. Addressing a greater time depth and a considerably broader geographical range, Nancy Turner (pers. comm. 1999; Turner and Deur 1999) has identified 22 plants that were traditionally owned and inherited among the coastal peoples of British Columbia. These include numerous plants with edible roots or bulbs, including: springbank clover (*Trifolium wormskioldii*), Pacific silverweed (*Potentilla anserina ssp. pacifica*), riceroot (*Fritillaria camschatcensis*), blue camas (*Camassia leichtlinii*), giant camas (*Camassia quamash*), “wild carrot” (*Conioselinum pacificum*), sea milkwort (*Glaux maritima*), wapato (*Sagittaria latifolia*), bracken fern (*Pteridium aquilinum*), wood fern (*Dryopteris expansa*), and lupine (*Lupinus nootkatensis*). These plants also include numerous fruiting or berrying plants: Pacific crabapple (*Pyrus fusca*), highbush cranberry (*Viburnum edule*), salal (*Gaultheria shallon*), red elderberry (*Sambucus racemosa*), grayberry currant (*Ribes bracteosum*), salmonberry (*Rubus spectabilis*), bog cranberry (*Vaccinium oxycoccus*), and several huckleberries (*Vaccinium alaskaense, V. ovalifolium, V. membranaceum, V. parvifolium*). (More specific information on ownership patterns can be found within Nancy Turner’s many publications on Northwest Coast ethnobotany [e.g., Turner 1995, 1979, 1975; Turner et al. 1983; Turner and Bell 1973]). This list is based on reconstructive studies, and it is quite possible that Northwest Coast peoples traditionally owned other plants not included on this list.

Reportedly, the boundaries of individual plots of food plants often were precisely defined, and commonly were marked with barriers or corner markers. Such patterns of

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2 Arguably, a much wider range of plants were “owned,” in general terms, within the territories controlled by Northwest Coast chiefdoms. Among the Nuu-chah-nulth, for example, chiefs controlled decisions regarding the use of plant resources within their entire hahuulthli, a sharply defined territorial unit, running from the mountains at the head of certain drainage basins to the offshore waters of the open Pacific. For
plot tenure have been frequently described in reference to camas plots. The camas plots of a village, clan, or household were commonly clustered together in one place, but were subdivided into individually demarcated family subplots. Among the Central Coast Salish, Jenness (1934-35: 9) noted that “every family had its own bed of camas” with boundaries that were marked out on the ground; the plot was inherited from generation to generation within kinship groups. Some of these beds were many kilometers from their villages, and were often accompanied by small clusters of houses that were used during the maintenance and harvesting of these plots. Suttles (1951: 60-61) recorded plot ownership and patterns of matrilineal tenure and inheritance of camas beds among numerous Salish consultants. These consultants described the traditional demarcation of individual camas plots through the placement of rocks or “lines drawn in the earth” along plot boundaries. In the absence of rocks, subdivided plots were marked off with wooden stakes or tall cedar poles, sometimes lashed together or flagged with cedar bark rope. No one else was allowed to dig there; digging on plots where one did not hold inherited rights resulted in potentially violent confrontations (Smith 1950, n.d.). Collins’ (1974: 55) Skagit Coast Salish consultants described similar practices:

Land was divided into individual plots in these prairies, marked by sticks at the four corners. A daughter inherited the right to obtain roots from one plot from her mother...Use rights were based on descent; during the late summer women with such rights came from widely distant villages to the plot of their mother... each plot was three to four acres in size.

the sake of simplicity, the current discussion is restricted to those cases in which distinctive prescribed tenure rights were documented for specific plants and plant sites.
Similar patterns of ownership and tenure were applied to other root plots. Marian Smith (1950, n.d. 5/3: 11) noted that in traditional Nooksack Coast Salish “Indian carrot” plots “each family had its own plot about 40 feet square, marked from one another with shallow ditch[es]...if they dug on others’ ground there was a big fight.” Likewise, Suttles (1997) reported Nooksack elders describing traditionally owned and inherited plots of “wild carrot,” wild onions, and chocolate lilies in long plots, roughly four feet wide. As with camas plots, their boundaries were demarcated with rocks, “lines drawn in the earth,” stakes, or cedar poles connected by cedar bark rope. Elsewhere, Turner (pers. comm. 1998) noted that her Salish consultants described using wooden stakes to mark plants and plant plots, in part so that they could be identified and dug up after their foliage died back in the fall. Suttles (1955) reported patterns of wapato plot ownership among the Katzie Coast Salish, with some plots reserved for collective village use and other plots owned by individual families; vegetation was cleared around the boundaries of each of these individual wetland wapato plots.

While the ethnographic record on plant management for the Salish peoples is quite detailed, similar accounts can be found from the far ends of the Northwest Coast. Darby (1996) demonstrated that Lewis and Clark’s passing references to wapato use in the Chinookan realm reflect patterns of plot ownership similar to those described for the Katzie by Suttles. Turn-of-the-century Haida elders reported that their gardens (probably tobacco gardens) traditionally “were owned by individual women and their size was in proportion to the rank of the owner.” These plots were sometimes fenced off with stakes, and sometimes these stakes, made of crabapple, were connected with cedar bark lashings to keep people, birds, and dogs out (Newcombe n.d. 46: 18); the first European descriptions of Haida gardens conform to these descriptions.
Kwakwaka’wakw also commonly marked off their owned and inherited plant plots with rocks, logs, wooden stakes or tall cedar marking posts (Bouchard and Kennedy 1990; Drucker 1953, n.d.; Boas 1934, 1921; Sapir 1913-14). Contemporary Kwakwaka’wakw elders recall hearing of the traditional use of markers for a wide range of plant resources, including cedar marker posts surrounding owned and tended crabapple trees, berry plots, and root grounds: “people didn’t just go pick anywhere; they had those [cedar] markers. If they weren’t yours, you don’t pick there” (Adam Dick pers. comm. 1999; Daisy Sewid-Smith pers. comm. 1998).

In most cases, plants were reportedly harvested by members of an extended family household, usually women. While individual families commonly held their own plots, women appear to have harvested on the behalf of (and with the permission of) the household or clan chief, who controlled access to the larger village or clan-owned plant resource site of which the family plot was a part. The plant products were then commonly given to the chief, who redistributed them both inside and outside of the household or village. Harvesters retained some portion of the products from their individual plot, which — in addition to providing them with foodstuffs — served as an acknowledgement of their rights to these plots and a partial repayment for their labor on the behalf of the collectivity. In a small number of cases, non-owners, including peoples from other villages or ethnolinguistic groups, appear to have sometimes been allowed to dig on owned plots of plants, but only after securing permission and establishing protocols for some partial repayment of the owners through harvest sharing or trade (Turner et al. 1983). With the rights of plant plot ownership reportedly came certain responsibilities - to maintain or enhance plant production for future generations, for example, and to equitably redistribute the plant output within the household or clan.
Soil Tilling and Weeding

Considerable evidence suggests that these individually and collectively owned plant plots were managed to enhance their productivity through various means, including the churning of plot soils and the weeding of competing plants. Some sources make it clear that the churning of the soil was viewed as a necessary act in maintaining the productivity of root grounds in particular; some sources also suggest that soil churning was performed both as a separate act, and as a byproduct of harvesting and weeding activities. In “Indian carrot” plots, Marian Smith (n.d. 5/3: 11; 1950) found that the Nooksack Coast Salish intentionally used their specialized digging sticks to keep the “soil...loose and easy to dig” within their root plots. Gibbs (1877: 39) and Babcock (1967) found corroborating evidence of soil tilling in camas plots among other Coast Salish consultants, which was said to increase the size and number of camas bulbs. Suttles’ consultants spoke of “turning the sod” as an integral part of the camas harvest. Such activities may have resulted in a certain degree of soil mounding. Likewise, there are references to the tilling of soil to produce the planting mounds for tobacco cultivation among the Haida (Turner and Taylor 1971).

Weeding is somewhat better represented in the ethnographic literature. Numerous Salish consultants mentioned traditional weeding of competing species from camas plots (Turner and Bell 1971; Babcock 1967; Suttles 1951a). It is widely accepted that all competing vegetation was weeded from tobacco plots among the Haida, as well as possibly the Tlingit, and Tsimshian (Turner and Tylor 1972). Compton (1993a) and others noted consultants describing the weeding of competing vegetation from around the base of crabapple trees. Occasional references from up and down the coast mention similar weeding practices for plots of edible lilies, including the tiger lily (Lilium
columbianum) and riceroot lily (Fritillaria camschatcensis), as well as weeding around medicinal plants or naturally-occurring food and medicinal plants within bog environments (Turner and Peacock 1997).

Moreover, on the basis of ethnographic descriptions of pure plots of native plants, it is clear that weeding was conducted in cases where it was not explicitly mentioned. References to owned and demarcated plots consisting solely of camas, “wild carrot,” wild onions, and chocolate lilies, for example – plants that almost never occur in pure stands under wild conditions – are telling indicators of management practices left implicit in indigenous consultants’ narratives. Occasionally, however, this connection was made explicit. According to Suttles (1997), for example, Salish consultants described the sod in their owned plots as consisting solely of camas bulbs: “There was no grass then because the patches were cared for.” In some cases, “intercropping” appears to have been the rule, and multiple plants were fostered simultaneously within the same location, most notably in the estuarine gardens that will be discussed in subsequent chapters.

Some Kwakwaka’wakw consultants have noted that red huckleberry and salal both are more productive if they are allowed to grow together (Kim Recalma-Clutesi pers. comm. 1998). Recognizing that the tilling and weeding of Haida tobacco plots is widely accepted, it is interesting to note that some of the earliest accounts of Haida tobacco gardens mention that there are additional plants growing in these mounded and well-tilled soils, including “wild celery” (Hoskins 1941). All of the plants commonly identified as “wild celery” in Northwest Coast accounts, including Heracleum lanatum and Conioselinum pacificum, were used extensively by Northwest Coast peoples for food or medicinal purposes. The latter plant in particular has been unambiguously described as an “owned” and both have been described as intentionally “tended” plants in other
ethnographic contexts (Turner 1995). Recognizing this, there appears to be strong evidence of food plant production within intercropped Haida “tobacco gardens,” which were undisputedly pre-contact.

Some sources mention that the clearing of competing vegetation (as well as stones or large woody debris) was the first step in establishing a family claim to individual food plant plots amidst naturally occurring or “fallow” plant communities. This has been reported in the case of camas among the Coast Salish (Babcock 1967) and wapato among the Chinook (Darby 1996). The stones and plant debris that were cleared in this manner often lined the edges of these plots or were incorporated into boundary markers. In addition to fostering enhanced plant output, such actions visibly demonstrated enduring patterns of human proprietorship at these sites.

**Transplanting and In situ Replanting of Propagules**

Vegetative transplanting and replanting of plant foods also appears to have been widespread on the Northwest Coast. These practices make sense in light of the geographically “fixed” nature of traditional plant plot tenure, the cultural pressures for enhanced and sustainable plant output, the utilization of native plants, and the density of food plants within owned plots as described ethnographically. The bulbs of camas (*Camassia quamash* and *Camassia leichtlinii*) were traded over long distances, and appear to have been both intentionally or unintentionally replanted. Suttles’ (1997; 1951a) Coast Salish consultants described transplanting desirable bulbs into their individually owned plots from elsewhere: “women, they said, dug bulbs they happened upon and planted them in their plots.” Stern (1934: 42-43) refers to similar practices among the Lummi, and viewed them as pre-contact. The enduring and widespread remnant distribution of small camas patches in locations that lie beyond the natural range...
of this plant serves as an additional strong indicator of similar transplanting methods (Deur 1999, 1998). As shall be discussed in subsequent chapters, there is biogeographic evidence of transplanting of camas and possibly native onions into estuarine rhizome gardens, such as the Nuu-chah-nulth gardens at Somass Inlet. Hesquiaht Nuu-chah-nulth consultants reported that they transplanted camas from southeastern Vancouver Island into the meadow behind Hesquiat Village, where camas does not grow naturally, though the date of this activity remains unclear (Turner and Efrat 1982).

Chinookan oral traditions collected by Boas (1901:6) make reference to transplanting wapato (*Sagittaria latifolia*) – a plant of the freshwater wetlands with edible tubers – by relocating tubers and “placing [them] into the mud.” In ethnographic notes from the turn-of-the-century, Haeberlin (in Haeberlin and Gunther 1930: 21) notes a tradition of transplanting wapato among the indigenous inhabitants of Puget Sound, though the antiquity of this practice is unclear. Central Coast Salish oral traditions speak of similar transplanting of wapato to wetland areas beyond its natural range on eastern Vancouver Island and the adjacent Gulf Islands (Nancy Turner pers. comm. 1999). Compton (1993a) found evidence of transplanting of “wild carrots” to more convenient locations by the Nuxalk. Other accounts (e.g., Smith 1950) mention the transplanting of edible lilies, including the tiger lily (*Lilium columbianum*) and riceroot lily (*Fritillaria camschatcensis*). The great majority of the plants transplanted in this manner were

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3 Wapato is a very close relative of the Chinese water chestnut, *Sagittaria trifolia*, which was, like wapato, widely abandoned as a dietary staple after the introduction of potatoes by Western missionaries. Darby (1996) has attributed the dramatic declines in the historic abundance and distribution of wapato to the introduction of carp and cattle. The end of aboriginal management – as in the case of many other plants in this region – may have also resulted in a dramatic reduction in the range of wapato and in the presence of large pure plots as described at contact.
sources of starchy root foods, a pattern which is to be expected among sedentary fishing peoples with access to abundant animal protein (Sauer 1952).4

Still, there are exceptions to this general rule. Numerous elders have commented on the former transplanting of desirable specimens of berries from wild locations to near their home villages, but few have been certain that this is a pre-contact practice (Adam Dick pers. comm. 1998; James McDonald pers. comm. 1997). Compton (1993a) cites sources mentioning the "planting" of crabapple trees among the Haisla, although here too, the dates of this practice are not clear (see also Raley 1897).

A small number of species were transplanted to improve the localized output of valuable plants used in traditional material culture. Compton (1993a: 394) noted that springbank clover and Pacific hemlock-parsley (or "wild carrot") were

"obtained from the Nuxalkmc who were said to have brought this plant to Hanaksiala territory. In return, the Nuxalkmc from Kimsquit and Bella Coola, as well as some Coast Tsimshian people from Metlakatla, were known to have returned home with stinging nettle plants from Hanaksiala territory following trading visits."

Nettle was primarily used as a fiber for nets, ropes, and other durable goods; its former 'cultivation' has been noted by such authors as White (1981) and Turner (1975). Remnant isolated patches of nettle can still be found adjacent to abandoned village sites, far from its ancestral range, possible corroborating evidence of such transplanting efforts.

Nuu-chah-nulth consultants also have reported traditions of transplanting basket

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4 There are occasional early references to Northwest Coast tribes harvesting well-defined plots of "sunflower" with edible roots (e.g. Gibbs 1877: 193). Nancy Turner (pers. comm. 1998) has correctly noted that these descriptions do not match any native plant of known food value in the region, but would be an apt description of the Jerusalem artichoke (Helianthus tuberosum), an important endemic root crop found elsewhere in North America. This interpretation has not been put forward here, however, due to limited evidence and the potentially contentious nature of this interpretation. Certainly, if this interpretation were true, its implications for the current argument would be tremendous.
materials, such as bulrush (Scirpus spp.) and cattail (Typha latifolia) to more convenient or wetland sites or sites owned by the transplanters (Nancy Turner pers. comm. 1999; Turner et al. 1983).

Several sources mention the intentional replanting of plants in situ to maintain their productivity into the future. Camas is widely accepted to have been managed in this manner, with individuals replanting small bulbs in situ within their individually owned plots (Suttles 1997; Turner 1995). Further, Marian Smith's field notes (n.d. 5/3: 11) report that “Indian carrots” were “dug up, the little root broken off and the sprout was planted again, so there would be crop the following year” among the Nooksack Coast Salish. There is further evidence of "wild carrot" (Conioselinum pacificum) rootlets being replanted following root harvests elsewhere on the coast, including among the Nuxalk (Compton 1993a, 1993b; Nancy Turner pers. comm. 1998). Numerous lilies were also replanted in situ to enhance future harvests; smaller bulbs were replanted in plots so that they might mature and get larger for future harvests (Loewen 1998).

Selective Harvesting

Selective harvesting appears to have been widespread, and has been mentioned almost invariably by indigenous consultants when traditional plant use has been the object of focused inquiry. The localized exhaustion of resources was not only unwise for obvious subsistence reasons; in light of the tenure obligations of individual plot owners and managers, the total exhaustion of localized plant resources appears to have often been heavily stigmatized within Northwest Coast societies. For this reason, in part, harvesters often only gathered certain mature specimens of plants or plant segments within their own plots, leaving enough plants in place to facilitate future harvests (Turner and Atleo 1998). Suttles (1997; 1951a), Turner (1995, 1975), Babcock (1967), and
others have documented the testimony of numerous Salish consultants, describing how they never harvested all of the camas bulbs at a site, leaving the smaller camas bulbs for future years' harvests. Similar testimony has been recorded regarding most of the plants that were subject to traditional patterns of ownership, as listed above (Turner and Atleo 1998; Turner 1995, 1975).

This approach to plant resource conservation, incidentally, was also employed with reference to tree resources that were within individual, owned territories. Numerous researchers (e.g. Turner 1975; Boas 1921: 616-617) report that cedar bark was harvested selectively to avoid the localized exhaustion of the bark or the killing of individual cedar trees; so too were individual planks removed from the sides of living trees. Similar controls were placed on the exploitation of trees with medicinal bark, such as cascara (Rhamnus purshiana) (Turner and Hebda 1990). Likewise, tree roots, widely used in baskets, ropes, and other items of material culture, were selectively harvested from spruce and other trees, in order to not permanently damage the living tree.

Fire

Many authors have described the traditional practice of setting fires to improve forage for game, or to create prairies for the intensive maintenance of shade-intolerant plants such as camas, "wild carrot" and bracken fern. This approach to land management was widespread among traditional "hunter-gatherers" in many parts of the world, and – in addition to tobacco cultivation – now appears to be the one other plant management practice widely recognized by Northwest Coast specialists (Boyd 1999b; Pyne 1993). There have been many written references to this practice, particularly with regard to the drier rainshadow portions of the Northwest Coast, such as the Willamette Valley, the Puget Sound lowlands, and southeastern Vancouver Island (Boyd 1999b, 1986; White
A smaller number of authors have mentioned small scale burning in the region’s coastal rainforests (Deur 1999, 1998; Craig and Smith 1997: 46; Gottesfeld-Johnson 1994, 1993; Turner 1991; Liberman 1990).

Of the many plants discussed so far in this chapter, very few grow well or at all under the region’s dense forest canopy. As even the casual observations of early explorers suggested of anthropogenic burning in the region “their object is to clear away the thick fern and underwood in order that the roots and fruit on which they in a great measure subsist may grow more freely and be the more easily dug up” (Grant 1848). The use of fire, then, was a prerequisite for many of the plant management methods described above, such as camas plot maintenance, which were often carried out in the Northwestern equivalent of a “swidden.” Fire appears to have been particularly effective at expanding the potential range of herbaceous plants within “edge environments” such as shorelines, riparian areas, or subalpine meadows, where the forest canopy could be gradually pushed back, allowing greater overall insolation. It was in these locations that the most intensive forms of non-estuarine plant management arose. Such methods also appear to have been used in the cleared areas immediately surrounding villages, to expand small and readily accessible plots of useful plants (Turner 1999).

In addition to clearing the ground of competing forest vegetation, fire served to improve the output of fruiting plants, increasing the size and number of berries, and eliminate competing or woody vegetation. As one Kwakwaka’wakw “prayer,” said to berry plots before burning, suggests “I set fire to you the way it is done by my root (ancestor) who set fire to you in his manner when you get old on the ground that you may bear much fruit” (Boas 1930: 203). As Gottesfeld-Johnson (1993: 94) suggests, “given
the low caloric value and small size of individual fresh berries, the location and maintenance of large and productive berry patches with predictable harvests was necessary... Burning was the mechanism to enhance or maintain berry patch quality.” Turner (1999) has identified several berries that were intentionally enhanced through the use of fire, including several relatives of the blackberry: wild raspberries (*Rubus idaeus*), wild blackberry (*Rubus ursinus*), blackcap (*Rubus leucodermis*), salmonberry (*Rubus spectabilis*), and thimbleberry (*Rubus parviflorus*). Other berries that were enhanced through the use of fire include salal (*Gaultheria shallon*), wild strawberries (*Fragaria* spp.), red huckleberry (*Vaccinium ovalifolium*), and a wide range of blueberries and blue huckleberries (*Vaccinium* spp.). Hazelnut (*Corylus cornuta*) patches were also sometimes maintained through the use of fire (Liberman 1990). These plants share a capacity for rapid regrowth from undamaged rootstocks following low-temperature fires, a trait not shared by many competing species within the forest understory. Through burning, then, Northwest Coast peoples were able to maintain pure or mixed plots, containing only culturally valuable species, even in locations where plot maintenance was otherwise minimal.

**Pruning**

Pruning, the selective removal of branches from living trees or shrubs by hand, served as a common means of managing woody plants on the Northwest Coast. Pruning techniques were employed in two general ways: the pruning of neighboring and competing plants minimized the impacts of these plants on culturally preferred species, while the careful pruning of culturally preferred species served to stimulate their production of branches, shoots, or fruits. Numerous Kwakwaka’wakw elders report that their grandparents told them of pruning red huckleberries (*Vaccinium parvifolium*), salal
(Gaultheria shallon), soapberries (Shepherdia canadensis), and numerous species of currant (Ribes spp.). This, they reported, made the berries and berry-bearing stems grow back more abundantly in the following year (Nancy Turner pers. comm. 1999; Adam Dick pers. comm. 1998; Daisy Sewid-Smith pers. comm. 1998). Compton (1993a) reported similar pruning techniques among the Tsimshian and Haisla. Leslie Johnson (1993, pers. comm. 1999) reports Gitksan pruning of berry plots, including soapberry and huckleberry, to improve berry yields. Some central Northwest Coast peoples employed similar methods with owned crabapple trees, facilitating the development of multiple new fruiting branches on their most productive trees.

Salmonberry (Rubus spectabilis) and thimbleberry (Rubus parviflorus) were both commonly pruned to stimulate the production of berries as well as to enhance the growth of their soft green shoots, which were an important springtime food source. Numerous elders have reported pruning plots of other plants with edible shoots, including cow parsnip (Heracleum lanatum), horsetail (Equisetum telmateia), and fireweed (Epilobium angustifolium). The primary stems of these plants were sometimes broken off at the ground level, stimulating the production of multiple shoots from a single rootstock (Turner 1995; Kuhnlein and Turner 1983; Turner et al. 1983). Reportedly, such pruning might facilitate two or more annual harvests of shoots from the same plots of plants before they were allowed to reach maturity late in the growing season. Similar methods were used to maximize the output of preferred patches of Devil's-club (Oplopanax horridus), a ginseng relative and one of the Northwest Coast's foremost medicinal plants (Nancy Turner pers. comm. 1999). Numerous basket making materials, including sedges, cattail, tules, and nettle, also appear to have been intentionally cut back to stimulate the

64

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regrowth of an increased number of stems from single rootstocks. In turn, this enhanced the localized availability of these valued resources (Craig and Smith 1997).

Another practice that receives occasional mention involved the pruning of vegetation to maintain access to plant harvest sites. Nuu-chah-Nulth consultants told Bouchard and Kennedy (1990:64-65) of a place called “tl’aaxaktis” or “cleared area” that was traditionally cleared of vegetation in order to provide access to a nearby lake used for picking bog cranberries. Likewise, James McDonald (pers. comm. 1997) reports that the Tsimshian pruned vegetation along trails and around berry plots so that they could easily pick and pack away large numbers of berries. This rationale may also partially explain the aforementioned practice of removing vegetation around the periphery of owned wapato plots, which grew within densely vegetated wetland environments.

Fertilization

The intentional fertilization of plant plots receives occasional mention in Northwest Coast ethnographic sources. The causal relationship between fertilization and the enhanced output of plant plots seems to have been broadly appreciated. The fertilization of tobacco plots with rotting woody debris is widely acknowledged; the Haida (and possibly the Tlingit and Tsimshian) fertilized their tobacco gardens after the fall harvest by mixing rotten wood into the soil (Turner and Taylor 1972). There is also some evidence that the Haida fertilized their berry plots, though it remains unclear what substances or methods were used (Newcombe n.d.: 35/8: 4). Early accounts from the Columbia River, hundreds of kilometers to the south, suggest that the peoples of that area were mixing wood ashes into the soil at the base of planted tobacco plants, noting that this “invariably made it grow very large” (David Douglas, quoted in Newcombe n.d. 46/18). Salish consultants told Suttles (1997) that they recalled hearing of the
fertilization of camas plots with seaweed gathered from the strand, prior to European settlement in the region: "When they had finished [digging], they leveled the ground and covered it with seaweed. Later, when it was all dry, they burned it over. This was said to make the bulbs bigger the next year." Similar reports of camas fertilization with kelp or shoreline detritus were recorded by Turner and Efrat (1982), Turner (1973), and Suttles (1951a). Leslie Johnson (pers. comm. 1999) reports that Gitksan consultants referred to former intentional "fertilization" of nettle plots adjacent to oolichan fishing and processing sites, presumably with the wastewater and materials left over after oolichan processing. The fertilizing effects of fire appear to have been recognized by indigenous peoples of the region, although the motives for burning were many. Highly localized fire management techniques appear to have been employed for the dual purpose of fertilization and weed removal within plots of chocolate lily, tiger lily, various onions, and bracken fern, which were cleared, burned, selectively harvested, and replanted in situ (Turner 1995; Norton 1979b).

**Seed Cultivation**

In addition to the well-documented practice of tobacco cultivation by seed, as found on the northern and far southern Northwest Coast culture area, there have been occasional mentions of cultivation by seed in the ethnographic literature. Twentieth century consultants commonly mentioned the reseeding of camas in situ.\(^5\) Stern (1934) reported the collection and planting of camas seeds by the Lummi of Puget Sound, in a manner similar to the collection and replanting of tobacco seeds found on the northern

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\(^5\) Suttles (1997) has questioned on the basis of linguistic evidence whether Northwest Coast peoples understood the role of seeds in plant propagation, as there were few terms for "seed" in the region's recorded languages. Without further corroboration, this argument seems specious. Indeed, after exhaustive ethnographic investigation, Flannery (1968: 68) was led to conclude that "We know of no human group on
half of the coast. Stern’s consultants (1934: 42-43) said that when digging camas and "wild carrot" they "crush the soil directly afterwards and plant the seeds broken from the stems." Stern considered these practices to be pre-contact, though the antiquity of this practice remains contentious. Newcombe (n.d. 35/11) reports the Haida having “planted” an unidentified plant with edible seeds, in a manner likely similar to their seed cultivation of tobacco. Kim Recalma-Clutesi (pers. comm. 1998) reports that some north Coast Salish and Kwakwaka’wakw used to intentionally leave behind or scatter seeds of the Lomatium nudicaule, the seeds of which were used for medicinal purposes, so that patches might grow back or expand in following years. Here too, the antiquity of the practice is unclear on the basis of known ethnographic data, but the widespread and atypical dispersal of patches of this plant, often found in association with settlement or ceremonial sites, lends some support to the interpretation of this practice as pre-contact.

Domestication

These traditions of plant maintenance raise the question of whether the peoples of the Northwest Coast developed endemic domesticates. If not, this would lead to the conclusion that, in the terms of Harlan (1975), these plants were “cultivated,” but not “domesticated.” However, the long-term selective propagation and weeding of plant communities always raises the possibility of genetic consequences. And, as such authors as Sauer (1952) have suggested, periods of European conquest have been accompanied by the loss of many domesticates, many of which disappeared before European documentation was possible, as indigenous peoples suffered epidemics, relocations, and the collapse of traditional cultivation practices.

Earth so primitive that they are ignorant of the connection between plants and the seeds from which they grow.”
There is some evidence of localized domestication on the Northwest coast, although much of this evidence remains quite tentative. Haida tobacco is a likely candidate as a distinct domesticated variety, a plant which was growing far from its ancestral range, and which apparently became extinct following the cessation of indigenous cultivation (Turner and Taylor 1972). By all accounts, the giant camas (*Camassia leichtlinii*) was preferred to blue camas (*Camassia quamash*) in inter- and intra-regional trade because of the former plants’ larger bulbs. Many of the smallest anthropogenic camas plots outside of the native range of this plant consist primarily of the great camas. The size difference between the common and great camas might reflect very long term selection for larger bulbs when camas was being transported from their ancestral beds and introduced (accidentally or otherwise) to burned clearings on the outer coast. Moreover, in areas where intensive human management has been documented ethnographically, there have been occasional reports of atypically productive food plants. Denis St. Claire (pers. comm. 1998) recorded testimony regarding unusually large and flavorful berries within formerly managed plots. Likewise, Compton (1993a: 269) and others have noted oral traditions regarding particularly productive crabapple trees (Nancy Turner pers. comm. 1999). It has been noted that tending of these plants has ceased, and specimens no longer exist. While the origins of these variations are unknown, it is an intriguing, but as yet unexamined possibility that prolonged protection and selective propagation facilitated genetically discontinuities within population of these plants, domesticates or proto-domesticates, which were largely lost once human selection and vegetative propagation of distinctive, individual plants ceased. At present, however, the potential presence or absence of all of the possible domesticates remains strictly conjectural.
CHAPTER 5

ETHNOGRAPHIC ACCOUNTS OF ESTUARINE CULTIVATION

Surprisingly, among the many researchers who have investigated Northwest Coast subsistence, none have addressed estuarine rhizome cultivation as a topic of focussed investigation until now.\(^1\) Despite this fact, the abundance of passing references to rhizome use and cultivation, within both ethnographic and linguistic literatures, is impressive. There are also numerous passing references to intensive estuarine plant management in archival sources that have never been addressed within published literatures (e.g., Boas n.d.; Drucker n.d.1/2: 2; Newcombe n.d. 24/6: 1551-52; Dawson 1887a: 65, 1887b). From these fragmentary references, one can produce a tentative picture of a rhizome cultivation complex that was found along the length of the Northwest Coast at the time of European contact.

These passing references are revealing on many counts. Importantly, in the nomenclature of Harris (1979), infrastructural, structural, and superstructural factors all served as motives for rhizome cultivation at the time of European contact. Not only did these root vegetables serve as an important food source (and the primary source of dietary starches for most pre-contact Northwest Coast peoples). Estuarine root foods were also intricately and intimately associated with indigenous cosmology and ceremony, and trade in these rhizomes served both social and economic ends (Turner and Kuhnlein 1982). In addition, the methods of rhizome cultivation reflect a detailed appreciation of the interplay of cause and effect within environmental systems. The

\(^1\)Turner and Kuhnlein (1982) and Kuhnlein et al. (1982) wrote of the dietary significance of the two most common plants in these gardens, \textit{Potentilla} and \textit{Trifolium}. There is only brief mention of rhizome cultivation methods and these practices are largely dismissed as post-contact phenomena in these sources.
peoples of this coast repeatedly modified soil, plants, and other materials, in anticipation of a predictable outcome: the qualitatively and quantitatively enhanced output of root foods.²

As with the plants discussed in previous chapters, estuarine root grounds were managed through plot ownership, weeding, vegetative transplanting, in situ replanting, selective harvesting and fertilization. The methods of cultivation applied to estuarine gardens, however, exhibited a level of intensity that exceeds the cultivation methods applied to other plants; these often involved extensive modifications of estuarine soils. While the rhizomatous springbank clover (*Trifolium wormsksjoldii*) and Pacific silverweed (or “cinquefoil,” *Potentilla anserina ssp. pacifica*) were the primary plants maintained in estuarine root plots, these plots also appear to have occasionally contained other plants with edible root segments, including Nootka lupine (*Lupinus nootkatensis*) and the riceroot or “chocolate” lily (*Fritillaria camschaticensis*). Less frequently, these estuarine root plots reportedly contained such root vegetables as sea milkwort (*Glaux maritima*), and Pacific hemlock-parsley or “wild carrot” (*Conioselinum pacificum*).³ All of these plants are included in the discussion that follows.

² These two plants, incidentally, have a history of cultivation elsewhere. In Eurasia, clovers (*Trifolium*) have been cultivated as a fallow cover crop, for animal feed, and as a supplementary component of the human diet. In contexts such as the Middle East, intensive use of *Trifolium* for human subsistence was eclipsed upon the arrival of other cultigens, and only the larger legumes have persisted (Miller 1992: 44, 50). Similarly, rhizomatous colonies of *Potentilla anserina* served as a cultivated crop in the Hebrides Islands and elsewhere in the northern British Isles prior to the introduction of the potato; the cultivation and consumption of *Potentilla* was readopted during the famines that followed the potato blight (Hedrick 1972: 451).

³ Like “wild celery” and “Indian potatoes,” the term “wild carrot” has a long history on the Northwest Coast, and is a source of much confusion. Compton (1993b) suggests that the plant designated as “wild carrot” was primarily *Conioselinum pacificum.* It is clear, however, that ethnographers and explorers – unfamiliar with the native plants of the region – referred to several other plants by this generic common name because of similarities to the root, leaf, or flower of domestic carrots. Other plants termed “wild carrot” included, significantly, *Potentilla anserina ssp. pacifica.* *Conioselinum pacificum* can grown both in the upper estuary and within upland meadows. The plant was often subject to indigenous cultivation, but as many references to the management of this plant apparently refer to upland environments rather than estuaries, I have relegated most references to this plant to Chapter 4.
In order to set the stage for a more detailed discussion of the implications of rhizome cultivation in subsequent chapters, I provide an overview below of both linguistic and ethnographic references to these rhizomes and their cultivation. I employ semantic analysis, in addition to providing a summary of ethnographic evidence of rhizome cultivation and use, in order to reveal the “emic” perspectives of Northwest Coast peoples. Linguistic and folkloric evidence embodies the shared assumptions, lore, values, and agendas of these peoples, illuminating the extent to which they understood the precise causes and effects of their modification of the tidelands (Blaut 1979). Thus, this linguistic evidence sheds valuable light on practices recorded ethnographically, often revealing indigenous understandings of plants and the human role in their cultivation. By interweaving linguistic analysis with ethnographic data in order to illuminate indigenous environmental knowledge, I am continuing a minor but venerable ethnolinguistic tradition, advanced by such authors as Sapir (1912), Harrington (1916), Boas (1934), and Basso (1996). I begin here with a discussion of the roles of rhizomes, generally, within the economic, ceremonial, and cosmological life of Northwest Coast peoples, particularly among the well-documented Kwakwaka’wakw and Nuu-chah-nulth. This discussion is followed by a description of the specific methods of rhizome cultivation.

Rhizomes in Economic, Ceremonial, and Cosmological Life

According to available ethnographic accounts, the demand for *Potentilla*, *Trifolium*, and other estuarine root vegetables was quite high along the entire Northwest Coast. It is clear that these estuarine root foods served as the primary source of starch foods among most Northwest Coast peoples (Turner and Kuhnlein 1982). Yet the
importance of these root foods also may be attributed in part to the related fact that rhizomes held significant roles with Northwest Coast economic and ceremonial life. If material wealth was 'convertible' into prestige, and prestige was 'convertible' into material wealth, these rhizomes were 'convertible' into both. As such, rhizome production was a means to many ends – dietary, material, and ceremonial – a fact that appears to have encouraged their intensified production (Wagner 1996, 1977: Hayden 1990).

Root vegetable production was vital among Northwest Coast elites as a means of meeting ceremonial obligations, which was, in turn, vital for their maintenance of social and economic privilege. Along much of the coast, crates of estuarine roots were standard items of exchange at potlatches (McIlwraith 1948, I: 537), and estuarine roots were consumed as a regular part of winter ceremonial dances (McIlwraith 1948, I: 194). Boas (1921: 527-31, 535-542) notes the use of these estuarine roots as an important part of the Kwakwaka’wakw ceremonial barter economy, with, for example, several crates of estuarine roots being used as a regular part of the bride price. Elsewhere, oral traditions mention several crates of estuarine roots being exchanged for high-prestige ceremonial items, such as elaborately decorated copper shields, which served as a mnemonic, at once asserting and insuring the elite owner’s economic and political clout (Boas 1910b: 93).

Northwest Coast ethnographers, most notably Boas (1921), also discuss entire ceremonialized feasts, regularly held among the Kwakwaka’wakw, alternatively devoted entirely to the consumption of either Potentilla rhizomes or Trifolium rhizomes. Drucker (1951: 62) noted similar feasts among the Nuu-chah-nulth. Among the Nuu-
chah-nulth, these feasts were commonly held in the early winter, following some two to
three months of post-harvest storage; the rhizomes reportedly grew sweeter with this
duration of storage (Drucker n.d. Box 2, 23/1: 81). Each feast had its own intricate
etiquette surrounding the act of rhizome preparation and consumption. (Rhizomes were
commonly dried, and later rehydrated for consumption. Boas [1921: 527-43] describes
several methods of preparation for *Potentilla* and *Trifolium* rhizomes, which largely
involve steaming or boiling with hot rocks; both raw and cooked rhizomes were also
commonly rolled into balls and dipped into grease rendered from the oolichan smelt.)

Drucker’s elderly informants expressed pride in great rhizome feasts of their ancestors:
“Tales of famous feasts speak of young men having to go up on the roof of the house to
pour in water to make steam, so high were the piles of clover roots” (Drucker 1951: 62).
At these events, the chiefs would identify the estuarine root plots in his ownership that
had supplied the feast, and recounted the lineages through which he had inherited these
plots (Drucker n.d. Box 2, 23/1: 64).

So great was the demand for these rhizomes for social, economic, ceremonial,
and dietary purposes that the peoples of this coast, such as the Kwakwaka’wakw,
reportedly traveled hundreds of kilometers by canoe in order trade these estuarine root
foods in conjunction with other plant foods used in ceremony and subsistence (Turner
and Bell 1973: 300). Indeed, Lepofsky (1985 pers. comm. 1997) found that access to
prime estuarine root grounds was a better predictor of the relative wealth and prestige of
different villages among the Nuxalk than access to animal resource sites, such as
productive salmon streams. Salmon, she concludes, were comparatively ubiquitous,
while the control of these coveted plant resources provided households and villages with
surplus wealth that, over time, shaped their dealings with neighboring tribes and enhanced their relative status (see also Lepofsky, Turner, and Kuhnlein 1985).

Kwakwaka’wakw elder Daisy Sewid-Smith (pers. comm. 1998) notes that her ancestors from the village of Haada reported that they “used to plant enough [Trifolium, Potentilla, and Fritillaria] to trade with the northern people... The northern people would come and trade with them...[the Heiltsuk and] the Nuxalk.” She notes that the people of Haada would dry this surplus of estuarine root vegetables for shipment and that trade in these articles was a major part of the region’s intertribal economy. This trade effectively ceased during well-documented inter-village warfare during the mid-1850s, which brought an end to these inter-tribal trade alliances (see Galois 1994).

References to the importance of rhizomes as a trade good and feast food also may be found in the very earliest explorer’s accounts from the Northwest Coast. While held captive by Chief Maquinna of the Mowachaht Nuu-chah-nulth, John Jewitt purchased bundles of Potentilla rhizomes for a Christmas meal in 1803. Jewitt noted that the plant was a coveted trade item, but — as a captive — he did not have the opportunity to observe garden sites: “the plant that produces it I have never seen” (1987: 120). Likewise, during his 1792 stay at Nootka Sound, Moziño (1970: 21) saw these plants while bartering, and reported that the most important plant foods of the Nuu-chah-nulth included “the silver weed...the roots of the trailing clover, and the scaly, onionlike bulb of the Kamchatka [i.e. riceroot] lily.”

The longest, thickest rhizomes of both plants — usually taken from the taproots of the plant — were associated with high status. As Boas’ primary field assistant, George Hunt (1922) reported, the largest clover roots were called by a special name,
“laxabales,” and “is a food specially for the chief and his family. No one else may use it.” These large roots were actively sought by cultivators in these gardens, and were given to the chiefs of each Kwakwaka’wakw clan as a form of tribute (Boas 1921: 1333-39). Boas (n.d.: 67-68) reported that “In digging cinquefoil-roots, the smaller upper roots are distinguished from the long lower ones....The baskets with the long roots are kept in the right corner of the house, [i.e. the side associated with the chief’s immediate family] those with the short roots in the left corner of the house. [i.e. the side containing less prestigious individuals and items].” Kwakwaka’wakw plank houses commonly contained rhizome storage areas beneath the sitting area of the household’s chief or chiefs (Daisy Sewid-Smith pers. comm.; Boas 1888; 1909). In addition, “chiefs” were referred to with a number of laudatory, metaphorical terms, including LEgwa’nEwe⁴, which Boas (1929) translates as “the thick root of the tribe,” a term that appears etymologically related to the Kwak’wala term for large clover and silverweed rhizomes “Ihaxabális” (Boas 1947, 1929: 235). This term appears to have been used frequently in ceremonial contexts in which one spoke of chiefs or ancestors (Boas 1930a).

The social, economic, and ceremonial significance of rhizomes was no doubt enhanced by their importance in Northwest Coast indigenous cosmology. As Haskins (1934: 184) suggests, Potentilla held a “prominent...place in the tales and myths of the Coast Indians from Oregon to British Columbia.”⁵ According to the Kwakwaka’wakw, during the earliest myth age before the arrival of certain transformers, when the world was still dark, chaotic, and devoid of human mortals, there was no water for the

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⁴ “Kwak’wala” is the language of the Kwakwaka’wakw people, otherwise known as the “Kwakiutl.”

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ancestral beings to drink; these ancestral beings survived on the moisture inside of starchy rhizomes. When discussing later periods of the mythic past, the period after the arrival of the transformers, *Potentilla* and *Trifolium* rhizomes were commonly depicted by the Kwakwaka'wakw as one of the primary foods eaten in ‘heaven’ by these ancestral and supernatural beings (Boas 1935: 85, 1908: 167). In addition to being of importance to supernatural beings, Northwest Coast tales commonly assert the importance of *Potentilla* and *Trifolium* rhizomes in the diet of human mortals. In diverse folkloric contexts, it is suggested that estuarine rhizomes are the most important plant foods in the human diet (e.g., Boas 1908: 45; Boas 1905: 178). The socio-economic importance of estuarine root vegetables also receives frequent mention in oral histories regarding the pre-contact period, with human characters bolstering their status by giving away crates of estuarine roots in special “rhizome feasts,” potlatches, marriages, and in trade (Boas 1910b: 95, 357; Boas 1905: 82).

There is also some folkloric evidence that rhizomes sometimes served as a more dependable food source than animal foods, lending some support to the contention that rhizome gardening was a “risk-reducing” subsistence strategy. Many tales speak of “roots” and animal foods alternately eclipsing one-another in importance, depending specifically upon the abundance of prized fish and game. A Nuxalk tale tells of a famine in the winter (probably the result of a poor salmon harvest) before the arrival of Europeans, during which the people survived only by rafting from marsh to marsh, digging clover rhizomes (Edwards 1979: 11).6 Likewise, Northwest Coast oral

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5 Actually, this range extended further north, into southeast Alaska, and south into northern California.

6 In the Chinook realm, where these estuarine roots were scarce but wapato was a significant wetland food source, Boas (1901) found tales of wapato serving a similar function during crashes in the availability of salmon.
traditions contain several references to the storage of estuarine rhizomes as provisions for the lean winter months (Boas 1908: 54; Boas 1910b: 457).

Methods of Plant Cultivation

In order to acquire their coveted root foods, Northwest Coast peoples expended considerable labor to enhance rhizome production and control access to rhizome plots. Ethnographic accounts and contemporary biophysical data, taken together, make it clear that the levels of rhizome productivity found on contemporary unmanaged flats would not have met the ethnographically documented rates of root vegetable consumption. To achieve historically documented rates of production, human intervention was required. Accordingly, Northwest Coast peoples appear to have developed sophisticated methods of rhizome enhancement and reproduction, well suited to the distinctive conditions of the region’s salt marshes. In the process, they became competent cultivators. Returning to the definitions proposed by Harlan (1975) and others, the diagnostic characteristics of “plant cultivation” include such actions as the seeding or transplanting of propagules, the intentional fertilization or modification of soils, improvements of irrigation or drainage, and the clearing or “weeding” of competing plants. All of these practices reportedly were integral components of the estuarine gardening tradition of the Northwest Coast, as reported by indigenous consultants, early ethnographers, and explorers.

While the accounts of cultivation methods that follow are drawn extensively from archival and published accounts of estuarine gardening on the Northwest Coast, this material has been augmented by the contemporary accounts of a small number of Kwakwaka’wakw elders. In the course of my dissertation research, I had the
opportunity to work with a small circle of unusually informative elderly consultants, with considerable training in traditional lifeways. When it became apparent, at the close of the 19th century, that the colonial assault on native traditional practices was beginning to have pervasive effects, the Kwakwaka'wakw identified a small number of youngsters from chiefly lineages to be isolated from the white world and given traditional chiefly training. This continued effort to maintain hereditary chiefdomships and ceremonialism in the face of colonial opposition represented a significant, but largely undocumented, part of the Kwakwaka'wakw "underground potlatch" movement as described by Cole (1991a, 1991b), Cole and Chaikin (1990) and others. This resistance movement was so effective that it motivated Franz Boas to seek out and study this 'tribe' which he felt provided him with a rare example of Indians who had largely escaped the acculturative influences of the Anglo world (Codere 1959). Many of these specially trained children were chosen at birth, and were designated to become a future generation of hereditary chiefs, "uncorrupted" by European influences. Over the course of several years, in isolated locations where European influence was negligible and English was seldom if ever spoken, these youngsters were drilled on aspects of traditional life that would contribute to their future roles as leaders and as resuscitators of their own traditions. European introductions, including foods and land use methods, were self-consciously rejected, and traditional plant use and management represented one component of this training. The instructors for these youth were themselves specially trained hereditary leaders born in the mid-19th century; these training episodes were carried on clandestinely in the hinterland, even as Boas conducted his field research in the Anglicized core settlements of the Kwakwaka'wakw. Today, a small number of these
children survive as tribal elders, and through the intervention of Dr. Nancy Turner, I was able to meet a small number of these people in the course of my research. Significantly, these elders' testimony regarding traditional gardening practices agrees on most points with the data recorded by Boas (1934, 1921, n.d.) and others, while allowing for the elaboration and clarification of many points not addressed by Boas' original research. Moreover, their testimony coheres with data collected in other ethnographic contexts on the Northwest Coast, where a small number of elders still assert that cultivation was widespread, and that “individual and family stewardship of these gardens was a factor in their [enhancement] and sustainable use” (Craig and Smith 1997: 36).

Among the surviving members of this Kwakwaka’wakw movement, I have worked most closely with hereditary Chief Kwaxistala “Adam Dick” of the Dzewadenux Kwakwaka’wakw of Kingcome Inlet. As part of his training, Adam Dick was given detailed instruction on traditional methods of estuarine rhizome management by a number of elders, and was also involved with maintaining a few remnant gardens with his elderly maternal grandmother, Wotkineyga. In addition to conducting numerous interviews with Adam Dick, I have had the opportunity to visit former garden sites near Kingcome Village as his guest, and to work with him in the reconstruction of a traditional garden on an intermittent estuarine channel behind his home on the Qualicum Indian Reserve. These experiences have provided a wealth of contextual information on traditional plant management not available through other sources. Other Kwakwaka’wakw individuals, including Daisy Sewid-Smith Myanilth (herself a traditionally trained elder) and Kim Recalma-Clutesi Oqwilowqua, have also provided me with valuable information. They have also aided immeasurably in providing me with
the knowledge of Kwak’wala and protocols for inter-generational communication that have allowed me to make the most of my communications with Adam. The accounts of these elders are integrated with published and archival accounts in the notes on traditional cultivation methods that follow.

Ownership

According to numerous ethnographic accounts, all cultivated patches of estuarine root foods were subject to some form of ownership on the Northwest Coast. Indeed, Boas (1921) itemizes chiefly ownership of patches of each of the plants traditionally cultivated in estuarine gardens: silverweed, clover, sea milkwort, “wild carrot,” Nootka lupine, and riceroot lily. Among the Kwakwaka’wakw, Boas (1934) notes that the Kwakwaka’wakw clan (which included at least one extended-family household) owned each large garden site, while family sub-units of the clan owned individual plots within this garden. Among the Kwakwaka’wakw, each garden, as well as each garden subplot was given a name; some, but not all, of these names were descriptive of biophysical properties of the site (Adam Dick pers. comm. 1998; Daisy Sewid-Smith pers. comm. 1998; Boas 1934). Occasionally, these garden subplots appear to have been partitioned into smaller plots at some later date, reflecting changes in the composition of the clan that owned the larger garden, or the individual families who owned each subplot. Thus, as Boas (n.d.: 166) noted, “generally the various garden-beds belonging to the women of one numaym [i.e., clan] are close together.” Arguably, this reflects the cumulative effects of long-term plot apportionment and subdivision within larger plots owned by (presumably matrilineal) kinship groups. This Kwakwaka’wakw pattern of garden plot tenure is similar to the pattern found along
much of the central and northern Northwest Coast, wherein chiefs controlled large
garden sites, and families owned and maintained subdivided garden plots. Similar
patterns of estuarine root plot and subplot ownership have been reported among almost
every ethnolinguistic group in the region, including the Nuu-chah-nulth (Sapir and
Swadesh 1939; Drucker n.d.; Sapir 1913-14), the Kwakwaka’wakw (Boas 1934, 1921),
the Tsimshian (Compton 1993a; Darling 1955:10-12), the Haida (Blackman 1990: 249;
Turner pers. comm. 1998; Newcombe n.d.: 46/18), the Tlingit (Oberg 1973: 59), and
others. As shall be discussed in subsequent chapters, this pattern of garden plot tenure
is reflected in the appearance of large garden sites in archaeological contexts, often
consisting of large ovals and crescents, which have been subsequently subdivided by
walls lining individual plots, and added on to by fragmentary extensions (Figure 2).

The importance of garden site ownership (and, by extension, the high demand
for plant resources) is illustrated by the observation, recorded by Boas (1921: 1345-48;
1910b: 187, 383) and others, that people who trespassed on and utilized the resources
from owned resource sites, including gardens, were subject to sometimes violent
reprisals. Likewise, Kwakwaka’wakw elder Charles James Nowell Owadi (in Ford
1941: 51) reported that “in the olden days...if one woman gets in another’s [clover]
patch, they fight over it.” Kwakwaka’wakw oral traditions regarding mythtime events
also mention warfare waged over productive resource lands during this period, possibly
including estuarine root gardens. In some cases, garden sites even appear to have been
guarded against rhizome theft. Turner et al. (1982:120), for example, describe recurring
stories among the Nuu-chah-nulth of a Pachenaht Nuu-chah-nulth chief who had
between six and ten slaves guard a particularly productive garden to insure that no
unauthorized person would dig there; these slaves would also dig these rhizomes. This rigid system of land tenure clearly indicates that the demand for these resources had, at some times, and for whatever reasons, exceeded the readily foraged supply (Millon 1955). Though the demand for these root foods declined during the contact period, patterns of land tenure persisted. In the 1890s, according to multiple accounts, white settlers’ violation and damage of individual families’ rhizome gardens – such as the multiple Kwakwaka’wakw rhizome gardens at the head of Kingcome Inlet – were among the primary reasons for inter-racial hostility at this time (Galois 1994; Cotton 1894: 801; Kwagiulth Agency n.d., Vol. 1648: 407-10, 572; Adam Dick pers. comm. 1999, 1998).

Site Preparation and Soil Modification

According to the ethnographic literature, the peoples of this coast created their gardens by rearranging large amounts of rock and soil on the tidal flats. However, my ethnographic and archaeological research suggests that the ways in which this was accomplished appear to have varied from site to site, depending on local physiographic conditions. In the course of my research, I have found ethnographic references to several levels of intensity in site modification, all involving the same basic technologies, applied in different ways to achieve the same basic ends.

There are gardens in which all root plots were encircled by rock enclosures. Boas (1934: 37, 1921: 186-94, n.d.) provided a basic description of these sites. According to Boas and Hunt’s consultants, these gardens were the product of a labor-intensive process: garden beds were constructed by the removal of rocks and boulders down to a level rock and soil surface. These rocks were placed in “large piles or in
walls which surround a bed” (Boas n.d.: 166). As Boas (n.d.) described the traditional Kwakwaka’wakw garden,

The garden-beds are separated by stone walls, but often also by blocks [or “planks”] which are put up on edge right into the ground, being held between the pairs of short posts [or “pegs”] (bracketed terms from Boas 1934).

Forde (1934: 80) also noted that “patches of the wild clover root were enclosed in stone fences by Kwakiutl women, each of whom had her individual plot,” an account that appears to have been derivative of his communications with Boas. As will be discussed in future chapters, these rockworks appear to have been situated in the high estuary in such a way that they retained mounded estuarine soil and detritus, creating an organically rich planting medium.7

Such rockwork gardens appear to have been quite widespread in certain high-relief portions of the Northwest Coast, such as the Nuu-chah-nulth territories of western Vancouver Island. In addition to Boas’ accounts, there are, for example, numerous accounts in Bouchard and Kennedy (1990: 306) of individuals or groups cultivating rhizomes “by clearing the ground and placing rocks around” the root grounds in their possession. Writing in the 1850s, Gibbs (1877:223) reported of the Coast Salish, on the southern Northwest Coast, that

7 More precise details regarding rockwork construction methods are rare in ethnographic accounts, perhaps because rock construction had been an essentially dead art for at least 50 years prior to the arrival of anthropologists. Still, a persisting tradition of competitive boulder lifting was evident among young men in ethnographic accounts from throughout the region (e.g. Jacobs 1990; Suttles and Lane 1990). A strong lifter of boulders commanded much respect, perhaps echoing a time when the lifting and moving of rocks was an important component of native subsistence technologies.
"Inclosures for garden patches were sometimes made by banking up around them with refuse thrown out from clearing the ground, which, after a long while, came to resemble a low wall."8

Edwards' (1979) reports of garden construction methods among the Nuxalk appear to cohere with this general pattern. Newcombe's (n.d.: 35/4) notes on the Haida, recorded among elders at the turn of the century, somewhat cryptically refers to "stones cleared off" of clover gardens and how traditionally "people even separated [their plots] with fences," probably fences made of stone. Clearly, there are strong parallels between these practices and the management of terrestrial resources described in Chapter 4.9

Some gardens were managed in the same general manner, but the mounded estuarine soil appears to have not been retained by rock walls. Daisy Sewid-Smith (pers. comm. 1998) notes that people built mounds of soil in which to plant at some locations, such as near the village of Haada, where her ancestors lived. People used to push the marsh soil together with their digging sticks, adding height to existing plots or pushing mounded soil out laterally: "[they] mound...to extend it...to make their garden bigger." These mounds were not retained with rocks, within the recollection of her grandmother, who dug roots at the remnant gardens at this site. Testimony suggests that, whether or not rocks walls were used, the practice of mounding expanded the area where these important root foods could grow within the estuary. On some large and

8 Suttles (1951b) assumed that this quote was a description of potato cultivation, and Suttles' interpretation is sometimes accepted uncritically. Gibbs, however, simply provided this as information as a description of the "gardens" constructed by Coast Salish peoples. There are no references to potatoes in Gibb's original text. Considering the date of the writing, the use of the past tense, the mention of cultivation over "a long while" and the compatibility of the practices with known rhizome cultivation methods described in other sources, the burden of proof should be placed on those who presume this is a reference to 19th century potato gardening methods.

9 As mentioned in Chapter 4, references to patterns of land ownership for "wild carrot" and chocolate lily fit these same general patterns. Some of these ethnographic accounts may well refer to estuarine gardens. Nooksack elders described to Suttles (1997) traditionally owned and inherited plots of "wild carrot," wild
comparatively low-gradient tidal flats, poles appear to have been laid out around garden plots; while serving to mark off boundaries, this also appears to have sometimes aided in retaining mounded soil (Bouchard and Kennedy 1990; Boas 1934, 1921; Daisy Sewid-Smith pers. comm. 1998).

Nuu-chah-nulth consultants of the late 20th century related a tale that suggested that logs around the boundaries of plots had served as the foundation for the subsequent production of rockwork enclosures in some cases. At the place called “wa7uus,” at the mouth of the Cypre River on Clayoquot Sound, individually owned subplots were all located contiguously on the tidal flats, in the manner described above:

“the extent of each owned plot was marked by poles laid on the ground… there used to be strong disagreements over the boundaries of these cinquefoil beds, and some owners moved the poles to extend their own boundaries. This occurred until a strong man named hinkaa7at…of the Ahousahts, placed large rocks on the poles to prevent them from being moved” (Bouchard and Kennedy 1990: 377).

It is not clear when this event took place, or its significance in the origin or widespread use of rock barrier walls in the Nuu-chah-nulth world. To a Nuu-chah-nulth audience, this tale may have served to explain why wa7uus, a place with very low gradient tidal flats, ultimately came to have stone barriers in a manner that was more typical of high gradient tidal flats.

On large, low-gradient flats, such as at the Kingcome and Somass Rivers, there were reportedly no structural modifications to increase the soil elevation or retain soils through the use of barrier structures. In these places, paths of compressed soil marked onions, and chocolate lilies grown in long narrow plots, roughly four feet wide; boundaries were
the edges of garden plots that contained churned and tended soil. In addition, individual
garden plots in these low-gradient environments appear to have been marked off with
cedar marking posts. As Adam Dick (pers. comm. 1998) recalled of Kingcome Inlet,

“Every family’s got their own little garden, see. They’ve got pegs in
the four corners, and there’s no overlapping. ... And they go
continuously, because you’re moving the soil around.”

Adam Dick reported that at Kingcome, these corner boundary markers consisted of
cedar poles, some 1.5 meters high, with “flags” of pounded red cedar bark tied at their
tops. Charles James Nowell Owadi (Ford 1941: 51) described traditional ownership of
clover gardens similarly: “In the olden days, the women had their own clover patches
marked with sticks on the four corners.” This matches accounts from other
ethnographic contexts, such as the Nuu-chah-nulth notes of Sapir (1913-14: 23), whose
consultants described root plots at the low-gradient Somass estuary that

“had four cedar stakes marking the boundaries of [each plot] which
were about one acre in extent. The stakes were six feet high and
called tlh’aqiyqikhama. These posts were changed about every
10 years to prevent rotting” (see also Arima et al. 1991:190).

In some cases, these Nuu-chah-nulth marker posts also appear to have been marked with
cedar bark “flags,” as described at Kingcome Inlet.

Ethnographic accounts tend to suggest that the degree of human modification
was a function of the tidal flat gradient and the availability of rock or wood construction
materials. Explaining why the peoples of Kingcome didn’t make rockworks like those
described by Boas (1934, n.d.) at the Nimpkish River flats, Kwakwaka’wakw elder,
demarcated with rocks, “lines drawn in the earth,” stakes, cedar poles connected by cedar bark rope.
Daisy Sewid-Smith (pers. comm. 1998) noted “it depends on the land, how much land there is.” She suggested that soil mounding and rockwork construction might expand the amount of area in which these plants might grow. Adam Dick noted of rockworks that “you have to have something like that to make flat ground” in places where it isn’t already available. He also added that people “can’t find rocks on the [Kingcome] flats. It’s all sand. It’s different from the Nimpkish River [where] you find lots of rocks.” Still, the general layout of large deltaic gardens appears to have been similar in both cases, with large clusters of contiguous, subdivided plots.

The estuarine soil of garden sites was distinctive from all other soils in the region, and was itself recognized as an important resource by Northwest Coast peoples. Ethnographic accounts from early this century hint that Northwest Coast peoples recognized a strong correlation between the atypical soil of the estuarine tidal flats and the growth of these edible plants (Harrington n.d.: 373). Accordingly, Edwards (1979: 6) reports that the Nuxalk stored living *Potentilla* and *Trifolium* rhizomes in boxes of soil taken from salt marsh gardens and placed within recessed areas in the floors of longhouses. Boas (1934) reports a silt dam made of hemlock boughs in the estuarine channel adjacent to the Nimpkish River gardens, though he does not explain its function or significance. Moreover, such Northwest Coast peoples as the Nuu-chah-nulth had an elaborate traditional taxonomy of soil properties, with distinct terms for “soil that is easily broken up,” “soft, yielding soil in which one sinks easily,” “level soil” “muddy soil,” or “sandy soil,” for example (Sapir and Swadesh 1939: 281 ff.) The Nuu-chah-nulth also had distinct terms for numerous soil modification techniques: “to dig,” “to dig by scratching away dirt from the surface with a digging stick,” “to poke into the...
ground with a digging stick," "to cover with soil." This taxonomy parallels patterns of traditional soil knowledge found among wetland cultivators elsewhere in the world (Wilken 1987).

Adam Dick, Daisy Sewid-Smith, and other Kwakwaka'wakw elders (pers. comm. 1998) insist that the soil was churned up as an intentional act, sometimes done separately from the actions of garden plot weeding or harvesting. Likewise, Nuxalk elder Felicity Walkus informed Edwards (1979: 6) that there was "soft sand" at one cultivated site only because someone was regularly "looking after it. The more you soften it the more they grow in there." The Nuxalk reportedly turned the soil in the springtime, at the same time that clover rootlets were transplanted from elsewhere. It appears that this act both increased the porosity of the soil, and mixed in the most recent deposits of estuarine or alluvial debris that builds up and, as Adam Dick put it, "feeds the garden" with new soil.10 "Adam Dick (pers. comm. 1998) explains:

"You’ve got to keep that earth soft...soften it up! You’d..."plow" it, I guess... And then you continue on that, digging the soft ground... so it will grow better every year... "fertilizing?" I guess that's... the word for it."

Adam Dick (pers. comm. 1999) recalled that the soil at his grandmother’s former garden contained diverse materials, of a wide range of sizes. The best gardens, he suggests, had a little sand in the soil but it was very important that they “have a little bit of everything” including soil materials of diverse size and composition. Importantly, porous soils of such diverse texture do not occur naturally on the tidal flats of the

10 Once again, ethnographic references to “wild carrot” gardening mentioned in Chapter 4 may be instructive on estuarine root gardening methods, such as Marian Smith’s (n.d. 5/3: 11; 1950) finding that the Nooksack Coast Salish intentionally kept the “soil...loose and easy to dig” around root plots.

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Northwest Coast, where waves and fluvial processes commonly produce a signature sedimentary structure, with distinctly banded strata of relatively uniformly textured soils. To "have a little bit of everything," natural estuarine soils would require plowing through these distinct strata, or augmentation from external sources. And significantly, as shall be addressed in subsequent chapters, texturally diverse and structurally amorphous soils appear to be diagnostic of managed root gardens in archaeological contexts, a fact that appears to corroborate this testimony.

The removal of rocks and the creation of a porous, texturally diverse soil had palpable benefits for the size and quality of rhizomes. Large, straight rhizomes were clearly sought and fostered, for reasons both dietary and ceremonial, as described above. Indeed, gnarled rhizomes, as are typically encountered in unmodified or rocky soils, are implicated as a source of supernatural misfortune in Northwest Coast tales, and rituals were prescribed for those who encountered them (see McIlwraith 1948, I: 537). Moreover, it is almost impossible to remove unbroken rhizomes from the dense sod that develops on unmanaged soil, or on gardens that were abandoned long ago (Lepofsky, Turner and Kuhnlein 1985). Yet the Kwakwaka’wakw considered it essential that rhizomes not be broken while being removed from the soil; both Boas’ (n.d.) consultants and contemporary consultants, including Adam Dick, mention that it was considered shameful for a person to break rhizomes as they were extracted from the soil. In addition to facilitating the bundling of rhizomes for drying and storage, the harvesting

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11 The Skokomish of Puget Sound also reported that the roots of *Potentilla* would squirm when they were dug. Other accounts mention that this power caused the roots to squirm when cooked. This was due to the fact that the plant contains a spirit; this spirit reportedly could give certain women the power to identify the most productive patches of wild *Potentilla* roots (Elmendorf 1992: 127). Elmendorf (1992: 127), a student of Kroeber, derided this suggestion, saying that the women's root digging duties were not as demanding or as technically complex as men's hunting and fishing, and that any able-bodied woman could be a plant gatherer. Both of his informants were men.
of unbroken rhizome segments appears to have aided in the procurement of the long rhizomes associated with chiefly status.

One of the most revealing forms of evidence of the emics of rhizome cultivation can be found in the grammatical categories employed within terms for plant resource sites, as recorded by Boas (1947; 1934; 1920) and others. What becomes apparent in the grammatical analysis of resource site terms and placenames is that the Kwakwaka’wakw, at least, viewed estuarine gardens and their soils as the “manufactured” products of human agency, and quite distinct from naturally occurring plant resource sites. The Kwak’wala, terms for “gardens” and “natural root grounds” are grammatically distinct, and allude to different qualities of each site (see Table 1).

Naturally occurring plant resource sites are referred to with grammatical constructions that suggest that such sites naturally “have” or “contain” these resources, such as roots or berries, or that they are, for example, rhizome “places” or “beaches.” Gardens, by contrast, are referred to by terms that grammatically denote that they are products of human agency. Most commonly, they appear to have been called “t’aki’lakw” or “[places of] human-manufactured soil.” (In some cases, gardens also were referred to by a host of terms that translate as “[places of] logs manually laid crosswise.” Not surprisingly, this term provides an apt physical description of certain garden sites mentioned before, including those with mounded soil, with plots outlined or reinforced by log barriers.) Some Kwakwaka’wakw elders still know the former term. Adam Dick (pers. comm. 1998) explains that they used the term “T’aki’lakw,” because you made that soil. That’s what it means, t’aki’lakw. It’s yours!” Daisy Sewid-Smith (pers. comm. to Nancy Turner 1998) explained that the term, with its suffix “lakw”
grammatically indicated that “it’s not natural...[it is] made by human hands.”

Similarly, there is at least one Nuu-chah-nulth garden site, with remnant garden rockworks, that bears the placename “ts’isakis,” or “place with soil,” a name that is etymologically distinct from terms referring to naturally occurring root grounds (Bouchard and Kennedy 1990: 464).

There are, as suggested above, a number of descriptive terms which Boas (1934: Map 21) mentions for individual plots of rhizome gardens, which describe plot attributes, such as “patch of sandy beach,” “place of long rhizomes,” or “having everything just right [for growing rhizomes].” Also, it is important to note that the one garden which Boas mapped in exacting detail was likely constructed to expand a small, ancestral patch of naturally-occurring rhizomes, so that, within a single larger garden, there are individual plots named “place having [naturally-occurring] rhizomes” and “[places of] human-manufactured soil.”

Vegetative Transplanting, Replanting, and Selective Harvesting

Though ethnographic references to plant propagation techniques are comparatively rare, much evidence supports the contention that the vegetative planting of garden sites was widespread. References to transplanting of Potentilla and Trifolium appear frequently in those few accounts in which the question of plant use has received serious attention (e.g. Turner et al. 1983). Further, the accounts of rhizome transplanting appear among geographically distant indigenous groups, and consultants from each of these groups depicted rhizome transplanting as an ancient practice, long predating European contact. Vegetative transplanting and replanting are implicit, if

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12 It is possible (but unclear) that the term for some gardens used by the linguistically related Nuu-chah-
Table 1:
Kwak'wala Grammatical Categories for Plant Resource Sites

Naturally occurring root grounds
ts'o'yadi' -adi' “having” roots
 -is “beach” with roots

Berry grounds
go'lad'i' -adi' “having” salmonberries
 -ats" “receptacle” of berries
 -as “place” of berries
 -nukw “having” berries

Rhizome gardens
1) t'ak'i'lakw -i'lakw “[human-]manufactured” soil
2) k'agekw “[human-]placed” logs, crosswise
   and other constructions, such as:
   k'agis “[human-]placed” logs, crosswise
   k'aqwilkw “[human-]placed” logs, crosswise
3) bi's [Koskimo Kwakw'aka'wakw dialect: etymology uncertain]

unexamined, components of Boas’ (1934; n.d.) accounts of estuarine gardening. Boas makes it clear that traditional rhizome gardens were regularly constructed by the complete removal of all vegetation down to a level rock-and-soil surface. Though Boas did not say so explicitly, his narrative makes it clear that surfaces stripped bare in newly constructed gardens would have been subsequently revegetated with plants from the tidal marsh.

Other ethnographic sources, however, have clarified the significance of transplanting and replanting left implicit in Boas’ narrative. Numerous ethnographic

nulth “tlh’ayaqak” is related to the Kwak’wala term. This term was recorded by Sapir (1913-14) et al.
Trifolium, Fritillaria and Conioselinum roots were replanted in situ, from specimens within, or in the immediate vicinity of, traditional rhizome gardens. This appears to have been done regularly, ordinarily at the time of the harvest. Hesquiat Nuu-chah-nulth consultants repeatedly told Turner and Efrat (1982: 68, 73) that the ends of Trifolium rhizomes, and entire Potentilla rhizomes were traditionally “placed back in the ground so they would grow the following year.” Nuu-chah-nulth consultants told Bouchard and Kennedy (1990: 23) about the same vegetative replanting practices, and identified a number of locations that were traditionally managed in this way; during the harvest, this “had to be done “just right” in order to ensure there would always be more plants” (see also Craig and Smith 1997: 73). Nuu-chah-nulth consultants suggested that vegetative replanting of garden sites demonstrated individual or collective proprietorship, and partially explained why owners of these root beds were so possessive of them. Turner (pers. comm. 1999), Compton (1993a) and Edwards (1979) documented similar testimony when working with elderly Nuxalk informants: during the fall, “In consideration for the next year’s clover and harvest, immature white roots were returned to the earth” from within and immediately around garden sites (Edwards 1979: 5-6). Similar accounts of vegetative replanting have been given by other Kwakwaka’wakw elders (e.g. Daisy Sewid-Smith pers. comm. 1998). Adam Dick (pers. comm. 1999) asserted

“You don’t take those little pieces [of root]. You leave them here. They come back. You put them back in the ground ‘cause that’s going to be your texwsus [Trifolium] and tliksem [Potentilla] next year.”
Adam Dick reports that children were given the job of taking harvested *Fritillaria* bulbs, removing the edible bulblets from the plant, and replanting the main bulb and stem within the garden plot.

There is also evidence, albeit less widespread, of long distance transplanting of propagules. (Arguably, this was a less common practice, as small patches of these plants could be found growing naturally in most of the sites where gardens are known to be situated.) According to Edwards (1979: 6), the Nuxalk enhanced their gardens in the springtime by “transplanting clover roots from elsewhere.” Compton (1993: 251) also encountered Nuxalk consultants who described long-distance transplanting of rhizomes between tribal territories. Nancy Turner (pers. comm. 2000) heard similar reports from Nuxalk consultants, and learned that that the *Trifolium* patches in the Kitlope Lake had been transplanted there from the Kimsquit Flats early in the 20th century by Nuxalk elders, Margaret and Stephen Siwallace; prior to this time, no *Trifolium* had grown there. Early in the 20th century, Chief Humseet of the Knight Inlet Kwakwaka’wakw testified to the McKenna-McBride Commission that he still visited a portion of Knight Inlet that had long since been abandoned for settlement, in order to harvest the “roots there which my forefathers planted there.” When asked to identify what sorts of roots had been planted there, he provided a list of Kwak’wala names; translated, they consisted of the following plants: springbank clover, silverweed, lupine, riceroot lily, and “wild carrot” (McKenna-McBride Royal Commission 1913-16: 188). While Adam Dick only recalled *in situ* vegetative replanting of propagules from his childhood, he nonetheless explained that the elders before his time “must have planted [*Potentilla, Trifolium, Fritillaria* and other] roots from other places,” to their gardens, because the
gardens described to him as a child were grown in relatively geometric plantings, and in places well beyond the plants’ natural distribution.

Though it appears that all of these plants were commonly grown together in polycultural plots, this was not always the case. Over time, the combined practice of weeding and in situ transplanting appears to have resulted in the creation of contiguous monocultural plots. Adam Dick (pers. comm. 1998, 1999) described the patches that his grandmother maintained as containing largely monocultural columns of plants running parallel to the adjacent shoreline: *Trifolium* sat beside *Potentilla*, which sat beside *Fritillaria*, which sat beside *Lupinus*. Interestingly, though Adam Dick did not seem to feel that this particular pattern of relative placement was important, based on his recollected conversations with his grandmother, this sequence conforms to the natural gradient of these plants in the tidal column, from lowest to highest. It is possible that this segmentation of the plants may reflect a traditional appreciation for the relative tolerance of these plants for saltwater inundation in garden sites.\(^{13}\)

Remnant linguistic evidence hints at the role of vegetative propagation in garden contexts. When discussing terms for “planting,” turn-of-the-century Nuu-chah-nulth consultants reported two different terms: “c’opqa,” to “stick something into” the soil and “tokwa” or “to cover something with soil” (Sapir and Swadesh 1939). Both terms appear to refer to vegetative planting methods such as those employed within estuarine gardens. Adam Dick (pers. comm. 1998) provided a Kwak’wala term that was used for replanted propagules of *Fritillaria* (and possibly other plants), “gagemp” which translates literally as “grandfather.” This metaphorical term alludes to its production of
a subsequent generation of offspring, and is consistent with the rich vocabulary of metaphorical terms employed in Kwak’wala (Boas 1947, 1929). A small amount of placename evidence lends additional insight into the role of transplanting in the maintenance of estuarine gardens. Bouchard and Kennedy (1990: 43) document a garden site mentioned by Nuu-chah-nulth elders called “shishp’ika” because of the traditional maintenance of Potentilla plots there. Bouchard and Kennedy translate this term literally as “cultivated,” but the term appears to be etymologically related to terms for vegetative transplanting. This site and placename was also documented by Drucker (1935-36: 23, 12) who was, ironically, among the most vocal proponents of the view that Northwest Coast peoples did not cultivate plants.

**Weeding and Garden Hunting**

Numerous ethnographic accounts note that both weeds and pests were eliminated from estuarine garden sites. By most accounts, competing plants were weeded out of rhizome plots, leaving only Potentilla, Trifolium, and other preferred plants. This allowed the expansion of rhizomes into areas formerly containing competing plants. Among the Kwakwaka’wakw, Boas (n.d.) and Forde (1934: 80) reported that estuarine gardens were “kept weeded to insure good growth.” Similar practices, involving the weeding of all unwanted plants from garden plots, have been reported by Nuu-chah-nulth, Nuxalk, and Haida ethnographic consultants (Nancy Turner pers. comm. 1998; Turner et al. 1983; Edwards 1979; Newcombe n.d.: 2/4). Here too, Adam Dick’s (pers. comm. 1998) testimony provides additional insights:

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13 Kim Recalma-Clutesi (pers. comm. 1999) felt that this was the intention of this segregated planting scheme, but did not recall specific testimony from past elders to confirm this point.

14 Here too, Forde’s accounts appear to be derivative of Boas’ reports.
“they worked on it all day...when [they] used to go down there and
clean them up. All...the weeds that grow. Oh yeah, they wouldn’t let
anything...one little grass on there. They’d go there and clean them
up...they’d go down there and clean it...To weed. Just
to weed... they’d go down there, I don’t know how many times a year,
just to keep that takilakw clean. They told me that... I remember they
used to talk about, you know, when you keep working on the garden,
and keep it alive! You know, keep it alive. You keep working on the
garden. You don’t...walk away from it!”

On other occasions, both Adam Dick and Daisy Sewid Smith shared the term for
weeding: “We siixa it, when they go down to the flats. Siixa – that’s what they called
it....when they pulled all of the weeds of the takilakw.” Both insisted that weeding was
a separate activity from harvesting, sometimes performed in conjunction with soil
churning activities performed several times a year. Plot owners removed a diverse
assortment of wetland plant species, which repeatedly invaded garden plots both by seed
and by rhizomatous shoots, in order to foster the growth of a small number of culturally
preferred species. These practices, therefore, resulted in the localized, biotic
simplification of the salt marsh flora (cf. Harris 1997: 219).15

Similarly, some ethnographic references refer to these gardens being guarded by
hunters, because waterfowl eat Potentilla and Trifolium rhizomes (Turner and Kuhnlein
1982; Edwards 1979). Hunting both allowed for the protection of estuarine gardens’
vegetable output and provided a secondary dietary benefit from the gardening process.
Edwards (1979) reports that the Nuxalk constructed waterfowl traps adjacent to their

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15 While there is physical evidence of past pruning at ethnographically documented garden sites, as will
be discussed in later chapters on archaeology, I have been unable to find ethnographic references to
pruning in the vicinity of estuarine garden sites. This may be due in no small part to the fact that pruning
would not be required on the large tidal flat gardens that were still utilized in the colonial period. Only
smaller, more peripheral gardens would have been crowded by adjacent forest vegetation, and the
majority of these secondary sites appear to have been abandoned prior to the arrival of ethnographers.

97

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gardens prior to European contact, consisting of nets that were dropped from poles alongside garden plots. Turner et al. (1983) have reported similar waterfowl traps on tidal flats among the Nitinaht Nuu-chah-nulth. Traps were reportedly abandoned for guns, once these weapons became available through trade with Europeans (Edwards 1979). Numerous contemporary consultants mention that men continued to hunt at garden sites through the end of the 20th century, even long after these sites have been abandoned for gardening purposes. Likewise, the ethnographic and folkloric evidence suggests that many peoples of the Northwest Coast recognized a close association between waterfowl and rhizome gardening (Turner and Kuhnlein 1982).

**Harvest**

Traditionally, the Kwakwaka’wakw selectively harvested estuarine gardens during the fall, when the foliage died back following the first hard frost. However, the season for digging appears to have varied among different peoples within the region (Turner and Kuhnlein 1982; Boas 1921). Some oral traditions depict the maintenance of rhizome plots as the longstanding domain of women or slaves — within much Northwest Coast oral history addressing the pre-contact period, it is a humbling experience for a free man to harvest rhizomes (Boas 1908: 45). This does not appear to have been universally the case during the contact period, however, and numerous accounts describe the active, albeit supporting, role of men in the harvest process (Boas 1921, n.d.; Adam Dick pers comm. 1998).

Along much of the Northwest Coast, specialized digging sticks were made for this purpose from the wood of the western yew (*Taxus brevifolia*), which is characterized by unusually high tensile strength. Less commonly, other woods, such as
crabapple (*Pyrus fusca*) were used. According to Kwakwaka’wakw and Nuu-chah-nulth consultants, root plows varied in length, and Boas (n.d.: 166) reports that two distinct tools were used, alternatively for *Trifolium* and *Potentilla*, with the *Potentilla* plow being “a little thinner and one span shorter than the clover digging-stick” (Turner et al. 1983). Specimens available in ethnological collections have averaged roughly 1.3 meters in length from end to end, arched with a maximum arc depth of roughly 25 cm, which provided a rounded base for efficient prying. When a woman dug roots with these sticks, as Turner et al. (1983: 18) recount “She leans on it, twisting it when going into the sand, always watching how far down it goes, then she pries it.” Digging sticks included an articulated handle segment, often with a knob at its terminal end, while they were characterized by a sharp or slightly splayed digging end (Boas 1921: 146-47). According to Boas (1921: 149-50) and others, these digging sticks were constructed and waterproofed by specialists in a procedure that was carried out over the course of several days.

Digging sticks of this type have been reported along the entire Northwest Coast, contributing to the overall picture of a region-wide cultivation “complex” at contact (Turner and Kuhnlein 1982). The Royal British Columbia Museum holds several specimens in their artifact collections from many coastal peoples of the Province, dating from the contact and early colonial periods (Nancy Romaine pers. comm. 1997). By the late 19th century, some rhizome cultivators used metal tools, but many elders reportedly still retained their aged yew-wood root ploughs, blackened with age and

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16 None of these digging tools has been subjected to absolute dating methods. Nancy Romaine (pers. comm. 1999), Royal British Columbia Provincial Museum archaeological curator, suggests that she is “absolutely certain they were one of the commonest tools used on the British Columbia coast but do not survive” in the region’s archaeological record. Few pre-contact specimens may be available for analysis.
wear. Adam Dick (pers. comm. 1998) reports seeing very old root plows when he was a child:

“They had a stick called, k’ellákw, it was yew wood... three-cornered... like a three-cornered file... when they’re breaking the earth. They got a knob on the end, where you’re hanging onto, when you’re breaking the ground... They’re all different sizes... It was really sharp [on the tip], like a pencil. I remember what it’s like. I’d play with that. I used to dig with that. It’s hard... because when you push it down and you put all your weight on it when you’re breaking, softening that ground, that t’aki’lakw.”

In Kwak’wala, the term “k’ellakw” is typically used in a verb form – it is a term that translates “to break up” or “to break up the soil;” in its noun form, it alluded to these specialized tools (Daisy Sewid-Smith pers. comm. 1998). Likewise, the Nuu-chah-nulth had an etymologically distinct verb “t’ikwa” that alluded solely to the use of these specialized digging sticks for digging estuarine Potentilla, Trifolium, and Lupinus roots (Sapir and Swadesh 1939).

When gardens were distant from village sites, families would relocate to small collections of houses next to large garden sites. Such transhumance to permanent, owned root digging plots was noted by numerous ethnographers, including Boas (1934, 1921), Drucker (n.d. Box 1: 2/2), Newcombe (n.d. 24/6: 1551), and was viewed as a precontact phenomenon by each. These small houses were constructed at the sites of individual gardens to shelter harvesters, as harvesting took place over the course of several days at each garden site (Figure 2).17

17 Daisy Sewid-Smith (pers. comm. 1998) reports that her mother was born in one of the digging houses mapped by Boas on the Nimpkish River tidal flats.
Boas (1921: 190-91) suggests that, during harvest season, a single woman would work for several days selectively digging rhizomes from the family’s individual plot inside the larger garden site. Such authors as Turner et al. (1983: 18) have reported similar, multiple day harvests for the Nuu-chah-nulth. Though Boas (n.d.: 167) notes that “a good garden [subplot] may yield a hundred bundles of roots” per harvest, it is unclear how many roots were contained in each bundle. Sometimes, during the harvest, tied bundles of rhizomes were suspended in the digging house. Women reportedly had distinctive knots that they would use to tie their bundles, so that they could be discerned from other women’s harvests.

According to Boas (n.d.) and others, harvests began in the morning, with the women digging with the sun at their back. Women kneeled on mats while digging, pulling roots from the “moving soil” and placing them in spruce root baskets to await further cleaning and processing. This process was repeated over the course of several days:

“This is continued until the whole of the garden bed has been dug over. Every evening the clover roots are spread out on mats and covered over with others. In the morning, the covering is taken off, if the sky is clear. The clover dried outside is considered better than clover dried in the house. And finally the baskets are covered with grass, and are taken home, where the roots are preserved in a cool place” (Boas n.d. 166).

Some groups appear to have timed harvests on the flats so that the morning work could begin with the receding tide, allowing plenty of time before the returning tide might submerge portions of the work area. Harvests at the gardens downstream from Kingcome village began in the morning: “The river would push us down to the flats [at
the beginning of the outgoing tide]. And when the tide starts coming up then we paddle up again with the tide” (Adam Dick pers. comm. 1998).

Boas (1921: 618-19; n.d.) describes individuals leaving the “digging-house” at the end of the harvest, taking canoes full of roots as well as the boards from the digging house exterior with them to the winter village. As they departed for the final time, they directed “prayers” at their digging houses:

“Look upon my wife and me, and protect us, so that nothing may happen to us, friend! and wish that we may come back to live in you happily, O house! when we come next year to dig cinquefoil. Good-bye!”

If gardens were outside of the visual range of one’s village, it was reportedly considered taboo to look back at the house and gardens after uttering this prayer and departing. Such a plea for protection might corroborate other claims that rhizomes served as a “risk-reducing” resource, though this “protection” may have been conceptualized as being dietary, economic, ceremonial, or some combination.

Scale and Distribution

The scale of these gardens appears to have varied considerably. The size of the entire garden in Figure 2 is estimated to be slightly over 2 acres or roughly 0.8 hectares in size. Adam Dick (pers. comm. 1998, 1999) indicated that the gardens at Kingcome and Knight Inlets were considerably larger; this is possibly due to the high level of surplus production at these sites for trade and ceremonial redistribution. Looking over the tidal flats on the western bank of Kingcome Inlet, he indicated that at one time “There wasn’t a square inch of these lands that was not part of someone’s gardens,”
from the mud flats downslope to the treeline above. The area he alluded to in this case was over 10 acres or roughly 4 hectares in extent. The individual family plots he learned of as a boy were roughly five to seven meters wide and at least twice as long; these measurements are comparable to those mapped at Nimpkish River by Boas. Both of these Kwakwaka'wakw cases are somewhat smaller, however, than the individual Nuu-chah-nulth garden plots of up to one acre reported by Sapir (1913-14) at the Somass River flats. As shall be discussed in subsequent chapters, gardens appear to have been much smaller in peripheral locations, far from these large tidal flats.

Some 55 reported Kwakwaka’wakw “garden” sites were documented in McKenna-McBride (1913-16) and Galois (1994), throughout their traditional territories, though it is unclear whether these sites included sites other than estuarine gardens. In the course of my interviews with Kwakwaka’wakw elders, eight or nine individual sites were mentioned within their territories that were known to have housed large scale, subdivided gardens adjacent to villages, but all consultants insisted that this list was merely a sample, and was not a comprehensive list. (This number is indeterminate as two placenames may have been used in reference to the same location. The majority of these sites were included in the list of 55 sites derived from the aforementioned written sources.) Every major winter village had its own gardens nearby, they asserted, but other, more distant gardens were also commonplace. This is consistent with the general pattern that is evident on the basis of data regarding plots maintained with gardening methods, as presented in Bouchard and Kennedy (1990; see Figure 3). While Boas was imprecise in his mapping of rhizome garden distribution, a map of resource site distribution which he compiled (1934) shows numerous garden sites within the territory.
Figure 3a: Garden Sites Identified by Indigenous Consultants: Nuu-chah-nulth
of a single winter village. If these various sources provide even a hint of pre-contact
garden distribution, the total acreage of these estuarine gardens per village could have
been vast. On estuarine sites, within the defined territories of single villages, these
gardens were often located in close association with burned-over clearings containing
patches of berries (and possibly camas). These clearings had defined property
boundaries, often marked with stakes, and elaborate systems of land tenure (Lando
1988). Together with dip-nets, fishing weirs, and territorially-defined hunting areas
which adjoin these plant resource sites in the maps of Boas (1934), this pattern resulted
in a notably intensive pattern of overall resource use.

The overall, region-wide distribution of rhizome gardens is uncertain.

Documentation of the full range of practices described here, with complexly subdivided,
intensively managed estuarine gardens can be found for much of the central Northwest
Coast, particularly among the Nuxalk, Kwakwaka'wakw and Nuu-chah-nulth. As

Adam Dick (pers. comm. 1998) asserted:

"Every village had their own gardens. You know, every different
village had gardens like the one we had at Kingcome...Oh yeah,
they had them, because that's what we eat. Not only these people
here, but all over the whole coast."

Aspects of these management practices can be found from southeast Alaska to western
Washington, but additional research would be required to confirm the presence of this
entire gardening "complex" in the northern and southern portions of the ethnographic
Northwest Coast. The fact that the Nuxalk, Kwakwaka'wakw and Nuu-chah-nulth have
the best-documented traditions of estuarine cultivation may simply reflect the
disproportionately large amount of ethnobotanical research that has been conducted with these peoples.

Dense distributions of estuarine rockworks, including some likely garden rockworks, have been well documented along the coastline of southeast Alaska and along the entire British Columbia coastline, up to and abutting the boundary of the State of Washington. Strangely, there are apparently no intertidal rockworks of any kind documented in the archaeological or ethnographic records for the State of Washington (Washington State Office of Archaeology and Historical Preservation pers. comm. 1997). This abrupt boundary might reflect an ethnographic boundary, or perhaps a physiographic boundary along the coast’s glacial terrain. More likely, this reflects the combined effects of dense settlement south of this border (hence greater destruction of shoreline archaeological features, and the rapid displacement and depopulation of native peoples) and a comparative lack of archaeological or ethnographic inquiries in the contiguous states of the American Northwest. Still, ethnographic and folkloric evidence (e.g. Jacobs 1990; Harrington n.d.) clearly suggest that the peoples on the southern edge of the Northwest Coast, along the Washington and Oregon coast, appear to have relied heavily on these estuarine rhizomes and engaged in some degree of plot tending.

Whether the peoples of the southern coast constructed impoundments, or whether households owned individual rhizome plots (as opposed to maintaining them as village common property) is unclear (e.g., Jacobs n.d.). Unlike most of the region’s terrestrial plants, both Potentilla and Trifolium grow beyond the confines of the ethnographic Northwest Coast, and it is important to note that they were important food sources outside of the region as well, though I have found little documentation of intensive
management in these areas. For example, Fred Kniffen (1936: 387) notes that among the coastal Pomo of California, “fresh tender clover roots provided a tempting dish [during the summertime] and it was eaten in prodigious amounts,” in addition to salmon and other staple foods.

**Ethnography and the Question of Antiquity**

Those few 20th century authors that have acknowledged the presence of estuarine cultivation on the Northwest Coast have been reluctant to use the term “cultivation,” or have suggested that aboriginal plant cultivation must have been inspired by intercultural exchanges during the proto-historic period (Turner and Kuhnlein 1982; Turner 1975). This assertion has been based on a paradoxical interpretation of the ethnographic data, in which it is assumed that the cultivation of endemic plants must have been a development subsequent to the European introduction of alien domesticates. In such writings, no support is given for this conclusion, except the fact that these researchers have inherited the scholarly truism that the Northwest Coast was non-agricultural, and that most late-20th century consultants never engaged in the transplanting of rootlets or the construction of root gardens and associated features. This interpretation has persisted, even though the accounts of endemic plant cultivation have often been recorded among older informants, and recovered from older archival sources than those accounts in which informants have claimed no recollection of pre-European cultivation practices.

On the basis of historical and ethnographic information, alone, there are several reasons to interpret all aspects of this cultivation complex as a pre-contact phenomenon, and no particular reason to assume otherwise. Despite the general superficiality of
ethnographic data recorded by Archibald Menzies, botanist for George Vancouver’s expedition, Menzies recorded the intensive harvesting of rhizome plots at Nootka Sound during Vancouver’s first circumnavigation of Vancouver Island:

In the evening our curiosity was excited in observing a number of Females busily occupied in digging up a part of the Meadow close to us with Sticks, with as much care and assiduity as if it had been a Potato field, in search of a small creeping root about the size of a pack thread. This I found to be the Roots of a new species of Trifolium which they always dig up at this time of year for food.... Wherever this Trifolium abounds the ground is regularly turned over in quest of its Roots every year (Menzies log, September 4, 1792, quoted in Newcombe 1923: 116]

The celebrated explorer, James Cook, the first European to make landfall on the Northwest Coast, recorded the presence of certain foods of particular significance that he saw in his brief visit to Nootka Sound, including estuarine roots (Newcombe n.d. 24/6: 1536).

Certainly, explicit references to “gardens” can be found in the region’s earliest ethnographic record. Kwakwaka’wakw consultants reported former garden sites, using the term “takilakw,” to Franz Boas during some of Boas’ earliest travels on the Northwest Coast (see Boas 1895a: 133). George Dawson (1887b) recorded clover garden sites, called “beece,” by the Koskimo Kwakwaka’wakw, and a stream that transects one of these sites still bears this name as a byproduct of Dawson’s mapping of the aboriginal placename. Boas (1934, 1921) found a well established pattern of rhizome garden plot tenure among consultants born prior to white settlement in the region, and elderly consultants from the turn-of-the-century stated that these gardens had been planted or managed by their ancestors (Boas 1921; McKenna-McBride Royal
Commission 1913-16). Detailed environmental and cultural knowledge is encoded in etymologically distinct terms for plants, soils, tools, units of property tenure, and many other aspects of estuarine cultivation; some of the languages for which this is true were no longer in common use by the time ethnographers recorded these facts. And, as will be described in subsequent chapters, many of the patterns of soils and vegetation described by early explorers were in no way “natural.” These modified marsh environments can be found in portions of the Northwest Coast which were depopulated immediately after the first epidemics spread through the region, in some cases prior to direct European contact. Yet, from these rapidly depopulated portions of the coast, one still finds placenames mentioning garden sites, and endemic terminology for gardening practices (Boas 1934, 1921).18

Estuarine root use and cultivation appear to be at the center of elaborate ceremonial traditions, which provide suggestive (but not conclusive) evidence of considerable antiquity for the practices described by ethnographic accounts. In addition, it is telling that rhizomes appear prominently in oral traditions along the entire coast, including oral traditions that were essentially “dead” by the early contact period (particularly on the southern Northwest Coast) as a result of “acculturation,” relocation, and epidemic-induced demographic collapse. Patterns of estuarine garden plot maintenance and ownership, similar to those found during the contact period appear in several Northwest Coast tales. And significantly, oral traditions depict the maintenance of rhizome plots as a very ancient practice, associated with the beginnings of the world.

18 It is telling that there is no clear etymological relationship between the terms used for gardens in the dialects of the Queen Charlotte Strait Kwakwaka’wakw and the Koskimo Kwakwaka’wakw. The latter dialect was no longer being actively spoken at the time of Boas’ researches, and had largely disappeared from common use by the end of the fur trade, prior to white settlement in the area.
Potato cultivation, in contrast, was widely recognized as a very recent phenomenon throughout the region's oral literatures (Suttles 1951b).

Estuarine root ground tending, harvesting, and preparation are pivotal plot devices in many tales from the mythic past (e.g. Boas 1910b: 203, 357-59, 457; Boas 1908: 15, 45, 54, 233-34; Boas 1905: 95, 178, 318; Adam Dick pers. comm.. 2000). Indeed, many significant mythtime events hinge on harvest time, including the origins of animals, such as the Killer Whale, the Mallard, and the Goose. Along much of the coast, there are recurring stories of a powerful male transformer being tricked or taunted in some way by women digging rhizomes at village-owned plots. This man places the women’s rhizome digging tools on their backs, and turns them into the first killer whales (*Orcinus orca*), with their prominent, long dorsal fins. A recurrent tale along much of the coast (importantly, that portion of the coast in which rockwork gardens can be found) tells of the transformer discovering blind women tending rhizome plots at the mouth of a river; the transformer gives these women their sight, rubbing estuarine rhizomes on their eyes, but then turns these women into the first mallards or geese (Boas 1905: 95; McIlwraith 1948, II: 475, Turner and Kuhnlein 1982: 428). On the southern edges of the Northwest Coast, where this particular tale appears to have been absent (and there is little evidence of intensive gardening), *Potentilla* and *Trifolium* rhizomes were nonetheless central plot devices, particularly in tales from before and during the transformation era that centered on the activities of women. In the tales of the Tillamook of the northern Oregon coast, for example, young women of the chronologically distant transformation era monitor the output of productive estuarine *Potentilla* plots. They do so, motivated by the fact that both their status and their
security are dependent upon the acquisition of rhizomes. They bring baskets of the largest rhizomes possible to neighboring villages when looking for a husband (and, in the end, those who bring Potentilla rhizomes usually succeed at finding an outstanding husband). When being held against their will, a young woman ties her hair to Potentilla rhizomes so that she will be discovered by feasting rescuers (Jacobs and Jacobs 1990: 36-38, 80-82). Analogous tales, asserting the importance of rhizomes and estuarine garden maintenance during remote mythical times, can be found in the oral literatures from along the full length of the ethnographic Northwest Coast (Bouchard and Kennedy 1990: note 888).

**Domesticates**

The evidence for the emergence of domesticated Potentilla and Trifolium are few, but they are provocative. Numerous Northwest Coast peoples have mentioned two types of Trifolium wormskjoldii, sharply differentiated by the size and appearance of roots and leaves, although botanists investigating contemporary plant specimens along the coast have noted no such distinction. References to such distinctions can be found most abundantly in the literature addressing the Kwakwaka’wakw (Hunt 1922; Boas 1921; Newcombe n.d. 24/6: 1552, 59:10). Adam Dick (pers. comm. 1999) also asserted that he knew of two types of estuarine Trifolium, one larger than the other, but he was not certain whether this difference was a product of environmental variability or an inherent property of the plant itself. The Nitinaht Nu-u-chah-nulth also recognized two types of estuarine Trifolium (Turner et al. 1983). Turner et al. (1983) and others have noted readily-apparent phenotypic bifurcation between rhizomatous colonies of Potentilla in the vicinity of formerly cultivated sites (but no wide variability in rhizome...
characteristics), which may possibly reflect the impress of long term human intervention. As Turner (1975) and Suttles (1951) have suggested, some explorers’ descriptions of tidewater “Indian potatoes” on this coast, with long, finger-like, white starchy segments probably refers to a plant other than *Solanum tuberosum*. This description would better fit a root segment of *Potentilla* or *Trifolium* that had been enhanced through environmental improvements or long-term vegetative selection. One might interpret the certain references to “Indian carrot” similarly (Drucker n.d.). As with the plants mentioned in previous chapters, the origins of these variations are entirely unknown, and may reflect environmental variation, genetic variation, or quite possibly both. It remains an intriguing, but as yet unexamined possibility that prolonged tending and selective vegetative propagation facilitated genetically discontinuities within population of these plants. These domesticates or “proto-domesticates” would have been largely lost once human selection and vegetative propagation of distinctive, desirable plants ceased. At present, the potential past domestication of Northwest Coast estuarine plants remains strictly conjectural.
Garden Sites Identified by Kwakwaka'wakw Consultants, ca. 1840-1914

- site described as having "clover gardens," Indian "gardens," or "Indian cultivation" in Boas (1934), Galois (1994), McKenna-McBride Royal Commission (1913-16), and selected documents from Canadian Land Survey, excluding all sites at which the authors mention the presence of "potato" or other introduced crops

Nimpkish - selected rhizome garden sites discussed in the dissertation text
Despite the abundant evidence of plant cultivation on the Northwest Coast, almost all academic accounts suggest that the indigenous peoples of this region did not cultivate plants prior to European contact. As beneficiaries of vast salmon runs, so the orthodox argument goes, these people fed themselves with minimal effort. In the process, they became ethnological anomalies, with highly stratified societies, sedentary villages, and complex ceremonialism, but no cultivation. However, in light of the evidence provided in the preceding chapters, one is compelled to ask: why was the presence of “cultivation” wholly discounted on the Northwest Coast? The process by which the presumed absence of cultivation on the Northwest Coast became anthropological orthodoxy clearly demands attention at this juncture.

Written representations of the Northwest Coast have been highly selective in their content, and shaped by the agendas of each successive generation of writers (Willems-Braun 1997; Clayton 1996; Said 1993; Webster and Powell 1994; Cannizzo 1983; Jonaitis 1981; Michaelson 1979). The earliest accounts of indigenous resource use were frequently the byproduct of exploration conducted as a prelude to the appropriation of lands, and for this reason its record shall always be somewhat suspect (e.g., Mayne 1862). Certainly, the origins of the “non-agricultural” designation have deep roots in the colonial project. Indeed, the designation appears to have first emerged in the widely read journals of James Cook, one of the earliest, and by far the most celebrated explorers to reach the Northwest Coast. These earliest writers – consistently...
impressed by the region's abundant marine and terrestrial life – concluded that food was at most times and most places, plentiful for the region's native inhabitants (Folan 1984). Agriculture, it was assumed, was unnecessary in such fecund environments, and there was little on the landscape that looked like agriculture as it was known in Europe. Northwest Coast plant management defied conventional European notions of “cultivation” during these first contacts of the late-18th and 19th centuries. Within academic discourse, the “non-agricultural” label can be traced to the early anthropological writings of the 19th century, which adopted, elaborated upon, and arguably legitimated colonial assumptions regarding indigenous resource management. The prominent adoption of this colonial appellation within the scholarly writings of the time, I would argue, tells us as much (if not more) about the condition of the social sciences in the late 19th century as it tells us about subsistence practices of indigenous peoples.

Since the first publication of explorers' accounts of the Northwest Coast, the relationship between the native peoples of the region and their environment has received frequent, but consistently brief mention in scholarly literatures, particularly within the discipline of anthropology. Though commonly and consistently described, the relationship between environmental and cultural phenomena in this region has been frequently misrepresented and has seldom been the object of focused study. Researchers' descriptions of human land use on the Northwest Coast – including those of Franz Boas – were informed by a number of now-discredited a priori assumptions regarding the nature of agriculture. These scholars based their conclusions primarily on brief travels to tribal villages and the post-hoc analysis of oral accounts of indigenous
ceremonialism. Subsequently, Boas and his students downplayed the importance of indigenous plant cultivation as part of their larger challenge to the evolutionary and environmentalist models of cultural development that were prevalent in his time. Since then, the label has taken on a life of its own, as it has been accepted uncritically by successive generations of scholars (cf. Bean and Lawton 1993: 29-30). What follows, then, is a brief examination of the genesis and dissemination of the “non-agricultural” label.

Explorers

Many of the first explorers noted aspects of Northwest Coast cultivation practices, but did not see evidence of agriculture in anthropogenic plant communities lacking rectilinear plantings or a monoculture of familiar plants. Initially, gardens were largely overlooked by European explorers, fur traders and colonists - people whose sense of the region was based on brief encounters and biased expectations. These people arrived in the region assuming that its inhabitants were the primitive beneficiaries of an abundant environment. This perspective was not merely a by-product of their European cultural inheritance, but was also inextricably tied to racist and ethnocentric assumptions forged in the colonization of other portions of the Americas, Africa, and Asia (Clayton 1999). As Fisher (1992: 82) suggests, early explorers and settlers were troubled by Northwest Coast environments and peoples – they brought to mind the “tropical exuberance” found in their Empires’ more equinoctial realms, where a presumably luxuriant environment “yielded a livelihood with little effort…[making] its inhabitants not only lazy, but also “gross, sensual, and for the most part cowardly.” Indigenous peoples exerted little effort in order to survive, it was suggested; they were
fortunate fishermen, random diggers of roots, indiscriminate pluckers of berries. Indeed, the fecundity of this environment was viewed as a source of moral torpor. It was apparent to early explorers that, as one commentator noted, the tremendous (and, it was assumed, natural) abundance of wapato and camas “engenders the most indolent habits among these people” (Slacum 1912: 200). Viewed with the Protestant eye, the indigenous peoples of the region were frequently accused of the inefficient utilization of the land and its resources, leading many authors to discount even the more intensive forms of resource use and management (LaViolette 1983).

The fecundity of the anthropogenic plant communities tended to be viewed, not as a byproduct of human action, but as something that was simply exploited, or even besmirched, by the region’s human inhabitants. Viewing camas prairies cleared by human burning along the shores of Puget Sound, Captain George Vancouver (1798: 227-9) proclaimed,

“I could not possibly believe any uncultivated country had ever been discovered exhibiting so rich a picture. Stately forests... pleasingly clothed its eminences and chequered its vallies; presenting in many places, extensive spaces that wore the appearance of having been cleared by art... [we] had no reason to imagine this country had ever been indebted for its decoration to the hand of man.”

Yet, it is apparent that the places described by Vancouver were managed landscapes, cleared not by art, but by people with very specific technologies and objectives. Seeing families within one of these anthropogenic clearings, harvesting plots of camas in what were almost certainly owned and cultivated plots, Vancouver (quoted in Gibbs 1877: 233) expressed aggravation, comparing these people to “swine, rooting up this beautiful
verdant meadow.” They were “attracted...to this spot,” he felt, by the natural abundance of roots. Certainly, in this untouched wilderness, they were not to be credited with the presence of plants. Though, in retrospect, anthropogenic plant communities were widely mentioned in early explorers’ accounts, most were summarily dismissed and subsequently interpreted as natural features.

Estuarine root gardens, too, I contend were observed from the earliest European presence on this coast, but were seldom documented as the outcomes of human action. As noted before, Archibald Menzies (1923: 116-17) noted Nuu-Chah-Nulth women tending abundant plots of *Trifolium* at Nootka Sound in 1792 “which they always dig up at this time of year for food... with as much care and assiduity as if it had been a Potato field” and learned from indigenous informants that “the ground is regularly turned over in quest of its roots every year.” Similar observations regarding the importance of estuarine roots, the recurring use of individual plots, and the digging of estuarine rhizomes from deep rich soils, were made by members of other expeditions to this coast, such as in Mozino’s (1970: 21) log of the 1792 encampment of Bodega y Quadra at Nuu-Chah-Nulth Sound. While Menzies, Mozino, and others assumed these productive patches of estuarine rhizomes with loose organic soils to be natural phenomena, very few of the sites described by these early writers were ‘naturally’ endowed with either workable soils or productive root plots. These sites represented highly modified environments of a sort that was alien to the European world. Certainly, this oversight is not surprising. In many cases throughout the Americas, Europeans were apt to see no signs of human intervention on cultivated landscapes, *particularly* when observing the landscapes produced through the alien practice of wetland cultivation. Many cultivated
wetlands were commonly recorded as "natural" features in the American tropics (Siemens 1990; Denevan 1992), as was the case with the comparatively inconspicuous estuarine gardens of the Northwest Coast. As Edwards (1979: 6) suggests: "Unlike showy berries and blossoms, clover roots are not easily sighted. At harvest time, clover foliage is frost-bitten and obscured by autumn ground cover, and in the spring it is absent." Visually, these plants easily can become lost in the unfamiliar and dense tangle of high marsh vegetation.¹

The only plant which was recognized as a "cultivated" plant on this coast was tobacco (*Nicotiana quadrivalvis*) (Turner and Taylor 1972). That this plant, the one cultivated plant of this coast which was familiar to the peoples of Europe, was commonly described as the only evidence of agriculture on this coast, and as a total anomaly, is quite telling (Harris 1997: 219; Murdock 1934: 223; Vancouver 1801).² However, the methods of tobacco cultivation did not differ substantively from the methods used to cultivate most of the other plants discussed here. Tobacco, like *Potentilla*, *Trifolium*, camas, and others, was transported to and maintained on owned plots – possessing anthropogenic soils and situated on anthropogenic clearings – and often fertilized. Perhaps the only significant difference is that indigenous peoples regularly planted tobacco by seed, rather than planting tobacco vegetatively. Recognizing this, the representation of tobacco as an exotic and anomalous case ultimately tells us more about the biases inherent in European observations and

¹ Importantly, in the course of fieldwork, I have found that garden rockworks, sitting on the horizon, are easily mistaken for natural rock outcrops (which are common along the entire coast) from less than 30 meters offshore: it is difficult to locate these gardens unless one is looking for them.

² “Potatoes” were also noted by some explorers, but were not viewed as endemic crops (Suttles 1951b).
classifications of the endemic peoples and practices of the Americas as it tells us about indigenous practices of resource management (Foucault 1970).³

Nonetheless, on those rare occasions when cultivation was detected, when the plots of plants appeared suitably geometric and the crops seemed familiar, this was largely interpreted as evidence of prior European influence.⁴ In 1789, during one of the first Euro-American fur trading expeditions on the northern Northwest Coast, members of John Meares’ crew saw numerous cultivated plots among the Haida, with mounded soils, boundary markers, and sprouting tobacco plants. In his official log, Meares’ assistant, William Douglas (1790: 369), asserted that “In all probability Captain Gray, in the Sloop Washington, had fallen in with this tribe, and employed his considerable friendship in forming this garden,” though he admitted that there was no evidence to support this claim. Indeed, as noted above, Gray did not visit this village and Meares was probably the first European to pull ashore there. Today, few would ascribe Haida tobacco cultivation to the “considerable friendship” of early fur traders and explorers: the pre-contact antiquity of Haida tobacco cultivation is widely accepted (Turner and Taylor 1972). Yet similar accounts of gardening and presumed European influence are abundant in explorers’ accounts from western Washington to southeast Alaska, and most remain unchallenged.

Recognizing the early dates of these observations, the presumption of European introduction seems to be, on initial consideration, rather incomprehensible. Such assumptions arguably can be traced back as far as the accounts of James Cook’s third

³ Lewis (1973) has made a similar case about the representation of tobacco as a unique cultigen among the indigenous population of northern California, despite the presence of other plants that were subject to similar forms of maintenance.
voyage, which had brought Cook to the shores of the Northwest Coast at Nootka Sound. This represented one of the final stops on Cook’s monumental effort to document, represent, and appropriate the lands of the Pacific. The written accounts of this voyage, written by Cook and members of his crew, were well known to all of the earliest explorers who visited the Northwest Coast in Cook’s wake. Indeed, Cook’s narratives, speaking of the abundance of sea otter and the high value of otter pelts in Asia, were largely responsible for inciting much of the Northwest Coast’s subsequent exploration, for both commercial and strategic purposes. Basing their few statements on Northwest Coast subsistence largely on their brief observations of men’s fishing and hunting activities, the journals of Cook (1967) and his crew provided an image of a seemingly non-agricultural people, “indolent” but blessed by a tremendous natural abundance of animal life. While the widespread consumption of root foods was noted by Cook and his crew, there were no efforts made to identify the origins of these plants.

Yet the a priori presumption that all Northwest Coast cultivation must have emanated from Europe arguably has deeper roots than Cook’s third voyage. This view manifests one of Europe’s most enduring ethnocentric biases: that the West was one of few “permanent, natural centers of creativity and invention” and that “New World cultures did not invent agriculture and other civilizing innovations on their own but received them via transoceanic diffusion” (Blaut 1993: 173). Together, this diffusionist ideology and the prominence of the inherited wisdom emanating from Cook and the explorers who followed him assured that even perceptive observers traveling through

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*j The role of Eurocentric bias in explorers’ narratives should not be underestimated. Often, the outcomes seem nonsensical; the region’s first European explorer, Juan Perez, for example asserted that the Indians he encountered uniformly “despised food and drink.” The adjective “European” remains implicit.
the region were reluctant to depict Northwest Coast plant management as true
"cultivation."

**Boas**

Of the many scholars who accepted and broadcast the colonialists' image of a
non-agricultural Northwest Coast, none did so much to institutionalize this label within
academic discourse as Franz Boas. Yet Boas was deeply aware of the rudiments of
estuarine cultivation on the Northwest Coast; indeed, his writings represent some of the
most informative sources available on the topic (Boas 1966: 17, Boas 1934, 1921, 1909,
n.d.). Still, Boas chose to endorse rather than to challenge European explorers'
dismissals of Northwest Coast subsistence as "non-agricultural."

Boas' own dismissal of Northwest Coast cultivation is enigmatic, but was deeply
rooted in the intellectual history of Boas and his contemporaries. The reasons for Boas'
stand on Northwest Coast cultivation were compatible with his overall project in the
time of his writing, and serve to illuminate the ideological and ontological positions that
shaped his larger theoretical program. Trained in physics and physical geography, Boas
sought to employ the most rigorous traditions of European natural science in order to
document and to celebrate the achievements of the non-European world. At once,
holding leftist views that earned him an extensive FBI file, and conducting his work in
what was then viewed as solid scientific form, he compiled volumes of empirical data in
order to falsify the arguments of environmental determinists, eugenically-minded racial
determinists, and theorists of unilinear cultural evolution (Krook 1993; Hyatt 1991;
Herskovitz 1953). As one of his students, Irving Goldman (1975: 9), remarked "Boas
was a scholar in whom the scientific and social conscience were wedded for life. He
had in mind liberation both from social and academic dogma.” Yet, as another of his students, Melville Herskovitz (1953: 112) suggested, “as a Nineteenth Century liberal he rejected, in principle, the colonial system. But as a Nineteenth Century scholar with a European orientation, he tended to think in [European] terms.”

As with most other authors of his time, Boas equated “agriculture” and “cultivation” with the propagation of a finite range of domesticates. Writing prior to the publication of most of the classic, revisionary works on the hearths of New World domesticates, such as Vavilov (1950) and Sauer (1952), Boas’ understanding of New World cultivation was defined quite narrowly. In a strict diffusionist turn, Boas asserted that Mesoamerica was the hearth from which all New World “agriculture” had emanated. “Indian corn, beans, and squashes are the basis of North and South American agriculture,” Boas (1933: 347) suggested. He did acknowledge, however, a separate South American agricultural tradition, centered on the cultivation of manioc, potato, yam, beans, and chili pepper (Boas 1933: 347). Through much of his career, Boas viewed the presence of Mesoamerican domesticates as the litmus test by which the presence of agriculture could be established in New World contexts, particularly in North America. Further, with his bias toward the seed-based Mesoamerican agricultural complex, Boas was reluctant to term vegetative agricultural complexes as true “agriculture.”

Estuarine cultivation on the Northwest Coast must have presented Boas with a challenging exception to his own preconceived categories of cultural and agricultural practices. To Boas, the cultivation practices of the Northwest Coast were ambiguous, in
the gray area, the intervening spaces between the widely accepted categories “hunter-gatherer” and “agriculturalist.” Though Boas openly challenged notions of directional or causal linkages between these two states, he did not effectively challenge the categories themselves. (Today, these categories, alone, are seen by some as discredited relics of evolutionary, unilinear stage theories of cultural development [Smith 1995; Sponsel 1989]). On the Northwest Coast, Boas saw an absence of Mesoamerican crops or widespread seed agriculture, and a people not primarily dependent upon cultivation for their dietary needs. By this strict definition, clearly, Northwest Coast peoples were non-agricultural, no matter how extensively they might cultivate native plants. Not acknowledging the existence of intermediate categories of cultivation between the category “hunter-gatherer” and the category “agriculturalist,” Boas opted to designate these peoples as being in the former category.

While Boas (1966:17; 1934, 1921, n.d.) was clearly aware of rhizome cultivation on the Northwest Coast, and seemed to accept it as a pre-contact phenomenon, he devoted little time to its investigation, and even less to its discussion in print. To understand this oversight, it is also important to note that Boas – trained in geography and a former Ratzelian environmentalist himself – was deeply averse to investigating most forms of human-environmental interaction beyond those which could be discussed solely in terms of the “mental life” of a people (Speth 1977; Codere 1959). Boas’ minimal attention to rhizome cultivation was additionally complicated by his heavy reliance on the post-hoc analysis of indigenous oral literatures provided by male elites in the study of indigenous subsistence practices, rather than engaging in field observation.

5 On similar grounds, Steward (1930) suggested that sites of the American Southwest were cultivated, with irrigation and transplanting of propagules (analogous to Northwest Coast practices), but that this did
or conducting interviews with women or lower status males, who were the primary cultivators (Fiske 1991; Ray 1989).

But also, and importantly, Boas had a particular axe to grind. Proponents of unilinear, evolutionary theories of human cultural development, including prominent anthropologists such as Tyler and Morgan, had posited that large-scale agriculture was a precondition for large communities, social stratification, and complex ceremonialism, in the progression from savagery to an essentially Northern European model of civilization. During Boas' formative years, these models were prevalent, directing the agendas of both social scientists and colonial authorities alike. In the purportedly "non-agricultural" Northwest Coast, Boas and his students found one of their most striking, and widely publicized exceptions to these general, evolutionary rules.

Deeply suspicious of all deterministic models of cultural development, Boas' entire ethnographic project on the Northwest Coast could be viewed as a massive effort aimed toward the falsification of 19th century academic dogma (Lakatos 1970; Popper 1959). Boas' theoretical program was fueled by exceptional cases, and the presence of a non-agricultural Northwest Coast suited Boas' needs well (Harris 1968). Boas did not use the presumed absence of agriculture on the Northwest Coast to refute racially deterministic theories: there was, after all, ample evidence of American Indians' capacity to practice agriculture. (Boas did not seriously entertain the notion that the concept of agriculture diffused to the Americas from a Eurasian hearth). However, the non-agricultural Northwest Coast provided Boas with some of his foremost exceptions to the rules espoused by environmental and economic determinists. This was most clear, not constitute "agriculture." Here, the presence of "agriculture" is no longer contested (Doolittle 1992).
not in Boas’ ethnographic works, directly addressing Northwest Coast tribes, but in
Boas’ few general statements of ethnological principles, in which his enthusiasms for
falsification were most apparent.

As a direct challenge to the environmental determinism of Ratzel and his
students (most notably Ellen Semple, whom Boas sometimes invoked in these contexts),
Boas utilized the example of the Northwest Coast to prove that “the same environment
will influence culture in diverse ways,” and that “the most fertile soil will not create
agriculture” (Boas 1930: 266). To make his point, Boas compared the region to places
such as Norway, “where climatic and geographic conditions are similar...Evidently
contact with the rest of Europe was sufficient to teach the early Norwegians the tilling
of the soil. The Northwest Coast of America was not so favored” (Boas 1966: 23).
According to Boas, the absence of cultivation on the Northwest Coast could thus be
traced to historical, rather than environmental causes.

More significantly, as a challenge to the “economic determinism” of his
evolutionist contemporaries, Boas depicted the peoples of the Northwest Coast as
exceptional hunter-gatherers. As hunter-gatherers, the peoples of the Northwest Coast
broke most of the evolutionists’ rules, and defied any law that linked cultural disposition
to socioeconomic stages. Unlike most hunter-gatherers, the hunter-gatherers of the
Northwest Coast ostensibly possessed so much material wealth that their needs for
subsistence scarcely influenced social behavior. Rather, life was “dominated by the
desire to obtain social prominence by the display of wealth and by occupying a position
of high rank,” through lavish displays of accumulated wealth, or the squandering or
destruction of surplus wealth (Boas 1928: 154). While many hunter-gatherers
experienced severe privation, and "have not produced much that would help towards the enjoyment of life," the hunter-gatherers of the Northwest Coast "enjoy seasons of rest during which they live on stored provisions," and "have developed a complex art and a social and ceremonial life full of interest to themselves" (Boas 1928: 218). These hunter-gatherers even exhibited degrees of religious specialization, with full-time shamans and a host of "secret societies." Unlike some hunter-gatherers (with more precarious subsistence economies), the hunter-gatherers of the Northwest Coast valued generosity and encouraged pity on the less fortunate (Boas 1928: 224-25). Unlike most hunter-gatherers, the hunter-gatherers of the Northwest Coast lived in highly stratified, sedentary villages, and individuals owned resource sites (Boas 1928: 192, 238-39).

There were few generalizations that could be made about "hunter gatherers" which were not, in some manner, compromised by the example of the non-agricultural Northwest Coast. Clearly, Boas was aware of this region's unique potential in falsifying the prevailing cultural theories of his time.

Why was the Northwest Coast anomalously non-agricultural? Boas' answers to this question were brief, and relied largely upon the presence of geographic barriers to diffusion. Certainly, in Boas' opinion, resource abundance played some minor role, but he attributed the absence of agriculture primarily to the region's isolation from prevalent currents of diffusion within the Americas. Speaking of the Northwest Coast and southern South America, Boas (1911: 328) suggested that "These districts remained almost excluded from the general flow of American culture, as it developed in the agricultural areas of the middle parts of the two Americas. Here we may perhaps still find something similar to what existed in our continent before the period of rapid
cultural advance set in [following the emergence of agriculture].” In contrast to the agricultural societies of the Americas, characterized by “a continuous flowing to and fro of ideas and inventions which stimulated continued growth,” the isolated Northwest Coast “remained in a more stable condition” (Boas 1911: 327-328). While referring to this as a “historical” cause, his argument relied upon the geography of western North America: “The arid plateaus and the cold subarctic plains, as well as the western arid prairies, shut them off from contact with the eastern agricultural tribes” (Boas 1966: 23). Thus, without access to Mesoamerican agriculture, the peoples of the region maintained smaller populations than the agricultural empires of the tropics, stable ceremonial practices, and an absence of state-level social organization (Boas 1910a: 333). Boas also used this departure from the prevalent cultural traits of the Americas (including maize agriculture) as evidence of the Northwest Coast being influenced by late stage migrations or diffusions from Siberia (Boas 1911:329; Boas 1933). As the conduit of contacts between Asia and the Americas, the absence of pre-European diffusion of crops between the Old World and the New, the non-agricultural Northwest Coast confirmed for Boas (1933) that the agriculture of the Americas was an endemic development, without influences from Eurasian agricultural complexes.

Boas’ Students and Allies: Kroeber, Lowie, and Sauer

Subsequently, the preeminence of Boas’ students, such as Ruth Benedict, Robert Lowie, and Alfred Kroeber, in American anthropology assured that the truism of a Northwest Coast without cultivation became a part of most anthropologists’ early training, a prominent factoid within introductory textbooks, and a cornerstone of later theoretical developments among Northwest Coast specialists. Through the writings of
Boas, his students, and his sympathizers, the Northwest Coast became the preeminent textbook example of hunter-gatherers who defied deterministic rules of cultural development, an example employed in attempts to refute of materialist and evolutionary theories of cultural development.

Among all of Boas' students, Robert Lowie was perhaps the most vehement and vocal in his references to the hunter-gatherers of the Northwest Coast as anomalous ethnological examples. Noting that most non-agricultural peoples did not practice exogamy or possess complex and hierarchical social structures, Lowie (1920: 128-29) cited the Northwest Coast as his primary exception. Unlike non-agricultural peoples elsewhere, Lowie (1920) noted that the foragers of the Northwest Coast had abundant property and rituals of property destruction, owned resource sites, and had a high degree of personal specialization in both secular and religious pursuits (Harris 1979: 308-10).

Accepting the claims of Boas and his students at face value, Carl Sauer saw the Northwest Coast as a non-agricultural region, and attempted to integrate this anomalous case into his diffusionist explanations of agricultural origins and dispersals. Sauer was skeptical of materialist theories of agricultural origins, and also favored the notion of a Mesoamerican hearth for North American agriculture, like his allies in the Boasian camp. Writing in Kroeber's festschrift, Carl Sauer (1936: 294) challenged the growing sentiment that "the adequacy of wild food supplies and the cultural inertia of the population" were sufficient to eliminate agriculture from the Northwest Coast. Instead, Sauer suggested that both the currents of cultural diffusion and environmental forces explained the absence of agriculture on the Northwest Coast. Sauer (1936: 295) speculated that the peoples of the Northwest Coast and California were not isolated
from prevailing currents of agricultural diffusion due to a lack of contact with outside, agricultural peoples. He did suggest, however, that the crops of the arid-land agriculturalists that they did encounter were never adopted, because they were poorly suited to the region's climate.

Sauer's 1936 position on the absence of Northwest Coast agriculture was cited soon thereafter in the works of both Alfred Kroeber (1939) and Robert Lowie (1937), the two Boas students with whom Sauer worked closely during their tenure at the University of California at Berkeley. Citing Sauer (1936), Robert Lowie (1937) asserted that the absence of agriculture on the west coast of North America was due to the fact that its soils and climate were poorly suited to the crops of Mexico and the desert Southwest. The introduction of agriculture, Lowie suggested, was postponed until domesticated crops could be introduced from other lands with Mediterranean climates, via European intervention. Similar, environmental arguments were presented by Kroeber (1939) in reference to both California and the Northwest Coast. Kroeber suggested that the dramatic climatological contrast between the arid Southwest and the humid Northwest Coast placed a limit on crop diffusion between these zones. Equating agriculture with Mexican crops, Kroeber (1939: 219-20) suggested that the pre-Columbian peoples of the America simply "carried farming as far north [and west] as it could be practiced," and that the environments of the Northwest Coast were beyond agriculture's "limits of possibility."

Later in his life, Sauer (1952) would note that the Northwest Coast Indians, largely sedentary fisherfolk, matched his ideal conditions for agricultural development, conditions which he felt had allowed Southeast Asia and the Caribbean lowlands of
South America to become two of the world’s foremost agricultural hearths. As a presumably non-agricultural land of sedentary fisherfolk, the Northwest Coast presented Sauer with a challenging exception to his oft-cited ‘sedentary fisherfolk’ hypothesis. In response, Sauer (1952: 55) hinted that the Northwest Coast was a place hamstrung by environmental obstacles to agricultural development and geographical obstacles to agricultural diffusion. It was a region with “matrilineal societies, living in multifamily houses with notions of property, prestige, and art” which were, in his view, “about what might be left of Southeast Asiatic culture from which an adverse environment had eliminated certain possibilities, in particular agriculture.” After years of exchanges between Kroeber, Lowie, and Sauer, the three ultimately seemed to agree that the explanation for the absence of Northwest Coast agriculture was not, as Boas had suggested, a simple lack of inter-regional cultural diffusion. Instead, they felt that it was a direct result of environmental barriers to the diffusion of Mesoamerican crops.

Other Schools of Thought

While many people outside of the Boasian sphere have written about the absence of agriculture on the Northwest Coast, all have arguably been influenced by the interpretations and agendas of Boas and his students, through which most Northwest Coast data has been filtered. Further, because of the prominence of Boas’ Northwest Coast work in the development of American anthropology, the anomaly of a Northwest Coast without cultivation has loomed large for each successive generation of theorists, at once defying and demanding explanation. This has resulted in some illuminating biases in the interpretations of Northwest Coast cultures; like India’s “sacred cow,” the
Northwest Coast proved to be a theoretical Rorschach test for successive generations of anthropologists, archaeologists, and geographers.

This trend began quite early in American anthropology. Beginning with the diffusionist view that Mesoamerica was the hearth of all American agriculture, Spinden (1917) composed a highly influential manuscript on agricultural distributions in the Americas that agreed in most respects with the views of Boas. Noting that the northern and southern extremities of the Americas were by most accounts (including Boas’ accounts of the Northwest Coast) non-agricultural, Spinden attempted to demonstrate a diffusion of agriculture and state-level societies from the continents’ equinoctial latitudes. This appears to have been the first widely read account that systematically addressed the absence of agriculture on the Northwest Coast.

As Boas and his students grew prominent within American anthropology, considerable interest was generated by Boas’ Northwest Coast work outside of Boas’ ‘inner circle’ of students. Instead of reading the vast and sometimes cryptic ethnographic writings of Boas, most relied on the accessible summaries of Northwest Coast cultures produced by his students. It is through these writings, I contend, that most popular and scholarly conceptions of Northwest Coast cultures have been derived. Those few sources by Boas’ students which first popularized Northwest Coast cultures, such as anthropologist, Ruth Benedict’s Patterns of Culture, were highly influential, and — in many cases — of dubious accuracy on certain key points regarding human-environmental interaction.

In Patterns of Culture, Benedict depicted Northwest Coast food gathering as a simple and leisurely affair: salmon was the staple, and, as these fish were available in
limitless quantities, there was simply no need for agriculture. Speaking of the
Kwakwaka'wakw, Benedict (1934: 173-74) noted:

“They were a people of great possessions as primitive peoples go. Their
civilization was built upon an ample supply of goods, inexhaustible, and
obtained without excessive expenditure of labour.”

Certainly, the idea of a people with absolutely no environmental limits on their cultural
development was in keeping with her mentor's anti-materialist biases - this anti-
materialist agenda, shared by all of Boas' students, likely influenced Benedict's decision
to depict Northwest Coast cultures in this light. Simultaneously, this assessment of
resource superabundance as a formative factor in the development of Northwest Coast
cultures was largely at odds with Boas' own interpretation of Northwest Coast
subsistence, and his diffusionist hypothesis for the absence of agriculture in this region.

The emergence of such popular accounts of resource superabundance spurred a
peculiar metamorphosis in anthropological interpretations of Northwest Coast
subsistence. Ironically, subsequent theoretical arguments, while deeply influenced by
the researches of Boas, have run increasingly counter to Boas' diffusionist model of a
non-agricultural Northwest Coast. Theoretical writings, produced by scholars without
specialized or first-hand knowledge of the Northwest Coast, have tended to cite resource
superabundance as the foremost reason for the presumed lack of agriculture in the
region. By extension, the region's presumed resource superabundance and lack of

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6 This is not to suggest that this was Boas' position. While never publicly challenging Benedict's
opinions, Boas was quietly skeptical of many of Benedict's widely-publicized views. Confiding in another
of his students, Irving Goldman, Boas noted: "The words are those of the Kwakwaka'wakw, but they have
nothing to do with the Indians that I knew" (Goldman 1975: 146). Subsequent writings on the
Kwakwaka'wakw, though citing Boas, drifted even further from the empiricist moorings of Boas' work.
Boas never produced a singular statement on indigenous uses of the environment, and such information
can only be gleaned from his larger works. Benedict never conducted research on the Northwest Coast;
much of her information on this region was derived from conversations with Boas.
agriculture has been employed as a commentary on the germinal importance of environmental “scarcity” in the emergence of agriculture (Cohen 1977). No doubt, Boas would be dismayed to see his own findings employed toward these environmentalist ends.

This trend is most evident in textbook discussions of the Northwest Coast. While dating from the beginnings of this notion of regional “superabundance” within the anthropological literature, Ralph Linton’s (1936: 213) comments are nonetheless representative of textbook statements which appeared throughout the 20th century:

“The best example of permanent settlements and a high culture in the absence of agriculture or any domestic animals of economic importance is that afforded by the coast tribes of British Columbia. Here the annual salmon runs and the abundance of wild berries provided a food supply as large and as thoroughly predictable as the results of agriculture in most uncivilized communities. Moreover, thanks to the development of techniques for food preservation, the group’s cycle of activities was not unlike that of agriculturalists.”

Few of the ethnologists making claims of resource superabundance, or the agriculture-like qualities of salmon, had research experience on the Northwest Coast. Indeed, remarkably few drew extensively or directly from the empirical literature on Northwest Coast cultures, save a smattering of second-hand accounts, and some of the claims advanced in textbook treatments were quite spectacular (Forde 1934: 69-95). As with most other facets of Northwest Coast ethnography, this form of academic discourse has drifted far from its germinal, empiricist moorings. Both the region’s resource

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7 It is unclear, for example, where Linton (1936) received his inspiration for the “abundance of wild berries.” While receiving little mention as a dietary staple in the works of Boas, berries seem to have captured the popular imagination, alongside salmon, and receive frequent mention in these textbook accounts, despite the relative significance of many other foods, including game, shellfish, and root foods. Moreover, it is clear that the abundance of berries was in part the product of anthropogenic influences.
superabundance and its absence of agriculture are now commonly asserted, based on
citations five and six times removed from Boas’ original and vast collections of data,
including those which describe the resource poverty of some Northwest Coast groups, as
well as some aspects of estuarine cultivation.

By the 1950s and 1960s, the three theoretical movements that had drawn the
scorn of Boas – racial determinism, environmentalism, and evolutionism – had
undergone considerable transformations. Racial determinism was essentially defeated
in mainstream anthropology. However, during this period, anthropology experienced
two resurgent theoretical movements: neo-evolutionism and cultural ecology. Arguably,
these represented theoretically refined counterparts, respectively, to the cruder
evolutionisms and environmentalisms of the previous century. At this time, and in part
as a response to Boas’ critique, the Northwest Coast’s non-agricultural designation
gained heightened theoretical significance in these retaliatory theoretical movements.
No other period, before or since, witnessed as much focussed speculation on the nature
of human-environment relations on the Northwest Coast.

A new generation of evolutionary theorists sought to account for the many
exceptions cited by the Boasians within a unified body of theory that explained cultural
evolution in environmentally situated terms. Within the neo-evolutionary literature,
authors responded to the critique of Boas and his students (and the role of a non-
agricultural Northwest Coast within this critique) by simply adopting the widespread
claim that the region was resource superabundant. Evolutionary interpretations
suggested that there was no incentive to adopt agriculture with the abundance of natural
foodstuffs (Sahlins and Service 1960: 77-80). To be sure, the Northwest Coast was still
recognized as an anomaly. As Service (1963: 208-09) suggested, a “chiefdom-level society” among hunter-gatherers was a rare thing, indeed, but “with an abundance of food and materials perhaps unsurpassed anywhere in the world” these hunter-gatherers possessed “a standard of living which can be matched only by societies possessing agriculture.” Such authors concede that the Northwest Coast was anomalous within any system of ethnological classification, but consistently attribute this to the pronounced abundance of fish and berries (e.g. Service 1963: xvi, 207-28).

Within the closely affiliated literature of cultural ecology, authors such as Vayda (1966, 1961), Piddocke (1965), and Harris (1968) addressed the lack of agriculture on the Northwest Coast. Suggesting that, elsewhere in the world, agriculture had developed as a response to infrastructural, dietary demands, these authors suggested that the Northwest Coast environment had been so blessed with natural resources that there had been no need to develop agriculture. However, each of these authors agreed that, as non-agricultural peoples, the inhabitants of the Northwest Coast were still plagued by unpredictable resource fluctuations, resulting in localized scarcity and starvation. As a result, these authors contended that social institutions, the potlatch in particular, emerged within this environment to foster risk-reducing exchanges of food. In turn, these social institutions – alongside the superabundance of natural resources – provided the dietary stability among Northwest Coast hunter-gatherers which allowed them to achieve levels of social complexity comparable to those of agriculturalists.

Few of these theorists had any first-hand knowledge of Northwest Coast cultures, and none paused to question whether the inherited wisdom regarding a non-agricultural Northwest Coast might demand wholesale revision. Still, this anomalous
case brought the theoretical positions of anthropological theorists into sharp contrast, and assured that there was little consensus regarding human-environment relations on the Northwest Coast during the last half of the 20th century. All that was universally accepted was that, as Kroeber (1962:61) claimed, the Northwest Coast peoples had a unique "civilization...a wholly non-planting and non-breeding culture - perhaps the most elaborate such culture in the world."* Ironically, this universally accepted truism was not particularly true.

Reconsiderations

Though cultivation on the Northwest Coast received almost no mention in the 20th century's anthropological literature, there were some exceptions. A handful of references of *Potentilla* and *Trifolium* estuarine cultivation appeared in the works of those few authors who were intimately familiar with Boas' writings on the subject. For example, drawing from Boas' published works, Forde (1934: 80) did note that, among these hunter-gatherers, "Patches of the wild clover root were enclosed in stone fences by Kwakiutl women, each of whom had her individual plot which she kept weeded to insure good growth." Forde (1934: 80-81) also noted the transport of camas on the southern coast and the cultivation of tobacco by the Haida and Tlingit.* Similar comments regarding estuarine cultivation, in less precise terms, appear in the writings of Benedict (1934), who depicted these practices as similar to agriculture, but not "agricultural" in a technical sense. More recently, such authors as Butzer (1990) and Hayden (1990) have mentioned Northwest Coast estuarine gardening on the basis of

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*It is important to note that Northwest Coast peoples also had domesticated dogs, used both for hunting and for the production of dog hair wool, which was used in robes, blankets, and other items.

*Camas cultivation has attracted some attention in late-20th century scholarship, most studies emphasizing cases in the interior Northwest (to which the plant is native) and not the ethnographic "Northwest Coast."
secondary references to Boas' published works on the topic. Authors less intimately familiar with Boas' works frequently mention tobacco as the only cultivated plant of the region, and describe the practice of tobacco cultivation in inexplicably diminutive terms. For example, Murdock (1934: 223) suggested that the only sign of cultivation on this coast involved "small plots of problematical tobacco." The basis for his claims are unclear, as, in the original accounts of the cultivation of this tobacco, it is not described as being particularly "problematical," nor its plots extremely small (Vancouver 1801).

There is some evidence to suggest that Boas, himself, ultimately began to doubt his own interpretations of Northwest Coast cultivation. Only late in life, when preparing his posthumously published *Kwakiutl Ethnography*, did Boas refer to the presence of agriculture on the Northwest Coast: the estuarine roots, he suggested, "are the only plants which receive any kind of cultivation" (Boas n.d.: 166). In the final printing, this admission was made more grudgingly: "The only trace of agriculture found in this area is a somewhat careless clearing of grounds in which clover and cinquefoil grow and the periodic burning over of berry patches" (1966: 17). It is quite possible that this change in wording reflects the editorial imprint of Helen Codere, a student of Ruth Benedict, who was responsible for compiling *Kwakiutl Ethnography* from Boas unpublished manuscripts more than two decades after his death. In this volume, Boas (1966:23) also mentions the cultivation of Haida tobacco as a puzzling enigma, apparently unrelated to rhizome cultivation, a practice which he suggests might have resulted from "an accidental, solitary influence" from elsewhere. Yet his strict diffusionist interpretation of Northwest Coast land use seemed to have diminished; no longer did he seem to strictly associate New World cultivation with the presence of
Mesoamerican domesticates. It is unclear if Boas reached the conclusion that the Northwest Coast was somewhat agricultural prior to writing this manuscript, but never published this opinion, pending a unified ethnographic treatment of the Kwakwaka’wakw. Here too, it is unclear to what extent these represent Boas’ unmodified words, and to what extent these words reflect Codere’s own reflection on the considerable theoretical developments regarding the nature of agriculture in the decades following Boas’ death (Herskovitz 1953: 120).

Regardless, while unmaking one set of European myths about the indigenous peoples of the Americas, Boasian anthropology assisted in the construction of yet others, intentionally or otherwise. Certainly, Boas’ findings have been misrepresented, with ethnographic truisms often being asserted by scholars based on citations many times removed from Boas’ empirical work. As a result, the potentially contentious designation of the Northwest Coast as “non-agricultural” has proven impervious to subsequent and more inclusive redefinitions of cultivation, applied to other parts of the non-European world, such as California and Amazonia, where this label was less intimately tied to longstanding scholarly agendas (Bean and Lawton 1993). This designation has so influenced contemporary anthropologists and archaeologists that even Northwest Coast specialists commonly initiate their research on human-environmental relations with the assumption that, not only were the peoples of this region wholly non-agricultural, but further, that “Northwest Coast peoples did not rely heavily on plant foods” (Huelsbeck 1988: 166). Only a handful of Northwest Coast specialists

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10 The depiction of a non-agricultural Northwest Coast continues to infect other disciplines as well. Geographers Harris and Demeritt (1997: 219), for example, note that “Except for a little tobacco grown on the Queen Charlotte Islands, agriculture was not a pre-contact relationship with nature in British Columbia.” With its diminutive terminology and its mention of the total novelty of tobacco cultivation,
specialists have challenged aspects of this orthodoxy, such as the region’s presumed resource superabundance (Suttles 1968b) or the assumption that plants were unimportant in the diet (Turner 1995; Norton 1981).

Still, as an anthropologist with scientific training, Boas accumulated a tremendous amount of raw ethnographic data, data that has sat for almost a century, largely unused, in his many published and unpublished works on Northwest Coast ethnography. This has provided subsequent generations of scholars with the opportunity to examine his data and challenge his conclusions. Contemporary scholars have been reluctant to delve deeply into Boas’ writings in search of data, however. This may be due to the sheer monumentality of the task. As Walens (1981: 7,19) suggested of Boas’ published works,

"for all their scope and detail, few scholars have returned to them when discussing some of the controversial questions in Northwest coast ethnography. This must, in part, be attributed to the very vastness of the work itself. Boas’s published materials on the Northwest Coast tribes are almost ten thousand pages in length... The data in Boas’ works is so overwhelming that there are many lifetimes of scholarly analysis of it waiting to be done."

To be sure, a perusal of Boas’ works is revealing on the point of cultivation, and such perusals have served as an important source of inspiration for this dissertation.

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this postcolonial tract sounds strangely reminiscent of the mainstream scholars and colonial apologists of an earlier generation.
CHAPTER 7

A CONTEXT FOR CULTIVATION:
CULTURAL INTENSIFICATION AND RESOURCE INTENSIFICATION
ON THE PRE-EUROPEAN NORTHWEST COAST

The suggestion that Northwest Coast peoples cultivated food plants should not
diminish the overall impression of the centrality of marine animals in the Northwest
Coast diet. On the contrary, I would suggest that an understanding of marine animal
harvesting is essential to understanding the importance of plant intensification in the
region. With varying tempos along the coast, large, sedentary villages emerged at a
finite number of estuarine sites, rich in salmon and other resources. This development
brought with it the creation of discrete resource territories, patterns of village resource
ownership, and an increasingly constricted range of foraging for the post-Pleistocene
"fisher-hunter-gatherers" of the region. Plants would have presumably maintained a
degree of importance in native diet, economy, and ceremony, while their gathering
would have been increasingly constrained by growing populations and semi-sedentary
settlement patterns. Further, as human societies grew increasingly reliant upon a discrete
range of marine resources with varying levels of abundance, concentrated populations of
plants would have served as a welcome source of carbohydrates and as a risk-reducing
resource. (As discussed in Chapters 4 and 5, sources such as Boas [1901] and Edwards
[1979] describe oral traditions that lend support this to this interpretation). Along with
these changes came settled villages, organized subsistence activities, and levels of
individual task specialization; in turn, each of these developments brought a host of new
social, economic, and ceremonial motives for resource intensification. Thus, gradual
changes in the settlement and subsistence patterns of the Holocene Northwest Coast brought with them a succession of strong incentives to intensify plant resources, which were alternately infrastructural, structural, and superstructural.

The need to intensify plant resources, or any other resources on the Northwest Coast, seems contradictory in light of the widespread notion that the Northwest Coast was naturally resource superabundant. But, of course, there are many reasons to question the region’s presumed fecundity. If, as authors such as Benedict (1934) have suggested, the Northwest Coast was a place of inexhaustible abundance (in the form of salmon), then how do we account for the elaborate system of land and sea tenure which was found along much of the coast, a system in which unauthorized harvesters on food resource sites were routinely fought or killed? Why did displacement from traditional fishing and gathering sites result in such material hardship for the native peoples of the region? Or, why were occasionally long and brutal wars fought over particular territories and resource sites?

The answer to these questions — and the key to success in Northwest Coast aboriginal subsistence — was location. It is perhaps true that many of the natural resources of the Northwest Coast were in some manner “abundant.” They were not, however, ubiquitous. Natural resources were unevenly distributed in time and space, and native peoples’ valuation of particular landscapes varied accordingly. Indeed, much

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1 For example, when the Spanish garrison at Nootka Sound occupied an important Nuu-chah-nulth fishing site, Francisco de Eliza reported that Chief Maquinna and his people “do not cease in coming to question me daily about when we will leave” and would show their emaciated bodies to the Spanish as proof of their inability to find adequate food elsewhere on their lands. This incident is recorded in Francisco de Eliza’s “Costumbres de los Naturales del Puerto de San Lorenzo de Nuca” (ms., Archivo Generales de las Indias, April 1791), which is translated and quoted in Archer (1993: 149, 153).

2 The Kwakwaka’wakw, for example, had a well-documented tradition of taking neighboring tribes’ lands by force, before and after the arrival of Europeans. Likewise, resource rich lands were taken under threat of warfare. For example, shortly before contact, amid threats of military retaliation, the Tlingit of what is today southernmost Alaska gave the Kaigani Haida resource-rich lands in their territory as repayment for
of the pre-contact history of Northwest Coast subsistence appears to have involved maximizing output and tribal control of a finite range of conveniently located, resource-rich sites (Deur 1999). And while this intensified production of foodstuffs clearly contributed to Northwest Coast peoples’ diet, the motives for enhanced food production were not solely infrastructural; they were also heavily influenced by demands for resource control and surplus production brought about by structural and superstructural concerns.3

The Northwest Coast: Environments and Resources

Though the coastal zone of Northwestern North America is sometimes depicted as environmentally homogeneous, it is characterized by considerable environmental diversity. Along the coasts of Oregon, Washington, British Columbia, and southeast Alaska, mountain peaks rise abruptly from sea level to well over 3,000 meters, particularly in the northern portion of this region. Sharp environmental gradients distinguish the environments of the shoreline from the forests, from alpine areas. Marine air moving inland across the region distributes precipitation unevenly, with temperate rainforests on windward slopes, and relatively dry rain shadows on leeward slopes. Within a single ethnographic “tribe’s” territory, annual precipitation at one site can be over 3 meters greater than in another, and each of these locations possesses distinctive biota. Landslides, glaciers, wind, natural fires, and human clearing of the land have produced a diverse assortment of clearings containing grasses and herbaceous plants. Marine environments vary from open ocean, to ocean shoreline, to protected

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3 Admittedly, the archaeological hypotheses advanced below differ from many indigenous peoples’ accounts of their origins; these alternative views deserve greater attention than space allows here.
inlets extending far inland. Sediment size on the ocean floor varies as a function of
wave action, while temperature ranges and salinity vary considerably, and currents move
water and organisms from place to place. In combination, these factors facilitate the
emergence of very different quantities and types of marine life at different locations.

As a result, the Northwest Coast is characterized by a considerable variety of
“patchy,” small-scale environments - discontinuous concentrations of forest, rocky
outcrops, grassy clearings, sandy beaches, mudflats, rocky intertidal areas, and so forth.
Animals feed and breed, and plants grow in a finite range of habitats, and their
geographical distributions therefore tend to be somewhat “patchy” as well. With limited
technologies for transporting food and materials over long distances, the humans who
depended upon these plants and animals at the beginning of the Holocene tended to
conform in part to this regional biogeography. By necessity, they located near places
where food plants and animal were naturally abundant, and may have sought to control
access to these sites (Fladmark 1975).

All staple plants and animals in the Northwest Coast diet were characterized by
varying degrees of spatial and temporal discontinuity. Streams with large populations of
salmon or eulachon (the “candle fish” from which many coastal peoples extracted oil, an
important dietary supplement) could be tens or hundreds of kilometers apart. Level,
rocky areas on which seals or sea lions would gather could be even more widely spaced.
Elk or deer could be relatively scarce outside of the small forest clearings in which they
grazed. Each type of mussel or clam was limited to sites with particular rock or
sediment sizes, particular levels of salinity, and particular levels of wave action. One
might certainly catch individual animals outside of these concentrations – on the move
between feeding and breeding sites, for example — but if one was to catch game animals in abundance, one went to the places in which they were most abundantly and predictably concentrated.

Similarly, plant foods were unevenly distributed. While the Northwest Coast’s forests were (and still are) among the world’s most productive environments, measured as volume of carbon stored per unit of area, the vast amount of this biomass occurred in conifer trees, in the form of inedible cellulose (Alaback and Pojar 1997). The abundance of vegetation is deceptive, as the densest forests of the Northwest Coast often possessed only a diffuse scattering of edible plants. Requiring ample sunlight, many berries would not grow well under the dense forest canopy that blankets much of the zone, but did flourish along streambanks or in other small, moist clearings. Edible roots, bulbs, and rhizomes were also limited to finite natural environments. Camas, bracken ferns, and many lilies, for example, only grew well in clearings, while other root foods grew only along the margins of salt marshes. These isolated plant food gathering sites were characterized by such geographical patchiness and cultural importance that they can still be identified on the basis of abundant indigenous placenames (Deur 1996b; Boas 1934; Harrington n.d.). Even the western red cedar (*Thuja plicata*) — from which the peoples of the coast made their homes, canoes, bark clothing, and the majority of their other durable goods — was irregularly distributed along the coast, and was often of limited distribution in montane areas, or fronting the open ocean. Best suited to moist sites, but unable to compete for sunlight under the dense spruce-hemlock canopy, red cedar often grew in small groves, on streambanks or along south-facing slopes where insolation is relatively great, and wintertime windthrow
of the trees of the upper forest canopy are more common. While some sections of the coast contained abundant cedar, other sections were thus characterized by small groves, separated by many kilometers (Hebda and Mathewes 1984). Clearly, this discontinuous geography of natural resources presented a number of challenges to the peoples of the coast throughout the pre-contact history of the Northwest Coast.

The Move Toward Sedentism

During the earliest archaeologically detectable human settlement on this coast, in particular, the uneven distribution of resources placed limits upon human subsistence and sedentary settlement. Based on evidence from a very small number of late-Pleistocene and early Holocene archaeological sites, one can conclude that most of the resources mentioned above were already being widely used by the native inhabitants of the coast by 10,000 years ago, not long after their presumed first arrival on this coast. Many of the staple animal foods were being exploited from very early in this occupation: salmon, a number of other freshwater and marine fishes, seals and sea lions, as well as large and small land mammals. Plants biodegrade rapidly in this region, and are poorly preserved within the archaeological record. One can safely assume, however, that the earliest inhabitants of this coast also relied heavily upon the region’s many plant foods, which required less technological specialization to obtain than is true of most animal resources. Archaeological records show little evidence of settled life or of the intensive use of the resources of any single location (though specialized hunting tools, such as seal harpooning points, do appear in the region’s oldest archaeological sites). Food gathering at this time therefore involved much migration between environments in
which key resources were most concentrated (C. Carlson 1979; Matson 1976; Borden 1975).

However, the resource use patterns of these peoples changed much in the years to come. In contrast to the *earliest* inhabitants of this coast, the peoples of this coast at the time of European contact were settled in large, sedentary villages, and highly dependent upon specific resource sites. In addition, at the time of European contact, the region’s most powerful villages and clans were those with particularly diverse and productive environments within their territories, and who had devised means to control, harvest and trade the products found in each. The overall pre-European environmental history of the Northwest Coast is thus characterized by a region-wide transition, in which the migratory “resource generalists” of roughly 10,000 years ago became the more sedentary “resource specialists” which were encountered by the peoples of Europe.

The first archaeologically detectable changes in the direction of greater sedentism and resource specialization occurred roughly halfway through this 10,000-year history. Though the precise timing is unclear and appears to have varied from case to case, the hunter-fisher-gatherers of the Northwest Coast gradually increased their exploitation of the region’s most abundant food resource: salmon. This process seemingly began along the lower stretches of particularly productive salmon rivers between 6000 and 4000 years ago, but occurred perhaps as late as 3000 years ago at the mouths of less productive rivers and streams.⁴ There were probably several causes for this transformation, including improved technologies for fishing, hunting and food

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⁴Archaeological remains from prior to this period are not so well-preserved as to rule out earlier beginnings for this transformation. Evidence of sedentism at the earlier extreme of this chronology can be found in Cannon (1991). Evidence of a more recent emergence of sedentism is provided in Matson (1992).
storage, rising population pressures, and growing social complexity to a level where organized fishing and food storage efforts became increasingly feasible. Also, growing runs of salmon and other fish followed the expansion of estuaries and the elaboration of estuarine ecosystems, after eustatic sea levels stabilized following Pleistocene deglaciation (Cannon 1991; Fladmark 1975; Borden 1975). While abundant salmon appears to have been among the primary motivations for the location of larger settlements, some groups gathered around other types of particularly productive and predictable resource sites. There is strong archaeological and ethnographic evidence for major seasonal village aggregations emerging simultaneously for the purposes of marine mammal hunting (particularly among the "Nootkan" peoples of western Vancouver Island and the northwestern Olympic Peninsula) as well as for the harvesting of shellfish, plant foods, or other varieties of fish (Mitchell 1979).

Forsaking some of the dietary diversity facilitated by spatially extensive patterns of hunting, fishing and foraging, the prehistoric inhabitants of the coast began to spend increasing amounts of time stationed at productive estuarine sites, where freshwater streams and rivers met saltwater bays and inlets. Villages appeared with greater density around these estuarine environments, which, in addition to providing the entire coastline's most abundant concentrations of salmon, also provided the richest concentrations of other fishes, shellfish, waterfowl, and an assortment of other edible animals and plants. In the archaeological record, shell middens and mammal bones appear in unprecedented densities at emergent village sites from 4000 to 6000 years ago (Cannon 1991). Again, the resources of the Northwest Coast were abundant, but they were spatially discontinuous. Increasingly sophisticated technologies for resource
harvesting allowed the peoples of the coast to exploit many of these resources with growing proficiency. At the same time, the geographical distribution of their population increasingly mirrored the uneven spatial and temporal distribution of their primary food resources.

While all of the factors mentioned here were important to the emergence of sedentary villages, sedentary life would have been wholly impossible on the Northwest Coast without effective methods of food storage. Arriving in runs that lasted only days or weeks, fresh salmon was available for only a limited time; without effective techniques to preserve and store the bounty, much fewer fish could have been caught and utilized. By perfecting methods of smoking and storing salmon, as well as other fish, mammal, and plant foods, the brief bursts of available resources such as salmon could sustain a population throughout the year (Matson 1992; Schalk 1978). By the time that sedentary villages appeared along the coast, the peoples of this region had perfected many methods of food smoking and drying. Further, they had mastered the manufacture of watertight baskets and cedar boxes, which could hold stored foods in house rafters, or recessed areas along the walls or in the floors of houses.

While the causes of this shift towards sedentary estuarine villages were perhaps rooted in basic attempts to materially improve food procurement, the social consequences of this transition appear to have been profound. Regular gatherings of people into large villages brought about growing potential for organized social, political, and subsistence activities. In the process, it is likely that this period marked the increasing social and economic centrality of Northwest Coast political elites, who were

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5 For a summary of contending perspectives on the causes and effects of this transition, see Ames (1994).

149
involved in the organization of such complex processes as house construction, food procurement (including the construction and utilization of fish weirs, for example), and food storage (Ames 1981).

Importantly, this emergent sedentism also appears to have contributed to the development or fixedness of bounded tribal territories. The emergence of geographically fixed villages and hunting and gathering territories would have increased human dependence upon a finite constellation of resource sites. This placed a premium upon productive sites of salmon, shellfish, game, berries, or roots within one’s territory, particularly those that did not, because of location or harvest time, create scheduling conflicts with salmon procurement. Seasonal migration patterns thus became increasingly restricted (Richardson 1982). The need to have uninterrupted access to specific resource sites, to prevent others from using them and maintain their use by one’s kin, likely led to or enhanced a tradition of resource site ownership during this transition to sedentism. And, growing sedentism would have limited the extent to which peoples could relocate to more productive or predictable resource sites without generating conflict with neighboring peoples. Thus, at the same time that the successful exploitation of salmon from sedentary village sites created the potential for unprecedented salmon consumption, it also raised the specter of potential scarcity: some resources, such as plant foods, would have been too widely distributed to be effectively foraged. Irregular or poor salmon harvests on single river systems (as have been frequently documented on the coast) could have become increasingly devastating to a settled population without a diversity of alternative productive resources, or access to food sources outside one’s territory (Donald and Mitchell 1975).
Still, there is little evidence of malnutrition in any of the skeletons found at archaeological sites throughout the region, from 5000 years ago to the time of European contact (Cybulski 1990a). We can speculate on the reasons for this apparent good nutrition: estuaries provided uniquely low-risk environments, with a wide assortment of concentrated food resources, such as shellfish, flatfish, marine mammals, and edible roots and berries, which could be relied upon when higher-priority foods, such as salmon, ran low. This contrasts with interior, upriver areas – areas commonly possessing only a fraction of the population densities found in the coastal zone – where salmon might be equally plentiful but secondary resources relatively scarce.

Furthermore, one may reasonably conclude that effective mechanisms for the production and exchange of food and other resources co-evolved with increasing dependence upon finite resource territories. Indeed, such mechanisms for inter-village resource trade were quite apparent among the peoples of the Northwest Coast at the time of their first encounters with Europeans (Suttles 1968a, 1968b).

**Circumstances of Resource Intensification after 4000 B.P.**

The successes of sedentary fishing strategies seem to have fueled the coast’s first archaeologically-detectable period of population growth, a rapid increase which took place between 4000 and 3000 years ago (Croes and Hackenberger 1988). In turn, sedentism and population growth appear to correlate temporally with a period of rapid “cultural intensification,” involving increasing social complexity, ceremonialism, and economic stratification. These changes placed additional demands on local resources, beyond those originally posed by the rise of sedentism, facilitating war, elaborating patterns of trade and wealth redistribution, and leading to increasingly sophisticated
methods of food storage and resource specialization. Moreover, the display of wealth, through surplus food production or the use of totemic crests arguably became increasingly important as sedentary villages began to function as independent polities.

Taken together, these factors facilitated the intensified exploitation of many natural resources. While the growth of sedentary villages had originally centered on productive fishing sites, the gradual increase in specialized food harvesting appears to have facilitated a growing, secondary pattern of settlement. This pattern emerged as a constellation of several sites of "secondary resources," such as whale or seal hunting sites, eulachon or halibut fishing grounds, and clam, berry or root gathering sites (Minor 1983; Thompson 1978). Thus, while these peoples became "sedentary," their settlement pattern during the last 4000 years might better be described as being centered on a primary village, surrounded by a constellation of small but permanent, resource-specific settlements, between which segments of the community traveled seasonally.

Though I describe these changes as generalized across the region, in fact, they played out somewhat differently along the long latitudinal gradient of the coast, in part due to the influence of ecological factors. Importantly, as one moves from south to north along the coast, opportunities for some food gathering activities grows increasingly restricted. While marine productivity remains high, terrestrial productivity declines. With cooler temperatures, increased seasonal variability in sunlight, and, generally greater moisture in the north, certain edible plant and terrestrial animal resources become less abundant, and the potential for burning clearings in the forest canopy diminished as well. Accordingly, villages' terrestrial hunting and gathering territories — and indeed, entire ethnolinguistic territories — were larger at the northern
end of the Northwest Coast culture region (Schalk 1981). Perhaps most importantly, salmon runs are of shorter duration in the northern portion of the coast. Prior to European settlement, salmon runs in the southern Northwest Coast, on the coasts of northern California and Oregon, persisted discontinuously for months. However, on the northern rivers of southeast Alaska, large runs lasted only a few days. As a result, in order to utilize these salmon runs, the peoples of the northern coast were compelled to catch and store the bulk of their salmon in a matter of only a few days. Many of the peoples of the north coast, such as the Tlingit, appear to have developed sedentary salmon fishing village sites comparatively late in the archaeological record. When they did, the organizational feat of conducting their major food gathering activities in such compressed times ostensibly facilitated a more rigid social hierarchy and greater authority among elites than was found on the southern coast. This likely contributed to the northern coast’s comparatively hierarchical social structure and the relatively ostentatious displays of secular power and wealth by its elites, as found at the time of European contact (Schalk 1978). This turns traditional arguments regarding the cultural results of resource superabundance on their heads. The elaborate art and ceremony of the Northwest Coast is often interpreted as evidence of the leisure time provided by a fecund environment. Within the ethnoregion, however, the inverse was true: it was the peoples with the most severe environmental limitations who developed the most elaborate artistic and ceremonial traditions.

Precarious Polities, Prestige, and Resource Production

Prior to European resettlement, what we refer to as “tribes” had no formal political existence on the Northwest Coast. Ceremonial, economic, and kinship ties

153

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may have bonded villages together, but the “Kwakwaka’wakw” or the “Nuu-Chah-Nulth,” for example, were not “tribes” in the conventional sense; rather, they were groups of villages which spoke the same (or very similar) languages. The village served as the primary political unit - each was largely autonomous in matters of politics, war, and trade, and each appears to have formed inter-village allegiances based upon mutual, inter-village interests. To underscore this point, it is important to note that cases of warfare between villages within ethnographically-designated “tribes” was a common occurrence according to the region’s oral history, as were alternating periods of armed conflict and cooperation between villages, linguistically similar or not (Drucker 1983).6

Individual households - essentially extended kin groups and their slaves living in individual houses - were the fundamental social unit in most issues of ceremony, food procurement and resource ownership. Households served as largely independent economic units, and shared (albeit disproportionately) in the output of their labor. Large houses served as spaces for living, as well as ceremony, specialized work, and food storage. Each household controlled a subset of resource sites within the overall tribal resource territory. Villages consisting of “longhouses” of a scale similar to those of the 19th century appear in the archaeological record by roughly 3000 years ago. By this time, social units and economic activity probably were somewhat similar in organization and scale to those recorded in the 19th century (Ames 1995; Chatters 1989; Coupland 1985).

As Northwest Coast peoples were not organized into “tribes,” neither did they have “chiefs” in a conventionally ethnographic sense. Ethnographic and archaeological

6 Examples of warfare within conventionally designated “tribes” underscores this point: for an overview of oral accounts of inter- and intra-group warfare along the entire coast, see Ferguson (1984).
evidence suggests that each household had a ranking individual, generally of hereditary title, who served as the leader in internal household matters, and served as the household's representative in external matters. Each of these houses possessed slightly different levels of power, reflecting each kin group's ceremonial titles, prestige, and past and present wealth (Coupland 1985). (Yet social stratification was most marked within, rather than between households. Relations between households were comparatively egalitarian, and longhouses have exhibited only minor variability in size, for example, as a result of variable rank within any given village [Coupland 1985]). As a result of this disproportionate ranking of both individuals and households, the ranking person in the highest ranking household generally served as the “chief” of the village, sometimes representing the village in external matters, but lacking formal authority within the village beyond that which would already be secured by the privileges of their relative wealth and rank at the clan or household level. Such chiefs, by and large, had no overarching, executive control over village affairs. While it is difficult to discern archaeologically, increasing intra-village variability in the ostentatiousness of burials and personal ornamentation suggests the formation of an elite social rank. These individuals of higher status became discernible from a larger population of “commoners” along different sections of the coast between 3500 and 2500 years ago (though these events may have begun earlier in places, at 4000 years before present or sooner) (Carlson and Hobler 1993).

While there is little consensus on the roles of slaves in Northwest Coast cultures, there is strong ethnographic evidence that slaves played a significant role in food gathering activities, particularly the gathering of surplus foods used in ceremonial
contexts. Consisting largely of war captives and their descendents, slaves became an integral component of many households. Slavery may have appeared shortly after the emergence of a sedentary elite, as archaeological evidence suggests the possible presence of slavery by 3000 to 2000 years ago (Donald 1983). Together, a small number of “elites,” a much larger group of “commoners,” and a variable number of “slaves” made up the three general strata of Northwest Coast societies.

This political structure was sustained by a number of distinctive cultural institutions. Perhaps most important among these, at the time of European contact, was a tradition of ritual exchanges of goods, the potlatch. Potlatches accompanied significant events such as marriages, deaths, times of pronounced personal shame, or when a child reached puberty and took on adult roles. Through these exchanges, elites would repay or generate debts, mediate and ameliorate inter-personal disputes, and enhance their personal and household status. Historically, many (but not all) of these potlatches were conducted in such a manner that elites receiving more than received were shamed, and indebted to repay their rivals with ‘interest’ at a future potlatch. Goods were exchanged among elites from one or more villages, and these goods would then be partially redistributed within the elites’ households. A strong case could be made that the prestige of a household or village was equal to their track-record of wealth, which was, itself, transitory and influenced by potlatch exchanges, trade, and fluctuations in the availability of natural resources within their territories.

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7 For an overview of the roles of slaves in Northwest Coast cultures, see Donald (1983) and Oberg (1973). On the antiquity of slavery, see Cybulski (1993).
8 Northwest Coast totemism likely co-evolved with this political structure. Probably originating as an animistic spirit-guide tradition, which grew increasingly secular, serving to indicate a person’s ancestry and inherited privileges. An elaborating tradition of totemic art paralleled these changes, serving as mnemonics of social standing. On the chronology of emergent totemic art styles, see Fladmark, et al. (1987), and Holm (1991). On the shamanistic roots of clan totemism, see the papers in Carlson (1983).
emergence of the potlatch has been very difficult to document archaeologically, there is persuasive evidence that its rudiments had emerged by as early as 3500 years ago, from which time masks and surplus goods have been found in association with burials (Carlson and Hobler 1993).

This pattern of legitimation among elites appears to have greatly influenced indigenous patterns of resource use, and may explain many of the practices seen in the ethnographic record (Boas 1921). Resource production was required not only to meet the daily dietary needs of the people of the Northwest Coast, but also, the political structures of these peoples were vitally dependent upon the display and redistribution of wealth acquired through surplus resource production. In order to maintain their position, elites had tremendous incentives to acquire resource wealth and enhance the productivity of resources within their finite territories (Maschner 1991). Commoners, too, as beneficiaries of their household, clan, or village elites’ dynamic wealth and prestige, sought to enhance their overall resource output. These resources became the commodities of both ceremonial and mundane trade relationships along the coast, which likely facilitated localized resource specialization and the strong ties and exchanges of ideas between coastal peoples (Huelsbeck 1988).

While the socio-political structures of Northwest Coast peoples on the eve of European contact have been discussed extensively by anthropologists, they remain among the most commonly misunderstood facets of native life. Motivated in part by their reactions against the excesses of 19th-century environmental determinism, Boas...

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9 Such exchanges are reflected in common motifs in the material culture of the entire culture area. Artistic design on household and ceremonial goods exhibit stylistic continuities and parallel patterns of development along the entire coast as early as 4000 years ago (Holm 1991). Local specialization and
and his students explained the potlatch and other Northwest Coast institutions almost exclusively as a means of securing social position. Warfare or surplus production, they argued, were almost exclusively responses to social pressures rather than to material needs (Codere 1950).\textsuperscript{10} Echoes of this position can be seen in the subsequent sympathetic theoretical works of the structuralist school of anthropology, including Claude Levi-Strauss (1982) and his adherents. However, cultural ecologists of the mid- to late-20th century countered this Boasian assessment with a materialist critique.\textsuperscript{11} Returning to the Northwest Coast data, they concluded that coastal peoples' social institutions (especially the potlatch) could be interpreted merely as the most effective means of responding to booms and busts in the availability of salmon (Vayda 1968; Piddocke 1965; Donald and Mitchell 1975; Netting 1986: 27-40).\textsuperscript{12} These authors noted that villages with poor salmon harvests could nonetheless obtain food through the potlatch; these villages would incur both political and material debts and would be obligated to repay their debt at some future time when salmon harvests were good locally, but poor elsewhere. In addition, they noted, villages with consistently good long-distance trade in both foodstuffs and durable goods appears to have been common; see, for example, Huesbeck (1988).

Boas' emphasis on prestige at the expense of material concerns may additionally reflect the peculiar milieu of native social life during the time of his fieldwork. Epidemics had radically reduced the native population to as little as 10% of their pre-contact totals. Alongside the economic readjustments during and after the fur trade, this facilitated unprecedented upward social mobility, as many elites died, vacating their ranks and titles. Per capita resource pressure declined precipitously while newly-ascendant elites appear to have become particularly concerned with legitimating their status. With the declines in pressure on resources, social legitimation was largely achieved through elaborated ceremonialism, the redistribution of trade goods, and the retelling of oral history which confirmed their connections to noble lineages. For additional perspectives on Boas' approach to the interplay of culture and resource procurement, see Speth (1977, 1972). On the demographic consequences of the contact period, see Boyd (1990).

\textsuperscript{10} Influenced by the economic-determinism and evolutionism of Marxist theory, Leslie White (1963, 1945) provided the earliest and most vitriolic criticisms of Boas' historical particularism and idealism.\textsuperscript{15} These writers were inspired, in part, by the work of Wayne Suttles. Suttles' work hinted that the potlatch ameliorated the impacts of periodic salmon population "crashes" on particular villages, providing a system for importing food from outside tribal resource territories, bartered, in essence, in exchange for promises of future repayment. And evidence suggests that Kwakwaka'wakw inter-village ceremonial rankings correlate with the dependability of each village's salmon streams (Donald and Mitchell 1975). While Suttles' writings were not overtly environmentally-determinist, this was not true of the many
salmon runs held the highest political rankings, suggesting that they had a history of “bailing out” less resource-rich villages, thereby building long-standing political capital. By redistributing wealth between villages with a system of mandatory repayment, they argued, the potlatch served as a formalized means of “banking” resource wealth, of depositing resources into a larger pool of communities during productive years and withdrawing resource wealth from this pool during locally poor salmon harvests. Prestige, they suggested, was largely a by-product of this ecologically logical system, an organizing principle that was augmented for an individual or a village by long periods of comparatively high resource output from their territories.

While each of these positions revealed much about the ideological inclinations of their adherents, and occasionally illuminated the inner workings of Northwest Coast cultures, these competing camps created a false dichotomy. The material and social implications of Northwest Coast social life and resource use were inseparable: both within and between villages, access to resource wealth was contingent upon one’s prestige, and one’s prestige was contingent upon one’s access to resource wealth. One could not be held for long without the other. As 19th century ethnographic consultants often suggested “A person who lacks hunting grounds [and other resource sites] is little better than a slave, whereas one who has much land is important” (McIlwraith 1948, I: 132). Noble titles, transferred between elites, were accompanied by the ownership of specific resource sites; as Edward Sapir suggested, on the Northwest Coast “privileges are bound to the soil” (Sapir 1915).13

13 A similarly partisan debate has surrounded the topic of Northwest Coast warfare. Helen Codere (a student of Franz Boas’ student, Ruth Benedict) postulated and popularized the long-held view that theoretical tracts which cited and popularized his work (e.g. Vayda 1968; Piddocke 1965; Netting 1986: 27-40).
While, at contact, most Northwest Coast elites derived their initial rights to a privileged social position from family lineage, the elites' hold on power appears to have been, at best, precarious. If elites did not uphold the duties associated with their rank – most notably the maintenance of group wealth and prestige through the potlatch and other forms of socio-economic validation – they could easily lose their ability to influence the people or command the resources of their household or village. The economic wealth and the relative social standing of the entire population of a village or household was shaped by the economic and social successes of the elites who represented them. ‘Commoners’ thus had a vested interest in their own clan leaders' successes at most times and in most contexts (Huelsbeck, 1989).

Northwest Coast warfare was of little or no material significance, a largely ceremonial event with few casualties that served to bolster village prestige. Codere (1950) concluded that the potlatch eclipsed warfare as a means of securing status during the inter-tribal peace of the colonial period. This, however, contradicts the archaeological evidence, which frequently exhibits apparently battle-related injuries on human skeletal remains. While battle-related injuries seem to be present in some 5000 year old sites, it is following a second period of rapid population increases, around 1500 years ago, that evidence of warfare becomes the most pronounced, with the appearance of widespread, battle-related injuries, weapons and such war trophies as skulls among some human burials, and forts and fortifications. Discontinuities in the archaeological record, beginning at this time, indicate that human populations were sometimes replaced by outside invaders at rich resource sites. This evidence all tends to corroborate early European accounts of warfare -- sometimes brutal warfare -- on the Northwest Coast. For a thorough overview of the written accounts and stated causes of Northwest Coast warfare, see Ferguson (1983, 1984) and Swadesh (1948). On evidence of warfare in human skeletal remains, see Cybulski (1994, 1990a) and Curtin (1984). On the antiquity and forms of forts and fortifications, see M. L. Moss and J.M. Erlandson (1992). This warfare underscores the degree to which natural resource sites were coveted commodities prior to European contact. Following the early leads of ethnographer Morris Swadesh, Brian Ferguson demonstrated that the indigenous oral history of Northwest Coast warfare suggests that access to resources was the primary reason for prehistoric wars on the Northwest Coast. By these oral accounts, the objects of this warfare were productive resource sites – estuarine locations with abundant salmon in particular – as well as resource trading routes. Consistently, 19th century consultants suggested that “property disputes [over resource sites] were the principle cause of war” (Mcllwraith 1948, I: 132). Again, it is important to note the interdependence of resources and status on this coast. Both Codere and Ferguson were partially correct: while aggressors may have been motivated by a desire for subsistence or social standing, neither was available without access to and control of an adequate resource base (Coupland 1995). On the forcible displacement of populations during the prehistoric and early historic periods, respectively, see Mitchell (1988) and Taylor and Duff (1956). Codere was correct in her recognition of the increase in ceremonial competitions at the expense of warfare during the colonial period, but this may have had little to do with a Pax Britannica - rather, it was likely the combined results of declining resource pressure and the need for newly ascendant elites to legitimate their positions within the context of the resulting decline in the value of traditionally limited resources. The landscape was modified in a number of ways toward this end. As was the case with totemic art, the trophies of war - enemies heads or entire bodies - were suspended at the entrance to the victor's household, as a mnemonic, oriented toward both household residents and outsiders, a means of advertising the might and the and forcefully taken prerogatives of the household elite. During the colonial period, elaborated totemic carving replaced some of these mnemonic functions.
The status of unfit leaders, while maintaining their titles, could be effectively eclipsed by other elites from the same village or household who could better defend group interests. Without standing militaries or the capacity for forceful internal controls, elites required popular consensus, as well as public complacency regarding their disproportionate control of resource wealth in order to maintain leadership. Thus, in order to maintain and legitimate their authority, chiefs were compelled to demonstrate and redistribute their wealth and prestige to their constituency. The potlatch was therefore not just a means of "banking" resource wealth, but could also be interpreted as a form of "profit sharing" for household resource production. Population growth increased the demands on the resource wealth of elites, likely contributing to greater attempts to produce and control resource wealth, and aiding in further social stratification in those villages where elites were successful (Ames 1995; Croes 1992; Drucker 1983; Adams 1973).

The Intensification of Finite Resource Sites

Between 4000 and 1500 years ago, many factors conspired to change the ways in which the native peoples of the Northwest Coast made a living. Population pressures on finite territorial resources, trade and potlatch exchanges of goods, and the continuous need for elites' legitimization together facilitated attempts to increase the resource output of particular environments within their territories. This was achieved through the creation of a number of "ingenious and complex technologies" (Drucker 1983: 89).

Among the better-known examples of these technologies were the salmon weirs and traps found along the entire coast, made of interwoven lattice-works of wood, staked into the estuarine sediments, or otherwise secured to the bottom or sides of
waterways. Aligned where fish ascended the streams in great numbers – across all or part of the waterway’s channel – these partially-submerged traps and weirs would allow fish to pass in to the trap unharmed, but would bar their exit with flexible stakes, or would ensnare them in labyrinthine baskets. Fish traps made of “V”-shaped or semi-circular rock piles in the mid- to low-intertidal zone of estuaries served to trap fish and shellfish on the outgoing tide. Similarly, woven dipnets allowed the capture of eulachon and other small fish as they entered rivers along the coast. These technological advances appear to have occurred at varying rates along the coast following the emergence of sedentism and levels of social stratification, some time after 3500 b.p.14 Beds of clams and other bivalves were considerably expanded by the removal of stones, and the possible production of silt-trapping rock alignments in the lower intertidal zone of some protected sections of the coast. Together, these resource enhancement strategies greatly improved food-gathering prospects, and likely co-evolved with the growth of sedentary fishing villages along the coast. Furthermore, Northwest Coast oral history is peppered with stories of indigenous’ peoples “transplanting” animals such as clams and salmon smolts from places outside of easy or defensible access to sites near villages, within their own resource territories. As Darryl Forde (1934: 78) noted of Nuu-chah-nulth salmon management,

“if the run on a particular stream began to fail, they actually restocked it, obtaining spawn from another river at the breeding season and carrying it back in moss-lined boxes to start a new generation in the depleted stream.”

14 On the antiquity and distribution of fishing weirs, see Moss, Erlandson, and Stuckenrath (1990) and Eldridge and Acheson (1992). On the design of archaeological stone fish traps in the intertidal zone, see Pomeroy (1976).
Similar accounts of transplanting salmon have been found among late 20th century Nuu-chah-nulth and Coast Salish consultants (Bouchard and Kennedy 1990; Nancy Turner, pers. comm. 1999).

The availability of plant resources was also managed within discrete tribal territories as a means of enhancing plant output. There is new evidence of intensive coastal camas production far outside of the native range of camas by roughly 4000 b.p. (D. Lepofsky, pers. comm. 1998). Moreover, the records of the British Columbia Archaeology Branch suggest that possible rhizome gardens of the sort described in this dissertation appear in close association with major habitation sites which experienced rapid growth (inferred from C14 dating of faunal remains) between 2500 to 2000 b.p. on the central Northwest Coast. The timing of plant cultivation would tentatively suggest that the intensification of plants paralleled or lagged slightly behind the intensification of other resources, and the emergence of largely sedentary settlement patterns approximating those of the “late prehistoric.”15 Presumably, by replicating and enhancing natural conditions which visibly fostered plant growth, such as the use of fire or the modification of estuarine soils to promote the growth of edible plants, the peoples of this coast appear to have developed means of intensifying plant resources. In response to dietary, economic, and ceremonial motives – each inextricable from the others – the peoples of this coast likely developed the cultivation practices that were recorded during the contact period. While each of these motives has been acknowledged in the generation of intensive indigenous strategies of animal resource intensification, scholars have overlooked their role in facilitating the intensive

15 The precise chronology of plant intensification is ambiguous, and will remain so until further concentrated study.
management of particular plants. The remainder of this dissertation seeks to remedy this oversight.
CHAPTER 8
THE ECOLOGY OF ESTUARINE ROOT CULTIVATION

In the practice of estuarine cultivation, the peoples of the Northwest Coast developed an adept, elegant response to the environmental, dietary, and social motives for intensified plant production. Today, the collection of these root vegetables from naturally occurring patches is labor intensive, requiring several days of intense root gathering in order to prepare for a traditional meal for a single extended family.¹ Thus, the spatial concentration of these root foods within gardens appears to have increased total plant output, lessened the time required for foraging, and placed dependable concentrations of estuarine roots within each village or clan's defensible territorial control. But these factors, alone, cannot explain the functions and placement of estuarine gardens.

Rhizomes from sandy sites were reportedly preferred for their size and the ease with which they could be dug.² However, the gardens of the Kwakwaka'wakw, Nuu-chah-nulth and others appear to have often been located on rocky tidal flats, where considerable labor was required to clear glacial rock, maintain the garden surface, create rock barriers, and in some cases create rock barriers. Boas (1934, n.d.) noted that the rockworks that were often built at garden sites lined plot boundaries, though it is unclear whether he suspected that there were additional functions to these walls. While these rock walls did often conform to garden plot boundaries, we must ask why the

¹ I have found this to be true when collecting rhizomes for isotopic testing. See also Lepofsky, Turner and Kuhnlein (1985), Turner and Kuhnlein (1982: 423), Edwards (1979: 6), and Boas (1921: 186-94).
² On the preference for sandy sites, see Turner and Kuhnlein (1982: 415). Garden soils facilitated these characteristics, and such preferences may reflect the difficulty of post-abandonment harvesting.
inhabitants of this coast expended days or weeks of labor to encircle each plot with a stone wall. Why not simply use stakes as markers, as was done in beds of camas, or some low gradient estuarine garden plots, for example?

Based on my year-round (though largely unsystematic) monitoring of known remnant garden sites, I have concluded that the design of these gardens, particularly gardens in which the soil was mounded or reinforced with stone or wooden barriers, reveals many complementary environmental functions. At once, gardens with mounds and stone or wood reinforcements dramatically expanded the cultivatable shoreline, and augmented the nutrient composition, porosity, and fresh water retention of the high marsh soil. While all of these etic outcomes may or may not have been fully understood by the garden builders, consultants’ testimony suggests that they were emically apparent in the form of the increased size of garden plots, the increased size of plants and root segments, and the increased ease of weeding, tilling, and root digging (Adam Dick pers. comm. 1999, 1998; Daisy Sewid-Smith pers comm. 1998).

Ecology of the High Salt Marsh

The ecology of unmodified patches of Potentilla, Trifolium, and other estuarine root vegetables deserves brief attention here. This attention is due because the gardens of Northwest Coast peoples were situated within an ecologically unique position in the estuary. Here, these peoples exploited the peculiar properties of a very narrow band of the upper intertidal zone where, in the terms of Eugene Odum (1974, 1963), the “energy subsidy” from outside sources is particularly high, while the cumulative stresses on these plants are relatively low. This property of the upper salt marsh is vital in understanding why the peoples of the Northwest Coast expended the labor required to
build mounds or elaborate rockwork gardens in high gradient sites. As I will
demonstrate below, these garden plots functioned in ways reminiscent of raised beds
and muck- or floodwater farming techniques identified as diagnostic of intensive
cultivation elsewhere in the Americas. Through the construction of such features, the
peoples of the Northwest Coast harnessed the tremendous biological productivity of the
mid-latitude estuary — one of the world’s most productive ecosystems — in a way that
has had few parallels elsewhere in the world (Thom 1987).

The *Potentilla-Trifolium* zone represents a narrow band of the upper estuary,
sitting high enough to avoid daily inundation by brackish estuarine water, but low
enough to be periodically inundated by peak annual tides and streamflows which occur
during winter, particularly on the southern coast. As a result, the narrow band that
outlines the upper estuary is one of the only places in the entire spruce-hemlock zone
where the overall soil fertility remains quite high. This is especially true of the newly
emergent marsh environments that appear upslope of natural and human-constructed
barriers to flow in the high estuary; these are among the most productive and species-
rich environments along the entire Northwest Coast (Pollock 1995). This is because the
upper estuary is periodically inundated with water, which regularly deposits narrow
bands of detritus in this slow-moving backwater. And importantly, this detritus contains
a wide assortment of organics, including such materials as plankton, bacteria, marine
algae, estuarine eelgrass, animal remains and wastes, and particulate and dissolved
organics from upstream sources. On average, approximately one-quarter of the total

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3 While rainfall is highest in winter, the timing of this process differs, because of meltwater freshets on
waterways originating at elevations with glaciers and significant seasonal snowpack, particularly on the
northern coast. In northern rivers much of the detrital deposition takes place during the spring thaw. The
timing of indigenous cultivation activities appears to have been somewhat different in these places.
organic material that enters the estuaries of the south and central Northwest Coast is redistributed to the upper marsh in the form of detritus (Thom 1981). This occurs most intensively in the fall or early winter, when there is a die-off of estuarine plants and animals, and materials are uprooted and transported to the high tide line by floodwaters and heavier wave action. The region's high rainfall tends to dilute the salinity of this estuarine margin just enough to allow the entrance of terrestrial decomposers, such as earthworms. Still, salinity periodically rises high enough throughout the upper marsh to eliminate most terrestrial plants, and thus the forest canopy is kept at bay (Ranwell 1972). The bulk of the region's terrestrial and marsh vegetation must contend with leached soils, usually containing only very low levels of nitrogen and phosphorous (and in most cases have lost a number of trace elements such as calcium due to leaching). However, the plants of the upper estuary benefit from the nitrogen-fixing bacteria on the accumulated and decomposing roots of marsh plants and the binding of phosphorous to the estuarine detritus and sediments which amass there (Wissmar 1986). Plants and sediments in places with reduced stream velocities, most notably the backwaters of the upper estuary, thus tend to serve as nutrient sinks, capturing and storing the estuary's organic output (Howes and Teal 1995; Odum 1974). The main obstacle to the productivity of Potentilla, Trifolium, and other estuarine root vegetables in this narrow band, then, is the presence of rocks and competing salt marsh plants (which were regularly removed from garden sites by the region's indigenous inhabitants). However, the abundant detrital input and the absence of salt-intolerant competitors are not the only reasons for the high productivity within the infrequently inundated Potentilla-Trifolium zone. In addition, this zone exceeds the productivity of salt marsh zones lower in the
tidal column because regular tidal inundation requires plants to devote energy to osmotic regulation and related metabolic functions in response to abrupt shifts in temperature, salinity, and moisture within these lower-elevation zones (Thom 1981; Eilers 1975).

As a result of these many factors, the narrow *Potentilla-Trifolium* zone is the most productive portion of the entire salt marsh, and indeed, is one of the most productive environments on the entire Northwest Coast. While the plants of the lower marsh (such as *Triglochin maritimum*) produce less than ½ pound of biomass per square yard per year, the *Potentilla-Trifolium* zone, under natural conditions, produces between 5 and 5 ½ pounds of biomass per square yard per year. This proportional relationship emerges consistently in repeated trials on the southern Northwest Coast (Eilers 1975; Hoffnagle and Olson 1974).

**Rockworks, Mounds, and the Expansion of the Upper Marsh**

The distribution of salt marsh environments in which *Potentilla, Trifolium*, and other estuarine root vegetables can grow, however, is very limited. Salt marshes occur only in discrete environments, where low gradient shorelines are accompanied by “low-energy coastlines,” coastlines that are protected from the heavy wave action characteristic of most of the region’s ocean coast. The glacial topography of the Northwest Coast, from the State of Washington northward to southeast Alaska, further complicates this pattern. Here, true salt marsh vegetation may occur only in small patches of a few square meters, at the mouths of small streams and rivulets separated by kilometers of steep shorelines, where sheer fjord slopes plunge, vertical and uninterrupted, into the water without a discernible break in slope.
More importantly, however, the natural range of the *Potentilla-Trifolium* zone is very limited within the salt marsh, and it is perhaps the most spatially restricted range of any plant community in the Northwest Coast salt marsh (Jefferson 1973; Table 2). Like most other intertidal organisms, the upper and lower limits of these plants’ ranges in the tidal column are defined by their limited tolerance for salt and submersion, as well as their competition with other species in adjacent tidal zones. Generally, the lower range of these two plants is defined by their inability to sustain regular submersion, particularly in saline water. Their upper range is defined largely by their inability to compete for sunlight with the taller plants clustered just upslope, where an almost uninterrupted absence of tidal inundation allows the dense clustering of terrestrial species, maximizing access to the sunlight of the salt marsh edge. The result is that the *Potentilla-Trifolium* zone, under natural conditions, represents a narrow band stretching discontinuously across the upper marsh, running roughly parallel to the peak waterline. Accordingly, some authors (e.g. Akins and Jefferson 1973) classify these two plants not as “high salt marsh” plants, but as “transitional zone” plants, which occupy only a thin band along the fringes of the high marsh where tidal inundation is infrequent, while detritus input is high. These two plants, however, are capable of dramatically expanding their narrow range following physical disturbances that alter patterns of saltwater inundation or in any way hamper the growth of their competitors. For this reason, *Potentilla*, in particular, has become one of the most prevalent plants on the diked tidelands of the southern Northwest Coast during the 20th century, expanding rapidly into the silted-up freshwater flats (with mildly saline soils) that develop behind these dikes (Johannesen 1961).
Table 2:
Potential Distribution of Certain Northwest Coast Salt Marsh Plants within the Tidal Column

Marked Plants Represent those Plants Encountered in Northwest Coast Rhizome Gardens

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>ELEVATION ABOVE BASE TIDAL LEVEL, IN FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zostera marina</td>
<td>4</td>
</tr>
<tr>
<td>Ulva linza</td>
<td>5</td>
</tr>
<tr>
<td>Cladophora gracilis</td>
<td>6</td>
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<tr>
<td>Fucus distichus</td>
<td>7</td>
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<tr>
<td>Scirpus validus</td>
<td>8</td>
</tr>
<tr>
<td>Enteromorpha compressa</td>
<td>9</td>
</tr>
<tr>
<td>Scirpus americanus</td>
<td>10</td>
</tr>
<tr>
<td>Spergularia marina</td>
<td>11</td>
</tr>
<tr>
<td>Carex Lyngbyei</td>
<td></td>
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<tr>
<td>Ruppia maritima</td>
<td></td>
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<tr>
<td>Enteromorpha intestinalis</td>
<td></td>
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<tr>
<td>Scirpus maritimus</td>
<td></td>
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<tr>
<td>Cyanophyta spp.</td>
<td></td>
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<tr>
<td>Eleocharis parvula</td>
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<tr>
<td>Jaumea carnosa</td>
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<tr>
<td>Salicornia virginica</td>
<td></td>
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<tr>
<td>Lilaeopsis occidentalis</td>
<td></td>
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<tr>
<td>Triglochim maritimum</td>
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<tr>
<td>Cotula coronopfolia</td>
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<tr>
<td>Distichlis spicata</td>
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<td>Desempsia caespitosa</td>
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<tr>
<td>Scirpus cernuus</td>
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<td>Agrostis alba</td>
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<tr>
<td>Atriplex patula</td>
<td></td>
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<tr>
<td>Juncus gerardii</td>
<td></td>
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<tr>
<td>Juncus lesueurii</td>
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<tr>
<td>Grindelia integrifolia</td>
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<tr>
<td>* Glaux maritima</td>
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<tr>
<td>Hordeum brachyantherum</td>
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<td>Plantago maritima</td>
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<td>Cordylanthus maritimus</td>
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<tr>
<td>* Potentilla anserina ssp. pacifica</td>
<td></td>
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<tr>
<td>Picea stichensis</td>
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<tr>
<td>Rumex maritimus</td>
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<tr>
<td>Heracleum lanatum</td>
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<tr>
<td>Achillea millefolium</td>
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Adapted from Jefferson (1974)
The construction of rockworks in the middle to upper intertidal zone of high gradient tidal marshes served to expand this narrow, naturally occurring *Potentilla-Trifolium* band (see Figures 4a and 4b). In archaeological cases, the tops (remnant or inferred) of garden rockwork walls are at the same elevation as the *Potentilla-Trifolium* zone. This point can be confirmed by simply observing level lines-of-sight across the tops of garden walls, which consistently align with remnant detritus soils and remnant patches of the two plants in the upper intertidal zone. When the intervening space between rock walls and the *Potentilla-Trifolium* zone was filled with mounded silts and detritus, this created a distinctive environment, expanding laterally the low-gradient shoreline at precisely the elevation in the tidal column to which these two plants are uniquely adapted. Rock walls appear to have been shorter (less than 1/3 meter) on comparatively low-gradient shorelines, taller (up to approximately one meter) on the highest-gradient shorelines, but consistently the wall elevation is equal to that of the *Potentilla-Trifolium* zone. (In a few cases, a shorter and apparently older wall is accompanied by a taller wall with a top of equal elevation, but a base that is situated lower in the marsh; this provides archaeological corroboration of the ethnographic claim that gardens were expanded incrementally.) This design allowed a seaward expansion of the narrow *Potentilla-Trifolium* zone into an area once occupied by a host of less culturally valued plants. This effect was augmented considerably by the regular weeding of these plots, eliminating all plants from this enhanced environment but *Potentilla, Trifolium, and other culturally preferred species, which are often unable to compete with other salt marsh plants (see Figures 4a and 4b).
**Idealized Marsh Cross-Section**

**a. Prior to Garden Rockwork Construction**

- **Low Marsh**
  - *Triglochin maritimum*
  - *Carex lyngbei*
  - *Scirpus americanus*
  - *Salicornia virginica*

- **High Marsh**
  - *Plantago maritima*
  - *Carex lyngbei*
  - *Eleocharis spp.*

- **Edible Rhizomes**
  - *Potentilla anserina*
  - *Trifolium wormskjoldii*

- **Transitional Salt-tolerant Meadow**
  - *Deschampsia caespitosa*
  - *Juncus effusus*
  - *Atriplex patula*
  - *Fritillaria camschatcensis*
  - *Agrostis spp.*
  - *Calamagrostis spp.*
  - *Rumex spp.*
  - *Aster spp.*

**b. With Intact Garden Rockwork**

- **Low Marsh**
  - *Triglochin maritimum*

- **Edible Rhizomes**
  - *Potentilla anserina ssp. pacifica*
  - *Trifolium wormskjoldii*

- **Transitional Salt-tolerant Meadow**
  - *Deschampsia caespitosa*
  - *Juncus effusus*
  - *Atriplex patula*
  - *Fritillaria camschatcensis*
  - *Agrostis spp.*
  - *Calamagrostis spp.*
  - *Rumex spp.*
  - *Aster spp.*
Certainly, living on the narrow margins between mountains and saltwater, Northwest Coast peoples were keenly aware of the full range of tidal fluctuations. Travel by foot or by canoe, the acquisition of intertidal foods, and a host of other daily activities had to be coordinated around the regular fluctuations of the tide. This keen sense of tidal fluctuation was reflected in their engineering of fish traps, garden rockworks, canoe skids, and other intertidal features. Further, the languages of this coast had terms for a wide variety of tidal stages, including the extreme monthly and annual tides to which garden rockworks were calibrated, terms which describe these extreme tides in terms of predictable phases of the moon (Suttles 1987: 67-72; Boas 1938: 274; Adam Dick pers. comm.. 1999).

In some cases, garden building through mounding or rockwork construction appears to have resulted in an expansion of pre-existing Potentilla-Trifolium patches to several times the size of that found in the pre-cultivation marsh. In other cases, the creation of rockworks appears to have allowed the expansion of Potentilla, Trifolium, and other root vegetables into shorelines in which these plants had not previously grown. This quality of rockwork gardens is well illustrated by the fact that the areal extent of ethnographically documented Potentilla and Trifolium plots has shrunk considerably after these rock walls have collapsed and their soil has eroded back to what appears to be a pre-cultivation marsh gradient. For example, only a small proportion of the vast tidal flat garden mapped by Boas (shown in Figure 2) still contains any Trifolium or Potentilla. Only those segments that still have standing, remnant rock features contain these plants - elsewhere, collapsed rock features appear to have allowed
the partial erosion of garden plot soils, thus returning significant portions of the garden to below the tidal level at which these plants can survive.

**Rockworks, Mounds, and the Properties of Marsh Soils**

How did the soils accumulate behind these rock walls? Certainly, ethnographic references suggest that soils were sometimes manually mounded and reinforced behind these walls. However, I would suggest that, like the stone fish traps which they resemble, the rockwork estuarine gardens of the Northwest Coast sometimes served to catch something as the water receded, and thus to expand the nutrient-rich high-marsh intertidal zone. The peoples on the Northwest Coast placed their gardens in linear patterns in the intertidal zone; in high-gradient marshes, the upslope end of each garden aligned squarely along this narrow band of high productivity. Further, by constructing mounds and low-level rock works, which slowed and impounded water, they devised settling areas for detritus and sediment. Small dams and interwoven hemlock boughs being placed a short distance downstream from the Nimpkish site for the expressed purpose of trapping floating sediment, according to Boas’ notes (Boas 1966: 35; Boas 1934: 37; Boas 1921: Fig 139). Thus, these rock gardens functioned in a manner reminiscent of other silt trapping, low-intensity agricultural practices indigenous to the Americas, such as the check dams which were constructed to capture water and detritus along streambeds by the indigenous peoples of the desert Southwest (Doolittle 1992; Steward 1930; Bryan 1929). But, appropriately, the gardens of the Northwest Coast were designed in such a way to harness estuarine and marine productivity rather than

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4 The silt dam shown on the channel in Figure 2, like so many others of its type, have been summarily categorized as a 'fish trap' by past archaeological surveyors, despite considerable evidence that challenges this interpretation, including the testimony of Boas' (1934) informants. (British Columbia Archaeology Branch, n.d.).
exclusively terrestrial productivity. Accumulated soils thus “fed the garden” as Adam Dick explained, as it was churned into the soil each successive year. Expanding this narrow zone, with its comparatively high nutrient input and high levels of insolation, this plant management strategy overcame the dual limitations of low soil fertility and dense forest canopy structure, which inhibit the growth of edible, herbaceous plants along the entire coast.

The product of these estuarine gardens was consistently – by several orders of magnitude in some cases – a more nutrient-rich organic soil than one could find anywhere on dry land in the spruce-hemlock zone. These soils possess a nutrient balance approaching that of a contemporary, fertilized greenhouse potting soil. With the assistance of A&L Agricultural Laboratories, mean nutrient composition of soils taken at rooting depth at natural and remnant impoundments were tested at seven rhizome garden sites on the southern Northwest Coast, visited in the course of archaeological reconnaissance. While results varied widely, mean figures for marsh sites with impoundments or naturally abundant accumulations of detritus registered at over twice the level of available nitrogen and phosphorus found in randomly chosen estuarine sites sediments. Calcium and other trace elements are also abundant in these soils at levels that far exceeded surrounding terrestrial soils, while only magnesium, potassium and sodium were found to be available in comparable levels between soils on sites with and without impoundments.

Sodium levels are high in this combined sample (though not so high as to prohibit the growth of Potentilla, Trifolium, and other estuarine root vegetables), as all

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5 The high levels of nitrogen in these plots reflects in part the nitrogen-fixing properties of clover. Growing within these plots alongside other estuarine plants, clover likely enhanced total garden output.
samples were taken shortly after the wintertime peak of tidal inundation, but salinity declined rapidly throughout the winter season. Before the spring sprouting of *Potentilla, Trifolium,* and other estuarine root vegetables, between approximately 90 and 250 cm of rain fell on the various sites from which samples were taken, while there were few if any tidal inundations of these sites. Generally, salinity was reduced by the design of these mounded or reinforced garden sites. By raising rhizome beds to a uniform, peak-tide level, mounds and rockworks served not only to catch detritus and to raise *Potentilla, Trifolium,* and other estuarine root vegetables of the high intertidal zone to the level at which they grow best; they also served to exclude the inundation of gardens with salt water during the peak growing season, when such inundation would inhibit plant growth.

Moreover, the porous structure of the organic soils in garden sites also facilitated more prolific rhizome growth than is possible in the denser mineral soils of the unmodified salt marsh. As a result, I have found that the detrital soils found in experimental tended gardens produced by Adam Dick can be worked with one’s fingers, while the soils of the remainder of the marsh – with a relatively high content of rocks, sand, and matted roots – are often very difficult to work, even with steel tools. This porosity has a number of important implications: not only does it dramatically simplify weeding as well as rootlet transplanting and digging, but it enhanced overall rhizome output. Dense soils provide a severe mechanical obstacle to rhizome growth, limiting the size of the entire plant: rhizomes from rocky soils are notably small and gnarled, a point mentioned by both mythic accounts and 20th century ethnographic consultants.
alike (Turner and Kuhnlein 1982: McIlwraith 1948, I:537). In contrast, plants that
grow in dense accumulations of detritus tend to have considerably larger, straighter
rhizomes than plants growing under other conditions. This facilitated the growth of the
larger rhizomes that were actively sought by the peoples of the coast as a source of food,
as a trade good, and as a form of tribute to clan chiefs. The ease with which the high
marsh soil was churned with digging sticks also aerated, and infused detritus into soil,
replacing nutrients removed with the previous year’s crop.

The churned soils, mounds, and rockworks of estuarine gardens did serve as
hydrological devices of yet a different sort, however. With their porous organic soils,
and their common placement near rivulets, seeps, and small streams, these gardens also
enhanced freshwater retention. This may seem a strange point for those accustomed to
thinking of the region as a place of incessant cold and rainy weather. Yet, the fact
remains that the Aleutian Low Pressure Zone gives way to the Pacific High Pressure
Zone in the summertime along much of the Northwest Coast, bringing long periods of
rainless weather, which can last up to four months. While portions of the Northwest
Coast strand experiences up to 600 cm of rain annually, much of this falls during the
winter, with roughly 90% of precipitation on the southern Northwest Coast falling
between late fall and early spring. For deciduous trees and herbaceous plants, however,
this time of heavy rainfall is spent in winter dormancy. Such plants require an ample
supply of moisture during the spring and summer, during their period of peak biomass
accumulation. Unlike most other temperate forests zones of the world, the Northwest
Coast’s long and uninterrupted drought periods are sufficient to eliminate most

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6 As mentioned above, gnarled rhizomes from rocky soils brought supernatural misfortune in Northwest
Coast oral traditions; rituals were prescribed for those who encountered them (McIlwraith 1948, I: 537).

178

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deciduous trees, and restricts the number of non-riparian herbaceous plants (Waring and Franklin 1979). Without access to a fresh water source, specimens of *Potentilla* and *Trifolium* can both exhibit mild desiccation during the summer months, and under such circumstances, both plants will remain far below their maximum potential size. Stream mouth patches of these plants contain larger plants than are found in patches without adjacent freshwater under natural conditions, all else being equal. Remnant rockwork gardens appear to contribute moisture both by impeding the flow of very small, freshwater rivulets, and by accumulating or retaining spongy, porous organic soils which absorb water and resist soil water evaporation much more effectively than nearby mineral soils. It is important to note, too, that these gardens had the added advantage of an extended ‘harvest’ season compared to other terrestrial plant harvest sites. Even as frosts killed the herbaceous vegetation of the region, the low elevation and the partial inundation of garden areas by winter floodwaters and peak tides assured that root gardens remained largely frost-free.

With anomalously high nutrient levels, soil porosity, and fresh water retention (none of which were commonly found in such combinations in the unmodified upper marsh), there are few obstacles to realizing the genotype’s maximum potential rhizome output. The product of these practices was a crop of rapidly growing starchy rhizomes, up to roughly triple the size of naturally occurring plants elsewhere in the marsh (if the plants at remnant gardens are any indication). Further, *Potentilla* and *Trifolium* rhizomes were demonstrably more nutritious than the potato, which replaced these
estuarine foods following European colonization.7 This level of productivity would have been particularly valuable as the village populations of the “late prehistoric” reached unprecedented peaks, and demographic, economic, and ceremonial demands on these plants increased accordingly.

And importantly, as discussed before, linguistic evidence corroborates this interpretation of garden sites as intentionally modified environments. In Kwak’wala, locations with abundant edible roots that were uncultivated but still used were termed “ts’o’yadi” or “having root digging.” As discussed in chapter 5, Kwakwaka’wakw gardens were termed “logs [manually] laid crosswise” and “t’aki’lakw” a semantically distinct term translating roughly to “[place of] human-manufactured soil,” suggesting some awareness, among the Kwakwaka’wakw, at least, of the ecological functions of estuarine garden mounds and rockworks discussed here (Boas 1934).

These gardens may have served as precursors to the practice of planting camas and, ultimately, potatoes within rotting piles of detritus, a practice found during the contact period on this coast (Suttles 1951b). This practice has paralleled by Haida and Tlingit planting of tobacco in organic debris (Turner and Taylor 1972). As with the rhizome gardens, this cultivation technique enhanced the productivity of transplanted plants, and may have been necessary to maintain the output of camas, in particular, on some terrestrial sites with particularly leached soils on the outer coast. In this light, it is particularly ironic that the cultivation of tobacco and, to a lesser extent, camas, have

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7 For nutritional analyses of these two plants, see H.V. Kuhnlein et al. (1982). This parallels developments in other parts of the Americas, wherein crops introduced by Europeans were of lower nutritional value than endemic crops; the replacement of amaranth with wheat provides one case in point.
been represented as the sole forms of cultivation on this coast, and as wholly anomalous forms of plant management within the region.

The design of these rockwork and mounded gardens does not provide any easy answers to the question of the origins of these gardening practices. Certainly, there are analogous wetland gardens containing raised beds around the Pacific and throughout much of the Americas. Though the estuarine gardens of the Northwest Coast are somewhat distinctive, it is not impossible that the concept of wetland gardening diffused to this coast from outside of the region. However, it is equally (or more) likely that the practice originally developed through the observation and enhancement of natural impoundments which enhanced the productivity of estuarine roots. Like wetland gardens elsewhere in the world, the functions of these root gardens were, in the terms of Mathewson (1985), “physiomimetic,” replicating and enhancing certain naturally occurring environmental features within the region. The technological developments that led to estuarine gardening would have easily emerged in situ, among indigenous peoples who regularly observed and exploited naturally occurring root grounds.

Regardless, it seems clear that through the construction of gardens, the peoples of this coast were able to expand the cultivatable shoreline, and augmented the nutrient composition, porosity, and fresh water retention of the high marsh soil. These might be termed “etic” outcomes of people acting over long periods of time in response to emically-apparent dietary, economic, and ceremonial motives to increase rhizome production. In turn, these practices allowed the peoples of the Northwest Coast to enhance the size of estuarine garden plots, the size of plants and edible roots, and the ease of plot weeding and root digging.
CHAPTER 9

ESTUARINE GARDEN SITES IN ARCHAEOLOGICAL CONTEXTS

As inheritors of the Northwest Coast ethnographic record, archaeologists working in this region have tended to accept the ethnographic assumption that “Northwest Coast peoples did not rely heavily on plant foods” (Huelsbeck 1988: 166). As a result, archaeological research strategies have seldom been designed in a manner that would illuminate plant use or plant management practices, even at well-preserved, water saturated sites. Archaeologists have almost never sought evidence of estuarine root gardening. Indeed, only one publication from the region’s “gray literature” reports on efforts to locate evidence of an ethnographically documented garden site, and its findings were inconclusive (Provenance Research Inc. 1984: 40-41). Even if rhizome gardens had been an enduring topic of archaeological inquiry, comparatively little evidence of gardens would be expected on the turbulent coastal margins where these gardens were situated. Moreover, plants are poorly preserved in archaeological sites on the Northwest Coast, with its almost uniformly acidic soils and heavy precipitation, though seeds, stems, “potentially edible starchy tissue,” and other plant fragments do sometimes appear in well-preserved archaeological contexts (Gill 1983).

Moreover, garden sites on low gradient deltaic marshes, constructed without the use of rock walls or barriers, prove particularly difficult to detect. Little physical evidence persists at these sites, even after comparatively brief periods of abandonment.

1 Field visits to this site, at the mouth of the Nimpkish River, lead me to the conclusion that the consulting archaeologists conducting this study very likely were surveying in an incorrect portion of the salt marsh for the garden as reported by Boas (1934).
Adam Dick (pers comm. 1998) describes returning, five or six decades later, to the places he gardened with his grandmother as a child:

"you don’t see [the garden plots] anymore. It’s all overgrown with those tall grasses in the flats, and all that. [You] see, it’s never been looked after… The last time I was there, I took a funeral party up there, and I told my son “Let’s stop by there where we used to dig kwani and all, dliksam and texwsus.” And there’s nothing there… You can’t even see it… You don’t see them anymore, because I guess it’s just like any other garden. If it’s not looked after it’s overgrown. You know, all that with weeds.”

During low-level airplane flights over low-gradient deltaic sites in the Kwakwaka'wakw territories, in places where post-abandonment disturbances have been few, I have occasionally detected hints of geometric patterning in the remnant salt marsh vegetation. These geometric outlines conform to ethnographic patterns of garden plot subdivisions, but would not be readily apparent from casual ground-level inspection. Such patterning may be due to vegetation and soil modifications associated with longstanding gardening activity, and may be detectable through a future analysis of soil properties. This remains unproven, however, pending further investigation. As shall be discussed later, deltaic garden sites may possess other properties, such as distinctive biota or geomorphological characteristics that may be viewed as diagnostic of long-term human modification.

The rockwork sites characteristic of higher-gradient shorelines, however, prove considerably more detectable on the basis of ground-level site surveys, and it is these features that I actively sought out for more thorough analysis in the course of my dissertation research. Ironically, those few garden sites with rockworks that have been investigated by archaeologists have been classified automatically and almost invariably as stone fish traps, on the basis of their stone impoundment structures. These rockworks
are classified as fish traps despite considerable evidence to the contrary. In order for a stone fish trap impoundment to function, it must be placed low in the intertidal zone, with the top of the walls placed at or below the mean tidal level, so that fish become trapped during high tides, and can be gathered during low tides. For garden rockworks to function, as described in the preceding chapters, it must be placed meters higher in the tidal column. Garden walls are of distinctive design, placed in the highest part of the tidal zone, with the tops of rock walls at or above mean high high water, and level with naturally occurring patches of Potentilla, Trifolium, and other upper estuary plants.

Here, sitting entirely beyond the range of the daily tides, gardens can expand the Potentilla-Trifolium zone, trap detritus, and provide the desalinization effects of the rains through much of the year.

Accordingly, an analysis of the entire database of intertidal rock features available from the British Columbia Archaeology Branch, conducted for this dissertation, reveals certain distinct categories of intertidal rockworks. Some are unambiguously fish traps, creating ponds at low tide or funneling fish into narrow enclosures once occupied by perishable basket or weir traps; all of these features sit low in the tidal column. There is a somewhat smaller number of rockworks with anomalous designs. Several of the rockworks in this second category consist of terraces or complexes of ovals, sometimes subdivided by linear walls into smaller plots; these features sit very high in the tidal column and are surrounded or partially submerged by sediments and rhizomatous plants.²

² Only a handful of large-scale systematic surveys of intertidal archaeological features have been carried out in British Columbia, in such locations as Clayoquot Sound and the Heiltsuk territories of the central mainland coast. In every one of these systematic surveys, archaeologists have identified several anomalous high intertidal rockworks of the sort described here.
As knowledge of garden construction has not been widespread among archaeologists working in the region, few have recognized the potential function of these anomalous rock features as garden rockworks. The British Columbia Archaeology Branch archives abound with comments by researchers who are unable to explain the presence of anomalous high-intertidal rockworks, as it is apparent to them that fish could not be caught behind their rock walls. Encountering high-elevation, intertidal rock enclosures (often surrounding \textit{Potentilla} patches) every few kilometers along the shores of Clayoquot Sound, archaeologists are at a loss: “the function of a fish trap is assumed for want of a better explanation” (Mackie and Martin 1982). Noting that these traps could not catch salmon, and finding herring eggs elsewhere in the Sound, they suggest that the traps might have caught herring (though, of course, these features sit well beyond the range of herring too). Elsewhere, archaeologists are puzzled to find several inexplicable “series of rockworks connecting together to form a series of horizontal terraces in the upper intertidal zone” dotting the coastline of the mainland coast of central British Columbia, each full of soil and high-marsh plants. Their conclusion: each of these features is a fish trap, though it is entirely “unclear how it functioned or what its actual purpose was” (Hallett et al. 1990). Occasionally, archaeologists have resorted to even more tenuous speculation in these reports, suggesting that vast, elaborate rock features with subdivided plots were natural features, or were built by historic loggers for reasons that can only be imagined (e.g. Marshall and Lyons 1989; Carlson and Hobler 1976). Only in one previous B.C. Archaeology Branch report, conducted by a team of accomplished central coast archaeologists, does one find an interpretation of a rockwork as a soil modification device. At a high intertidal site, Pomeroy et al. (1977) note a
particular rockwork "which caps a natural contour bank on the stream's margin and may have served as a silt dam." Though this represents a likely garden site, there is no mention of "gardens" in their report. A few terrace-like structures have also been recorded as "agricultural features" in southeast Alaska and on Haida Gwaii (the "Queen Charlotte Islands"), but scholars have assumed that these were constructed during the early historic period. On the basis of this assumption, these features have not been subjected to absolute dating methods (Steve Acheson pers. comm. 1997; deLaguna 1960).

Incidentally, several rockworks were identified in the course of fieldwork for this dissertation that clearly did not function either as fish traps or as garden rockworks. Their functions seem apparent, however, on the basis of ethnographic documents and field observation. Some high intertidal rockworks represent defensive or lookout sites; others have served as prayer seats or for other ceremonial functions. These rockworks sit just above the tidal column, like garden rockworks, but are comparatively quite small and are not adjacent to salt marsh vegetation. Other rock walls, lower in the tidal column, appear to encircle clam beds, reflecting an ethnographically documented tradition of clam bed maintenance wherein rocks were removed to the periphery to expand finite, productive mud or sand flats (Bouchard and Kennedy 1990). Here too, many of these anomalous rockworks have been documented as fish traps in past archaeological surveys, despite obvious structural incompatibilities, due in part to an absence of ethnographic data.

Despite the obvious inappropriateness of many of these diverse rockwork sites as fish traps, the erroneous assumptions of field surveyors have become encoded in the
official records of the British Columbia Archaeology Branch database. This official
data, interpreting these sites as fish traps, have been incorporated in turn into analyses of
fish trap distribution in such published studies as Moss et al. (1990) and Eldridge and
Acheson (1992). Still, there has been growing, informal speculation among
anthropologists and archaeologists that clearly “many of these rockworks were used for
some purpose other than to catch fish” (Sandra Peacock, pers. comm. 1997). Few
scholars have stated as much in print, however.

The Destruction and Preservation of Garden Rockworks

In order to set the stage for the archaeological survey data that follows, I first
summarize the many factors have contributed to the destruction of rockwork sites.
Human disruptions of these sites have included the scavenging of rock for alternative
functions, such as the production of new rhizome plot boundary markers during the
‘disintensified’ rhizome exploitation of the colonial period. Artifact hunters are
rumored to have disassembled sections of some of the more impressive rock walls,
under the erroneous assumption that these walls might contain artifacts. Rumors in the
British Columbia backcountry (from both white and First Nations informants) suggest
that whites may have destroyed some undocumented rock intertidal features as a means
of circumventing contemporary indigenous land claims on former resource sites. Also,
during the mid- to late-20th century, British Columbia fisheries officials concluded that
abandoned fish traps might be continuing to catch fish, contributing to the decline of
salmon runs on many of the Province’s rivers; they hired teams to travel the coastline,
breaking holes in stone fish traps so that salmon might be able to escape (Steve
Acheson, pers. comm. 1997). As these teams interpreted all intertidal rockworks as
potential fish traps, all intertidal rockworks were targeted for breaching, and many rockwork walls visible today are punctured by a hole of toppled rock, whether they appear to have originally served as fish traps, clam bed enclosures, or garden walls.

The most severe human disturbances, however, appear to have been in the form of largely unintentional, mechanical destruction of rhizome garden sites. The absence of level land on the rugged glacial coastline of the Northwest Coast has resulted in a high demand for level sites, and salt marsh flats are among the few level sites to be found along much of the Coast. In areas that have been resettled by Euro-Canadians, almost all rock features have been toppled, and are often covered with rock and soil fill or covered by waterfront development. On several occasions when working along segments of the Coast that had been subject to industrial logging, I found log dumps and log loading depots where my archival sources had indicated a garden site. Historic logging operations have taken an additional toll on some garden rockworks, as logs often appear to have been dragged over rock walls to the water, or floated in rafts which bob and careen against exterior rockwork walls during high tide in the often turbulent inlet waters. In such cases, one often sees only an irregular outline of rock following the original wall face, and a beach littered upslope and downslope with scattered cobbles.

Several environmental factors have contributed to the destruction of archaeological rock walls on the Northwest Coast as well. At the tidal flats occupying mouths of large streams and rivers, the erosive action associated with recurring floods and freshets has destroyed many rock walls in the time since abandonment. Indeed, walls recorded early in the century (such as the Nimpkish River flats shown in Boas 1934) would not be detectable to the eye of an untrained observer, as they have
collapsed in several locations, and been buried by fresh sediment in others. Stray logs
from logging operations have drifted into the upper marsh of some sites, lifted and
rocked by peak tides during severe storms when the water is high and turbulent,
sometimes damaging rock walls. Further, indigenous consultants sometimes note that
the tsunami following the Alaska earthquake of 1964 resulted in the damaging of rock
walls, both puncturing walls, and knocking stones from their tops (thereby shortening
these structures). It is likely that other tsunamis that have occurred in recent centuries
have also damaged these sites. Moreover, bears commonly scavenge rocky beaches for
crabs and other edible organisms by flipping over rocks, and I witnessed more than one
reported garden site having its stones repeatedly turned by bears; similar observations
were made at other garden sites by my ethnographic consultants. Together, these
natural factors indicate that garden maintenance must have required constant vigilance
to maintain intact rockworks, boundary markers, and the like. Without the enduring
presence of individuals who maintain garden rockworks, such damage has not been
repaired. For this reason, there are very few rockworks in any level of the tidal column
today that do not exhibit some form of damage severe enough to undermine their
original subsistence functions.

Cumulatively, within many garden sites, these processes have allowed the
substantial erosion of anthropogenic soils. On low gradient beaches, the seaward sides
of garden sites tend to exhibit deep erosional gullies, downcutting through the silts and
organic soils underlying a level, high marsh surface at the Potentilla-Trifolium level of
the tidal column (see Figure 5a). Frequently, on high gradient beaches, much of the soil
has eroded away, leaving only small, remnant patches of texturally diverse soil,
Damaged Garden Rockworks

a. Low Gradient Shoreline

- Fucus spp.
- Triglochin maritimum
- Carex lyngbei
- Eleocharis spp.
- Potentilla anserina ssp. pacifica
- Trifolium wormskjoldii

b. High Gradient Shoreline

- Carex lyngbei
- Triglochin maritimum
- Potentilla anserina ssp. pacifica
- Trifolium wormskjoldii
containing *Potentilla* and *Trifolium*, on its upslope margins, and pockets of remnant soils against the rock walls' upslope face (see Figure 5b). Such sites are suggestive, as they lend tentative support to the contention that there have been little or no marsh soil on the site prior to human intervention. These appear to have truly been "places of manufactured soil."

Fortunately for the purposes of archaeological analysis, many remote sections of the British Columbia coast, far from the centers of European resettlement, still have fragmentary rockworks. Further, the central coast of British Columbia appears to have had a comparatively stable sea level for the last 1000 years, despite some minor tectonic deformation (Duff 1981; Pomeroy 1976; Retherford 1970). This considerably simplifies the analysis of rockwork functions, as almost all rock features were constructed at roughly the same elevation in the tidal column in which they now sit.

**Archaeological Surveys**

In order to lend additional support to my claim that the peoples of the Northwest Coast were "cultivators" prior to European contact, I attempted to systematically investigate the archaeological evidence of rhizome cultivation. This investigation involved systematic surveys of discrete sampling areas on the west coast of Vancouver Island. In the course of these surveys, I conducted visual surveys for surface stone features, and recorded the locations of all remnant rockworks encountered that were consistent with ethnographic descriptions of garden sites. I also took photographs and produced sketch maps of identified rock features. While stone features were not expected in association with all former garden sites, they do provide one of the few
archaeological traces of cultivation that would be apparent in the course of rapid
archaeological reconnaissance.

The survey sampling methods employed in this investigation were designed to
achieve several distinct objectives. I sought to provide some insight into the number,
distribution, and density of archaeologically detectable garden sites. In turn, I hoped that
this information might provide a general sense of the scale and number of such garden
sites per pre-contact village, and therefore might allow some inference of per-capita
rates of rhizome production prior to European contact. Further, systematic survey
information was sought to allow the tentative modeling of garden distribution in
territories outside of the survey areas. I also hoped to generate some general statements
regarding the design of such features and their relationship to local biophysical
conditions. Taken together, the data gathered in the course of my field surveys was to
provide some hint of the relative veracity of ethnographic, oral, and archaeological
literatures in light of the full range of sites that are apparent in the field. On the basis of
these data, I hoped to infer the origins and forms of bias inherent in each data source.
Perhaps most importantly, these reconnaissance surveys served to locate former
cultivated sites that were in sufficiently preserved condition that they might allow
further archaeological examination and dating.

In the summers of 1997, 1998, and 1999, I conducted systematic surveys of the
costline in the three study areas, in order to locate garden sites with well-preserved
remnant rock features. These three sampling areas — within Quatsino Sound, Nootka
Sound, and Clayoquot Sound — were located within the traditional territories of the
Kwakwaka'wakw and the Nuu-chah-nulth. All three sampling areas are located on the
west coast of Vancouver Island. All surveys were conducted by boat, as few roads were available in any of the surveyed areas. In each sampling area, I sought to visit those locations that possessed biophysical characteristics that would have been conducive to garden construction, particularly low-gradient shoreline areas of greater than 100 meters square, containing some salt marsh vegetation. As a comprehensive survey of all possible garden sites would be prohibitively time-consuming, I instead attempted to visit a predetermined proportion of those sites that fit these biophysical criteria within each survey area, from which total predicted garden site densities could be inferred. The locations of these surveyed marshes were randomly chosen. Each of these surveyed salt marsh areas is spatially discrete within the sheer glacial terrain of western Vancouver Island, and generally no larger than a hectare. Therefore, a comprehensive visual survey of surface features within each surveyed site was possible within the available time, seldom requiring more than 30 minutes. In larger marsh sites, I walked linear transects at four meter intervals to provide adequate, controlled coverage.

The three survey areas were selected in part because they represented areas that had not been widely reoccupied by Euro-Canadians during the colonial period, and therefore comparatively few garden sites were damaged by historic era human disturbances. I also chose these three study areas, in part, because particularly detailed information regarding the location and use of rhizome gardens was available for each, through both documentary and ethnographic sources. Thus, these surveys were informed by data on garden site location recovered through the oral testimony of elders and from written sources on traditional land use sites, including Galois (1994), Bouchard and Kennedy (1990), Boas (1934), McKenna-McBride Royal Commission (1913-16), and
Dawson (1887b). Further, my surveys included several locations where anomalous, high-intertidal rockworks, consistent with the ethnographic descriptions of garden rockworks, had been documented in archaeological reports and recorded in the comprehensive databases of the British Columbia Archaeology Branch in Victoria.  

Prior to these surveys, this database had already led me to rock features with diagnostic garden characteristics (Deur 1998). In subsequent ethnographic inquiries, I was able to confirm that some of the anomalous features identified in this database did, in fact, outline former gardens.

In the course of this survey research, I ultimately encountered several garden sites and probable garden sites, representing considerable diversity in their design and degrees of preservation. In an effort to systemically document the presence of rockworks that conform to ethnographically documented garden designs, I used specific criteria for the designation of rockworks as "garden features." Rock features were designated as conforming to the diagnostic criteria of garden rockworks if they:

a) were located at a point in the tidal column that is level with or slightly above the mean high high tide line, and level with the visible Potentilla-Trifolium zone;

b) abutted some remnant and texturally amorphous soil, as well as remnant patches of Potentilla or Trifolium;

c) were located in a portion of the shoreline of sufficiently low gradient to allow garden maintenance, and in a manner that the rock barriers could have either expanded adjacent salt marsh areas or demarcated areas within existing salt marshes;

3 These databases are not open to the general public, but were made accessible through the courtesy of the British Columbia Archaeology Branch staff.
d) exhibited structural characteristics, such as subplot divisions, that were incompatible with ethnographically documented fish traps but compatible with known garden site plot layouts, and

e) did not consist solely of rock alignments that could be attributed to any known natural causes, such as sedimentation associated with fluvial action or glacial moraines.

Sites that fit all of these criteria are identified in the survey accounts that follow, and are indicated by an “X” in the “compatible feature” column of the survey data in Appendix 1. In a small number of cases, identified rock features conformed to all of these criteria above except “d” or “e,” either being of unclear function, or exhibiting such fragmentary forms that I could not conclusively determine that they were not the product of natural processes. These features are also discussed in the survey data that follows, and are indicated with a question mark in the “compatible feature” column of the survey data in the Appendix.

Quatsino Sound

Early in the 20th century, when the McKenna-McBride Royal Commission (1913-16) received testimony on the whereabouts of indigenous resource sites, Kwakwaka’wakw informants identified several former “garden” sites on northwestern Vancouver Island, on Quatsino Sound and its tributary waterways on Holberg Inlet. Much of this area was depopulated due to epidemics and relocation, in the period from shortly before, to shortly after European contact. Indeed, much evidence suggests that many of the villages on these inlets were vacated by both Nuu-chah-nulth peoples and the Hoyalas Kwakwaka’wakw in the two centuries before European colonization, due to the diffusion of introduced diseases and warfare with other Kwakwaka’wakw peoples.
Presumably, then, many of the Kwakwaka'wakw peoples who lived in the area in the 19th century – often referred to as the Koskimo, Giopino, and Quatsino peoples – only briefly and sparsely repopulated many portions of these inlets during the “proto-historic” period. Soon thereafter, these peoples relocated to concentrated settlements at Coal Harbour, Winter Harbour, Alert Bay, and elsewhere in the aftermath of colonial occupation in the 19th century (Galois 1994). Accordingly, Boas (1934) reported both a relative paucity of precise information about these inlets among the Kwakwaka'wakw, as well as a smattering of Nuu-chah-nulth placenames still being used in reference to the area. While it is possible that a small number of the “gardens” identified by Kwakwaka'wakw informants in the McKenna-McBride tribunals represent potato gardens, the area was largely unoccupied during the peak of potato cultivation, and it likely that most identified gardens were pre-contact rhizome gardens. This inference is supported, somewhat, by the fact that Boas (1934, 1895a) and Dawson (1887b) identified locations on these inlets which were called “Bi’s” or “[place of] clover gardens.”

The Quatsino Sound area survey was conducted by boat in June of 1997. The survey covered 75 kilometers of shoreline, including areas within both Quatsino Sound and Holberg Inlet (Figure 6). I attempted to visit approximately 2/3rds of those sites that possessed appropriate biophysical conditions for gardens; a total of 18 locations were visited in the course of this survey, representing roughly one surveyed site for

4 My field surveys suggest that Boas misidentified the precise location of some of the clover gardens sites mentioned to him by indigenous consultants.
Figure 6: Quatsino Sound Archaeological Survey Areas
every 4.17 kilometers of shoreline. Of these 18 locations, 10 were reported to have had "gardens," in Galois (1994), Boas (1934), McKenna-McBride Royal Commission (1913-16) and Dawson (1887b); in most of these cases, the documentary record simply mentions the presence of "Indian cultivation" or "Indian gardens" and it is unclear what plants were grown in these sites. Only one of these 18 locations, EdSw4, at the mouth of Hathaway Creek, was reported to have anomalous rockworks in the B.C. Archaeology Branch Database.

In the course of the Quatsino Sound surveys, a total of two locations were determined to fit the diagnostic criteria of garden sites: the previously recorded site at EdSw4, and small fragmentary rock alignments, with possible wooden stakes, at the site recorded as "Bi's" or "clover garden" by Boas (1934, 1895a) and Dawson (1887b). No known ethnographic information confirms the role of the former site as a garden, while clearly, the latter site is a well-documented rhizome garden. Soil preservation was poor at both sites immediately adjacent to these rock features, though large flat marsh areas sit adjacent to both. If the two confirmed sites are gardens, this represents a detectable archaeological site density of one site per every 37.5 kilometers (or every 25 kilometers, if one accounts for the probabilistic sampling of 2/3rds of all possible sites). If all four are accepted as garden sites, this raises the site density to one site every 18.75 kilometers (or every 12.5 kilometers, if one accounts for the probabilistic sampling of 2/3rds of all possible sites).

Of the two probable garden rockworks encountered, the best-preserved example identified was at EdSw4 (see Figure 7). In an archaeological survey report on the Quatsino Sound area, Carlson and Hobler (1976) mentioned the rock alignments at this
Figure 7: Hathaway Creek Tidal Flats, EdSw4
site, located on the tidal flats where Hathaway Creek enter Holberg Inlet. Carlson and Hobler (1976) identify a former village site at this creek mouth, which is still detectable on the basis of disturbed vegetation, and this site has all of the topographic characteristics appropriate to a village location. There is, however, no historical record of a village at this site, and it is probable that this village was abandoned well before European arrival on these waterways (Galois 1994).

The rockwork on this site is large, very similar in scale and plot configuration to multi-family gardens described ethnographically, and those mapped by Boas (1934) on the Nimpkish River tidal flats. However, unlike the Nimpkish garden rockworks, which are clustered together on the high point of an intertidal island, the rockworks at EdSw4 are strung along the high intertidal zone of an east-facing beach in a linear pattern, a little over \( \frac{1}{4} \) km in length. Like the Nimpkish garden rockworks, these rockworks' fragmentary form reveals an elaborate pattern of converging crescents and ovals, each subdivided by straight walls, which are sometimes met at right angles by secondary straight walls. Rocks in these walls vary widely in size, from roughly 10-65 cm in diameter. Some wall segments are anchored on irregularly placed rocks of over one meter in diameter, and most of these were likely present in situ prior to the original rockwork construction. Walls stand from roughly \( \frac{1}{4} \) meter in height on the upslope portion of the site to over \( \frac{1}{2} \) meter in its downslope portions. All wall segments' heights are roughly level to the peak high tide line, which is evident by their juxtaposition with marsh vegetation. Portions of the forested uplands were logged some time ago, and it appears that logs were dragged over these rockworks from the logging site before being launched into the Inlet's waters. The beach is scattered with rocks;
these appear to include many of the rocks that have been dislocated from the crumbling rock walls of the site. Many rock wall segments appear to have been entirely destroyed. Only intact rock walls are mapped in Figure 7, though one could easily infer the past configuration of some of these destroyed wall segments.

The patterns of soil and vegetation in these walls provide additional insights into the function of the site. Severely damaged, only a small number of these rock walls are sufficiently intact that they retain soil. The beach gradient is steep, and the lower walls generally do not contain soil, their interior spaces consisting of highly eroded soils, or an exposed and rocky beach surface. Many of the shoreward walls, however, still appear to function like terraces, each containing accumulated soil, with high organic composition and diverse texture, abutting their upslope surface. One finds Potentilla and Trifolium only at the top of the site, along the upslope portion of each of the upper rockwork enclosures. It is apparent that these elaborate, high-intertidal rockworks would not serve to catch fish. Due to the inappropriateness of these rockworks' designs as fish traps, Carlson and Hobler (1976: 129) sought alternative explanations for the presence of these rockworks, suggesting that they may have been produced in the course of logging activities. However, they did not speculate why loggers would have been motivated to construct a vast and elaborate series of subdivided terrace-like rockworks in the upper intertidal zone.

While Potentilla and Trifolium are quite sparse in the immediate area of these rockworks, it is interesting to note that there are abundant patches of these plants a short distance away, on intertidal flats closer to the mouth of Hathaway Creek. On the beach between these tidal flats and the rockworks, there are a few, remnant patches of a deep
organic soil (just under one meter in depth at its deepest point) which has almost entirely eroded away from the remainder of the site. If the interpretation of these rockworks as garden sites is correct, it is likely that these rockworks were being constructed to laterally expand the high salt marsh, and to augment rhizome production beyond the level that was obtainable at the naturally occurring tidal flats at the Creek mouth.

Nootka Sound

The Nootka Sound survey was conducted by boat in June of 1997. The survey covered approximately 39 kilometers of shoreline, including western Bligh Island, Tlupana Inlet, and eastern Nootka Island (Figure 8). The vast majority of the territories covered in this survey were within the traditional territories of the Mowachaht Nuu-chah-nulth; the survey also involved a brief and inconclusive examination of that portion of Bligh Island traditionally claimed by the Muchalat Nuu-chah-nulth. I attempted to visit approximately one-half of those locations that possessed appropriate biophysical conditions for gardens; a total of 14 locations were visited in the course of this survey, representing roughly one location surveyed for every 2.79 kilometers of shoreline. Of these 14 locations, none were reported to have had “gardens,” in the literature checked for this dissertation. However, ten of these locations, or some 71% of those visited, were reported to have anomalous rockworks in the British Columbia Archaeology Branch database.

On the basis of the Nootka Sound survey, three locations were determined to fit the diagnostic criteria of garden sites, including sites at Boco del Infierno Bay (DjSp8), Valdes Bay (vicinity of DkSo20), and a site on an unnamed inlet (DkSp20). In addition,
Figure 8: Nootka Sound Archaeological Survey Area
one location was determined to have a possible garden-related archaeological feature, but this feature could have conceivably been designed as a fish impoundment. No ethnographic source consulted in this dissertation confirms the role of any of these locations as gardens. All rock features were in fragmentary condition; soil preservation was poor at all three documented sites immediately adjacent to these rock features, though large low-gradient marsh areas sat adjacent to each. If the three confirmed sites are gardens, this represents a detectable archaeological site density of one site per every 13 kilometers (or every 6.5 kilometers, if one accounts for the probabilistic sampling of one-half of all possible sites). If all four are accepted as garden sites, this raises the site density to one site every 9.75 kilometers (or every 4.875 kilometers, if one accounts for the probabilistic sampling of one-half of all possible sites).

Of all of the probable garden sites visited in the Nootka Sound survey, none possessed such large wall segments as those at DjSp8 on Nootka Island. Nootka Island is the largest island on the west coast of Vancouver Island, facing the Pacific Ocean on its western shores and Nootka Sound to its east. DjSp8 is located on Boco del Infierno Bay, a ¾ kilometer-long inlet on the southeast coast of Nootka Island, near the heart of the ethnographic territory of the Mowachaht Nuu-Chah-Nulth (see Figure 9). DjSp8 is within three linear kilometers (and roughly 5 km by boat) of the large Mowachaht village of Yuquot, which is now enclosed within the Yuquot Indian Reserve. Boco del Infierno Bay was so named by the short-lived, late-18th century Spanish garrison at Nootka Sound because of the nature of this Bay’s entrance. Little more than 2 meters across, the mouth of this Bay becomes a surging, seaward-flowing chute of water as the tide drops, and a surging, landward-flowing chute of water as the tide rises. DjSp8 is
Boco del Infierno Bay, DjSp8

Figure 9: Boco del Infierno Bay, DjSp8
located on deltaic tidal flats along the calm waters inside the Bay, where a small stream, Cox Creek, drains from a cluster of small lakes into the Bay.

The site is characterized by a complex series of rockworks in many levels of the intertidal zone. The main stem of the deltaic creek mouth contains three rock wall segments, running across the streambed (which is slightly wider than one meter in width). The lowest of these walls is close to the mean low tide line, and the middle wall is located at roughly the level of the mean low tide. The highest wall sits in the streambed at roughly the mean high high tide line, and lines the downslope edge of a large, flat bed of Potentilla and Trifolium with rich, organic soils. The other two channels of the deltaic creek mouth are also crossed with short rock walls abutting this level, high salt marsh. The westernmost wall extends some distance westward beyond the stream channel. There are several likely rockworks elsewhere on the site, but these are all too severely eroded by hydraulic action to be unambiguously identified as cultural features.

The streambed location and intertidal provenience of the lower two walls makes them likely candidates as fish trap segments or as fish weir supports (though the salmon fishing potential of these small streams is unclear). While the high intertidal rockworks of this delta may also have functions related to fishing, their positions in the high estuary and their close association with the Potentilla and Trifolium beds makes them likely candidates as rhizome garden features. The interpretation of these salt flats as a garden site gains additional support from the presence of what appear to be colonial period rock piles among the Potentilla and Trifolium beds. These stone markers are quite similar to those found on the ethnographically documented Nimpkish River and

206

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Cypre River garden sites, and possibly mark rhizome plot boundaries during a period of post contact disintensification.

Perhaps the most intriguing rock feature at DjSp8, however, is a high rock wall on a steep gradient intertidal area, aligned along a short bedrock isthmus, which connects a small rock islet to the mainland and separates the lower deltaic marsh from the open salt water Bay. This L-shaped wall is of solid construction. It is approximately one meter in height at its tallest point, roughly two meters across at its base, and, on intact segments, tapers to a little over one meter across on its roughly level top. This top is level with a productive patch of Potentilla and Trifolium on what appears to be a remnant soil of organics and silts, immediately upslope from the wall. The upslope end of the wall runs east-west (7 ½ meters in length) and tapers from just over one meter in height on its east end to a single-rock’s depth at its west end. On this western end, the wall abuts a low ridge of bedrock that lines the west edge of the intertidal isthmus. The other wall, running north to south (some 8 ½ meters in length) attaches at its north end to the bedrock islet at the isthmus’ end. The rocks in these walls are irregular cobbles, of roughly 10-35 cm along their longest axis.5

In an attempt to determine the age of the L-shaped wall, I recorded the diameter of the lichens that grow on the face and top of this wall. With larger lichens well over 15 cm on the walls cornerstones (with the largest at 15.6 cm diameter), one would derive an uncalibrated lichenometry date of just under 300 years b.p.; a standard deviation was not calculated in this case (Goudie 1990). This date has been established as a function of mean expected lichen growth at similar latitudes throughout Europe and North America. However, a host of local environmental factors can accelerate or delay lichen growth; this date has not been calibrated to local site conditions. The lichen may be older or younger than 300 b.p. Further, it is possible that the lichens were present on the rocks prior to their placement in the wall (though this is unlikely at the present site, where most available rocks are low in the intertidal zone where lichen does not grow). These lichen dates, regardless, lend tentative support to the interpretation of the site as a pre-contact feature. The sizes of lichens are also suggestive in another manner, however: the downslope face, the top, and the top of the interior of the lower segment of the L-shaped wall are covered with large and abundant lichen. On the interior of the wall, there is very little lichen below the level to which soil would be heaped for the site to contain a rhizome bed at the high tide margins. What little lichen grows below that level are of much smaller diameter, seldom more than 3 cm, suggesting that these rocks have only been exposed to open air for the last several decades.
North of the downslope wall's midpoint, the wall has been destroyed, down to the bare rock of the ancestral beach, and piles of rocks are placed both upslope and downslope of this break. The neatness of these piles suggests that the wall was disassembled by hand, possibly by B.C. Fisheries contractors or by artifact hunters. The section of the wall north of this break is lower than the rest of the downslope wall, and its top appears somewhat crumbled and irregular. This wall segment may have also been damaged manually or by natural hydraulic action. There are a number of scattered rocks downslope from this wall which may represent the rocks of this crumbled wall segment. Abutting the upslope face of the intact, lower wall is a very rich soil of fine silts and variously decomposed organic debris. Folan (1972) suggested that the Bay contained fish traps and that the rapids at the mouth of the Bay were sometimes fished as well. Marshall and Lyons (1989) suggest that the entire DjSp8 site was a fish trap, but that the L-shaped high intertidal rockwork “makes no structural sense as a fish trap as it is located just above high tide.” They speculate that the rockworks above the high tide line might have built by loggers. Once again, at this location, it is unclear why loggers would be motivated to construct elaborate rockworks in the upper intertidal zone.

**Clayoquot Sound**

Due in part to recent controversies surrounding indigenous land rights and proposed logging on Clayoquot Sound, this waterway has been subject to a higher level of ethnographic and archaeological investigation than the two survey areas described above. Clayoquot Sound encompasses the traditional territories of numerous Nuu-chah-nulth peoples, including the Ahousaht, Tla-o-qui-aht (“Clayoquot”), and Hesquiaht. For
the purposes of this study, Clayoquot provided a valuable case study, with its large shoreline segments that have escaped logging, and its large and recent literature on traditional indigenous land use (particularly the monumental compilation prepared by Bouchard and Kennedy [1990]).

The Clayoquot Sound survey was conducted by boat in May of 1997, June of 1998, and August of 1999. The survey covered approximately 130 kilometers of shoreline within the Ahousaht and Tla-o-qui-aht territories, including Bedwell Sound, Meares Island, and the surrounding Vancouver Island shoreline (Figure 10). I attempted to visit approximately one-half of those sites that possessed appropriate biophysical conditions for gardens; a total of 31 locations were visited in the course of this survey, representing roughly one location surveyed for every 4.19 kilometers of shoreline. Of these 31 locations, four were reported to have had rhizome gardens, in Bouchard and Kennedy (1990). Some 13 of these sites, or 42% of those visited, were reported to have anomalous rockworks in the B.C. Archaeology Branch Database, while one additional location (on Dawley Passage) contained a typical fish trap rockwork.

On the basis of the Clayoquot Sound survey, four locations were determined to fit the diagnostic criteria of garden sites, including locations at Lagoon Island, the DhSk12 site on Meares Island, the east cove of Matlset Narrows, and on the Cypre River flats. Of these locations with "diagnostic" archaeological garden characteristics, two were reported as rhizome garden sites in Bouchard and Kennedy (1990): the sites at DhSk12 and Cypre River flats. All rock features were in fragmentary condition; soil preservation was moderate at DhSk12 and Lagoon Island, but was poor immediately adjacent to the rock features at Cypre River and Matlset Narrows. If the four confirmed
Figure 10: Clayoquot Sound Archaeological Survey Areas
sites are gardens, this represents a detectable archaeological site density of one site per 
every 32.5 kilometers (or every 16.25 kilometers, if one accounts for the probabilistic 
sampling of one-half of all possible locations). In addition to these four sites, five 
locations were determined to have possible garden-related archaeological features; 
several of these features were so fragmentary that they could be explained by natural 
causes, or could be associated with non-garden functions. If all nine features are 
accepted as garden sites, this raises the site density to one site every 14.44 kilometers (or 
every 7.22 kilometers, if one accounts for the probabilistic sampling of one-half of all 
possible locations). A detailed description of one of the best preserved garden sites, 
DhSk12, will be provided in the following chapter.

Site Surveys at Documented Low-Gradient Gardens

In the interest of expanding upon the information available through these 
archaeological surveys, I visited certain large, low-gradient marshes outside of the three 
survey areas that had been documented as garden sites within the ethnographic 
literature. Foremost among these were the gardens at the Nimpkish River Tidal Flats, 
which I visited in the summers of 1996 and 1997. Among all archaeological garden 
sites, none has been the focus of such prominent ethnographic documentation as the 
gardens at the mouth of the Nimpkish River (Figure 2). This is the garden site mapped 
in great detail "as an example" of traditional Kwakiutl cultivation by Boas (1934, n.d.: 
166). The Nimpkish River is among the larger rivers that drain Vancouver Island, and 
is located on that island’s northeast side. The gardens mapped by Boas there covered 
roughly 0.8 hectares (or two acres) of tidal flats on the south side of the river where it 
empties in to the Queen Charlotte Strait. These gardens occupied the high, central
portion of a small intertidal island, which is cut off from adjacent intertidal flats by a small side channel during mean water levels. Prior to human modification, much of the island would have been submerged during floods and peak tides. Accompanying this garden site, there were several structures which were together referred to as “K’agis” or “logs [manually] laid crosswise.” The primary village of the Namgis Kwawaka’wakw, “Xwalkw,” sat on the opposite bank of the River; the village’s name is a term that refers to the rows of anthropogenic terraces, still visible today, on which each longhouse was built. Xwalkw was among the largest villages documented by George Vancouver in 1792 during the first European exploration of the Kwawaka’wakw territory (Vancouver 1801).

The configuration of the rockworks at the Nimpkish River represents an elaborate pattern of converging crescents and ovals, each subdivided by straight walls, which are met at approximately right angles by secondary, straight walls. Conceivably, the initial garden site was expanded by the addition of oval sections, and was subdivided into smaller plots with linear walls. According to Boas (1934) boughs of hemlock (Tsuga heterophylla) were placed across the water channel near this garden site for the purpose of slowing water and trapping silt. The dam described by Boas appears to correspond with the small dam-like wall on the channel to the southeast of the garden (see Figure 2). This feature is still clearly visible, consisting of an alignment of stones running across the channel, the tops of each sitting above the waterline except during peak water levels. These stones are not so densely placed as to create a wall, but rocks are often separated by considerable gaps. Presumably, as a sediment trap, these stones were not meant to impound soil, but merely to anchor the base of the hemlock boughs.
that served this purpose during peak water levels. Currently, and perhaps as a result of effective, long-term silt trapping, the channel no longer encircles the garden, but its western, upstream segment has partially filled with fine sediments, which are now being covered with low-marsh vegetation. The entire channel has thus become a calm backwater, and probably lacks running water save during peak water levels.

When Boas mapped the garden site at the mouth of the Nimpkish River (possibly during his turn-of-the-century work with the Namgis), he was likely engaging in a degree of reconstruction; rhizome gardening had largely been abandoned at Nimpkish by the time of Boas’ research, but was recalled as a “traditional” use of the site by Kwakwaka’wakw informants. It is quite likely that the rockworks at the Nimpkish River site were already in a state of disrepair when Boas viewed them. The current state of this well-documented estuarine archaeological site is revealing, as a prelude to the analysis of less well-documented low-gradient sites. Today, roughly geometric alignments of rock are still somewhat visible in freshly eroded locations, conforming to the overall geometry of the site as mapped by Boas. However, the highly turbulent waters of this River’s mouth have disassembled much of the garden, cutting channels through some of the riverfront portions of the garden while burying others. Adam Dick (pers. comm. 1999) and others have observed bears disassembling rock features on these flats while they forage the beaches. Further damage has been inflicted by nearby dredging and gravel extraction. In places, erosion has been severe. Texturally diverse and amorphous soils tumble from behind crumbling rock supports, and only a small portion of the site is so well preserved that it remains at the *Potentilla-Trifolium*

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6 Figure 2 is based on Boas’ 1934 map, but has been modified on the basis of field observations of the site to demonstrate the approximate scale of rock enclosures which were represented by lines in the original.
level of the tidal column and is vegetated by these two plants. Where the walls have toppled, the marsh surface has returned to below this level, and in places has been revegetated by middle and low marsh species. Cumulatively, only a small portion – roughly 25% – of the former garden site is still suitable for the growth of the plants once cultivated there. Despite the presence of fragmented walls of rocks, there would be little remaining here in the tangle of new vegetation and eroding soil that that would look like a garden to the untrained eye.

The best preserved portion of the site appears to be a long, raised swath running roughly east-west, along the middle 1/3rd of the garden complex. In this area, rock alignments still retain large amounts of soil, and are topped by mixed high marsh vegetation, primarily *Potentilla* and *Trifolium*. The most visible and intact rock feature on the site consists of highly fragmentary portions of the long lateral wall, which runs east-west across the larger, round portion of the garden, subdividing the northern 1/3rd of this garden segment from the southern 2/3rds (Figure 2). This wall is partially buried with a rich, organic soil in places, while in others, the wall tumbles onto the eroded beach flat to its north, exposing clumps of rhizomes and organic soil that erode away from the garden bed soon thereafter. The fragmentary wall in this section is roughly 0.7 meters in height, and rocks range from roughly 10-50 cm in diameter. North of this wall, the tidal flats consist of rocky beach; here, fragmentary portions of the garden’s northern rock walls are visible in the middle intertidal, in sporadic, one- to three-meter lengths, running roughly parallel to the course of the river on the garden’s northwest side. The soils formerly occupying these walls are completely eroded away, and no *Potentilla* or *Trifolium* grow there.
The erosional landforms and beach slope suggest that the ancestral tidal island had a slight rise in its middle, possibly high enough to facilitate the growth of *Potentilla* and *Trifolium* in a small portion of its highest-altitude center. The exposed garden walls appear to have been built directly on gravely tidal flats, well below the level of the tidal column at which these two plants can grow. In those places where rock walls have lost their integrity, the garden appears to be eroding back to the level of this ancestral beach, considerably reducing the artificially expanded extent of *Potentilla* and *Trifolium* beds. Cumulatively, these observations lend strong support the interpretation of the Nimpkish garden rockworks as a purposeful mechanism for enhancing soil retention and expanding the cultivable flats.

The site was reportedly used as a rhizome-gathering area into the 20th century, despite the decline of intensive site management. There are several small rock piles that appear to be of more recent construction than the garden, and have been made from the rocks that fell out of exposed walls. These rock piles are often many meters apart, but many appear to have been aligned in straight lines across the former garden site. Kwakwaka'wakw and Nuu-chah-nulth consultants have reported such markers as colonial-era rhizome plot boundary markers on ‘disintensified’ gardens (Adam Dick pers comm., 1998; Turner 1997; Bouchard and Kennedy 1990). These markers follow similar geometric patterns to those found in the original garden, but on a much larger scale. It is likely that these represent 20th century property boundaries between rhizome beds on the tidal flats, which have been adjusted considerably in response to both a reduced demand for rhizomes, and a reduced concentration of rhizomes in what had become largely untended garden beds.
Curiously, while the survey archaeologist who documented the Nimpkish garden site for in the B.C. Archaeology Branch database mentions and cites Boas' work on these gardens, all fragmentary rock features at this site are nonetheless classified as fish traps (Ham 1980). This fact seems particularly revealing of the ways in which rockwork sites have been documented generally. In addition to the documentation of the site's function, it is clear that, on the basis of their design alone, these rockworks could in no way serve as functional fish traps.

In addition to visiting the Nimpkish River site, I visited the Somass River flats, a similarly well-documented, if somewhat less famous, garden site. The Somass River tidal flats are located at the head of Vancouver Island's Alberni Inlet, near the present-day location of Port Alberni. These deltaic island tidal flats are much larger and contain more abundant salt marsh vegetation than the other salt marsh sites found within the Sheshaht and Opetchesaht Nuu-chah-nulth territories that encompasses the site. The flats at this site reportedly were cultivated by the Sheshaht and Opetchesaht; Sapir (1913-14) notes that the Somass River flats were an area of concentrated "L'layāqak," the clan-owned, subdivided estuarine root plots characteristic of large deltaic gardens within the Nuu-chah-nulth realm. According to Sapir's (1913-14) consultants, individual root plots at this site were up to an acre in extent, were marked off with tall cedar posts and walkways around their perimeter, and were presumably managed in ways characteristic of primary Nuu-chah-nulth root gardens as outlined in previous chapters. The area was not reportedly enhanced through the use of rockwork structures, however. The area continued to serve as an important plant gathering area well into the colonial period, when this intensive pattern of maintenance and tenure presumably
ceased (Arima et al. 1991: 193; Denis St. Claire pers comm. 1998). Today, however, even casual Nuu-chah-nulth plant use has largely ceased at this site, in part due to the fact that it is periodically flooded with the effluent from Port Alberni’s sewage treatment plant, built on the southeastern side of the island (Brandy Lauder pers. comm. 1999).

I conducted a survey of the site on June 11, 1999, with Earl Maquinna George of the Ahousaht First Nation, Brandy Lauder of the Opetchesaht First Nation, and Dr. Nancy Turner, Brenda Beckwith, and Kate Leslie of the University of Victoria. We spent approximately three hours surveying the vegetation of Johnstone Island. No rockworks, nor any other human-constructed features, were noted in the course of this survey, although the dense vegetation might conceal features below. The area is distinguished from other marsh areas, however, by atypical vegetation. The plants documented at this site were unique to salt marsh environments: in particular, tidewater portions of site are covered by extensive meadows of common camas, interspersed among Potentilla, Trifolium, Fritillaria, and a number of other plants more typical of salt marsh sites. Camas is not endemic to these marsh environments, nor is it widespread in the surrounding territories of the Sheshaht and Opetchesaht. In light of the ethnographic data presented in this dissertation, the presence of abundant camas in this documented garden area might logically be attributed to transplanting to the owned plots at this site from the large camas meadows at southeastern Vancouver Island. This point remains unresolved, pending possible genetic analysis of plants from the site. The site also contains culturally valued plants, in addition to camas, that are not native to tidewater meadows, and are more typical of rainshadow environments on the east coast.
<table>
<thead>
<tr>
<th>Trees and Shrubs</th>
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<tbody>
<tr>
<td>black hawthorn (Crataegus douglasii)</td>
<td>Pacific crabapple (Pyrus fusca)</td>
</tr>
<tr>
<td>black twinberry (Lonicera involucrata)</td>
<td>Nootka rose (Rosa nutkana)</td>
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<tr>
<td>sweet gale (Myrica gale)</td>
<td>willow (Salix hookeriana et al.)</td>
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<tr>
<th>Herbaceous Plants</th>
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<tbody>
<tr>
<td>Yarrow (Achillea millefolium)</td>
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<tr>
<td>Geyer's onion (Allium geyeri)</td>
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<tr>
<td>Sea-watch (Angelica lucida)</td>
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<tr>
<td>false onion (Brodiaea hyacinthina)</td>
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<tr>
<td>common camas (Camassia quamash)</td>
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<tr>
<td>sedges (Carex lyngbeyei, et al.)</td>
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<tr>
<td>paintbrush (Castilleja unalaschcensis)</td>
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<tr>
<td>mouse-eared chickweed (Cerastium vulgatum)</td>
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<tr>
<td>Canada thistle (Cirsium arvense)</td>
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<tr>
<td>Pacific hemlock-parsley (Conioselinum pacificum)</td>
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<tr>
<td>unidentified composite (possibly Crepis sp.)</td>
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<tr>
<td>hairgrass (Deschampsia caespitosa et al.)</td>
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<tr>
<td>shooting-star (Dodecatheon pulchellum)</td>
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<tr>
<td>spike-rush (Eleocharis palustris)</td>
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<tr>
<td>American dunegrass (Elymus mollis)</td>
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<td>northern ricero (Fritillaria camscatensis)</td>
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<tr>
<td>northern bedstraw (Galium boreale)</td>
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<tr>
<td>three-petalled bedstraw (Galium tridium)</td>
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<tr>
<td>sea milkwort (Glauces maritima)</td>
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<td>St. John's wort (Hypericum formosum)</td>
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<td>Siberian iris (Iris sibirica)</td>
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<tr>
<td>marsh peavine (Lathyrus palustris)</td>
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<td>beach lovage (Ligusticum scoticum)</td>
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<td>alfalfa (Medicago sativa)</td>
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<td>Canada mint (Mentha arvensis)</td>
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<td>water-parsley (Oenanthe sarmentosa)</td>
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<tr>
<td>reed canary grass (Phalaris arundinacea)</td>
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<tr>
<td>narrow-leaved plantain (Plantago lanceolata)</td>
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<td>Alaska plantain (Plantago macrocarpa)</td>
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<td>seaside plantain (Plantago maritima)</td>
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<tr>
<td>white bog orchid (Platanthera dilatata)</td>
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<tr>
<td>knotweed (Polygonum sp. - not flowering)</td>
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<tr>
<td>Pacific silverweed (Potentilla anserina ssp. pacifica)</td>
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<tr>
<td>straight-beaked buttercup (Ranunculus orthorhynchus)</td>
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<tr>
<td>western dock (Rumex occidentalis)</td>
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<tr>
<td>burnett (Sanguisorba sp.)</td>
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<tr>
<td>marsh mallow (Sidalcea hendersonii)</td>
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<tr>
<td>blue-eyed grass (Sisyrinchium littorale)</td>
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<tr>
<td>salt marsh starwort (Stellaria humifusa)</td>
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<tr>
<td>springbank clover (Trifolium wormskiioldii)</td>
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<tr>
<td>arrow-grass (Triglochin maritimum)</td>
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<tr>
<td>cat-tail (Typha latifolia)</td>
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(List compiled by Dr. Nancy Turner, Brenda Beckwith, Kate Leslie, and Douglas Deur)
of Vancouver Island, including Geyer's onion (*Allium geyeri*) and the false onion (*Brodiaea hyacinthina*). Moreover, the species mix visible at the site – with a particular abundance of opportunistically invasive high intertidal plants – may be indicative of prolonged disturbance, though further analysis would be required to confirm this point (Table 3). In the absence of rock features, such botanical evidence may provide one method of detecting prior cultivation at salt marsh sites, perhaps pointing the way to subsequent corroboration through soil analysis and other methods. Nonetheless, the presence of *Potentilla*, *Trifolium*, and *Fritillaria* is limited to the periphery of the island, while the center appears to have been overgrown by shrubby vegetation; if Sapir's notes are any indication, the range of these plants has shrank considerably since human management of the site ceased.

A similar, low-gradient garden site was well documented on the tidal flats at the mouth of Kingcome River, at the head of Kingcome Inlet. The gardens at this site, like those at Somass, were reportedly marked with paths and cedar posts but did not contain rock boundary markers. This site is discussed in considerable detail elsewhere in this dissertation. I conducted a survey of the site during August of 1999, with Adam Dick Kwaxistala and John “Bubba” Moon of the Tsawatainuk First Nation, Kim Recalma-Clutesi of the Qualicum First Nation, and Dr. Nancy Turner of the University of Victoria. Here too, no rockworks, nor any other human-constructed garden features, were noted in the course of this survey, although the dense vegetation might conceal features below. Most of the former garden sites visited in the course of the Kingcome survey were surrounded by a dike; while geometric vegetation patterns were detected within the diked area, it is quite possible that these patterns reflect post-contact
disturbances to the site. The dominant plant species on the tidal flats within these diked areas included *Potentilla anserina* ssp. *pacific* and a diverse assortment of both introduced and native grasses. As mentioned above, Adam Dick (pers. comm. 1999, 1998) recalled that the spatial extent of *Potentilla, Trifolium, Fritillaria* and *Lupinus* has shrank considerably since garden management ceased, overgrown by grasses, forbs, and shrubs both upslope and downslope of the contemporary patches of these culturally preferred plants. This appears to be particularly true of the sections of the Kingcome marsh that had not been subject to diking. Though no comprehensive vegetation survey was attempted here, the vegetation clearly displayed a narrower range of vascular plants than many salt marshes of comparable size within the region. While botanical surveys might prove enlightening in this case, it appears that the species mix has been impacted by post-contact disturbances. Moreover, while fragments of marker posts may persist below the soil surface, and compressed garden pathways may persist in some form, the long-term use of the site for cattle grazing has resulted in severe turbation of surface soils. On the basis of observations at Kingcome and similarly disturbed garden sites, it is apparent that archaeological detection will prove elusive, even at some of the best documented traditional garden sites.

**General Observations and Conclusions of Archaeological Surveys**

There are several observations that can be made on the basis of the sites described above, and my surveys of other garden sites or probable garden sites in their vicinities. Garden sites frequently appear in association with evidence of the exploitation of other resources: fish traps and rock-lined clam beds often sit a short distance away, downslope, while berry gathering sites and cedar trees partially stripped
of bark often sit upslope. This corroborates ethnographic accounts, such as Boas (1934: Map 22), which suggest that gardens existed in close association with other subsistence features. This may reflect the interaction of multiple factors, including a limited supply of estuarine sites (where most of these resources are concentrated), and the greater efficiency of spatially concentrated resource harvesting and intensification. Large, multi-plot garden sites on low-gradient tidal flats seem to correlate with the overall distribution of major villages, both being concentrated at the estuarine mouths of rivers; as these sites tend to be located in large deltaic deposits, they are poorly represented in archaeological surveys, but are comparatively well represented in the region’s ethnographic record. In the area surveyed archaeologically, village sites seemed to be accompanied consistently by at least one major garden site or possible garden site. The presence of large villages seems to provide the one strongest predictive variable for the presence of ethnographically documented garden sites. Archaeological surveys demonstrate, however, that neither ethnographic references nor archaeological records, when used alone, provide strong predictive value for the location of archaeologically detectable garden features. Indeed, many of the probable garden features identified in the course of archaeological surveys were not apparent in such sources (see Appendix 1). Only through field surveys, conducted in conjunction with diverse forms of additional evidence, will gardens be located in archaeological contexts.

As mentioned before, rockworks that are structurally consistent with garden designs mentioned in the ethnographic record frequently appear in abundance, near, but not on the prime tidal flats with naturally occurring patches of Potentilla and Trifolium. Appearing in the upper intertidal zone, in oval, rectilinear, or crescentic shapes, often
with subdivided plot boundaries, these gardens seem to be common in sites which are somewhat marginal, but which possess some potential for the growth of root vegetables. Most of these rock alignments have been partially damaged; many therefore contain eroded remnant soils or no soil at all in their lower impoundments, while still having remnant patches of *Potentilla* and *Trifolium* growing in and around their upslope segments. In a small number of sites, the discontinuous placement of rock walls, with gaps of roughly one-quarter to two meters, might reflect the ethnographically-recorded use of both rock and boards to retain garden soil (Boas 1934, n.d.). In many cases, it biophysical evidence suggests that there may have been little or no soil at rockwork sites prior to the construction of rock features, though natural marsh soils may sit nearby. The majority of rockworks which I encountered at known garden sites in the field are of this sort, and thus seem to have been built to allow harvesters to expand and capitalize upon the potential of marshes that were peripheral or had meager rhizome output.

From the perspective of Northwest Coast peoples, the prime tidal flats were located on the shorelines and deltaic islands at the estuarine mouths of major streams. On such sites, *Potentilla, Trifolium*, and other edible root foods still grow abundantly, though ethnographic evidence leads one to conclude that today these roots are not nearly as abundant as was the case when these plots were being actively managed.

Archaeological rockworks are less common at such sites, ostensibly reflecting both the reduced need for soil-retaining features in these low-gradient sites, and the high levels of post-abandonment fluvial turbulence in river mouth environments. Still, in such places one sometimes finds what appear to be highly fragmentary, buried and eroded rock alignments. In other large deltaic locations, such as on the tidal flats with
ethnographically documented Kwakwaka’wakw garden sites on Quatsino Sound, I encountered a large amount of wooden debris preserved in anaerobic conditions, eroding from freshly exposed cut banks. This wooden debris included some stakes that appear to have been worked or sharpened, and a number of narrow-diameter logs that together appear to have possibly exhibited some geometric patterning, consistent with the documented patterning of garden rock alignments.

Unlike the peripheral garden sites, these deltaic marsh gardens contained naturally occurring rhizome beds and detritus-rich soils, and took relatively less effort to intensify into productive rhizome gardens. There is some suggestion in the ethnographic literature that these prime tidal flats were coveted rhizome-growing sites, which were owned and even guarded by high-ranking tribal elites (Turner et al. 1983: 120). Ethnographic evidence (e.g., Boas 1934) also suggests that these tidal flats were commonly the site of major village gardens, which were called “logs [manually] laid crosswise.” Indeed, in these unusual depositional environments, drift logs are often more easily found (as potential building materials) than rocks, which are abundant along the remainder of the coast. If logs were the primary material for garden bed construction in some of these marsh sites, it is likely that garden bed alignments would have decomposed within decades of garden site abandonment, and no structural remnants should be expected, save within anaerobic strata below the soil surface.

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7 Floods, peak tides, and tsunamis have deposited logs on tidal flats near former garden sites. Commonly, logs so deposited create small, natural backwater areas upslope, capturing detritus during subsequent floods and retaining water during the summer. *Potentilla* and *Trifolium* often grow abundantly in narrow swaths (up to approximately one meter width) on these logs’ upslope sides, even when these logs sit as low as roughly 1⁄2 meter below the tidal level usually occupied by these plants. This natural phenomenon would have been readily observable to the peoples of this coast, and may have inspired subsequent technological developments in intertidal rhizome intensification, such as silt dams and rockworks.
Cumulatively, then, my archaeological reconnaissance research, in conjunction with my reading of the ethnographic record, suggests that there were two general categories of garden site locations. There were gardens on prime, low-gradient tidal flats, such as the Nimpkish, Somass, and Kingcome River Flats, which were sometimes (but not always) demarcated with rock or wooden impoundments. There was also a second category of gardens on peripheral and marginal beach sites, such as the Hathaway Creek and Meares Island sites (especially DhSk12) which were often enhanced through the use of more intensive methods, such as rock wall construction. And significantly, these two categories exhibit loose correlation, descriptively and geographically, with the Kwakwaka’wakw semantic differentiation between gardens termed “logs [manually] laid crosswise” and gardens termed “[places of] human-manufactured soil,” mentioned previously. Both garden types would have had similar functions. Both were weeded, selectively harvested, and replanted, and both served to retain moisture and enhance the fertility or retention of the soil. These two types of sites, however, would have been characterized by very different labor-to-output ratios. Gardens on preexisting flats would have required comparatively little labor to construct, and would have fostered abundant rhizome productivity almost immediately thereafter. Gardens on barren beach sites would have required comparatively intense labor to construct and maintain, and only with time and care would have matched productivity of tidal flat gardens. Interestingly, by most definitions of agriculture (e.g. MacNeish 1992; Harlan 1975), the gardening of marginal sites – with the addition of soil and plants from elsewhere – would have been more intensively “agricultural” than the tending and expansion of naturally occurring patches into larger tidal flat gardens.
This dual pattern raises some very interesting ethnographic questions (see Figure 11). If elite individuals or groups owned prime tidal flat sites, would individuals or clans of lower status be relegated to the periphery, where they could only produce rhizomes by creating “places of manufactured soil?” Or was such a premium placed on rhizome production that elites were motivated to expand beyond their tidal flats into more marginal sites? Both seem plausible interpretations of the ethnographic and archaeological records; indeed, both may have occurred. If, however, one views the cultivation of plants on marginal sites to have been more truly “agricultural,” these two hypotheses turn traditional hypotheses of the origins of agriculture on their heads. The first hypothesis would suggest that elites were not necessarily the agricultural innovators, but rather, that it was those people with disproportionately little control of the land who were forced to engage in agricultural innovation in order to obtain plant foods. The second hypothesis would suggest that the demand for root production or surplus production among Northwest Coast peoples exceeded the availability of rhizomes from prime sites, and that elites were able to organize group labor to enhance production in more peripheral places within their territories.

In light of these observations, it is reasonable to conclude that – speaking in the most general, region-wide terms – peripheral sites were only cultivated after prime sites had been occupied, and their development therefore would appear more recently in the archaeological record. Moreover, ethnographic evidence suggests that the peripheral gardens with rockworks may have been abandoned earlier than the prime, productive marshes. This process mirrors developments found elsewhere in the Americas. In Latin American contexts, population pressures on prime cultivating sites appear to have been
Winter Village

Idealized Rhizome Garden Complex

"Places of Manufactured Soil"
- Marginal sites with small or no naturally-occurring patches of Potentilla, Trifolium, and other edible plants
- Ownership uncertain (possibly lower-status)
- Plants intensified through creation of detritus soil within impoundments, transplanting, subsequent replanting, weeding, selective harvest, etc.
- Last to be intensified, first to be abandoned.

"Logs Laid Crosswise"
- Prime tidal flats with naturally-occurring patches of Potentilla, Trifolium, and other edible plants
- Owned by higher-status elites
- Plants intensified through transplanting, replanting, weeding, soil amendments and churning, selective harvest, creation of plot-expanding barriers on marsh
- First to be intensified, last to be abandoned.
fundamental in encouraging the labor-intensive construction of raised beds and other wetland modifications in marginal sites (Zimmerer 1991; Knapp 1991; Doolittle 1988; B.L. Turner 1974; Denevan 1970). Likewise, the abandonment of less productive cultivated wetland sites appears to have been widespread throughout the Americas following European contact and the emergence of subsequent dietary and population changes (Turner and Butzer 1992; Doolittle 1988). As Denevan (1970: 653) notes: “the most difficult habitats were brought into cultivation last, usually with elaborate reclamation. Presumably when population and production demands were reduced, as they were drastically [at the time of European contact] the least easily cultivated habitats were abandoned first.” On the basis of combined archaeological and ethnographic observation, the same conclusions appear reasonable for the Northwest Coast. Further archaeological testing may provide clarification on this point.

Regardless of the precise chronology, it does appear that sedentism made Northwest Coast peoples dependent upon finite plant resource sites, and that these peoples were motivated to improve upon the natural availability of plant resources by improving marginal sites with labor-intensive methods. “Scarcity,” broadly defined, was certainly a motivating factor in this process, but it remains unclear whether this scarcity was the product of dietary needs, economic or ceremonially motivated intensification, or disproportionate access to prime resource sites. In all probability, the construction of gardens involved a combination of these factors. More research, addressing both the chronology and the cultural significance of different garden sites, will be required to clarify these issues.
Meares Island is one of the principal islands of Clayoquot Sound, a large sound on the west coast of Vancouver Island, which comprises the traditional ethnographic territories of multiple nations of the Nuu-chah-nulth (or “Nootka”). This island was subject to an intense archaeological survey in the early 1980s, following conflicts over unresolved indigenous land claims and planned logging on the island. In the course of this survey, several high intertidal rockworks were identified, many conforming to the design of gardens: DhSk12 is one of these many high intertidal rockwork sites (see Figure 12). DhSk12 is located on the east coast of Meares Island, on a southeast facing cove fronting Fortune Channel. The only settlements on Meares Island are the small First Nations communities of Opitsat and Kakawis, some 9 kilometers west of DhSk12, and there are no roads on the island. Separated from these settlements by peaks of up to 792 meters, DhSk12 can only be reached by boat or floatplane.

In the survey report to the B.C. Archaeology Branch that followed the Meares Island survey, Atamanenko et al. (1982) reported a fragmentary rock wall at DhSk12, abutted by soils and salt marsh vegetation on its landward side. Atamanenko et al. (1982) noted several other fragmentary rock features at the site, including a rock alignment — running parallel to the rock wall — that was visible where small rivulets transect the salt marsh. Though the site is atypical, this survey report recorded the site as a possible fish trap. However, on the basis of structural characteristics alone, this designation seemed improbable. The primary rock wall lies very near the mean high
Figure 12: Excavation Units at DhSk12

DhSk12

overgrown area

canoe skid

Unit C

recently overgrown with crabapple

Unit B

observational unit

Unit A

site datum

bedrock outcrop

North

10 Meters
high tide line; tidewater inundation is rare, and only associated with extreme peak tide
and storm events (and, at these times, the site is generally inundated only along its
seaward edge). Also, significantly, both rivulets at the site are only intermittently
capable of bearing fish. Both are very short and very shallow; further, their mouths
drain through glacial rocks and gravels prior to reaching Fortune Channel, and are
especially subterranean streams for the last several meters of their course.

Confirming this point, Nuu-chah-nulth oral testimony regarding DhSkl2,
recorded after the Atamanenko survey, asserted that the salt marsh at DhSk12 had once
functioned as a traditional rhizome garden (Bouchard and Kennedy 1990; Mary Hayes
pers. comm. 1999). These parallel rock features, then, appear to have been built around
the garden site, likely serving to retain the adjacent soil. Structurally, the site is very
similar to those described by ethnographic consultants, wherein the salt marsh
vegetation was expanded incrementally through the mounding of estuarine soil from the
vicinity of the plot and the creation of stone barriers around the plot’s perimeter.
Accordingly, the placename remembered by Nuu-chah-nulth consultants for DhSk12 is
ts’isakis or “[place with] soil,” much like other human-modified garden sites on this
coast (Bouchard and Kennedy 1990: 464; Mary Hayes pers. comm. 1999). The
dominant plants on this tidal flat are Potentilla anserina ssp. pacifica and Trifolium
wormskjoldii, and there are many small patches of Fritillaria camschatcensis on flats
lining the forest edge. On the basis of this evidence, it appeared likely that the soils
abutting the rock features at DhSk12 were anthropogenic in origin.

During the course of this dissertation research, I had actively sought to locate
such a garden site, a site that was well-preserved, and which had both ethnographic and
archaeological corroboration of its former function as a garden. Through the
archaeological dating of soil samples adjacent to such well-preserved stone features, I
hoped to determine the dates during which these root grounds were modified and
subsequently abandoned. And among the many known and potential garden sites
encountered in the course of field surveys conducted for this dissertation, none proved
as well suited to archaeological testing as the ts’isakis site, DhSk12. In addition to
being an ethnographically documented garden site, DhSk12 possessed a well preserved,
terrace-like rockwork retaining an apparent anthropogenic soil horizon. The presence
of a discrete, seemingly anthropogenic soil considerably simplified soil testing and
archaeological dating of the site. Human expansion of salt marsh root grounds through
rockwork construction produces a discrete anthropogenic soil with a distinct lower
boundary, defined by the pre-modification shoreline surface. At DhSk12, preliminary
investigations indicated that this underlying ancestral beach was visible as a sharp
discontinuity in soil stratigraphy, where poorly defined strata of porous, organically rich
soils gave way to a clearly defined graveled surface. Below this boundary, the soil
column exhibited well-defined stratigraphy of rock- and sand-sized materials.

In addition, unlike sites elsewhere on the coast, there were few obstacles to
archaeological investigation at ts’isakis arising from the concerns of local First Nations.
First Nations’ consent must be obtained for B.C. archaeological sites with clearly
defined ethnographic affiliations before research may proceed. Over the course of my
research, I was able to develop a good rapport with local First Nations, thanks in no
small part to the interest in my work expressed by Dr. Richard Atleo, also known as
Chief Umeek, of the Ahousaht First Nation. The garden site at DhSk12 sits close to the
traditional boundary of the Ahousaht and Tla-o-qui-aht nations of the Nuu-chah-nulth (or “Nootka”) and was probably transferred from Tla-o-qui-aht to Ahousaht territorial control during warfare that occurred close to the time of European contact. Umeek’s support of this research fostered the interest of both the Ahousaht and Tla-o-qui-aht First Nations, and both formally authorized my archaeological investigations of DhSk12. Once Ahousaht and Tla-o-qui-aht approval was obtained, I sought and received archaeological permits from the British Columbia Archaeology Branch. The research at DhSk12 was conducted under British Columbia Archaeology Branch permit # 1999-160.

Site Description

The stone features at DhSk12 encompass a largely level salt marsh, transected by two short rivulets that drain the forestland immediately landward of the site (see Figure 12). The marsh consists of a small meadow, roughly 1200 square meters in size, containing an assortment of variously salt-tolerant herbs and forbs. These plants exhibit slight zonal differentiation, reflecting their varying tolerance for variable soil moisture and exposure to salt water. The bedrock of eastern Meares Island is largely granitic, with varying accumulations of large cobble and gravel deposited in shoreline areas. Sitting in the zone of extreme high slack tides, the soils in the meadow at DhSk12 are augmented by the infrequent deposition of waterborne sand and organics from both upslope and marine sources. The site exhibits no evidence of potential upslope mass wasting or other sources of large external inputs of soil material.

The terrain surrounding DhSk12 is characterized by islets, deep fjords, and peaks in excess of 1000 meters - the terrain is characteristic of west coast locations.
north of 49 degrees latitude, a high-relief coastline which was subject to Pleistocene glaciation and subsequent eustatic inundation. The terrain immediately adjacent to DhSk12 is shrouded in dense, mature or ‘old-growth’ coniferous forest, with trees in excess of 30 meters in height. Forest canopy vegetation consists primarily of Western redcedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), Western hemlock (*Tsuga heterophylla*), and isolated patches of Pine (*Pinus* spp.). The understory contains abundant ferns, lichens, mosses, and diverse members of the family Ericaceae (including salal and a number of species of the genus *Vaccinium*). The area’s forest soils are generally shallow and highly acidic, and differ substantively from the soils located in meadow environments atop alluvial and deltaic deposits. The adjacent forest contributes a small amount of litter (such as leaves, needles, and branches) to the site, although prevailing site winds carry most of this litter away from the salt marsh area. Facing east-southeast, most portions of the site, including all three excavated units discussed below, sit in the shadow of these trees by mid-afternoon, even during the summer months. There is a small boggy area sitting below the forest canopy a few meters eastward of the site, and the two rivulets that cross the site drain this boggy area through well-defined channels. This area is characterized by heavy rainfall, in excess of 300 cm annually.

The salt marsh is outlined on its downslope side by a fragmentary, low-lying rock wall, which represents the primary wall on the site. This primary rock wall (designated Wall 1 here) is 14.6 meters long, meeting a break in slope to the west-southwest, and connecting to a bedrock outcrop to the east-northeast. The wall is essentially straight, with a very slight upslope arc, and runs east-west, at roughly 66
degrees clockwise of true north. During reconnaissance visits to the site in 1997 and 1998, damage – due to either human or natural causes – was evident. During these visits, a two meter wide hole lined by toppled rocks and eroded soils was visible just east of the wall’s midpoint, where it is met by the smaller of the two rivulets. By the time that excavation at the site was conducted, in the summer of 1999, following a winter of severe storms, much more severe erosion was apparent and only small fragments of the wall were still intact. A possible additional wall segment, much more crumbled, appears to run at a right angle to Wall 1, meeting this wall at its terminal eastern end, and running over two meters upslope. Scattered large rocks, possibly representing fragments of a former wall segment, are roughly aligned with the angle of Wall 1 on the opposite, northeastern side of the large rock outcrop.

Another rock wall (designated Wall 2 here) sits landward of Wall 1, and is roughly parallel in alignment. This second wall segment is severely damaged and has been revealed largely due to erosive action in the channel of the larger rivulet. A little under two meters of this wall is exposed in the channel, and this wall segment appears to continue in both directions just below the surrounding, intact sediments.

Gully erosion continues to transform the seaward portion of the site. Between Walls 1 and 2, several small channels have recently cut down through the soil, reaching bare gravel in some cases. A few small remnant patches of undisturbed soil still contain Potentilla and Trifolium, while elsewhere this soil crumbles into the expanding erosional gullies, freshly exposing root bundles and poorly consolidated soil. Between Wall 2 and the landward forest edge, however, the salt marsh soil is largely level, and this soil is unbroken by vertical relief, save the two rivulet channels that drain the
adjacent forestland. The dominant plants on the central tidal flat are *Potentilla* and *Trifolium*, and there are many small patches of *Fritillaria* on flats closer to the forest edge.

DhSk12 contains numerous additional archaeological features that were not tested in the course of this work. A cleared canoe skid, with a rectangular clearing (possibly a work or loading area) at its upslope end, runs east-to-west in a small cove just to the northeast of the site; presumably, this would have been where canoes were landed when the root grounds at DhSk12 were being maintained and harvested. Possible culturally modified trees — large red cedars with possible bark-stripping scars — are also visible a short distance upslope from the site. Further, much archaeological evidence indicates a continuing pattern of site use into the “historic” period. A historic campsite, with a hearth area containing weathered charcoal, is apparent on the northeastern edge of the marsh. There are several stumps of small trees visible around the site, apparently cut by hand between roughly 50 and 120 years ago; their removal appears to have improved sunlight exposure on the root ground, but it remains unclear whether this was the intended outcome of this modification. An old and severely rusted metal peg has been stuck into the soil on the northeast edge of the tidal flats, though its genesis is unclear. Possibly geometric placement of piles of loose rocks may indicate a historical (and possible disintensified) pattern of rhizome plot use and tenure. Shotgun shells were found at the site’s southwest and northeast corners, likely indicating a continued use of the site for waterfowl hunting.

Like many sites identified in the course of archaeological surveys, DhSk12 appears to be a small garden site, maintained a short distance from much more...
productive areas at the mouths of small streams which empty into saltwater a short distance to the north. Here, too, this seems to have been a less than ideal site for rhizome gathering, but had the potential to become productive with a small amount of human intervention. The ancestral beach at DhSk12 site represented an unusually low-gradient shoreline. As a result, the site occupies one of the only places on the eastern shore of Meares Island which, despite the absence of a major stream, likely had a small amount of natural salt marsh prior to human intervention. The much larger salt marsh flats on the mouths of the creeks to the north do have rock alignments that appear very similar to the eroding rock walls of the Nimpkish garden. However, it is unclear whether these are anthropogenic forms, and they were not identified as rockworks in my archaeological surveys. Unlike the large, complex gardens, such as those identified at the mouth of Nimpkish River, DhSk12 does not contain complexly subdivided plots; it is also, unlike these other sites, not adjoining a former large village site.

**Oxidizable Carbon Ratio Dating Methods**

In order to date the archaeological soils sitting adjacent to stone features at DhSk12, I conducted preliminary tests with Oxidizable Carbon Ratio (OCR) dating. Humic material in soils undergoes biochemical degradation at a predictable rate – OCR dating measures the ratio of the total carbon to the readily oxidizable carbon in a soil sample, to establish the length of time that each sample has been buried in the soil column. This rate is calculated by a formula that accounts for the biological influences of variable oxygen, moisture, temperature, and soil reactivity, measured as a function of
percentage of total carbon content, soil texture, soil depth, mean annual temperature and rainfall, local hydrology, and soil pH (Frink 1999; 1995, 1994, 1992).

Though still not universally accepted by archaeologists, this method shows growing promise as an effective, low-cost alternative to C14 dating. I chose to employ OCR dating at DhSk12, rather than the more conventional C14 dating, due to the high margin of C14 error for sites dating from after roughly 500 Y.B.P., caused by the deVries, Suess, and Atom Bomb Effects, as well as a host of other pre- and post-depositional influences. I expected that the soils at DhSk12 might have been deposited recently enough to generate spurious C14 dates. Even in comparatively recent soils, standard error for OCR dates do not exceed 3% (for samples with greater than 100 g of organic carbon) when compared to results derived from radiocarbon dating. For these reasons, its popularity has increased rapidly and it has been applied to a variety of archaeological contexts with results that have been verified by corroborative C14 dating (e.g. Wessler 1997; Kindal 1997; Perttula 1997; Saunders et al. 1997; Webb and Leigh 1995). Though still viewed as problematic by some researchers, the method is gaining particular support among researchers who must date archaeological soils.

Prior to the current research, I established dates for non-archaeological Potentilla-Trifolium plots in the vicinity of DhSk12 with the assistance of archaeological soil specialist and OCR developer, Douglas Frink, that fell comfortably within expected ranges. These findings confirmed that garden sites were not sufficiently

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1 A detailed discussion of the variables and calculations employed in OCR dating would be prohibitively lengthy for this dissertation. For a thorough overview, see Frink 1995, 1999.
2 For a critical evaluation of this method, see Killick et al. 1999. While I accept some of these criticisms of the OCR technique as valid, there is also clear evidence that OCR methods produce verifiable dates. Such criticisms demand that temporal inferences from OCR techniques be used with caution, but not rejected outright.
water-saturated to skew OCR dates, as has been found in some alluvial contexts (Frink 1994).

In the course of OCR sampling, soils are sampled and tested at five centimeter sampling intervals. This is done in order to identify any evidence of rapid post-abandonment erosion, deposition, or turbation, which might influence oxygen, moisture, temperature regimes and other variables that can alter rates of carbon oxidation lower in the soil column. Once identified, these influences are incorporated into the OCR equation for samples taken lower in the soil column. Each OCR test includes analyses of soil pH, texture, and organic content of each sample. When observed at five centimeter intervals, these tested variables aid considerably in the interpretation of non-chronological aspects of site history, such as the depth of repeated aboriginal tilling in the soil surface or the presence of soil horizons that were not produced by natural or gradual sedimentary processes.

Excavation Units

Stratigraphic soil samples were collected at three sampling units at DhSk12. The salt marsh was inspected immediately landward of both Wall 1 and Wall 2. Soil sampling units were placed in those segments exhibiting the least evidence of surface disturbances (erosional or depositional). Unit A was excavated 15 cm landward of Wall 1 – this unit was placed adjacent to one of the last intact sections of this wall, where soil stratigraphy was still well preserved. Unit B was placed 15 cm landward of the rock feature designated as Wall 2. Unit C was placed close to the center of the former root ground, in a location where no archaeological features were apparent in surface surveys - this landward portion of the salt marsh represents an unequivocal pre-modification salt
marsh area, which was used as a control sampling unit. This testing strategy allowed for the absolute dating of both Wall 1 and Wall 2, through the analysis of adjacent and underlying soil strata. Also, by comparing absolute dates obtained from each unit, this strategy was designed to reveal any chronological evidence of sequential, seaward expansion of the root ground through the construction of these rock features, as described by some ethnographic sources.

Soil samples were gathered from one-centimeter thick strata, at five centimeter intervals through the soil column in each unit. Excavation continued to one interval below the apparent ancestral beach surface. All soil was taken from each tested stratum within these excavation units. Once sampling was complete, unrecovered soils were returned to the excavated units, and the surface vegetation was replanted over the top of each unit. Horizontal and vertical provenience was measured from a fixed site datum point within the bisected bedrock outcrop immediately adjacent to Wall 1, using a 100 foot surveyor’s measuring tape, line level, and stadia rod (Figure 12). This datum point sits roughly 25-30 cm above the mean salt marsh surface.3

Unit A

Unit A was placed 15 centimeters landward of Wall 1, with its long axis at a right angle to this wall. The nearest (east-by-southeastern) corner of Unit A to the site datum point was located 206 degrees from site north, at a distance of 10.95 meters. Unit A sits roughly five meters east of the nearest forest vegetation boundary.

3 The location of this datum point can be identified as follows: the largest rock outcrop on the site, adjacent to the northeasternmost edge of Wall 1, contains a fissure that divides it into two pieces, a large westward section and a smaller section fronting the eastward shoreline. Three large immobile rocks of roughly 50 cm diameter are wedged into the southwestern end of this fissure; the datum point was placed at the top, center of the southernmost of these three rocks. Horizontal measurements are calculated from this site datum point. (Unless otherwise indicated, soil unit depths in this report are calculated from the marsh soil surface, and are not calibrated to this site datum.) Site north was designated as magnetic north.
Prior to the excavation of Unit A, a test unit of 25 by 35 cm was cut some 15 cm landward of Wall 1, to observe tested stratigraphy. The long axis of Unit A was aligned at a right angle to the alignment of the rock feature. (Because of the lack of soil remaining intact near this feature, sampling space was limited, and this observational unit was abutted on its northwest side by the southwesternmost rivulet channel.) Subsequently, Unit A was dug on the east side of this observational unit. Due to space constrains, Unit A was elongated, with dimensions of 25 by 45 cm; like the observational unit, its long axis ran at a right angle to the rock feature and its southeastern edge was aligned 15 cm landward of this feature.

The surface of this unit was covered with a dense accumulation of salt-tolerant herbaceous plants, and a 1 cm thick layer of mosses and detritus concealed the soil surface. Also, on the eastern edge of the unit, a shallow surface depression indicated that a rock of roughly 10 cm diameter had rolled onto this surface at some time in the past (apparently as the rock feature has crumbled over time) and was later removed. All surface vegetation and loose, organic debris were removed from the soil surface. By removing surface vegetation and debris, a roughly level soil surface was exposed, sitting at 28 cm below vertical site datum.

Soil samples were gathered to one interval below the apparent ancestral beach surface (see Figure 13a). The upper 2 to 3 cm of the soil column is very dark brown and peaty, consisting largely of living and decomposed rootlets from the herbaceous plants above. Below this level, the soil becomes dark brown, and is filled with abundant rootlets. Below 11-12 cm depth, small amounts of gray sand increasingly become visible in the soil matrix, and below 17-18 cm, gravel is increasingly present. The
Figure 13: Unit Stratigraphy and OCR Dates: DhSk12
ancestral beach surface appears to sit at roughly 23 cm below the soil surface. At this level, gravel becomes the dominant soil texture, and is densely packed, with soil present in pore spaces only. The location of the ancestral beach at roughly 23 cm below surface is also confirmed by the presence of a few large rocks in the south end of Unit A, the largest of which is roughly 13 cm in diameter. These rocks rest atop the 23 cm deep gravel surface, and appear to represent an irregular, buried, upslope face of the rock feature. The narrow pore spaces around these rocks are filled with abundant rootlets, and a casting of organic soil. Dark brown organic soil is present in the pore spaces of the gravel basement below 23 cm to a depth of roughly 27 cm, below which the pore spaces are filled with sterile coarse sand. Subsequent laboratory soil analysis corroborated and expanded upon these observations of soil properties.

Unit B

Unit B was placed 15 centimeters from the interior face of Wall 2, as interpolated from the fragmentary rock materials visible in adjacent stream channels. The nearest (east-by-southeastern) corner of Unit B to the site datum point was located at 258 degrees from site north, at a distance of 8.92 meters. Unit B sits some nine meters eastward of the nearest forest vegetation.

A 35 by 35 cm unit was excavated 15 cm landward of the feature; again, the unit's horizontal axis was aligned with the rock feature. This unit was placed in the intact soil between the two convergent channels of the easternmost rivulet. (I did not excavate an observational unit adjacent to Wall 2, due to the lack of remaining intact soil adjacent to this feature, and in light of my desire to possibly revisit the site for subsequent archaeological investigation and soil testing.) The surface of Unit B is
covered with a sod of salt-tolerant herbaceous plants, denser than that found overriding Unit A. By removing decomposing grasses and a small amount of moss, the soil surface was exposed. This surface sat at 57 cm below site datum.4

Soil samples were gathered to one interval below the apparent ancestral beach surface (see Figure 13b). Like Unit A, the surface soil of Unit B is very dark brown, but here it grades more gradually into dark brown soil. This soil, from its surface to the gravel basement at roughly 17 cm below the surface, contains abundant living rootlets, and is somewhat peaty, with a high concentration of decomposing rootlets and other organic materials. Below roughly 8 cm depth, sand becomes increasingly visible in the matrix; sand is abundantly present in the soil matrix below roughly 14 cm, some small gravel is present, and some orange staining is present along root channels. At 17 cm below the surface, gravel becomes dominant, and is densely packed with soil present in pore spaces only. Dark brown soil is visible in pore spaces to a depth of roughly 22-24 cm. Subsequent laboratory soil analysis corroborated and expanded upon these observations of soil properties.

Unit C

Unit C was located arbitrarily in the well-preserved upslope portion of the site, close to the midpoint of the entire salt marsh meadow. The nearest (east-by-southeastern) corner of Unit C to the site datum point was located at 302 degrees from site north, at a distance of 14.05 meters. The nearest edge of the solid forest canopy sits

4 While this is lower than either Units A or C, it does not necessarily represent a location that has undergone post-abandonment erosion. Rather, the ancestral beach surface sits lower here than at the other two units. Further, the feature adjacent to Unit B runs laterally across the midpoint of a slope where a significant drop (roughly 20 centimeters vertical over 2 meters horizontal) in the ancestral shoreline is detectable in rivulet channels. This may represent the edge of the pre-modification salt marsh, and a logical place for the construction of a soil-retaining feature. Likewise, the feature adjacent to Unit A sits
some 14 meters to the north of Unit C, although there is a continuous stand of small, young crabapple trees encroaching onto the marsh that comes within 6.3 meters of the north end of the unit. A single crabapple tree, roughly one meter high, stands one meter west of the unit, while logs deposited during a recent, severe storm sit roughly one meter to the northeast of the unit.

Unit C was excavated on a horizontal axis parallel to Units A and B, with dimensions of 35 by 35 cm. The surface of this unit is covered in a dense concentration of moderately salt-tolerant herbaceous plants and a thin layer of decomposing organic materials. Removing this material, the soil surface was exposed, at approximately 25 cm below vertical site datum.

Soil samples were gathered to a depth of 26 cm (see Figure 13c). The soils in the upper 6-8 cm of this unit are very dark brown, and filled with abundant rootlets. Below this level, the soil becomes dark brown. Below 17-18 cm, grey sand and dark brown clay become increasingly apparent. Below 20-24 cm, the soil contains large amounts of sand, and appears to contain materials (especially clays) translocated from higher in the soil column. Below 25 centimeters, gravel and sand become increasingly dominant with depth, with small amounts of dark brown soil in pore spaces. No clear ancestral beach surface is evident on the basis of structural discontinuities in the soil matrix. Subsequent laboratory soil analysis corroborated and expanded upon these observations of soil properties.

at a significant break in ancestral beach slope associated with a cobble beach ridge, presumably built up by pre-modification wave action.
Soil Processing

All samples were visually inspected for artifacts and diagnostic soil characteristics at the time of excavation, and then were individually bagged. In addition, all soil samples were later screened at the OCR Carbon Dating, Inc. laboratories for textural analyses through a graduated series of ASTM E mesh screens, with apertures ranging from 2.0 mm to 53 microns. No artifacts were encountered in the course of these tests.

Following excavation, all soil samples were kept in a cool, dark location for between 48 and 72 hours, and then were dried in a forced air food dehydrator at 43 degrees Centigrade (110 degrees Fahrenheit) until completely dry. All dried soil samples were then sent to the laboratories of OCR Carbon Dating, Inc. for textural analysis and Oxidizable Carbon Ratio (OCR) dating. Climatological, hydrological, and botanical data for DhSk12 accompanied the samples to establish pedogenic context for this site. All untested soils and non-soil materials captured in the 2.0 mm ASTM E mesh screen were returned to Douglas Deur. A subsample of each soil sample was curated at OCR Carbon Dating, Inc. for possible future testing.

In the course of obtaining soil samples for OCR dating, all large organic fragments – particularly woody materials – that appeared to be in primary contexts (i.e., not post-depositional) were removed from tested samples and bagged. A very small amount of wood, roughly 0.25 to 1.75 cubic centimeters cumulatively, was collected from several samples. These included Unit A at 5-6, 10-11, and 15-16 cm depth; Unit B at 5-6, 10-11, and 15-16 cm depth; Unit C at 5-6, 15-16 and 20-21 cm depth. (Unit C at 15-16 cm depth contained only a trace amount of wood, while Unit C at 20-21 cm also...
contained a small amount of charcoal). These fragments were collected for possible future C14 corroboration of OCR dates.

Expected Findings

I hypothesized that the dates of site modification would predate the first recorded European contact on Vancouver Island’s west coast – or James Cook’s visit in 1778. I also hypothesized that the date of apparent site abandonment would post-date this event, and would have occurred no later than 1939. In addition, I hypothesized that the antiquity of Wall 2 would be greater than that of Wall 1, resulting from the incremental expansion of the marsh through rockwork construction, as described by ethnographic consultants in reference to other garden sites. It was hoped that such incremental expansion might be correlated to other evidence of intensification in the archaeological record of western Vancouver Island.

In addition to establishing absolute dates for soils abutting rock features, soils from the three units were assessed for a detectable archaeological signature that would corroborate ethnographic information regarding the site. Soils adjacent to Wall 1 and Wall 2 were expected to have a discrete boundary with a former beach surface; Unit C was expected to exhibit no such stratigraphic break, but would instead exhibit a gradual continuum of texture, pH, and other variables with depth. Further, these root grounds experienced considerable rhizome digging and seasonal turning of the soil until rhizomes were replaced by introduced foods in the period since European occupation, two centuries ago. When speaking of soil management at these sites, many ethnographic consultants note the need to manually “churn it up” “fluff it up” or “turn the sod” every year. As a result, it was anticipated that the soil column would exhibit
features characteristic of a “plow zone,” with structurally distinct but amorphous and
texturally diverse strata in the middle depths of each modified Unit. Elements of the
gravel basement occasionally may have been mixed into the overlying soil, but manual
churning in this zone was expected to be infrequent. After abandonment, most sites
were expected to have been buried by more recent soil horizons, while anthropogenic
horizons would undergo a degree of ‘deflation’ as air pockets have been filled and the
soil has settled. Indeed, the soils at DhSk12 and other former root ground sites on
Vancouver Island seem to be thinner than the well-churned materials that consultants
describe, possibly as a result of such settling.

Findings

Laboratory results are summarized in Figure 13. Structural discontinuities in the
soil horizons indicate that Units A and B do not exhibit evidence of gradual, natural
siltation behind these rock features – an alternative, null hypothesis for the site’s
origins. Unit C, however, does exhibit soils characteristic of a natural, gradual pattern of
siltation and soil genesis.5

In Unit A, the soils between roughly 12 and 23 cm depth bear the diagnostic
characteristics of an anthropogenic soil. Samples from 15 cm (206 +/- 6 Y.B.P.) and 20
cm (375 +/- 11 Y.B.P.) exhibit evidence of heavy turbation, in the form of atypical and
non-uniform soil textures. This turbation exceeds the maximum expected range for salt
marsh environments, and arguably reflects a period of enduring human use and
maintenance of the site.6 The soils at 15 and 20 cm depth are texturally distinct from

5 I am indebted to Douglas Frink of OCR Carbon Dating Inc. for his considerable assistance in
interpreting these data. All dates are calibrated to the radiocarbon standard of 1950.
6 The strata interpreted as anthropogenic in Units A and B are quite similar, visibly and texturally, to
those found at other known garden sites, most notably those eroding from the Nimpkish River gardens.
strata above and below, and appear to have been produced by a limited number of amendments, other than the natural sedimentation sources that produced the overriding and underlying soils. Evidence of turbation is not apparent in the sporadically amended soils at 5 and 10 cm depth. As mentioned above, a gravel basement, located between 20 and 25 centimeters' depth in Unit A, indicates the ancestral beach surface; two large intrusive rocks, both extensions of the rock feature, sat atop this gravel surface. This discontinuity was also confirmed in laboratory analysis by a sharp, atypical discontinuity in texture and pH between the strata at 20 and 25 cm. This discontinuity in soil properties was sufficient that – without reference to accompanying field data – the sample of soil from the pore spaces at 25 cm was interpreted as a “buried soil horizon,” structurally and pedogenically unrelated to the overriding soils, by the laboratories of OCR Carbon Dating, Inc. The soil in the gravel’s pore spaces at 25 cm was dated to 635 (+/-19) years before present (defined as 1950 AD to correspond to 14C conventions). The soil at 20 cm dates from 375 (+/- 11) years before present. The rock feature, therefore, appears to have been constructed between these two dates. The absence of turbation at 10 cm depth suggests that intensive human utilization of the site ceased prior to 34 (+/-1) years before present.

In Unit B, the soils between roughly 13 and 17 cm depth bear the diagnostic characteristics of an anthropogenic soil. Like Unit A, Unit B also exhibits evidence of heavy turbation in the sample from 15 cm depth (206 +/- 7 Y.B.P.) and possible turbation in the sample from 20 cm depth (471 +/- 14 Y.B.P.). Texturally distinct from strata above and below, the soil at 15 cm depth appears to have been produced by a limited number of amendments, other than the natural sedimentation sources that
produced the overriding and underlying soils (which produce diagnostic soil texture properties). Discontinuities between the texture and pH of the soils at 20 and 15 cm depth indicate that the soils at 20 cm may consist in part of buried soil. The soils at 20 cm, then, may represent a gravel basement that was occasionally mixed into the overriding soil by mechanical turbation. Rockwork construction therefore appears to postdate 471 (+/- 14) Y.B.P., but predates 235 (+/- 7) Y.B.P. The absence of turbation at 10 cm depth suggests that intensive human utilization of the site ceased prior to 49 (+/- 1) years before present.

Only Unit C possesses a soil profile that would be expected under a natural pedogenic regime: the pH rises with depth, the percentage of organic carbon declines with depth, soil textures are relatively uniform with some indication of translocation of fines and clastics downward into the lower strata. This soil profile has been intact, in situ, since prior to 1173 (+/- 35) years before present – the soil column may predate this figure by a considerable figure, but additional sampling would be required below 26 cm to clarify this point. While human modification may have reshaped the soil profile in Unit A, this is not evident in the form of a texturally distinct and atypical soil horizon, as is the case in Units A and B.

**Interpretation of Findings**

Dates of apparent site intensification and site abandonment fit hypothesized ranges. The results of OCR dating suggest that the soils abutting the rock features at DhSk12 do predate European contact. Soil deposition patterns at both Unit A and Unit B suggest that the construction of both Wall 1 and Wall 2 occurred between 375 (+/-
11) and 471 (\(+/-\) 14) years before present, or between 1479 and 1575 AD (see Figure 13).7

On the basis of soil texture discontinuities in the upper portions of Unit A (between 10 and 15 centimeters in depth) and Unit B (between 10 and 15 centimeters in depth), the abandonment of intensive root ground maintenance can be tentatively dated to a time between 206 (\(+/-\) 6) and 49 (\(+/-\) 1) years before present, or between 1744 and 1901 AD. This, too, would fit expected ranges, correlating with the approximate dates of colonial occupation, epidemic-induced demographic change, and the replacement of traditional root foods with introduced crops.8

As Wall 1 and Wall 2 appear to be roughly contemporaneous, there is no clear evidence supporting the hypothesis regarding the incremental nature of root ground expansion. In earlier writings, I had posited that the comparatively dilapidated condition of the rock alignment at Unit B might indicate that – in accordance with indigenous consultants’ oral testimony regarding similar sites – marsh expansion at DhSk12 was incremental, reflecting growing pressures on the root resource over time (Deur 1998). However, the absence of a clear temporal discontinuity between the two features suggests that if marsh expansion was incremental, it occurred in the course of –

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7 This roughly coheres with lichenometry dates established for the site in the course of research reported in Deur (1998), inferred on the basis of latitudinal and climatological variables (Goudie 1990). The diameter of lichen whorls on Wall 1 would lead to an uncalibrated date of roughly 450 years before present. Extensive calibration would be required to establish accurately calibrated dates on the basis of lichenometric data at this site, however.

8 It is unlikely, though not impossible, that the site was abandoned abruptly; further, the soils from 1744 exhibit evidence of extensive modification, whereas the soils from 1901 show no clear evidence of human modification. On the basis of this evidence, it is unlikely that the dates of abandonment would correlate with the high or low ends of this range, but would instead be dated toward the middle of this range. Narrowing the range of dates by roughly 35 years, these numbers would correlate – on the high end – to the date of first European arrival, and – on the low end – to the date of the smallpox pandemic that resulted in the most dramatic declines in aboriginal population throughout all of coastal British Columbia (Boyd 1990, 1992).
at most—an approximately 100-year period, and was not detectable with the methods employed in this study. Further research would be required to determine if ‘incremental’ expansion of such sites occurred during shorter periods of time, such as over the course of decades. Ethnographic evidence lends tentative support to this notion (Daisy Sewid-Smith pers. comm. 1998).

Ethnographic testimony suggests that root gardens were commonly subject to intensive management prior to rockwork construction; rockworks represented the outcome of long-term and preexisting patterns of utilization at a root-digging site. Activities such as weeding, root digging, and churning of the soil ostensibly preceded the expansion of root grounds with rock features. Therefore, it is quite possible that the ‘buried soils’ found in the pore spaces in the ancestral beach surface in Units A and B represent translocated material from turbated marsh areas upslope. The dates of these soils may therefore reflect a time of resource intensification at these sites prior to rockwork construction. This point remains unresolved, pending further archaeological research.

9 The possible ranges of error inherent in such dating methods make simple temporal comparisons between units problematic for such short time periods.
CHAPTER 11
THE DEMISE OF ENDEMIC CULTIVATION:
DIETARY AND DEMOGRAPHIC FACTORS

During the contact period, several formidable factors appear to have combined, simultaneously, to largely eradicate endemic practices of rhizome cultivation. Returning to the terminology of Harris (1979), many of the infrastructural, structural, and superstructural incentives that fostered rhizome cultivation in the pre-contact period began to unravel, as the old order gave way to the chaos of the contact period. Simultaneously, newly emerging infrastructural, structural, and superstructural incentives, emanating from the circumstances of the contact period, commonly encouraged the adoption of new modes of subsistence that eclipsed traditional estuarine cultivation. The reasons for these changes were many — ranging from diseases, to changes in Northwest Coast ceremonialism, to colonial land alienation, to the introduction of the potato — and were the product of both intentional and unintentional influences from arriving Europeans (Spicer 1961).

By the time ethnographers arrived on this coast, subsistence activities centered on traditional animal foods as well as potatoes, which had replaced many of the traditional starchy plant foods in the Northwest Coast diet. Rhizome cultivation existed only in remnant form, practiced by a few people, most of them elderly and living in peripheral places, people whose practices were only marginally affected by the jarring changes which came to this coast. What follows is a brief summary of the dietary and demographic factors that contributed to the demise of endemic cultivation practices.
Contact and Demographic Contractions

During the late-18th and 19th centuries, a succession of severe epidemics swept through the Northwest Coast. What followed was an alternating sequence of both widespread and localized demographic collapses. The epidemics of the Northwest Coast arrived later than epidemics within many other portions of the Americas (and may have proceeded at an equal or greater pace). “Virgin-soil” epidemics diffused rapidly through the densely settled populations of the Northwest Coast from the first moments of direct European contact. (Indeed, epidemics probably occurred before direct European contact, transmitted along inter-regional trade networks that connected Northwestern peoples to the tribes of California, the Plateau, and the Plains.) Prior to widespread European resettlement, smallpox, malaria, and other diseases had been introduced and diffused through fur trade contacts. By 1830, these diseases were already producing radical changes in the region’s demographics. At this time, the population of the entire ethnographic Northwest Coast appears to have already been reduced to less than 50% of its pre-contact total (Boyd 1999a; 1992; 1990). As mortality rates soared, localized population pressure on many endemic resources and resource sites declined (Henderson 1978). Indeed, Cole Harris (1997) has argued that the entire colonial project in northwestern North American was dependent upon this early period of dramatic depopulation, which swept the lands and resources clear of indigenous proprietors who might effectively challenge European incursions in the years to come. And, as localized populations pressures on resources declined, so too did the incentives to intensify resources, including such plant resources as traditional rhizome gardens.
Still, even into the mid-19th century, large native populations persisted along certain segments of the Northwest Coast, particularly those that were far from European settlements. However, a second wave of epidemics, arriving at the onset of European resettlement in the mid- to late-19th century, dramatically changed the demographic patterns and resource practices along the entire coast. Smallpox was the foremost source of epidemic-related deaths at this time, having arrived on the British Columbia coast in 1862, brought there by an infected passenger who had traveled by steamer from San Francisco to Victoria. Once smallpox arrived in the colonial outpost at Victoria, it rapidly diffused through the encampments on the opposite shore of Victoria Harbour, encampments that housed members of numerous coastal tribes who had assembled for trade. Fearing a public health catastrophe, colonial officials ordered that the encampment be evacuated. The peoples from these encampments paddled home, to villages along the entire coast. Unwittingly, many carried smallpox with them as they traveled. The smallpox epidemic that ensued was the worst single epidemic to be documented by European observers. By the mid-1870s, the population of the entire coast had dropped to perhaps 10% of its pre-contact total, due to both deaths and infertility resulting from smallpox (Boyd 1999a; 1992; 1990).

As populations plummeted along the coast at this time, survivors regrouped in the former central village sites of individual tribes, villages that now housed individuals from numerous villages or, in some cases, multiple ethnolinguistic groups (Tollefson 1982; Henderson 1978). This trend toward relocation and inter-village or inter-tribal population amalgamation continued well into the 20th century (Galois 1994). The apparent importance of slave labor in resource procurement diminished as a result of
high mortality early in the 19th century; almost immediately thereafter, Northwest Coast peoples encountered forceful colonial opposition to this practice (Gough 1978). Many formerly land-rich tribal elites became social and economic exiles as this relocation uprooted them from their traditional territories, and their control of now-distant traditional resource sites diminished (Darling 1955). (As will be discussed in the following chapter, this trend was compounded by the legal alienation of lands once belonging to tribal elites by the governments of the United States and colonial Canada for settlement and resource extraction [Tennant 1990]).

As Northwest Coast peoples relocated in consolidated villages through the 19th century, traditional resource sites, particularly those of the remote hinterland, were frequently abandoned. Many resource gathering sites that had been of central significance to pre-contact diets and economies were transformed into minor outposts, visited briefly each year as part of a larger seasonal round (Boyd 1999a; Galois 1994; Henderson 1978; Oberg 1973). Most traditional foods, including rhizomes, were still eaten by Northwest Coast groups at this time. However, particularly labor-intensive food production strategies were rapidly abandoned. Several scholars have noted that, while salmon fishing continued throughout the 19th century, the use of elaborate stone fish traps and wooden salmon weirs largely ceased during this period, despite the frequent absence of equally effective technologies for salmon procurement among indigenous peoples (Hobler 1990: 301; Kennedy and Bouchard 1990: 325; Pomeroy 1976). Likewise, garden construction and repair appear to have largely ceased at varying tempos along the coast during the 19th century, paralleling this pattern of relocation, demographic collapse, and resource site disintensification. Ethnographic accounts
indicate that garden sites that were previously “owned...cultivate[d]...and look[ed] after” by earlier generations were still being visited, but only for the more casual collection of remnant, uncultivated roots (Bouchard and Kennedy 1990: 335). The reasons for this abandonment of labor-intensive resource procurement were many. No longer were intense demographic pressures placed on particular resources, for example, nor in many cases were there large and cohesive work groups capable of carrying out the tasks of rockwork construction, garden maintenance, intensive harvesting, processing and storage (Boyd 1999a). Further, as shall be described below, dietary patterns were changing rapidly due to the efforts of both missionaries and Indian agents.

This demographic shift and its accompanying resource disintensification represented some of the most potent factors contributing to the abandonment of traditional cultivation practices (Brookfield 1972). Though the exact levels of pre-contact population will never be known, the indigenous population of the Northwest Coast at the close of the 19th century, arguably, was numerically comparable to the coastal population as it existed prior to the emergence of large, sedentary villages. Dramatically reduced by epidemics, Northwest Coast population pressures on finite resource sites now dropped below the levels that had originally facilitated the emergence of the region’s endemic resource intensification technologies, including fish traps and gardens, in the preceding millennia. The resource pressures that accompanied the emergence of large sedentary villages evaporated in turn.

The Emergence of Potato Cultivation

The arrival of potatoes (Solanum tuberosum) and potato cultivation on the Northwest Coast presented an equally formidable threat to traditional cultivation
practices. Within the context of demographic upheaval, potatoes rapidly eclipsed
endemic starchy foods in their overall dietary importance. Potatoes arrived very early
on the Northwest Coast, and numerous accounts of indigenous potato cultivation date
from the early fur trade period (de Laguna 1960; Suttles 1951b). This Andean crop was
well suited to the cool, humid Northwest Coast in a way that was rare among other
introduced crops. And properly maintained, the short-term output of cultivated potato
patches could often match or exceed that of the traditional rhizome gardens. Perhaps as
a result, the potato diffused rapidly along this coast, so rapidly that potato cultivation
appears to have reached many Northwest Coast peoples prior to direct European
contact. Explorers’ accounts commonly mention the discovery of potato cultivation
among Northwest Coast peoples previously unknown to the Western world. Indigenous
oral traditions mention the original acquisition of potatoes before the first local arrival
of Europeans, “from other Indians,” and the exact route of first European introduction of
the crop remains highly conjectural (Suttles 1951b: 272).  

Clearly, the potato arrived in most Northwest Coast communities “indirectly,
and with only the barest instructions as to their cultivation,” but was nonetheless being
intensively cultivated by peoples throughout the region at the time of first, direct

1 The origin of the potato on the Northwest Coast has been a subject of perennial interest among
Northwest Coast specialists. Accepting Suttles’ (1951b) argument at face value, most scholars have
accepted that the crop was introduced through early European trade networks, primarily Russian or
English in origin. The common name for potato among Northwest Coast peoples, “kusi” was interpreted
by Suttles as a phonetic variant of the words “good seed,” indicating that English speaking peoples had
taught Northwest Coast peoples to cultivate this crop. However, the name “kusi” is a common Peruvian
name for garden potatoes (Karl Zimmerer pers. comm. 2000). In light of the fact that the Spanish garrison
at Nootka was engaged in both experimentation with potato cultivation in the late 18th century, and had
numerous “Peruvian Indians” working as servants at the garrison, this linguistic evidence is highly
suggestive of an early native-to-native diffusion of potato cultivation knowledge at Nootka Sound.
European contact (Suttles 1987: 144). This is perhaps a telling indicator of the sophistication of pre-existing endemic cultivation practices.

Indeed, I contend that potato cultivation was readily incorporated into indigenous subsistence repertoire because the practice of starchy root cultivation was quite familiar. Potatoes, with their higher yields and their trade value, simply took the place of estuarine rhizomes within the region’s rhizome cultivation complex. Thus, the potato – the primary starch food of colonial-period Northwest Coast peoples – replaced *Potentilla* and *Trifolium* – the primary starch foods of pre-contact Northwest Coast peoples. This contention is supported by numerous explorers’ accounts, suggesting that the potato was maintained in ways identical to those associated with rhizome gardening, but which bore comparatively little resemblance to European methods of potato cultivation. In the numerous early explorers’ accounts compiled by Suttles (1987: 137-51; 1951b) in particular, native women are depicted as bearing the primary responsibility for potato gardening, and are described using their traditional rhizome-digging sticks to both vegetatively plant and exhume potatoes; slaves were sometimes made to plant, dig, and guard productive potato patches; kelp was used as a fertilizer for these potato patches. Debris cleared from the ground, and accumulated detritus was piled along plot boundaries in configurations somewhat similar to those of the rhizome gardens. In some locations, potatoes appear to have been planted within networks of short rock enclosures and terraces, often with subdivided, family-owned plots; while matching the general design of pre-contact rhizome beds, these potato gardens were
distinct, being built well above the intertidal zone (deLaguna 1960). Soils were reportedly weeded, manually churned, and augmented with (though – unlike rhizome garden soils – not entirely composed of) estuarine detritus. Interestingly, such authors as Suttles (1987: 150) have reported the cultivation of distinct (and possibly endemic) varieties of potatoes. Different varieties of potatoes were reportedly kept separately by indigenous cultivators, including cultivators who had presumably not had prior contact with Europeans.

What differed most dramatically between the practices of rhizome cultivation and potato cultivation was the siting of the gardens. While Potentilla, Trifolium, and other edible estuarine root vegetables are salt-tolerant, the potato is not. As a result, potato gardens did not occupy the former sites of rhizome gardens, but were placed meters above the intertidal zone, in clearings produced by anthropogenic fire or human settlement activities. For this reason, there is little chance of confusing the two types of gardens when they are encountered in archaeological surface surveys, despite their occasional structural similarities.

The reasons for the adoption of the potato were not solely dietary. In the demographic and cosmological turbulence that followed the arrival of Europeans and their diseases, traditional ceremonial, social, and economic obligations often evaporated,

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2 Gibbs (1877: 223) reported of the south coast Salish that “Enclosures for their garden patches were sometimes made by banking up around them with refuse... which, after a long while, came to resemble a low wall.” Unfamiliar with rhizome cultivation methods, Suttles (1951b) had assumed that this reference described potato patches, but there is nothing in Gibbs work that would clarify what crops were grown in this manner. Indeed, the description would match documented practices of both potato and rhizome cultivation, which would have been differentiated by their placement vis-à-vis estuarine areas.

3 Following the opinion of his sources, Suttles (1951b) suggested that the potatoes were often planted alongside camas within “natural prairies.” However, as most of these prairies were rapidly overgrown following the cessation of native burning, it is likely that these prairies were maintained by the use of fire, and that camas, like the potato, had been manually introduced to these sites.
or were met through the exchange of new goods. While quite palatable to the native peoples of the Northwest Coast, the potato and other European crops also held value as status symbols, a sort of “European merchandise,” aiding in their rapid dispersal through trade networks. As prestige items, potatoes fit quite well into the preexisting social and economic structures. While the range of foods used in ceremonial events and exchanges expanded, the ceremonial functions of these food exchanges remained relatively consistent (Simeone 1995; McEwan and Mitchem 1984). Where crates of rhizomes had been exchanged in potlatches during the 18th century, crates of potatoes and other introduced foods increasingly served as the media of ceremonial exchange in the late 19th century (Fisher 1992a; Suttles 1951). This was particularly true among the more Anglicized nouveau riche that was emerging in some native communities. Consisting of trade-rich individuals from intermediate positions within the traditional hereditary hierarchy, these individuals tenuously occupied many of the top ceremonial titles vacated by the 19th century epidemics.4

Further, through the 19th century, a host of emergent external pressures fostered the adoption of potato cultivation by Northwest Coast peoples. During the height of the sea-based fur trade, European trade goods acquired in exchange for sea otter (and to a lesser extent beaver) pelts had gained heightened economic and ceremonial importance, and were emblematic of chiefly prestige. At the close of the fur trade, the sea otter and other fur-bearing animals were becoming rapidly depleted; sea-based fur trading posts...
disbanded, relocating to more remote locations in the Alaskan and Canadian interior where the land-based fur trade persisted. Native peoples of the coast, accustomed to what had been — until recently — a steady flow of introduced trade goods, urgently sought new items to trade with Europeans visiting by ship. While Europeans generally refused to purchase most endemic plant foods, including rhizomes, they were often eager to purchase potatoes after long sea voyages. Rapidly over the course of the mid-19th century, potatoes became one of the region's foremost trade goods. Potatoes diffused and were cultivated more broadly than ever before (Fisher 1992a: 44; Robinson 1983; Codere 1961; Suttles 1951b). Indeed, some authors have suggested that, at certain pivotal moments in the region's history, the European fur trade and early settlement was fundamentally dependent upon indigenous cultivation and trade in potatoes, particularly in Russian America (Gibson 1978). Perhaps not coincidentally, it was during the times and in the places of greatest trade with seafaring Europeans that the potato appears to have eclipsed the importance of most endemic root crops. By the late 19th century, many of the villages along primary shipping routes had adopted intensive potato cultivation as one of their foremost economic activities.

Shortly after this time, missionaries arrived in great numbers along the Northwest Coast. Not recognizing true "agriculture" in the unfamiliar plants and patterns of indigenous cultivation, they actively promoted the indigenous peoples' adoption of European agriculture as a necessary early step in the progression from savagery to civilization. Early agricultural experimentation by the Spanish, English, Russians, and Americans had demonstrated that most crops failed on the perennially

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5 For general overviews of the tempo and character of cultural impacts of European settlement upon native
drizzly ocean coast, but both European and indigenous cultivation efforts demonstrated unequivocally that potatoes would thrive. The potato, therefore, became the cornerstone crop of missionary agricultural efforts. As a first order of business, when missions were established during the mid-19th century, missionaries distributed potatoes and modern, western agricultural tools. Native peoples planted potatoes within their villages and within abandoned village sites nearby. Potatoes could not grow in the estuarine margins, but seemed to thrive when planted in the middens and house pits of homes abandoned during the epidemics of this period, places where soils had become tolerably acid-neutral and nutrient-rich due the long-term effects of human settlement. These potato plots at former settlement sites became minor outposts within the seasonal round of many groups who had consolidated at distant village sites (McDonald 1987, 1985). Missionaries, meanwhile, frequently discouraged traditional plant use and management, as a primitive and indolent means of securing sustenance, not suitable for the industrious Christian society that was to be created from the remnant native population.

As the region's indigenous peoples continued to relocate to both consolidated and impromptu mission-based settlements, potatoes had the added advantage of being comparatively portable and geographically 'elastic' in their planting demands. Unlike estuarine gardens, tied to the peculiar topography and ecology of the salt marsh, potatoes could be planted in any terrestrial location, provided that the forest canopy was cleared and the soil fertilized. Throughout the late-19th and early-20th centuries, the peoples of this coast continued to relocate into these consolidated villages, beyond their traditional resource territories, where they possessed little or no claims to nearby natural peoples, with occasional mention of ecological consequences, see Fisher (1992) and Duff (1965).
resources. There were diverse incentives to transport potatoes as they moved, and to plant them in their new home villages. There were fewer incentives every year, however – dietary, economic, or ceremonial – to continue rhizome cultivation and the production and maintenance of elaborate rhizome gardens in the intertidal zone.

Meanwhile, new settlers arriving in the late-19th century actively sought burned clearings made by native peoples only a few years before for camas or potato cultivation. These burned meadows, the only sizable clearings near sea level in this zone, were used both for the building of settlements and the grazing of livestock. Camas and potato plots were commonly destroyed in the process, and the use of fire actively suppressed, contributing to the further displacement of native peoples, particularly on the southern coast.6

As missionary activity, trade, and white settlement continued to push into more remote segments of the coast in the late 19th and early 20th centuries, potato cultivation diffused to increasingly remote locations. Meanwhile, the increasing integration of native peoples into the cash economy, and their growing dependence upon purchased foodstuffs contributed to the decline of all forms of cultivation altogether within the larger, more Anglicized communities. Increasingly, the purchased foodstuffs of the European settlers eclipsed the full range of traditional foods, likely contributing to the documented rise of malnutrition within the region’s larger native communities in the 20th century (Lee, Reyburn, and Carrow, 1971; Codere 1961). Through the first half of the 20th century, the comparative convenience and prestige of purchased, non-traditional

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6 For a time, in places such as Neahkahnie Mountain in the Tillamook territory of the northern Oregon coast, settlers continued to burn lands originally cleared by native peoples, in order to maintain grasslands for livestock grazing (Joe Scovell pers. comm. 1997).
foods grew dramatically while the ceremonial significance of native foodstuffs continued to decline. By mid-century, only a few traditional subsistence methods – non-commercial fishing, berry picking, and shellfish harvesting, for example – persisted as primary subsistence activities. Further, these traditional food-gathering activities persisted primarily within the region’s smaller and more remote indigenous communities where more traditional, impoverished, or elderly individuals were concentrated. To the vast majority of Northwest Coast peoples, traditional estuarine gardening had become little more than a historical curiosity.
CHAPTER 12

SUBSISTENCE AND RESISTANCE:
ESTUARINE GARDENS AS CONTESTED SPACES

As culturally significant resource sites, gardens have frequently become the geographical nexus of political, social, economic, and cultural conflicts between colonial and indigenous peoples. The pivotal role of prime resource sites within colonial encounters and inter-ethnic conflict has served as a cornerstone of several germinal documents within the expanding subfield of political ecology (Zimmerer 1991; Hecht and Cockburn 1989; Watts 1988, 1983; Blaikie and Brookfield 1987; Scott 1985, 1976). More recently, patterns of colonial-era conflict over resource sites have been noted by authors focusing on the subsistence practices and sites of Northwestern indigenous peoples, specifically (Harris 1997; Willems-Braun 1997; Blomley 1996; White 1995; McDonald 1990, 1985). In order to understand the demise of traditional cultivation and the disappearance of much of the ethnographic record pertaining to cultivation on the Northwest Coast, then, it is important to investigate the role of garden sites within the broader history of colonial-indigenous interaction.

Colonial objectives on the Northwest Coast played an important role in the elimination of traditional plant cultivation in this region. In many respects, colonial occupation and resettlement have been predicated upon the legal and physical removal of native peoples from their lands, both on the Northwest Coast and elsewhere. In efforts to secure territorial control, colonial authorities have, in many places and at many times, been motivated to sever the ties between native peoples and their resource base. Within densely settled aboriginal lands such as on the Northwest Coast, colonial
commercial enterprises, resource extraction, and agricultural settlement were fundamentally dependent upon the alienation of indigenous peoples' lands, in part or in whole. As colonial agendas shifted over time, so too did the extent and modes of territorial dispossession employed to advance colonial enterprises. Often, indigenous peoples - lacking the means for organized or forceful resistance - have opted to resist these changes in numerous ways, many quite subtle (Scott 1985). Their maintenance of traditional subsistence practices in the face of colonial opposition has sometimes served as part of this more general pattern of resistance. In turn, this process has enhanced the value of traditional foodstuffs as emblems of indigenous identity and persistence, as late 20th and early 21st century indigenous peoples seek to define and defend their boundaries, territorial and cultural, with the colonial world (Blomley 1996).

Modes of Dispossession

Historical circumstances have inextricably linked the processes of territorial dispossession and colonial representation, and neither of these categories can be understood separate of the other. As previous chapters have demonstrated, the representation of Northwest Coast peoples as non-cultivators had diverse roots, from the journals of James Cook to the ethnological writings of Franz Boas. Clearly, the dismissal of plant cultivation on the Northwest Coast reflects a long history of dispossession and misrepresentation, which began at the first moments of European contact. Colonial documentation of traditional land use was shaped in no small part by the goals of territorial appropriation, which served as the raison d'être of most colonial-indigenous exchanges of the early colonial period. Shaped by the territorial agendas of the colonial project, colonial representations of native peoples, in turn, served to
tangibly shape the native world by coloring colonial views, expectations, and policies
(PRatt 1992).

There is little doubt that the earliest representations of Northwest Coast peoples
were based on brief encounters and biased expectations. Encountering the seemingly
"tropical exuberance" of the Northwest Coast, explorers arrived on the Coast with
certain assumptions, shaped by their notions of racial and cultural superiority, forged in
their colonial experiences in other parts of the world (Clayton 1999; Fisher 1992: 82).
Beginning with Cook’s journals, Northwest Coast peoples were depicted as the
primitive and indolent beneficiaries of an abundant environment, with little need to
modify the landscape. Women’s work, including the vast majority of traditional plant
management activities, tended to dismissed as unimportant (PRatt 1992; Fiske 1991).
From the earliest moments of exploration, then, anthropogenic plant communities were
documented, but the apparent fecundity of the landscape was never, in the colonial
view, "indebted for its decoration to the hand of man" (Vancouver 1798: 229).
Elements of estuarine root gardening, specifically, received occasional mention in these
earliest accounts, but gardens were assumed to be natural features; the human role in
producing and maintaining their productivity was overlooked by each successive
generation of itinerant chroniclers. The peculiar claims of explorers, such as William
Douglas (1790: 369), who attributed cultivation detected at first contact to the
"considerable friendship" of early explorers are telling. Not only do they suggest the
significance of Cook’s accounts in shaping the ethnographic narrative of the Northwest
Coast, but also betray a deeply ingrained ethnocentric bias, manifested in unfounded
diffusionist reasoning (Blaut 1993). These situated, early representations of Northwest
Coast subsistence served to shape the ways in which indigenous and colonial peoples would negotiate their relationship, and their utilization of the region’s estuaries, from first contact up to the present day.

While gardens escaped the attention of early explorers and fur traders, arriving traders and settlers could not ignore the widespread cultural and dietary significance of estuarine root gardens, as the intermittent European presence of the fur trade gave way to the fledgling land-based colonial presence. Yet simultaneously, this period was characterized by a rapid worsening of white-indigenous relations, as amiable fur trade alliances dissolved and colonial authorities anxiously sought to control the indigenous majority in the coastal hinterland (Harris 1997; Fisher 1992). Increasingly, tribal control of the hinterland was depicted as both a strategic threat and an unacceptable limitation upon the settlement and industrial development. In turn, this threatened to undermine the potential success of the whole colonial enterprise in this remote outpost of the British Empire. The control and destruction of the aboriginal resource base was among the steps consciously employed in the legal and physical removal of native peoples from the land, as a means toward the end of controlling the colonial hinterland (Wishart 1994; McDonald 1987).

Estuarine gardens were not exempt from this policy. Ironically, some of the earliest and clearest evidence available that demonstrates colonial awareness of the significance of root gardens appears in the form of documented military attacks on garden sites. The best-documented attacks were associated with colonial attempts to quell tribal insurrection, during colonial conflicts with the Nuu-chah-nulth in the early 1860s. In 1864 the Ahousaht Nuu-chah-nulth people of Clayoquot Sound scuttled a
colonial ship, the Kingfisher, which had been sent to monitor their activities and enforce colonial prohibitions on illegal trade and ceremonial activities in the remote inlets that surrounded their villages. In response, two British gunboats, the Sutlej and the Devastation, conducted a scorched-earth campaign on tribal resource sites throughout the territories of the Ahousaht and other neighboring Nuu-chah-nulth nations. In an action that was, according to Victoria’s Colonist newspaper “conducted according to the strict rules of civilized warfare,” these ships bombarded occupied houses and destroyed salmon fishing weirs (quoted in Fisher 1992: 168). In addition, crews poured coal oil over each village’s rhizome gardens and set them ablaze. With the year’s crops destroyed, with garden soils left toxic, and with likely structural damage to stone retaining walls, many of these gardens were permanently abandoned at this time. These gardens include several of those identified by Bouchard and Kennedy’s Nuu-chah-nulth consultants on Clayoquot Sound (Figure 5; Bouchard and Kennedy 1990; Gough 1984, 1978b).

Less organized attacks on garden infrastructure appear to have also been carried out by ‘vigilante’ groups of settlers operating in the British Columbia hinterland. White settlers reportedly descended upon and burned down Kwakwaka’wakw digging houses at clover garden sites. Such attacks were documented as late as 1912, when white settlers on Quatsino Sound burned down the structures at the well-documented clover gardens at Bi’s, possibly to undercut pending Indian land claims on the site that were being negotiated through the McKenna-McBride Royal Commission (1913-16: 138).

While these attacks strengthened colonial control throughout the coastal hinterland, this control was further consolidated soon thereafter through missionary
intervention, and the survey and alienation of tribal lands, creating new obstacles to traditional gardening. As discussed in the previous chapter, missionaries played an active role in the elimination of traditional gardening practices, encouraging potato cultivation and the relocation of native peoples to mission settlements far from estuarine garden sites. Simultaneously, colonial surveyors traveled along the B.C. coast, assessing the extent of native occupation and identifying lands that were suitable for European occupation. Archival evidence makes it clear that surveyors visited and documented several estuarine garden sites, and there are numerous references to “Indian cultivation” at these sites (Galois 1994; Canadian Land Survey n.d.). Nonetheless, the published survey reports almost invariably denied the presence of any form of cultivation. One of the colonial surveyors involved in this process, Robert Brown (1873: 50), reported “Of agriculture they are quite ignorant - they have no aboriginal plant which they cultivate,” but even when cultivating potatoes, “their utter laziness prevents them from scratching over anything but a mere scrap of ground.” The precise reasons for this consistent editorial bias will forever remain unclear, although they may be inferred from the general context of Indian-colonial relations at the time.

Advocates of the forceful dispossession of tribal lands, in turn, cited this presumed lack of a cultivating tradition as a justification for advancing policies of tribal land alienation. In 1868, frontier capitalist and British Columbia Land Commissioner James Sproat (1987: 8) suggested that land dispossession within the province could proceed apace, due to the lack of agriculture, which demonstrated a general absence of indigenous proprietorship in the land:
“any right in the soil which these natives had as occupiers was partial and imperfect as, with the exception of hunting animals in the forest, plucking wild fruits, and cutting a few trees...the natives did not in any civilized sense, occupy the land.”

This characterization was quite typical, and was used by Sproat and others as justification for assuming ownership of the lands. Land tenure had purportedly not been demonstrated by these Indians, and there was little basis, therefore, for establishing land rights anew. On this basis, British Columbia colonial land policy promoted the creation of small reserves encompassing individual village sites and little else (Tennant 1974).

While the Crown did seek tribal testimony on the location and significance of resource sites, this ultimately protected few gardens from dispossession, in part due to indigenous peoples' lack of understanding of, or access to, the colonial legal system. Contemporary elders report that land alienation was inconceivable to many of their grandparents: some refused to make land claims to the tribunals, saying that there was no reason why their own title to the land should be challenged. Different Kwakwaka'wakw villages still have oral traditions regarding the arrival of Crown surveyors during this time, explaining their plans to cede new resource lands to the Crown, as a first step to the establishment of industrial scale forestry. Speaking of events at Kingcome Village, Adam Dick (pers comm. 1998) recounts:

“They called a meeting there, and said “how much [are you going to] claim around your [houses]?”...when they surveyors went up there. And [translators] tried to tell the people “you better [do something] you know.” And the [people] got up and said “What? What is he saying? What is he talking about?” [to] whoever was the interpreter of the room. And they told him what the guy said. “Ahhh,” [the chief] said “only Dzonokwa can pack those timbers out of here!” ....Oh, they said they didn’t believe him, “no we’re not going to do anything about it.” And...they took all that land.”
Only Dzonokwa, the immensely powerful, sasquatch-like woman of the woods could pack out all of the old growth timbers, in the way the white men claimed they would. The white men’s claims seemed very foolish. On the basis of this response, much of the land surrounding Kingcome Village, including the vast gardens on the Kingcome River tidal flats, was documented as unused, and open for donation land grants. The Kwagiulth Indian Agency received reserve land allotments solely in the vicinity of Kingcome Village, and the management of these lands were placed under the stewardship of Indian Agent William Halliday (Kwagiulth Agency n.d., Vol. 1648: 407-10, 572; Adam Dick pers. comm. 1998).

In short order, by many accounts, this confiscation of estuarine cultivation sites generated considerable inter-cultural conflict (Raley 1897). In the course of my research, I was able to hear of numerous cases of conflict over individual estuarine garden sites, most notably these Kwakwakw̱a’wakw rhizome gardens at the head of Kingcome Inlet. Remarkably, archival evidence makes it clear that both surveyors and colonial-era ethnographers were aware of the importance of the “root grounds” on the Kingcome River tidal flats in the diet, trade, and ceremony of the people at Kingcome Inlet (Dawson 1887a: 65; Newcombe n.d. 24/6: 1552). This is remarkable, in light of the general lack of recognition of garden sites, as it is remarkable in light of the inclusion of these flats in the lands deeded for cession.

Almost immediately after the Reserve surveys were complete for the Kingcome area, Kwagiulth Indian Agent William Halliday assisted his brother, Allen Halliday, in taking a land claim and occupying the broad tidal flats at the head of Kingcome Inlet.
As the Hallidays recognized, these flats, where most of the area's rhizome gardens were concentrated, also represented the largest level meadow area in the rocky and densely-forested Kwagiulth Agency, and one of the only sites suitable for commercial-scale cattle grazing within this jurisdiction. In 1892, the Halliday family secured a land claim on the whole of the tidal flats on the western side of the Kingcome River estuary, an area where, according to numerous contemporary elders, estuarine gardens were still present. During the first season on Kingcome flats, the Hallidays reportedly unloaded all of their provisions on the riverbank at a temporary encampment; this encampment was not above the flood level, and the majority of their supplies were swept away with the first late spring freshet. The residents of Kingcome or Gwai’i Village, living a few kilometers upstream, offered assistance, and claim to have been largely responsible for keeping the Hallidays fed during their first year in Kingcome. During this time, some Kwakwaka’wakw elders report that their grandparents began discussing the question of the ownership of the flats – the Hallidays informed the people at Kingcome that they had legally acquired the tidal flats on which the gardens sat. In response to the villagers’ stated concerns, the Hallidays reportedly made promises that access to the garden sites would not be hindered by their activities.

It is clear, however, that the Halliday family had other plans. A.F. Cotton, who surveyed the Kingcome area for the colonial government shortly after the Hallidays’ first arrival reported, somewhat ironically, that the Indians in this area “gather a great quantity of roots (clover and others)” on the tidal flats, but “do not cultivate any of their large reserve (Cotton 1894: 801). Cotton (1894: 801-02) then went on to report that the tidal flats at Kingcome were
“flooded during the summer freshets, also by the high tides, which occur every month. Messrs. Halliday and Kirby, who have been there for over a year, say a 3-foot dike is sufficient to protect it against the highest water they have seen [thereby making available for cultivation] about 800 acres of grass land without timber of any kind.”

By the mid 1890s, as the Hallidays became established at Kingcome, their public stance on these gardens shifted abruptly, according to the testimony of contemporary Kingcome residents. Kwakwaka’wakw elders with ties to the village at Kingcome Inlet still speak of this time, when the Indian Agent’s brother abruptly diked and covered with grazing cattle the lands they gardened, and the gardens of their ancestors:

“the Hallidays took over everything…. They built a dike right around there. They claimed the whole flats. [His brother, William] gave him the okay to have that, the whole flats, and they covered the gardens that the old people used to have… it was all gardens all over that field there. And they put a dike around it. They took the whole flat” (Adam Dick pers. comm. 1998).

Tensions grew, and there was talk of Indian reprisals. Asked if the people at Kingcome responded in any way to the Hallidays’ occupation of their gardens at Kingcome Inlet, however, contemporary elders suggest they could do very little

“because of the imprisonments. They had to be really careful… The brother was the Indian Agent. That is why we can’t do anything about it. They gave him the okay: “you take that land.” If you complained you ended up in jail somehow” (Daisy Sewid-Smith, pers comm. 1998).
Multiple consultants at Kingcome report that the Hallidays kept guard dogs for a time, and would walk the perimeter of the ranch to keep Indians from the nearby village off of the former garden sites.

While the land was held in the name of his brother, Allen, Indian Agent William Halliday resided at Kingcome for a time with his extended family. With his connections and considerable political clout within the growing colony of British Columbia, William Halliday aided his family in establishing a profitable cattle ranch at Kingcome; cattle were boated to markets in the growing resource outposts on Vancouver Island’s east shore. As elsewhere (Smith n.d. 5/3:11), introduced livestock fed on the tended root grounds, trampled estuarine plots, and effectively obliterated large sections of the original gardens, leaving only small remnant patches of these plants. Local oral traditions suggest that William Halliday also aided his family with manual labor on the ranch, including the construction of fences and dikes around the perimeter of the Kingcome tidal flats, and the clearing of adjacent brush (including certain traditional berrying and crabapple-gathering sites near the perimeter of the dike, which local villagers had still attempted to harvest). He also became active in promoting land speculation and purchases on the Kingcome flats, noting that the tidal flats possessed rare opportunities for the expansion of future commercial agricultural operations (Halliday 1910: 245). Simultaneously, the archival record makes it clear that, at this time, William Halliday became a vocal opponent of Indian land claims and the growing crescendo of grievances being expressed in the colonial courts as a result of such colonial land occupation.¹ Such grievances were being raised with particular

¹ In his memoirs, Halliday (1935) frequently noted that he had played a pivotal role in efforts to eliminate the Kwakwá’wał’wakw potlatch and other ceremonial traditions that were believed to undermine efforts to
frequency regarding settlers’ occupation of the salt marsh flats, where most of these early agricultural experiments were concentrated. In his official reports, Halliday asserted that the Indians had never needed land to survive prehistorically, and there was no reason why they would need it now. Not only did indigenous peoples “not till the soil,” prehistorically, but they had “made their living very easily, that is so far as the actual necessities are concerned.” Their diet consisted almost exclusively of fish, he noted, and the “waters of the coast teem with fish” (Halliday 1910: 238, 248).

Anthropology, Scholarly Legitimacy, and Territorial Dispossession

Anthropological knowledge of the Northwest Coast can not be easily understood without reference to the unfolding of colonial history. Arriving at the close of the 19th century, decades after extensive colonial disruption of traditional subsistence activities, early anthropologists found decimated villages of uprooted peoples, cultivating potatoes. That they often repeated the colonial orthodoxy uncritically is not wholly surprising. The question of Northwest Coast subsistence seemed settled from the onset; it was not the focus of any early anthropologists’ research. As mentioned in previous chapters, a repetition of the tautology on the “non-agricultural Northwest Coast” became a frequent and unexamined prelude to what were considered more substantive matters within the region’s anthropological writings. Northwest Coast food gathering was depicted as a simple, even leisurely affair: the potato was clearly introduced, salmon was the staple. As salmon were available in seemingly limitless quantities to this much-reduced population, there would have simply been no need for the peoples of

Christianize the Indians and incorporate them into the frontier capitalist economy. He aided in the establishment of intensive policing and surveillance operations near some of the larger Kwakwaka’wakw communities, a policy that forced many traditional practices ‘underground’ and into hinterland locations (Cole and Chaikin 1990; Sewid-Smith 1979).
this coast to modify their environment or utilize plants. The foundations for the conventional scholarly view of Northwest coast peoples was set – at this time, it seemed, they were remnant populations of “exceptional hunter-gatherers” with social stratification, private property, and complex ceremonialism but no apparent endemic tradition of plant cultivation.

While the categorization of Northwest Coast peoples as “non-agricultural” was a seemingly benign semantic exercise among western explorers and scholars, this designation was not without profound consequences during the colonial period. The colonialists’ depiction of a Northwest Coast without cultivation gained heightened levels of legitimacy through the scholarly reaffirmations of Boas and other anthropologists. The “non-agricultural” designation gained the status of popular wisdom throughout the British Empire and the United States, mediated in no small part through Boas’ turn-of-the-century writings on Northwest Coast cultures.

Bolstered by the authority of scholarly reproduction, colonial authorities invoked this “non-agricultural” designation with renewed vigor in the early years of the 20th century. Despite a growing body of formal documentation of estuarine cultivation, in both academic and official literatures, the label took on a heightening significance, serving as a cornerstone of textual dispossession that was employed in the almost total legal dispossession of tribal garden sites. Thus, as western Canada’s Indian reserve system was being designed, some colonial authorities invoked the authority of recent anthropological data, questioning whether the native peoples of British Columbia required any land whatsoever, save village sites, in order to survive. By the early teens, the McKenna-McBride Royal Commission had been formed to bring closure to the
Indian land question, fielding indigenous land claims and making legally-binding
judgements on their merits (thereby creating the pattern of reserve lands which persists
in somewhat modified form today). Though the potato and other European crops had
replaced most indigenous crop plants at this time, and many native peoples had
relocated far from garden sites, a few gardens were still maintained, and several claims
were made to the Commission for both active and abandoned garden sites. The
Kwakwaka'wakw, for example, petitioned the Commission for some 29 land claims on
“garden” sites in 1914 (McKenna-McBride Royal Commission 1913-1916).

The transcripts from the McKenna-McBride proceedings make it abundantly
clear that the misrepresentation of indigenous subsistence in this region tremendously
confounded inter-ethnic negotiations. Commission members and indigenous informants
spoke past one-another: asked whether a particular site was “cultivated,”
Kwakwaka'wakw elder Moses Alfred insisted that it was not. However, he noted, it
was used to grow potatoes. When told by Chief Humseet of longstanding indigenous
use and ownership of garden sites, with estuarine root gardens that their “forefathers
had planted” the Commission noted that cultivation did not exist prehistorically on this
cost, and officially designated cultivation on this site as a “proposed” or “potential”
use of the land (MMRC 1913-16: 181-82). In the end, noting prevalent scholarly
wisdom that there was no tradition of plant cultivation on this coast, the Commission
interpreted all claims on cultivation sites where potatoes were not harvested as a
speculative land grab, driven by enterprising Indians with possible commercial interests.
Only potato gardens within existing villages were granted protection within Indian
Reserves created during this final phase of tribal land allotments. Claims on estuarine
garden sites were summarily denied, in all but a small number of cases in which a site claimed for gardens coincided with another function, such as a village site. Invoking the Northwest Coast anthropological literature, and echoing the words of Halliday, the final findings of McKenna-McBride (quoted in Galois 1994: 74) explained their decision, suggesting that access to the sea was necessary to the survival of native peoples, but resource lands were not “reasonably required.” Strongly influenced by the “non-agricultural” designation of Northwest Coast peoples, the Crown authorized only a diffuse pattern of small reserves, encompassing 19th century village sites, and little else (Brealey 1995; Tennant 1990; Wagner 1972).

Once the Crown formally confiscated contested garden sites early this century, these sites were subject to direct occupation on a scale not seen in the previous century. As some of the only level, unforested land along the coast, these lands were in high demand by industrialists and settlers, as part of logging, mining, and farming operations. Tideland garden sites were diked and filled for cattle grazing in numerous smaller marshes, as had been done decades before at Kingcome. Elsewhere, garden sites were buried with fill and piers for the construction of log loading areas and both permanent and temporary mill sites. Even the sporadic use of remaining gardens largely disappeared soon thereafter, as traditional estuarine lands became less accessible, and the dietary, economic, and ceremonial motives for estuarine gardening dwindled into the late colonial period.

Turn-of-the-Century Resistance and Perpetuation

Outgunned from the onset of colonial occupation, the most effective mechanisms for tribal resistance involved the clandestine perpetuation of pre-contact
practices, far from the centers of colonial influence (Scott 1984). The late 19th and early 20th century marked the time of the “underground potlatch,” when traditional ceremonies were outlawed, but were carried on in remote locations, far from the colonial gaze (Cole 1991a, 1991b; Cole and Chaikin 1990). The exteriors of houses used for ceremonial events, formerly adorned in bold totemic art during the early contact period, were disguised as barns or storage buildings. Ceremonial goods and regalia were hidden in caves, and lookouts were posted to watch for approaching patrol boats. And while Anglicized Indians, who lived near the colonial outposts, adopted European cuisine, those who participated in this backwater resistance movement reportedly continued traditional food gathering and preparation, often refusing to adopt the crops promoted by missionaries. As the colonial hinterland had been secured, in the view of colonial authorities, the incentive to patrol these peripheral locations diminished rapidly in the early decades of the 20th century.

Within this context, among some Kwakwaka’wakw on the remote central mainland coast of British Columbia, a millenarian movement took form. As described earlier in this dissertation, the Kwakwaka’wakw grew convinced that the colonials were having a pervasive influence on their culture. For this reasons they began to isolate a number of youngsters of noble lineage – including Adam Dick, who has served as an important consultant for this dissertation – on isolated inlets where, for years, they were drilled on all aspects of traditional life, and never taught English. Elders hoped to produce a generation of future hereditary chiefs to rule and restore order during a prophesized time when the white influence would be challenged. Traditional estuarine gardening was an integral part of their training, and elders of the early 20th century
presented it to them as a pre-contact practice. As Adam Dick (pers. comm. 1998) notes, “it was important to them that we learned that....everyone had gardens!” In these places, these centers of tribal resistance, even potatoes were sometimes avoided. Though occasional root harvest persisted well into the end of the 20th century, the self-conscious reproduction of traditional gardens ceased by the late-1930s, as the millenarian movement began to unravel. As far as I can determine, this was the final moment of traditional gardening among Northwest Coast peoples.

When these people emerged from the hinterland in the post-War period, they found the white presence rapidly expanding, and indigenous identity quickly fading. Older people continued to dig roots on a handful of former garden sites and a few continued to claim hereditary rights to particular unmanaged root grounds. Still, rapid cultural assimilation, and a pervasive shift of the diet to Western foods resulted in the gradual disappearance of intensive gardening by mid-century. Today, to my knowledge, no-one gardens in the old way, except possibly Adam Dick, who built a sample garden with my assistance, so that he could show me how his people used to garden the flats.

Contemporary Identities and Traditional Gardens

Increasingly, at the close of the 20th century and the beginning of the 21st, the continued use of food plants and animals has become essential to the maintenance of a distinctive tribal identity. By the late 20th century, the potlatch and other traditional ceremonial practices were no longer illegal. Today, contemporary indigenous peoples commonly arrive at potlatches in pickup trucks or motorized fishing boats, wear western clothing, and ceremonially exchange rolls of Canadian currency. The diet of
the potlatch, however, has essentially remained (and has become increasingly) traditional, consisting in large part of traditional fish, shellfish, and berry dishes (Kasten 1990). This is not simply because these are their traditional foods; importantly, it is also because, in the view of many contemporary indigenous peoples, the use of these foods is now inextricably linked to a pattern of indigenous resistance. The use of these foods has come to be symbolic of their successful preservation of a distinct indigenous identity and access to traditional lands and resources. Moreover, “Indian food” is the preferred diet of those few elders who were raised in the millenarian backwaters, who still remember and practice the old rites, and are now sought for counsel by young people attempting to reconstruct their traditions. While traditional foodstuffs, such as salmon, berries, and shellfish, remained an important, albeit often a supplemental role in the native diet through the 20th century, the resurgence in indigenous identity during the last three decades has heightened interest in traditional foods and traditional food preparation. Along with this trend has come a revived interest in traditional ethnobotany, and plant foods are being experimentally re-adopted.

Until very recently, rhizome gardens did not play a role in this process. During the 20th century, as estuarine gardens fell into disuse, garden rockwork features were slowly disassembled and buried by sediments carried there by floods and peak tides. In the early 20th century, crumbling rock walls were commonly scavenged to maintain boundary markers to demarcate new boundaries, criss-crossing through old garden sites. Historical plot boundaries at archaeological garden sites appear to be much larger, but cumulatively use much less of the total marsh. This is a telling reflection of the “disintensification” of this resource, as pressures encouraging its production have
precipitously declined (Brookfield 1972). By mid-century, cultivation devolved into small-scale gathering on some former garden sites, carried out by a small number of elderly people. Most gardens were abandoned altogether along with their adjoining villages; throughout the depopulated hinterland, one finds only relicts of pre-contact practices, crumbling rock walls in the upper intertidal zone near the successional vegetation of abandoned village sites (Sestini 1962). Some families continued to claim rhizome patches and dig there for special occasions well into the late 20th century. Little incentive remained for the intensive maintenance of estuarine gardens. There was little rockwork repair or plot weeding and transplanting, though some patches were still used for occasional rhizome digging.

Interestingly, the ancient practice of garden hunting often persisted, even in cases where rhizome gardening did not. Some consultants are aware of the history of these sites: "I guess people used to dig roots there a long time ago...[now] we just go there to hunt." Others do not seem to be aware of this former use. Deteriorating rhizome garden sites are still attractive feeding sites to waterfowl, and shotgun shells are commonly found behind small blinds made of logs, or of rocks scavenged from crumbling rockwork walls. So common are these hunting blinds that today they seem almost "diagnostic" of former garden sites on some portions of the coast. The tradition of hunting at these sites seems to have persisted among certain men, even when women's cultivation of roots has become an essentially forgotten practice. While potatoes replaced native root crops, there has been nothing to replace the dietary or cultural importance of bird hunting.
Almost every Kwakwaka'wakw elder over the age of 70 has heard something of the traditional significance of estuarine gardening, though the depth of their knowledge varies greatly. Some oral traditions regarding pre-European estuarine cultivation persist among young people today, but it is clear that knowledge of these practices are not being passed orally, between the generations, as they once were. In a single Kwakwaka'wakw village, I have been told by one person "Of course we 'cultivated' plants... what else would you call it?" while being told by another person, roughly 20 years younger, "I never knew that our ancestors did that... I think that people might want to try doing that again, if they knew about it." The trajectories by which the oral history of cultivation have arrived in the present appear to have been interrupted by a number of factors, many of them quite unpredictable and tied to personal circumstances. The heightened tempo of cultural assimilation that characterized the 20th century (the mid-20th century in particular) appears to have been the most formidable obstacle to the continuation of most oral traditions on the coast, including those surrounding traditional resource management (Codere 1961).

For these reasons, it is interesting to note that, very recently, young people within some of the native communities that abandoned traditional rhizome cultivation practices in the 19th century have began to discuss whether they might attempt to revive some of these practices. These proposals are advanced for purposes dietary, economic, and ceremonial, reflecting a growing trend toward the use of traditional activities as a means of ameliorating the poverty, health problems, and uncertainty that plague contemporary Northwest Coast communities (Amoss 1977).2 Many also express such a

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2 This interest appears to have been stimulated considerably by my own research on the topic, and my communications about past cultivation practices and sites with tribal representatives.
renewed interest, recognizing that a return to traditional cultivation practices might provide tribal governments with more leverage in contemporary land claims on garden sites confiscated in the early 20th century. Despite their reasons, their efforts are hindered by past physical displacement from garden sites, which has contributed to the displacement of site-specific traditional environmental knowledge. Elders complain that the young people, generations separated from their lands, do not even know what these plants look like, what they taste like, nor what time of the year they should be harvested (Adam Dick pers comm. 1999, 1998; Craig and Smith 1997: 36; Drucker n.d. Box 1, 2/2). Their efforts also are hindered by a lack of access: as an outcome of McKenna-McBride era land apportionment, each village's former gardens now sit on Crown land or on the private property of whites. In recent year, people who return to gather plants in traditional sites close to white settlements report sometimes being confronted by new landowners, and some claim to have been escorted away by police and fined for trespassing and theft. And their efforts are hindered by the resource industries' collateral damage of garden sites on lands confiscated during the McKenna-McBride period: in the field, many abandoned garden sites have clearly been destroyed, buried under log loading stations, battered by floating log rafts, buried by sediments washed from nearby clearcuts. Further, several indigenous consultants from remote village sites report that industrial foresters now extensively use herbicides, sprayed by helicopter or airplane, to retard the growth of brush that might compete with planted tree seedlings. Recognizing that these herbicides seem to wash away, visibly harming downslope vegetation and reducing fish runs, there is much concern about using plants
from estuarine areas, to which all terrestrial runoff eventually flows (McDonald 1985:210).

Meanwhile, settlers’ politically motivated attacks on garden sites and infrastructure have only partially subsided since the beginning of the 20th century. Investigating a potential garden rockwork on Nootka Sound in the course of my 1997 dissertation fieldwork, I was met by a brusque man who recently had taken up a shoreline claim in the area and built a houseboat. He asserted that, had he suspected that the rockwork near his new houseboat might be used to substantiate Nuu-chah-nulth land claims in the areas, he “would have pulled up every rock and thrown it into the sea.” He hinted that others have done this recently, and nearby. It was too late for him to do this, he lamented, because the rockworks near his home had recently been documented (as a fish trap) by a passing team of archaeologists compiling data for treaty re-negotiation proceedings with the Nuu-chah-nulth, and was now being documented, once again, by me.

In addition, there are tremendous legal obstacles to the revival of estuarine cultivation. Much as the truism of a non-agricultural Northwest Coast has persisted in the contemporary academic literature despite evidence to the contrary, so it has continued to hinder contemporary indigenous land claims made as challenges to the outcome of the McKenna-McBride proceedings. In 1991, during the widely publicized case of Delgamuukw vs. The Queen, land claims on terrestrial plant management sites, still being managed in traditional ways, were once again denied. Citing the turn-of-the-century anthropological literature in his written Reasons for Judgement, Chief Justice Allan McEachern (1991: 31) suggested that the absence of agriculture and other
civilized practices in the ethnographic record suggested that Northwest Coast “civilizations, if they qualify for that description, fall within a much lower, even primitive order.” Presented with evidence of sacred sites, sedentary villages, and the long-term clearing, tending, and land tenure on plots of food plants, McEachern (1991:24) nonetheless relied heavily on the early accounts of colonial explorers and 19th century academic anthropologists. On this basis, he asserted that: “the primitive condition of the natives described by early observers is not impressive” and dismissed the land claims on plant resource sites which came before him at this time (Fisher 1992b). McEachern’s decision has since been overturned. However, it is widely recognized that Northwest Coast peoples’ reasons for continuing (or reviving) traditional resource management practices are contentious. Their motives are increasingly ceremonial, and intimately tied to the awkward politics of identity and land negotiations, rather than persisting exclusively for the purposes of sustenance. As a result, the indigenous peoples of the coast will continue to bear the burden of proof in the Canadian courts when they lay claim to lands long owned and cultivated by their ancestors. The obstacles are many, yet the determination of these people leads me to believe that, here and there, the traditional gardens will return.3

To summarize, then, territorial dispossession, colonial representation, and indigenous resistance cannot be understood separately. Emerging from the colonial period, European representations of indigenous subsistence on the Northwest Coast were inextricably tied to the assumptions and objectives of the colonial project. The

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3 Currently, Adam Dick is organizing the collection of estuarine roots, to be included among the other traditional foods featured at an upcoming potlatch to celebrate the raising of a new longhouse. He and many others have expressed the hope that these traditional foods will once again hold their importance as a prestigious potlatch food.
claims made about traditional indigenous subsistence by colonial occupiers remains suspect, and intertwined with colonizers overarching assumptions regarding the racial and cultural inferiority of colonial subject peoples, as well as the general insignificance of “women’s work.” Estuarine gardening, as a practice dissimilar from European traditions, and carried out primarily by women, was not featured prominently nor sympathetically by early observers. In turn, on the Northwest Coast, the representation of indigenous peoples as “non-cultivators” by scholars, policymakers, and settlers alike, served to undercut land claims on terrestrial resource sites. In turn, this facilitated the dispossession of lands, the displacement of native peoples, and ultimately the loss of many traditional practices and much traditional knowledge. However, indigenous peoples have not been passive puppets of the colonial regime in this process; at all times, they have exerted their agency, resisting change and redefining the cultural significance of traditional lands and resources. Consumed in particularly public contexts, traditional foods now serve as potent emblems, signifiers of tribal resistance to this history of colonial appropriation. Likewise, the proposed revival of traditional estuarine gardening is an expressive act, telling us at least as much about indigenous efforts to demonstrate their cultural persistence and their enduring ties to the land, as it tells us about the role of estuarine roots in their contemporary diet. This message is not just meant for tribal members; we, the outsiders, we descendents of the colonizers, are an equally important, intended audience of this display.
CHAPTER 13
CONCLUSIONS

Were the peoples of the pre-European Northwest Coast plant cultivators? Returning to the criteria for the presence of agriculture presented earlier in this dissertation, it is clear that — in some manner — they were. All of Harlan’s (1975) criteria for the presence of “cultivation” — plant propagation, soil modification, irrigation or drainage, and weeding — are represented in the Northwest Coast rhizome cultivation complex. Considerable evidence suggests that food plants were being relocated and reproduced, primarily through vegetative means. Indigenous peoples both created and augmented rhizome plots through the churning and mounding of marsh soils, and the expansion of cultivatable areas through the use of rockworks and other impoundments. Through the creation of raised mounds and impoundments, these peoples manipulated local hydrology, raising and, in essence, draining submerged areas so they might become cultivable; with porous soils, often mounded near natural seeps, this improved fresh water retention in the summer months, and excluded saltwater inundation year-round. And, through the weeding of competing species, plots of root vegetables were able to occupy expanded and otherwise inaccessible portions of the salt marsh. By Harlan’s (1975) criteria the peoples of the Northwest Coast were “cultivators.” By MacNeish’s criteria (1992), they were “horticulturalists.” Regardless of the precise terms employed, it is clear that the people of the Northwest Coast were not, as many authors have suggested, incapable of plant cultivation.
While the findings of this dissertation demonstrate that the Northwest Coast root cultivation complex existed prior to European contact, the precise origins and antiquity of these practices are as yet unclear. Nonetheless, the region’s archaeological record matches all of the criteria for agricultural origins proposed by MacNeish’s (1992) “affluent forager” model, and is coherent with the sedentary fisherfolk hypothesis advanced by Sauer (1952) and adopted by such authors as Anderson (1952: 142-44). Conceivably, the growing post-Pleistocene sedentism of these coastal fisherfolk, mirroring the natural distributions of salmon and other marine resources, contributed to their experimentation with root crop cultivation. They would have done so, it seems, not as an outcome of Malthusian demographic crisis (cf. Cohen 1977; Boserup 1965), but as the outcome of a successful subsistence strategy which facilitated the emergence of sedentary villages and a co-evolving demand for the spatial concentration of plant foods.

There is little doubt that plant foods were of secondary dietary importance to Northwest Coast peoples within this process.1 However, Northwest Coast subsistence

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1 Certainly, while salmon and other animal foods were of primary importance in the Northwest Coast diet, their significance has been overstated within the literature. Elsewhere, I have critiqued stable isotope studies which have been employed to discount the use plants in the Northwest Coast diet (Deur 1998). Past isotopic studies were calibrated on the basis of a priori assumptions regarding salmon use, arguably resulting in erroneous estimates of salmon consumption in excess of 90% of the pre-contact Northwest Coast diet (Chisolm 1986; Chisolm, Nelson and Schwartz 1983, 1982). The use of carbon isotope analysis was shown to be deeply problematic in the years following the publication of these Northwest Coast studies, and is viewed by many researchers as an invalid method for detailed dietary analysis (Radosevich 1993). Yet, even if one accepts the original isotope data, one can still mathematically demonstrate that up to 40% of the Northwest Coast diet may have consisted of plant foods. Salmon consumption at the levels suggested by these isotopic studies would have produced toxic hypervitaminosis-D, resulting in numerous adverse health effects and bone abnormalities (Lazenby and McCormack 1985; Mirsky, et al. 1985; Coburn and Brautbar 1980; Zeigler and Delling 1975). None of these effects is evident in the region’s paleopathological or ethnographic records (Cybulski 1991a; Cybulski and Pett 1981). For these reasons, past stable isotope studies demonstrate little more than the fact that Northwest Coast peoples were consuming large amounts of marine protein, a fact which is certainly not contested here. Ultimately, past isotopic studies shed little light on the issue of Northwest Coast cultivation.
practices arguably were intermediate between strict foraging and agriculture. They more closely approximated the “dual economy” that has been found archaeologically throughout the tropical lowlands of the Americas, wherein plant cultivation (primarily of root crops) played a supplementary and complementary role to well-established patterns of fishing and foraging. As a complementary activity, Northwest Coast wetland cultivation methods did not conflict with the seasonality and scheduling requirements of marine resources. Indeed, wetland root harvests exhibited greater scheduling flexibility than many animal resources, such as temporally discrete salmon runs. Accordingly, ethnographic evidence hints that the timing of wetland root harvests, while concentrated in the fall months generally, was scheduled so as to not conflict with the peak availability of alternative resources with less flexible seasonal availabilities. This is a significant point if, as Flannery (1968: 77) suggests, an “agricultural transformation” occurs only once scheduling conflicts emerge between plant and animal resource harvests, and a society responds by privileging plant scheduling tasks over hunting and gathering activities. On the Northwest Coast, there is no evidence that the maintenance of root grounds “siphoned” human labor from salmon fishing and other animal harvesting activities to any great extent. This, then, may be the crucial piece of evidence that might lead those scholars eager to classify modes of subsistence to designate Northwest Coast peoples as “cultivators” but not as true “agriculturalists.”

The wetland cultivation practices of the Northwest Coast, as a secondary component of an intermediate subsistence strategy, shed valuable light on the nature of early agriculture or “proto-cultivation” elsewhere in the world. “Intermediate” subsistence strategies, as found on the Northwest Coast, represent a necessary stage in
the early development of agriculture as found elsewhere in the world, as predicted by such authors as Sauer (1952) and MacNeish (1992). Several authors have noted that incremental “experiments with plants” conducted during this phase served as the genesis of plant cultivation worldwide, and ultimately provided the technological basis for the emergence of agriculture. Such authors as Flannery (1968: 79) have asserted that these “experiments” largely consisted of selective weeding, harvesting, and transplanting, carried out to increase the space in which useful native plants would grow, or to increase the output of desirable plants within these spaces. Though they were arguably elaborated beyond a merely “experimental” phase, the wetland cultivation methods of the Northwest Coast of the contact period fit this general model well. In such cases, as Johannesen (1987) and others have noted, the preferential tending and propagation of plants with desirable characteristics over time facilitated the emergence of domesticates; whether this occurred on the Northwest Coast remains unclear, pending further research.

The role of wetland root cropping in this process of agricultural intensification has been overlooked, despite the call for reevaluation by Lathrap (1970) and many others. This bias has been compounded by the fact that root crops are seldom well preserved in the archaeological record. Yet it is clear that wetland cultivation methods similar to those described in this dissertation appear to have been instrumental in facilitating sedentism and cultural complexity within the pre-Columbian empires of the American tropics. Significantly, the wetland cultivation methods of the American tropical lowlands, in their earliest phases, commonly appear to have involved endemic root crops – comparable to those found on the Northwest Coast – rather than introduced domesticates, which only arrived later in their history of agricultural intensification.
Likewise, selective replanting and weeding in wetland environments – methods comparable to those found in the Northwest Coast – played an important and widely-accepted role in the early development of Near Eastern cereal agriculture, as well as the taro, yam, and rice complexes of south Asia and Oceania, by isolating and fostering genetically anomalous cultivars (Flannery 1973: 282; Chang 1970). Clearly, the wetland cultivation methods of the Northwest Coast may yet yield additional insights into the early development of agriculture in these distant times and distant places.

These observations gain additional significance in light of the important role that resource-rich coastal environments, generally, appear to have played within the emergence of agricultural traditions elsewhere in the world. In such locations as coastal Peru and the Near East, the emergence of pre-agricultural sedentary villages at productive marine resource sites appears to have provided the impetus for the emergence of plant cultivation. Indeed, in these cases, it is only after large, sedentary villages appear in the archaeological record that culturally significant plants begin to exhibit genetic differences from their wild forebears (Flannery 1972).² In these cases, the intensified foraging of marine resources resulted in a positive feedback loop, wherein enhanced wild food exploitation facilitated increased population and structural changes within societies, which – in turn – created incentives for augmented food production, including plant food enhancement (Cohen 1981, 1977; Bronson 1977; Mosley 1975; Flannery 1968: 85; Parsons and Denevan 1967; Coe and Flannery 1967;

² In these cases, particularly coastal Peru, the subsequent introduction of crops from dry interior locations fostered the genetic isolation of plants, a development that was significant to their full domestication. This pattern of interzonal transport has close parallels in the ethnographically documented transport of camas and tobacco between the dry interior Northwest and clearings in the moist coastal forest. As discussed earlier in this dissertation, there is some evidence of the domestication of both of these plants.
Coe 1961). This same model provides an apt description of known intensification chronologies on the Northwest Coast, with parallel and archaeologically detectable periods of coastal resource intensification and localized population growth. Evidence for the emergence of cultivation on the Northwest Coast, as suggested elsewhere in this dissertation, should be sought during these moments of increasing, localized pressure on finite plant resources, as was the case in coastal Peru and elsewhere. Still, the timing of plant intensification on this coast remains largely conjectural, pending additional archaeological research.

Despite these observations, it is important to note that, while "intermediate," the mixed subsistence strategy of contact-period Northwest Coast peoples arguably represented a sustainable stage, and there is no reason to assume that it would have necessarily developed, inexorably, into intensive agriculture (Smith 1997). Indeed, in certain portions of coastal South America, there are archaeologically detectable cases of combined farming and fishing subsistence practices developing in the opposite direction, and gradually being abandoned in favor of an almost exclusively marine-based diet (Lanning 1967:53). It is not inconceivable that the Northwest Coast experienced periods of alternating plant intensification and disintensification, long before the arrival of Europeans.

While it is incorrect to suggest that the concept of cultivation was alien to Northwest Coast peoples, authors such as Boas (1966), Kroeber (1939), Lowie (1921) and Sauer (1952, 1936) were partially correct about the role of diffusion in prohibiting the adoption of introduced crops. It is clear that the peoples of the Northwest Coast were, at the very least, indirectly in contact with the agriculturalists of the Western
interior through networks of transport and trade. However, the barriers to diffusion were many. While many of the cultivation methods found among the agriculturalists of the arid Western interior do appear on the Coast, the crops of the interior would not have succeeded in these coastal locations; many, too, would have produced scheduling conflicts with marine resource harvesting activities. When Europeans attempted to introduce Mesoamerican crops on the 19th century Northwest Coast, the region’s acidic soils, frequently overcast skies, heavy winter rains, and long summer droughts assured that they met with little or no success. Moreover, as Sauer (1952) noted of other “sedentary fisherfolk” around the world, there was little motive to adopt the protein-rich crops of Mesoamerica, but there were strong incentives to obtain plant sources of carbohydrates not represented in the North American suite of Mesoamerican crops. Methods of wetland cultivation, somewhat similar to those found on the Northwest Coast, can be found throughout much of the Americas as well as the Pacific, and it is conceivable that Northwest Coast cultivation methods reflect a process of stimulus diffusion, that aided increasingly sedentary Northwest Coast peoples in meeting their demands for food plants. There is no reason, however, to assume that these innovative technologies for plant procurement were not developed in situ, as Northwest Coast peoples attempted to enhance the productivity of finite resource sites through transplanting and the incremental expansion of individually-owned root grounds.

By most definitions, the intentional creation of “[places of] manufactured soil” on marginal sites, as found in certain Northwest Coast contexts, may be viewed as being closer to true agriculture than the intensification of natural root plots through localized enhancement. The apparent correlation of linguistic, ethnographic, and archaeological
evidence regarding these two different garden site categories is quite intriguing. If the ethnographic record is any indication, these marginal environments may have been cultivated by people somewhat closer to the margins of indigenous societies than the land-rich elites. Proto-agricultural developments in these marginal locations therefore might reflect diverse dietary, economic, and ceremonial motives for plant intensification, as well as a pattern of plant resource site utilization that was severely constrained by structural factors. This, too, is conjectural, pending additional research. This hypothesis does, however, provide an alternative model for agricultural origins, with probable analogues elsewhere in the world.

Why did ethnographers and explorers overlook these traditions? On this topic, too, the parallels between the Northwest Coast and Latin America provide a revealing point of departure. As in Latin America, the demographic collapse that accompanied the arrival of Europeans on the Northwest Coast resulted in a broad abandonment of most wetland cultivation practices long before the arrival of researchers. In those parts of Latin America where the significance of pre-Columbian wetland cultivation is now widely acknowledged, early explorers and researchers seldom documented wetland cultivation methods and their associated landforms (Parsons and Denevan 1967). Indeed, the documentation of traditional wetland cultivation is considerably more thorough on the Northwest Coast than it is in many portions of South America, where there are simply “no historical descriptions of the garden beds in use” nor any oral record of the use of abandoned wetland landforms among living indigenous peoples (Denevan 1970: 651). In these Latin American contexts, the use of wetland agricultural landforms, by necessity, has been inferred from archaeological investigations and a
smattering of early historical accounts. Latin American landforms that are today recognized as raised beds for wetland cultivation were originally documented as fortifications, fish pond enclosures, remnants of logging operations, or natural features; the same has been said of the wetland landforms of the Northwest Coast (Marshall and Lyons 1989; Carlson and Hobler 1976: 129). Even as burning has been increasingly recognized as a vegetation management tool on the Northwest Coast, there has been little acknowledgement of the role of wetland plant cultivation (Boyd 1999). This situation brings to mind the condition of Maya studies three decades ago, when the presence of intensive Maya wetland agriculture was still widely overlooked, and most Maya cultivation was believed to have taken place in small swidden clearings within the tropical forest (B.L. Turner 1978; Mathewson 1977). The parallels between the two cases are many, and it is hoped that the current research on the Northwest Coast will have impacts similar to the productive and revisionary research on Latin American wetland cultivation conducted in recent decades.

The literature on Northwest Coast subsistence exhibits a longstanding Eurocentric bias, heavily influenced by the earliest writings on this coast. As an "intermediate" form, the subsistence practices of the Northwest Coast were poorly documented, as was the case in many other parts of the world. These practices eluded the conceptual categories of James Cook and subsequent explorers, just as they defied simple categorization by Boas and his turn-of-the-century academic peers. The view of 19th century writers that the Northwest Coast was non-agricultural was not an objective "view from nowhere," as some of its proponents suggested. Nineteenth century writers who dismissed the Northwest Coast as a place without cultivation, Boas among them,
did so without appreciation for the sophistication of Northwest Coast plant use, specifically, or non-Western systems of cultivation, generally. These writers seldom saw evidence of intentional “cultivation” in these anthropogenic plant communities, which lacked rectilinear plantings or a monoculture of familiar plants. As in many cultivated landscapes of the Americas, Europeans were apt to see no signs of human intervention, particularly when observing the landscapes resulting from the alien practice of wetland cultivation. To the European eye, wetlands of all descriptions appeared to be natural features (Siemens 1990; Denevan 1992). Likewise, Northwest Coast environments were completely unfamiliar to European eyes, and there was little to indicate that the tangle of scrubby marsh vegetation and rock alignments were unambiguously anthropogenic environments. In 1792, when the Vancouver Expedition's botanist Archibald Menzies (1923: 116-17) noted that Nuu-chah-nulth women “regularly turned [the soil] in quest of [clover] roots every year,” these explorers were unaware that there was very little naturally-occurring level soil or clover, and no naturally-occurring workable soil on the shorelines where they encountered these practices. As the findings of this dissertation demonstrate, the production of these wetland planting surfaces predates the earliest European arrivals on this coast.

During the early colonial period, endemic patterns of cultivation were rapidly eclipsed by those of European origin, while fishing continued (albeit in quite different forms). This adoption of introduced crops was initially a result of the higher yields and status of introduced crops, and soon thereafter, by the rigorous agricultural promotions of colonial officials and missionaries. Europeans arriving during the colonial period encountered an indigenous people subsisting primarily upon salmon, potatoes, and a
host of other plants and animals. Recognizing potatoes as introduced, it was automatically and erroneously assumed that prehistoric dietary practices consisted of the native dietary practices of the 19th century with potato cultivation subtracted from the diet. Certainly, "by the time we learned to be more thorough in [the study of dietary questions], there were no more Northwest Coast Indians living under anything approaching aboriginal conditions" (Isaac 1988: 6).

Boas' own biases and agendas institutionalized this European view. Boas was clearly aware of rhizome cultivation on the Northwest Coast, and seemed to accept it as a pre-contact phenomenon. His decision to deny the presence of agriculture on the Northwest Coast is a revealing commentary on Boas' own worldview. To Boas, as with his European predecessors on this coast, the Northwest Coast's cultivation practices were ambiguous, in the gray area, the intervening spaces between the widely accepted categories "hunter-gatherer" and "agriculturalist." Further, the absence of Mesoamerican crops, seed agriculture, or a dietary dependence upon domesticates led Boas to believe that Northwest Coast cultivation was not true agriculture. Boas' own Weltanschauung demanded that he classify these peoples, and without an appreciation for categories of subsistence intermediate between "hunter-gatherer" and "agriculturalist," he opted for the former.

Certainly, Boas recognized that the Northwest Coast, his favorite source of ethnological anomalies, defied simple categorization. However, it suited Boas' needs to use the Northwest Coast, not to challenge prevailing opinions regarding the existence of "stages" of subsistence, but rather, to challenge environmental and evolutionary models of cultural development. The discourse of Boas' times defined which arguments he was
to make with the Northwest Coast data (Foucault 1970). (No doubt, if alive in the mid-to late-20th century, Boas might have employed the Northwest Coast data to challenge, among other things, prevalent ideas regarding the nature of agriculture.) Boas and his students made the peoples of the Northwest Coast intelligible to their academic peers, providing a coherent narrative, but not without doing some violence to their subject. I do not doubt that this violence was accidental; it was, rather, a product of the profound, and largely inescapable situatedness of Boas' scholarship. However, the writings of Boas and his students, with all of their distinctive biases and agendas, have been accepted uncritically by the scholars into the late 20th century. Authors still attempt to justify fantastic and contradictory claims about the absence of plant resource management on the Northwest Coast by appealing to these "general conceptions of the relative use of marine protein in the area" (Chisolm, Nelson and Schwartz 1983: 397).

This scholarly debate is not without its practical repercussions. The denial of indigenous claims on cultivation sites can be viewed, in part, as the tangible outcome of the taxonomic rituals of the European world. Through seemingly harmless classification, the scholars of the late 19th century upheld a prevalent, European conceptual dichotomy. In the process, they lent credibility to colonial policies — from the dispossession of rhizome garden sites to the encouragement of potato cultivation — which demanded the elimination of intermediate categories, those parts of the world which simply did not "fit" (Foucault 1970). One might argue that the European worldview was thereby made manifest.

Ultimately, I would argue that the effective exploitation of abundant marine resources at once facilitated the emergence of plant cultivation, while — somewhat
ironically – inhibiting its emergence as one of the region’s primary forms of subsistence.

In response to the emergence of large villages and the gradual restrictions this placed
upon far-flung foraging, the peoples of the Northwest Coast created clustered plots of
otherwise widely dispersed plants, with higher levels of productivity than could be
achieved under natural conditions. Their intensified production served both as an
integral component of native subsistence, and as a means to social and ceremonial ends.

Northwest Coast rhizome production thus supports a model of resource intensification
that accounts for motives that are variously infrastructural, structural, and
superstructural. Certain aspects of the “ecological logic” behind these environmental
modifications were ‘emically’ apparent to these peoples – such as their role in
increasing plant output – while other aspects would have been elusive, ‘etic’, as they are
to most contemporary home gardeners, such as the role of soil chemistry in this process.

In light of the observations presented in this dissertation, I would suggest that we
should fundamentally reassess certain ethnographic truisms regarding the Northwest
Coast. Certainly, less intensive practices than we see here have been commonly
identified as “cultivation” or “agriculture” within the contemporary literature, in such
places as California, Amazonia, or the American Southwest. If the Northwest Coast
was not fully “agricultural,” it was, at the very least, a place of considerable plant
cultivation at contact. And while it is clear that the peoples of this coast generally ate
well, the common depiction of regional resource super-abundance oversimplifies
indigenous subsistence. The abundance of foodstuffs, including plant foods, utilized by
the pre-European peoples of the Northwest Coast reflects the development of effective
cultural strategies for resource intensification, as much as it reflects their fortuitous
presence in a resource-rich region of the globe. I therefore encourage contemporary
scholars to discard the intellectual baggage of the colonial era. The time is upon us for a
serious reevaluation of claims that plant cultivation was not practiced by the indigenous
peoples of the pre-contact Northwest Coast.
REFERENCES


304


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340

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343

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## Quatsino Sound Survey Data

<table>
<thead>
<tr>
<th>Number</th>
<th>Site Location</th>
<th>reported rock feature</th>
<th>reported &quot;garden&quot;</th>
<th>compatible feature</th>
<th>comments</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Hushamu Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Youghpan Creek mouth</td>
<td></td>
<td>X</td>
<td></td>
<td>Potentilla/Trifolium abundant</td>
</tr>
<tr>
<td>3</td>
<td>Wanokana Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nuknimish Creek mouth</td>
<td></td>
<td>X</td>
<td>?</td>
<td>Potentilla/Trifolium abundant; possible fragmentary geometric rock alignments</td>
</tr>
<tr>
<td>5</td>
<td>Hathaway Creek mouth</td>
<td></td>
<td>X</td>
<td>X</td>
<td>[EdSw4] elaborate rock enclosures; soil absent/eroded from seaward edge</td>
</tr>
<tr>
<td>6</td>
<td>Michelson Point Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>unnamed creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>50° 35' N 127° 45' W</td>
</tr>
<tr>
<td>8</td>
<td>unnamed creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>50° 34'40&quot; N 127° 42' 20&quot; W</td>
</tr>
<tr>
<td>9</td>
<td>Coal Harbour Creek</td>
<td></td>
<td>X</td>
<td></td>
<td>site has been developed – dock area</td>
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<tr>
<td>10</td>
<td>Kultah Indian Reserve</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Havishawki Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Bish Creek mouth</td>
<td></td>
<td>X</td>
<td>X</td>
<td>&quot;bish&quot; is term for garden; possible rock alignments seaward of marsh, fragmentary</td>
</tr>
<tr>
<td>13</td>
<td>Blumberg Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>Boas (1934) reports clover garden here; unlikely terrain; probably misidentified</td>
</tr>
<tr>
<td>14</td>
<td>Koprino River/Indian Reserve</td>
<td></td>
<td>X</td>
<td></td>
<td>Potentilla/Trifolium abundant; any surface features concealed by surface vegetation</td>
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<tr>
<td>15</td>
<td>Mahatta Creek mouth</td>
<td></td>
<td>X</td>
<td></td>
<td>former village site clearly visible</td>
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</tbody>
</table>
| Number | Site Location                          | reported rock feature | reported "garden" | compatible feature | comments                                                                 
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>unnamed creek mouth</td>
<td>X</td>
<td></td>
<td></td>
<td>[DkSo15] function unclear; probable fish trap; 49° 43' 28&quot; N 126° 27'40&quot; W</td>
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<tr>
<td>2</td>
<td>unnamed creek mouth - Three Coves Bay</td>
<td>X</td>
<td></td>
<td>?</td>
<td>[DkSo9] function unclear; poss. fish trap; much Pot./Tri. 49° 41' 34&quot; N 126° 29'52&quot; W</td>
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<tr>
<td>3</td>
<td>Three Coves Bay Creek mouth</td>
<td>X</td>
<td></td>
<td></td>
<td>[DkSo17] - recent landslide</td>
</tr>
<tr>
<td>4</td>
<td>unnamed creek mouth - north end Valdes Bay</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>unnamed creek mouth - west end Valdes Bay</td>
<td>X</td>
<td></td>
<td>X</td>
<td>[DkSo20] function unclear; highly fragmentary rockwork in Pot./Tri. zone</td>
</tr>
<tr>
<td>6</td>
<td>unnamed cove</td>
<td>X</td>
<td></td>
<td>X</td>
<td>[DkSp20] function unclear; rectilinear rock enclosure in Pot./Tri. zone with possible wooden stakes; not functional as fish trap 49° 42' 55&quot; N 126° 30'50&quot; W</td>
</tr>
<tr>
<td>7</td>
<td>unnamed creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>49° 42' 30&quot; N 126° 31'40&quot; W</td>
</tr>
<tr>
<td>8</td>
<td>3 unnamed islands - intervening tidal flats</td>
<td>X</td>
<td></td>
<td></td>
<td>[DkSp23] probable maintained clam beds w/rockworks around perimeter 49° 42' 15&quot; N 126° 31'35&quot; W</td>
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<tr>
<td>Number</td>
<td>Site Location</td>
<td>reported rock feature</td>
<td>reported “garden”</td>
<td>compatible feature</td>
<td>comments</td>
</tr>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>unnamed creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>49° 06' 20&quot; N 126° 46'40&quot; W</td>
</tr>
<tr>
<td>2</td>
<td>unnamed creek mouth</td>
<td>X</td>
<td></td>
<td>?</td>
<td>possible rock alignments in salt marsh - highly fragmentary; reported by Pacific Rim National Park staff 49° 05' 55&quot; N 126° 46'30&quot; W</td>
</tr>
<tr>
<td>3</td>
<td>McBey Islets flats</td>
<td>X</td>
<td></td>
<td></td>
<td>circular rock enclosure - possible prayer seat or defensive lookout; reported by Pacific Rim National Park staff</td>
</tr>
<tr>
<td>4</td>
<td>Ginnard Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td>[DhSl 12] rock feature, function unclear 49° 06' 48&quot; N 126° 53'15&quot; W</td>
</tr>
<tr>
<td>5</td>
<td>unnamed creek mouth</td>
<td>X</td>
<td></td>
<td></td>
<td>[DhSl 38] rock feature - probable fish trap</td>
</tr>
<tr>
<td>6</td>
<td>Kakawis Lake Creek mouth</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Site Description</td>
<td>Location</td>
<td>Notes</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lagoon Island – lagoon entrance</td>
<td>[DhSI 43] rock features - fish traps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Lagoon Island – flats connecting to Meares Island</td>
<td>[recorded as both DhSI 13 and DhSk 54] rectangular stone enclosures encircling almost pure <em>potentilla</em> patches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Lagoon Island – southwest cove</td>
<td>[DhSI 44] rock feature – fish trap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Almond Islets</td>
<td>rock enclosures – function unclear (defensive lookout?); reported by Pacific Rim NP staff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cove, immed east of Baxter Islet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Cove directly east of Heelboom Bay across Dawley Passage</td>
<td>stone fish trap enclosure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Heelboom Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Unnamed cove – Meares Island</td>
<td>[DhSk 12] rock walls enclosing salt marsh flats; &quot;ts’isakis&quot; = &quot;place with soil&quot; 49° 10' 25&quot; N 125° 47'33&quot; W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Unnamed cove – Meares Island</td>
<td>possible rock features in salt marsh – highly fragmentary 49° 10' 35&quot; N 125° 47'45&quot; W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Fundy Creek mouth</td>
<td>salt marsh flats; long rock wall – possibly recent enclosure of managed oyster beds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Wood Islets, south side intertidal</td>
<td>fragmentary rock enclosures in high and mid intertidal, associated with clam beds and possibly <em>potentilla/trifolium</em> in upslope area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Sutton Mill Creek mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Mosquito Harbor – NE cove</td>
<td>[DhSk 44 &amp; DhSk 48] miscellaneous rock alignments with unclear functions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Mosquito Harbor – E cove (immed E of Blackberry Islets)</td>
<td>[DhSk 52] rock enclosures above high tide line – function unclear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Unnamed creek mouth</td>
<td>salt marsh flats; no rockworks apparent 49° 12' 27&quot; N 125° 45'05&quot; W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Bulson Creek flats – Warn Bay</td>
<td>possible fragmentary, geometric rockworks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Matlset Narrows East Cove –</td>
<td>[DhSk 9] complex rockwork with multiple</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meares Island</td>
<td></td>
<td>geometric enclosures in salt marsh</td>
<td></td>
<td></td>
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<tr>
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<td>---------------------------------------------------</td>
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<td>-----------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Matlset Narrows West Cove – Meares Island</td>
<td>X</td>
<td>[DhSk 60] stone enclosure - probable fish trap; some <em>potentilla/trifolium</em> up slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>unnamed creek mouth – Meares Island</td>
<td></td>
<td>49° 14' 15&quot; N 125° 49'05&quot; W</td>
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<td></td>
</tr>
<tr>
<td>26</td>
<td>Bedwell Sound flats</td>
<td>X</td>
<td>? possible highly fragmentary rock alignments; two garden sites reported in Bouchard and Kennedy (1990)</td>
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<tr>
<td>27</td>
<td>unnamed cove</td>
<td></td>
<td>49° 17' 40&quot; N 125° 49'48&quot; W</td>
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<td></td>
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<tr>
<td>28</td>
<td>unnamed creek mouth</td>
<td></td>
<td>waterfall w/ abundant <em>potentilla/tri.</em> on flats 49° 17' 28&quot; N 125° 49'55&quot; W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>cove south of Quait Bay</td>
<td></td>
<td>49° 15' 45&quot; N 125° 51'20&quot; W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Cypress Bay cove</td>
<td></td>
<td>much <em>pot/tri.</em> 49° 17' N 125° 53'05&quot; W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Cypre River flats</td>
<td>X</td>
<td>X fragmentary rock alignments (large rocks only) and preserved marker post with rock base support on salt marsh flats</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VITA

Douglas Deur is deeply interested in understanding the many factors which shape humans' perceptions, uses, and modifications of the environments in which they dwell. His interests, therefore, lie at the intersection of the disciplines of geography and anthropology. Born in Portland, Oregon, his regional interests center on the environments and peoples of the circum-Pacific world, with a particular emphasis upon the Northwest Coast of North America. He received a bachelor of science degree in the University of Oregon Department of Geography. He earned his master of arts degree in Geography at Simon Fraser University, and his master of arts degree in Anthropology from Louisiana State University. The degree of doctor of philosophy will be conferred upon him in August of 2000.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Douglas Deur

Major Field: Geography

Title of Dissertation: A Domesticated Landscape: Native American Plant Cultivation on the Northwest Coast of North America

Approved:

[Signatures]

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: May 5, 2000