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## Landscape Response to Human Impact in Coastal Newfoundland, Canada: 29,000km of ‘Untouched’ Coastline

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Newfoundland; outports; beach modification; grazing; anthropogenic vegetation assemblages.

Landscapes in small coastal communities (“outports”) throughout Newfoundland, Canada, have undergone significant non-industrial anthropogenic modification over the past 350 years. Study of the coastline forms a central focus for any understanding of Newfoundland. For most of the plant and animal species, and for all the human occupants, life has revolved around the coastline and the coastal environment since deglaciation. All human cultures in Newfoundland have had an intimate relationship with the coast. However, in contrast to the situation in many areas of the world, a combination of low population density, diffuse social organization, and periodic abandonment of the island meant that anthropogenic impact on the landscape was essentially negligible prior to 1497.

For Newfoundlanders of European descent, the harbors have represented economic and cultural centers since the first Basque, English and French voyages, and the first attempts at colonization in eastern Newfoundland in the early 1600s. The deeply embayed coasts provided safe harbors for fishing vessels, with suitable onshore areas for drying and processing cod and for construction of the necessary stages, stores, and other buildings. Local fishing grounds, many within sight of the shoreline, supported fisheries for cod, flatfish, herring and crab, and capelin spawned on gravel beaches. By 1660, small coastal fishing communities (“outports”) dotted the shorelines of eastern Newfoundland, and by 1850 virtually all suitable coves supported outport communities.

Although the heritage of fishery remains central to the culture and psychology of Newfoundland, its economic importance has diminished in recent years. Government-sponsored programs of consolidation of services and communities (“resettlement”) led to the abandonment of many of the smaller outports, particularly between 1955 and 1970. The combined pressures resulting from collapse of key marine stocks, notably the northern cod in the early 1990s, the economic pull and diverse opportunities for employment provided by St. John’s and larger centers in mainland Canada; and the changing demography of aging populations have continued the process of community abandonment.

In many outports abandoned before 1970, the few houses present were frequently disassembled or entirely removed to new locations. The smaller outports generally lacked modern infrastructure, such as paved roads, concrete foundations, or electrical services. Thus, when the houses were removed or disintegrated under the effects of weather, there were relatively few traces of human activity directly evident. To the uninitiated, particularly visitors from other parts of the world, these landscapes are commonly perceived as ‘untouched.’ As tourism is a vital component in the economic sustainability of most communities, and is seen as a key component in the economic revitalization of formerly fishery-dependent communities, this perception is actively promoted in advertising. Environmental perceptions are an important factor in decisions made by prospective

tourists, particularly where the natural environment is among the destination's primary attractions. However, the former outport areas actually represent complex patchworks of geomorphic and biological processes and anthropogenic modifications.

Beach systems have been modified by extraction of sediment and realignment of outflow channels. Small-scale modifications formerly undertaken by outport residents, including construction of wooden retaining walls and channels dredged by hand, continue to influence beach dynamics and storm-surge modification, even though the original structures have disappeared. The buried foundations of retaining walls, including large boulders as footings, limit sediment resupply to the systems from the land. Interruptions in terrestrial sediment flux are especially evident in beaches which have undergone significant storm-induced activity during the past 20 years.

At sites where gravel beaches ("barachoix") were backed by lagoons, small-boat access to the outport was maintained by periodic dredging of artificial channels, often taking advantage of natural shallow, ephemeral 'guts' formed by terrestrial rainwater discharge from storm events. Maintenance of the channels acted to focus wave energy onto specific areas of the barachoix, locally accentuating shore normal transport and causing beach faces to steepen. Cessation of human maintenance results in gradual modifications to the beach systems, but as many of the areas have undergone successive anthropogenic modifications over time, it is difficult to establish their 'pre-anthropogenic' configuration or characteristics. Study of the effect of storm events and sea level rise on coastal erosion is complicated by this problem. Barachoix and tombolos in communities were commonly fortified to provide protection and improve access to shorelines, resulting in simultaneous widening and lowering of these landforms even during a period of rising sea level and increasing storm surge activity.

In areas where beach space was scarce, Basque and Irish fish harvesters frequently collected and aligned beach stones to create flat surfaces for drying cod. These gently sloping stone platforms constructed for drying fish have been misinterpreted as evidence for higher sea levels, as well as mistakenly considered as evidence of mass movement or frost action.

Grazing by sheep and goats, cutting of conifer forests, and human foot traffic has resulted in the removal of vegetation and enhanced frost action, producing thufur, polygonal ground, gelifluction creep and cliff failures through frost wedging. Neither relict nor active periglacial features are present in areas where the vegetation is completely undisturbed or where introduced vegetation species are not present. The distribution of small-scale gelifluction and creep features present shows a strong correlation with the degree of human and domestic animal disturbance.

The jointed, fractured and bedded nature of much of the bedrock facilitates frost wedging. Coastal sites lacking vegetation are more susceptible to frost wedging than those with vegetation cover, as the combined result of exposure of the rock to the atmosphere and removal of any potential snow cover insulation during the winter and spring. Areas with krummholz ("tuckamore") tree vegetation developed on thinly veneered or bare rock surfaces are more susceptible to wedging and erosion by block toppling than are sites with continuous herbaceous or grass vegetation cover. The presence of vegetation species introduced to Newfoundland with grazing animals is common in areas which show evidence of frost disturbance, indicating that the production of frost-related features is not linked to changes in regional or local climate.

Woodcutting for domestic purposes has substantially reduced the extent of forests in coastal areas. Once removed, recolonization of semi-exposed coastal slope and headland areas by the pre-1500 conifer-dominated vegetation assemblages was prevented by a combination of strong winds, enhanced frost action on exposed terrain and sediment erosion. Clearance of land by domestic woodcutting and for gardens and pastures produced distinctive areas of enhanced aeolian erosion and deposition of cliff-top loess. Palynological

assemblages, sediment texture and organic composition reflect anthropogenic influence in these areas, but are most evident where laterally-extensive sections of peat and cliff-top loess successions are exposed.

Enhanced colluviation and fluvial erosion have led to increases in sedimentation in coastal lagoons and salt marshes. With logging of the interior regions, the hydrological regime and habitat suitability of these streams changed drastically. Reduced sediment transport by the streams led to changes in beach texture and morphology. Locally, shorelines are dominated more by muddy and vegetated zones than they would have been at the time of initial European settlement.

Vegetation assemblages in the vicinity of outport communities were also affected. The lack of sediments and subsequent soil development, with a prevalence of bare rock outcrops, makes arable land very scarce. The steep slopes, ranging from 10°–35°, and the uneven ground created by meltwater channels further restricts availability of level building sites. Any pocket of arable ground was very precious, and gardens could only be developed in small isolated pockets such as on wave cut terraces. As imported food was expensive, the small gardens provided much needed dietary components. Arable land was very important to residents in deciding a suitable dwelling site. Construction of low stone walls, necessary for property delineation and domestic animal control, produced microclimates for both indigenous and introduced vegetation species, which have persisted after human abandonment of the terrain.

These multiple influences on the landscapes involved primarily local endeavors. Individually of relatively low intensity, they nevertheless resulted in substantial alteration to landscapes that superficially appear 'untouched.' The degree of human modification over a relatively short period of non-industrial activity poses challenges for both reconstruction of the natural landscapes and the assessment of ongoing change as well as posing questions concerning perception, tourism promotion, and conservation.

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