Preliminary Assessment of Natural Values
Gully Lake Study Area
Pictou and Colchester Counties
Nova Scotia

Department of Environment and Labour
Protected Areas Branch
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1.0 Introduction

The Gully Lake study area is a block of provincially owned Crown land located northeast of Truro on the Colchester / Pictou County line (Map 1). The area of the block is approximately 4600 hectares, of which approximately 3800 hectares are in a relatively natural or undeveloped condition, and approximately 800 hectares are developed (primarily managed forest land).

The majority of the study area is within the Cobequid Mountains Natural Landscape (#23), which is a primarily mixed forest landscape consisting of very broad, flat topped to gently rounded individual deciduous hills surrounded by coniferous undulating terrain and stream valleys, with a linear drainage pattern consisting of the headwaters of many rivers. A smaller portion of the study area is within the Central Rolling Hills Natural Landscape (#26), which is characterized by an elevated series of rolling hills and undulating terrain supporting Acadian mixed forest types. Drainage in Landscape 26 is dendritic and defined by the upper and middle reaches of a few moderate sized rivers (NSDOE, 2000).

The upper reaches of the Salmon River of Truro flow through the Gully Lake study area. Elevations range from about 450 feet (135 metres) in the vicinity of the river, to more than 1000 feet (305 metres) on some of the hilltops.

This report provides a preliminary assessment of the natural values of the Gully Lake study area as a basis for determining if this area merits consideration as a candidate for protection.

2.0 Study Context

On October 5, 1999, the Pictou County Naturalists and the Ecology Action Centre issued a press release calling for two areas of Crown land in northern mainland Nova Scotia, Eigg Mountain-James River near Antigonish, and Gully Lake, to be designated as wilderness areas under the *Wilderness Areas Protection Act*. These groups contended that there are no large protected areas on the northern mainland, and that these two proposed sites represent the best chance to establish protected wilderness areas in this region of the province. This initiative generated a high level of public interest and support as expressed through letters, e-mails, petitions supported by individual citizens, municipal councils and local MLAs, and the media.

Upon reviewing this matter, the Minister of the Environment directed the Department of the Environment to conduct "a preliminary review of the natural values associated with these areas, as a basis for assessing their merit as candidates for protection."

The following values are of interest when considering areas for protection: 1) ecological value of the area in a regional context, based on principles of the science of conservation biology; 2) landscape representation value, to identify the potential for an area to contribute to protection of native biodiversity through protection of the typical ecosystems of the landscape; 3) watershed integrity value; 4) elements of outstanding value, including rare or unusual natural features; and

Map 1: Gully Lake Study Area - Location Map

5) wilderness travel and nature tourism value.

This study represents a preliminary review of the natural values of the Gully Lake study area. Natural values have been assessed primarily from air photo interpretation, pre-existing information, and sources with first-hand knowledge of the area. Landscape ecosystem mapping of the study area was developed from 1:10,000 colour aerial photography taken in 1994 and from forest inventory maps generated by the Department of Natural Resources (DNR). An analysis of landscape ecological conditions was conducted using DNR's Forest Inventory Database on an ArcInfo Geographic Information System (GIS). Data on outstanding values were interpreted from air photos, and obtained from available sources including maps, published literature, and personal communications with individuals familiar with the area. Because the study is preliminary, it does not include a substantial component of field research. Reconnaissance visits conducted in late May 2000 and June 2001 were used as an opportunity to familiarize and assess forest conditions in typical stands of hardwood and softwood and to characterize in a preliminary way the ground plant communities within these stands.

3.0 Ecological Value Within a Landscape Context

Present global development trends are rapidly modifying the natural areas of the world. At the same time there is growing understanding of the value of protected natural areas to the maintenance of ecological integrity and native biodiversity. Decisions to protect land in the past tended to have an exclusive focus on uniqueness or outstanding features, or recreational potential. It is now an essential element of assessing the natural values of lands to consider their ecological value in the context of the region in which they occur, because the conservation value of a given parcel of land is influenced by the character and condition of the broader landscape in which it is situated.

Given the mandate of the government of Nova Scotia and the Protected Areas Branch of the Department of Environment and Labour to identify, document and assess the value of areas with potential to contribute to the provincial goal of a network of representative protected areas, the relevant scale of an assessment of the ecological value of an area of land is its value in a provincial, regional, and landscape unit context. The following section evaluates the ecological value of the study area in the context of the broader natural landscapes within which it is found, with particular reference to landscape fragmentation and forest age-class distribution in the surrounding region.

3.1 Fragmentation Analysis

Fragmentation of natural ecosystems is a key determinant affecting the ecological integrity of natural landscapes, and has been cited as the principal threat to biodiversity in the temperate zone (Wilcove *et al.*, 1986). Progressive fragmentation caused by anthropogenic disturbance results in diminishing patches of 'natural' habitats embedded in a landscape matrix of disturbed, early-

successional habitats, or non-habitats. Such early-successional, anthropogenically disturbed habitats often have little value to species which depended on formerly extant, late-successional habitats, or habitats maintained through characteristic natural disturbance regimes. Because of Nova Scotia's long settlement history, there exists today a predominance of early-successional, anthropogenically disturbed habitats, and a paucity of late-successional habitats evolved in accordance with natural disturbance regimes. Consequently, priorities for biodiversity conservation focus on maintaining and restoring networks of late-successional and/or naturally evolved ecosystems (termed 'natural' habitat in this study), their dependent species, and their associated ecological processes. Human developments like roads, urban areas, agricultural lands, intensively managed forest and other forms of industrial development all contribute to habitat loss and fragmentation.

Fragmentation reduces native biodiversity through several mechanisms. Reduction in available natural habitat reduces populations within the remaining habitat patches, and potentially entire species, if all core habitat for that species is compromised. In small habitat patches with small populations which have limited immigration or emigration opportunities, demographic phenomena, like normal variations in reproductive rates, and external or environmental fluctuations, like disease or large storms, may result in localized extinctions. Inhibition of natural movement and curtailing of natural dispersal patterns, which will occur with some species when habitat patches are highly segmented and isolated, leads to various genetic effects on populations, which can result in genetic deterioration and possibly extinction. Because of the interaction of species in any ecosystem, loss of one species may result in changes in abundance of another which effects the entire functioning of an ecosystem. The ecological scientific literature has documented many cases where "the decrease or disappearance of one [species] has cascading detrimental effects on the others" (Soulé and Simberloff, 1986). Alteration of natural disturbance regimes leads to long-term changes in biotic communities (Noss and Csuti, 1997).

Creation of edge habitats, and related climatic and biotic edge effects, reduces the functional area of interior habitat patches in an exponential relationship to the length of new edges. Therefore, even narrow linear developments can have large effects on interior habitat availability. Roads and other linear developments which cut through otherwise undeveloped lands are one of the most widespread contributors to fragmentation. Roads also have a variety of direct negative ecological consequences for both terrestrial and aquatic ecosystems (Trombulak and Frissell, 2000). Roads additionally provide the initial access from which additional development proceeds. The density of roads and other linear developments serve as good indicators for understanding landscape fragmentation and the ecological value of blocks of land between them.

As with many other parts of the province, the landscapes of the region around the Gully Lake study area have been intensively fragmented by human development. Road densities in the various landscapes which surround Gully Lake, in north-central mainland Nova Scotia (Colchester County, eastern Cumberland County and western Pictou County), have been calculated from 1994 data and are shown in Table 1. The average density of roads in the region was 1.7 kilometres per square kilometre of land in 1994. (Permanent linear developments through

previously unroaded lands have been added to the region since 1994, including new highways and utility lines).

The Gully Lake Crown land block (including both the developed and undeveloped portions) presently has a road density of 0.7 kilometres per square kilometre, in contrast to its host natural landscapes 23 and 26, which have densities of 1.0 and 1.6 km/km^2 respectively. In comparison to other large blocks of provincially owned land in the region which are not already designated wilderness, the Gully Lake Crown land block has a relatively low road density.

Table 1: Road and Linear Development Densities in North-Central Mainland Nova Scotia

Natural Landscape or Area	Road Density (km / km^2)
17 - Minas Basin Headlands	1.5
20 - Cumberland Foothills	1.7
22 - Northumberland Strait Plain	1.8
23 - Cobequid Mountain	1.0
24 - South Cobequid Foothills	1.4
25 - Cobequid Tidal Bay	2.4
26 - Central Rolling Hills	1.6
42 - Pictou River Hills	2.8
Region	1.7 (total regional road length / area of region)
Gully Lake Study Area	0.7
Riversdale Crown Block	1.6
West Branch North River (New Annan) Crown Block	1.1
Economy River Wilderness Area	0.5
Portapique River Wilderness Area	0.03

Maps 2 and 3 depict the distribution of roads and linear developments (data from 1994 (Colchester County), 1995 (Cumberland County) and 1990 (Pictou County)) for the north-central mainland region. Maps 2 and 3 also show the remaining patches of unfragmented natural habitat based on two thresholds: 1) patches more than 600 metres from roads, which reflects reported penetration distance of certain biotic edge effects like bird nest predation and parasitism (Robinson 1992, Wilcove *et al*. 1986, quoted in Meffe and Carroll, 1997); and 2) patches more than 200 metres from roads, a less conservative estimate of the penetration distance of edge

effects, based on a broader range of reported biotic and climatic effects.

The GIS was used to analyze the size distribution of these roadless 'interior' patches. The area-to-perimeter (interior-to-edge) ratio was calculated by dividing the area of each individual patch by its perimeter. Because edge habitats may contribute to negative effects on native biodiversity, patches that have a higher interior-to-edge ratio are preferred to patches of equal size with lower ratios. The results of these two analyses are displayed graphically in Figures 1 to 4.

As of the date of data collection, there were 808 habitat patches in the eight landscapes of north-central mainland Nova Scotia more than 600 metres from the nearest road or linear development (Figure 1, Map 2). The vast majority of these patches are small (Figure 1). The southern portion of the Gully Lake study area, south of the main road to Gully Lake, ranks as one of a small number with the important ecological characteristics of large area and high interior-to-edge ratio.

The largest patch, which also has the highest interior-to-edge ratio, is Economy/Gundalow (Figure 2, Map 2). This patch incorporates both a portion of the provincially owned Economy River Wilderness Area as well as a large area of privately owned land. Much of the private land in the patch shown is owned and managed for pulp production by Kimberly-Clark. According to local sources, contractors for Kimberly-Clark have recently been carrying out intensive forest harvesting using clear-cut methods on their land in this patch. The second largest patch is the Moose River block, which is also dominated by Kimberly-Clark owned land. Most of the other patches ranking higher than Gully Lake in both parameters are entirely or mostly made up of private land, much of it owned by forestry companies. One exception is the patch which includes part of the Riversdale Crown block. However, Riversdale block is now included in a 10-year licence agreement between the Department of Natural Resources and Irving Forest Products. Department of Natural Resources personnel have advised Department of Environment and Labour staff that during 1999 and 2000, many new roads were built and forest harvesting was carried out there. Kimberly-Clark owns a major part of the private land within this patch.

When the GIS analysis of patch size distribution was repeated using a 200-metre threshold for edge effects, 2902 patches located more than 200 metres from a linear development were identified. Again, the vast majority of these patches are small, while the southern portion of the Gully Lake Crown land block ranks within the top small group of ecologically important patches which have both a large area and a high perimeter-to-edge ratio. As described above, several of the larger and higher ranking Crown-owned parcels within the group have been subject to forest harvesting and road-building since these data were gathered.

The maps and GIS analyses demonstrate that the southern portion of the Gully Lake Crown block is therefore one of the largest remaining, relatively unfragmented Crown land areas in north-central mainland Nova Scotia.

In order to achieve protection of the full range of native biodiversity, relatively large, roadless, "core" natural areas, in which natural processes operate unencumbered to the greatest degree

possible, are essential (Meffe and Carroll, 1997). Opportunities to maintain relatively undisturbed, large, core natural areas within northern mainland Nova Scotia are rapidly diminishing. The Gully Lake Crown block represents one such opportunity.

Map 2: Fragmentation Analysis: Areas of Land > 600 metres from Roads and Utility Corridors in Selected Landscapes in North-central Nova Scotia

Figure 1: Size Distribution of Interior Patches > 600 metres from Roads or Linear Developments in Selected Landscapes of North-Central Mainland Nova Scotia

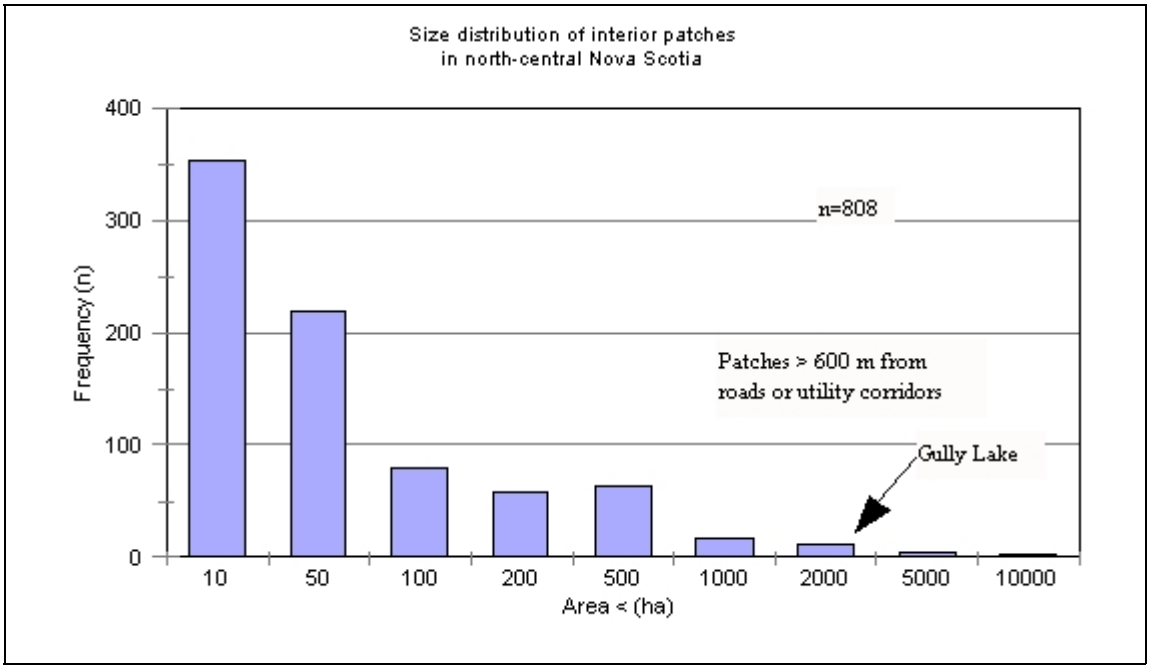
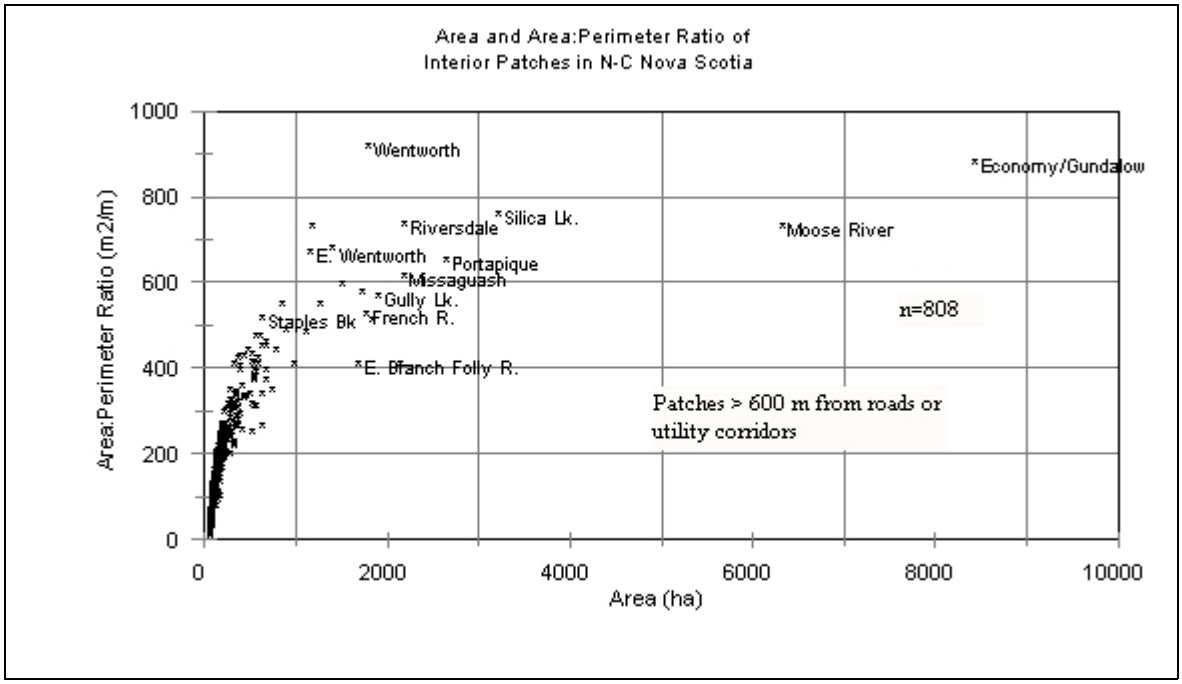


Figure 2: Area and Area/Perimeter Ratio of Interior Patches > 600 metres from Roads and Linear Developments in Selected Landscapes of North-Central Mainland Nova Scotia



Map 3: Fragmentation Analysis: Areas of Land > 200 metres from Roads and Utility Corridors in Selected Landscapes in North-central Nova Scotia

Figure 3: Size Distribution of Interior Patches > 200 metres from Roads or Linear Developments in Selected Landscapes of North-Central Mainland Nova Scotia

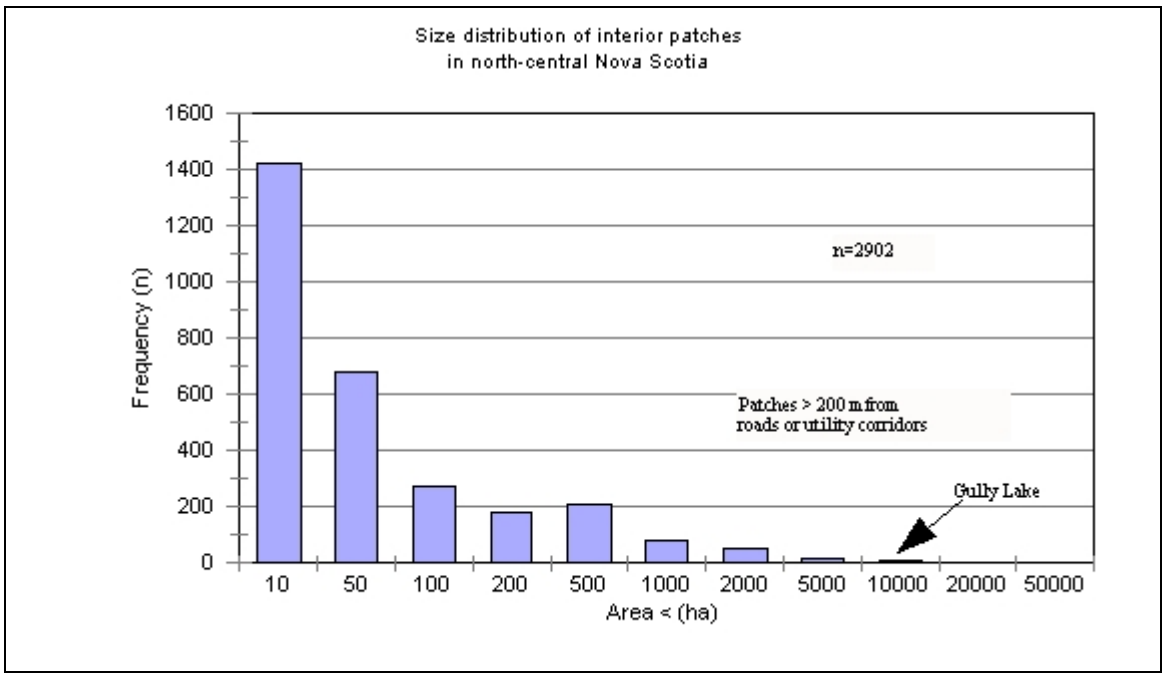
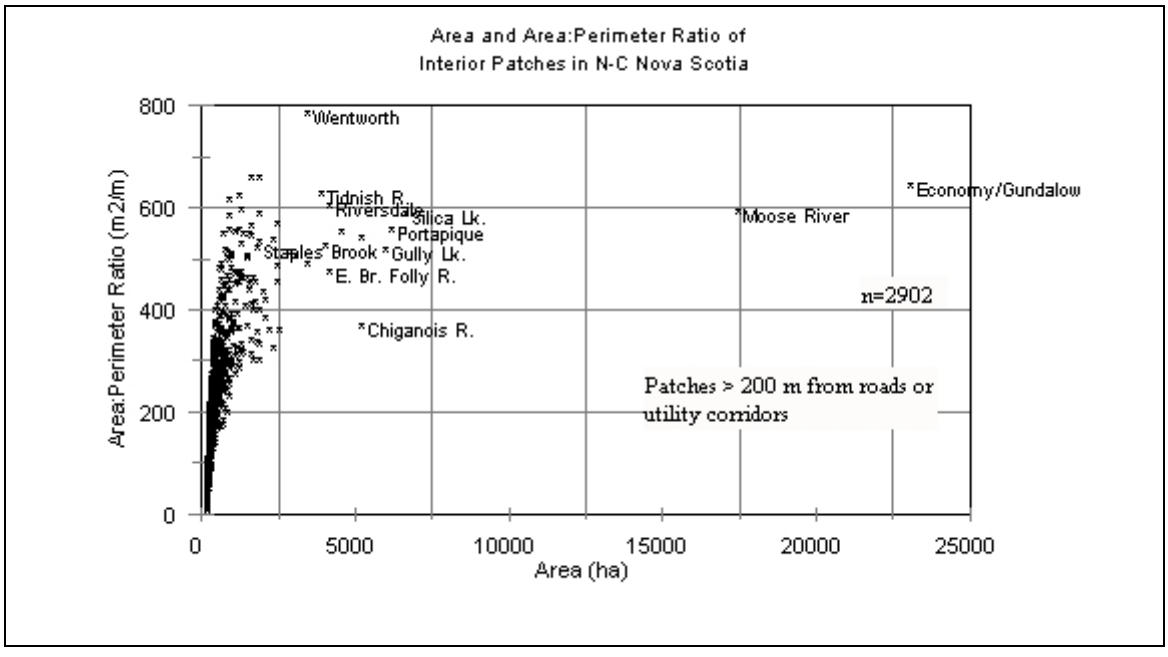


Figure 4: Area and Area/Perimeter Ratio of Interior Patches > 200 metres from Roads and Linear Developments in Selected Landscapes of North-Central Mainland Nova Scotia



3.2 Natural Old Forest Analysis

Prior to European settlement, much of Nova Scotia consisted of continuous natural forests of various types. The forests had some level of diversity introduced by natural disturbances regimes typical of that forest. A large proportion of the forest would have been in an "old-growth" state, composed of climax successional species which were self-perpetuating on the site. True old-growth primary forest is now very rare in Nova Scotia, and similarly very rare in all of eastern North America (Leverett, 1996), due to past harvesting. Older or "mature" stands of second-growth forest with climax species compositions can develop into old forest in future; however, these same stands tend to be at the top of priority lists for harvesting. Furthermore, as mill technology develops to allow use of smaller trees, commercial pressure increases on even younger forest.

The maintenance of representative old-growth forest ecosystems, is therefore dependent on the protection of remnant stands, as well as the setting aside of available areas of climax species dominated mature or "old forest." To restore their ecological function, these mature areas must be allowed to continue to age, and to develop old-growth characteristics, including microclimatic and natural disturbance patterns, and the complement of characteristic species from nearby available sources of recolonization.

Map 4 illustrates the distribution of forest cover by age class in the region surrounding the Gully Lake study area as of 1994. Forest age has been interpreted based on tree height and site class by the Department of Natural Resources, using air photo interpretation and permanent sample plot methods. The vast majority of the forest falls within the 0-20 years (yellow) and 21-80 years (pale green) age classes, which are non-forest or recently cut, and young or immature forest, respectively. Stands interpreted as older than 80 years, or mature to old-growth forest, are very rare. The only significant concentration of mature or old-growth forest on Crown land occurs in the South Cobequid Hills Natural Landscape (#24), at Staples Brook north of Debert. This site has been proposed as a candidate nature reserve by the Protected Areas Branch and is primarily coniferous old-growth forest.

3.2.1 Forest Condition at Gully Lake

Map 5 shows the distribution of forest age classes in the Gully Lake study area based on 1994 (Colchester County) and 1990 (Pictou County) data contained within the Department of Natural Resources forest inventory. Air photo interpretation was also conducted by Protected Areas Branch staff to determine species mixes, as well as to interpret site origin, where possible.

The majority of forest in the undeveloped portion of the study area is hardwood or hardwood-dominated mixed forest with calculated stand ages ranging from 20 to 80 years. Sugar maple - yellow birch - beech hardwood forest is present on most of the hillslopes, with maximum calculated stand ages ranging from 60 to 80 years. However, stand ages are calculated based on site class and estimated average height of canopy trees, and actual stand ages may sometimes be

older than the average age of the canopy trees (MacKinnon *et al.*, unpublished). Field work is required to test this theory in the Gully Lake study area. Most stands fall in the age range of 20 to 60 years, which is young or immature forest.

These forests probably require about 50 to 75 years of growth to start to develop old-growth forest structure, and a further 50 years to be considered mature old-growth hardwood forest. Some stands may start to develop old-growth characteristics within 25 to 40 years. While tolerant hardwood stands of this age are not unique in northern Nova Scotia, most ecosystems containing them are fragmented by roads and other development, including softwood plantations, and their ecological values are substantially diminished.

Spruce-balsam fir stands are present primarily in mixed forest of the Salmon River valley, in stream or wetland gullies, and on flatter areas at the tops of the hills in the undeveloped portion of the northeast part of the study area. Some stands have been typed as being approximately 60 to 80 years old. The majority are 20-to 60-year-old immature forest. Field work is necessary to determine their true age, to confirm spruce species, and to interpret stand origin. Similar to the hardwoods, they might be expected to develop old-growth characteristics if left undisturbed for a further 50 to 75 years, with a few stands expected to reach old-growth stage sooner. Large unfragmented areas containing older spruce stands are uncommon in northern Nova Scotia because they have been commercially desirable for many years.

There are no stands in the study area which, based on DNR's interpreted age, have old-growth or mature forest status. However, there are a number of stands which are of interest and should be examined in the field.

Map 5 shows many stands typed as uneven-aged in DNR's forest inventory. These are mainly mixed-wood stands of shade-tolerant hardwood and red spruce which could have a variety of origins, from partially harvested stands to older stands with diverse structure due to natural gap-replacement processes. They are located primarily along stream gullies and other linear depressions and lower areas. Field work is required to assess their age, species composition and structure.

An inventory of "significant older or unique forest" (SOUF) conducted by Protected Areas Branch, based on species and height criteria, has identified a spruce stand in the northernmost part of the study area. This stand shows on Map 5 as falling within the 61-80 year age range, but because it meets "SOUF" criteria (see MacKinnon *et al.*, unpublished) that other spruce stands of this age group do not, it should be examined in the field to determine its significance.

Map 4: Forest Age Classes for Selected Landscapes in North-central Nova Scotia

Map 5: Forest Age Classes in the Gully Lake Crown Land Area

The mixed forests of the Salmon River valley in the Gully Lake block consist of a few knolls of tolerant hardwood surrounded by lower lying spruce and fir stands aligned in ribbons of various width parallel to the valley floor. Some of the spruce stands are interpreted to fall within the 61-80 year age class or to be uneven-aged, while the hardwoods are typed as younger. As described above, stand initiation ages are often found to be older than the interpreted age based on site class and height. Because gap-replacement processes in older climax forests can create an uneven age structure, uneven-aged stands are of particular interest as to origin. However, human intervention can also create uneven-aged stands. Forested river valleys are very uncommon in northern Nova Scotia because most river valleys were converted to farmland and settled many years ago. This area needs to be studied in the field to determine the relative importance of human disturbance versus natural river processes in developing the ribbon-and-knoll character and the age-class distribution and species mix of the forest in the valley.

The developed portion of the study area in the northeast, on the Pictou County side of the county boundary, is recently cut and planted in softwood. Another area of recent cutover occurs near the southwestern boundary of the study area, between the Kemptown/Earltown road and the Salmon River. There are also some relatively small areas of old fields in the Salmon River valley and a few cutovers along the road to Gully Lake in the northern part of the study area. These are shown in Map 5 as areas in the 0-20 year age class.

3.3 Discussion of Landscape Ecological Value

The analysis of road density in the landscapes and Crown land blocks surrounding Gully Lake demonstrates the irreplaceability of this block in the context of fragmentation. The undeveloped portion of the Gully Lake study area has very high natural value as a large, relatively roadless patch of natural interior forest. Compared to the surrounding landscape, it was not the biggest unfragmented patch in 1994, nor did it have the oldest remnants of forest as of then. However, in comparison to other Crown land blocks in the region, and given recent harvesting on other Crown and Kimberly-Clark-owned lands which were components of the bigger patches in 1994, it is the best remaining Crown-owned, interior patch in north-central mainland Nova Scotia.

While much of the forest in the study area appears from interpreted ages to be relatively young, the majority of it is dominated by climax successional hardwood species with an element of red spruce, also a climax species, in some ecosystems. Left undisturbed by human intervention, the undeveloped portion of the block would be likely to develop into old-growth mixed hardwood forest within 50 to 100 years.

Given the expected changes to the landscapes surrounding Gully Lake and in other parts of the Cobequids and the Central Rolling Hills, toward younger, managed forest and non-forest, the Gully Lake block represents a good opportunity to allow climax-species-dominated forest to continue to develop into a regionally significant patch of functioning old forest.

4.0 Representation Value

The principle behind the conservation biology concept of "representation" is that if typical examples of all native ecosystem types in a region can be protected, most native species will receive some level of protection from habitat loss. One objective of a protected area network is then to secure representative examples of all ecosystem types in which viable populations of species in their natural habitats can be maintained. The representation approach to protecting habitats, to prevent reduction of populations of species to endangered levels, can be seen as a precautionary approach to maintaining biodiversity.

The province has been divided into 80 natural landscapes, characterized by distinctive local environmental and biotic factors or elements, which vary in size from several to many square kilometres. Natural landscapes are mosaics of "different but interacting ecosystems that are repeated in a similar pattern to form a distinct and definable unit of land (N.S. Department of Environment, 2000). Natural landscapes provide a more convenient unit for evaluation of representation than smaller, ecosystem-based units, yet incorporate enough detail to capture the full range of ecosystem diversity without oversimplification in describing that diversity.

With the designation of thirty-one wilderness areas in 1998, twenty-six (26) natural landscapes are now considered to be represented in Nova Scotia's Parks and Protected Areas System. A further 11 are considered partially represented. The majority of Nova Scotia's natural landscapes are considered inadequately represented. Many inadequately represented landscapes fall within northern mainland Nova Scotia, between the border with New Brunswick and the Strait of Canso, in part due to the long history of widespread, farm-based settlement, and the high proportion of private land in this region.

4.1 Landscape Representation Values in Gully Lake Block

The Gully Lake Crown land block occurs in the transition zone between Natural Landscape 23, the Cobequid Mountains, and Natural Landscape 26, the Central Rolling Hills. The Cobequid Mountains Natural Landscape is described as:

> a linear, 160,858-hectare, relatively smooth-topped upland area that is characterized by very broad, flat-topped to gently-rounded deciduous hills, and by coniferous undulating terrain and stream valleys, producing an overall Acadian mixed forest landscape. Drainage is parallel and dendritic and is defined by headwaters of many rivers.

The Central Rolling Hills Natural Landscape is described as:

> a 106,041-hectare landscape consisting of an elevated series of hills and undulating terrain supporting Acadian mixed forest types. Drainage is dendritic and defined by the upper and middle reaches of a few moderate sized rivers (NSDOE, 2000).

4.1.1 Physical Topics Description and Representation

A major contributor to variability of biotic communities between landscapes is the physical, abiotic environment in which landscape ecosystems develop and continue to change over time. Full representation of natural landscapes therefore requires representation of these abiotic factors, in addition to biotic communities.

Bedrock Geology

The Gully Lake block lies on the major fault boundary between the two dominant geological terranes of the province. The northern part of the block is underlain by granitic and dioritic crystalline rocks of the Cobequid Mountains, assembled during several mountain building episodes of the Appalachian system, while the southern half is underlain by predominantly sedimentary rocks, deposited during the Carboniferous period in basins adjacent to the highlands. The geology of the province is mapped in Keppie (2000). More detailed but less current geological mapping of the study area is available in Donahoe and Wallace (1982).

Table 2 provides a comparison of the representation of various geological units of northern Nova Scotia in existing wilderness areas, and their representation in the Gully Lake study area. Descriptions of exposure and interpretive opportunities are provided in Section 6.4 of this report.

Table 2 demonstrates that the Gully Lake area has better representation of the Carboniferous sedimentary rocks of northern Nova Scotia than what is present in existing protected areas. This variation in geology is reflected in the topography of the area, the surficial geology, the width of the Salmon River valley, soil textures and drainage characteristics, and probably the biota as well.

Topography, Surficial Geology and Soils

The north and west of the study area consists of a series of gently rounded to flat-topped hills, with maximum elevations of about 305 metres. Separate hill units are defined by several parallel northeast trending lineaments, which contain small lakes, wetlands and watercourses, which drain to the southwest into the Salmon River, including Gully Lake and Gully Lake Brook. The lineaments represent the inferred continuation of minor northeast trending faults. The hill/lineament complex is deeply incised by the Salmon River Valley, which trends southeast in this area.

In the north and west of the study area, which is dominated by crystalline rocks, the hillslopes are mantled by thin, stony, well-drained tills with very thin tills to bare bedrock on hill tops. In the southeast of the study area where the lithologies are somewhat softer sedimentary rocks, tills are thicker, with locally finer grain size and poorer drainage (Stea and Finck, 1988) developed on rolling terrain at maximum elevations of 230 metres.

Table 2: Representation of Bedrock Geology in the Gully Lake Study Area and Existing Wilderness Areas

In the southern half of the study area, the river emerges from between granitic rocks on both sides into an area where sedimentary rocks form the eastern side of the valley. At this point the river turns to the southwest and the valley widens from a relatively narrow "canyon" into a flat-bottomed valley of over a kilometre in width. The dominant surficial unit in this broad valley area is ice-contact stratified drift which forms flat, rapidly drained terraces on the valley sides.

Soil composition and drainage characteristics are closely related to the parent materials underlying the study area. Well-drained gravelly-to-sandy, very stony loams with localized pockets of imperfect-to-poor drainage occur above the crystalline rocks; and gravelly sandy-to-silty loams with good-to-locally imperfect drainage are present primarily above the sedimentary rocks (Webb *et al*., 1991). In the Salmon River Valley, rapidly drained gravelly sand soils overlie the older glacio-fluvial sediments and pockets of more recent fluvial deposits.

There are some similarities and some differences between the physical environments represented in the study area versus the existing wilderness areas in the Cobequids. The comparison is summarized in Table 3.

Portapique River and Economy River Wilderness Areas have surficial geological units, soils, and topography similar to those mapped in the northern part of the study area, consisting of well-to-poorly drained till-mantled hills with V-shaped, incised river canyons. However, the wide, terraced, flat-bottomed (U-shaped) valley with rapidly drained, glacio-fluvial and later fluvial sands and gravels present in the Gully Lake study area is not represented in the existing wilderness areas. Physically, this area is not typical of the upland landscape ecosystems of landscape 23 and is more appropriately included in Landscape 26. This observation is a result of the more detailed analysis of biophysical conditions conducted in this study, relative to previous, provincial scale, landscape boundary delineation. The boundary between landscapes 23 and 26 has been slightly refined to reflect this, in ecosystem mapping in this study (see Section 4.1.2).

Differences between terrestrial and aquatic habitats associated with a stream or river reach are controlled by differences in geology, topography and site conditions (Loo and Gorman, 1997). Because there are no wide, rapidly drained, U-shaped and terraced valleys present in the existing wilderness areas, river-related ecosystems not represented in the existing wilderness areas are present in the study area.

4.1.2 Ecosystem Description and Representation

Landscape ecosystems are illustrated in Map 6. Ecosystems are based primarily on the climax vegetation present, in combination with the abiotic factors, except for those not in a climax stage; in these areas the ecosystem mapped is based on expected or potential climax vegetation type using the surrounding climax remnants and the physical environment as a guide.

The degree of representation of these ecosystems within the study area, and their incidence in the landscape, are summarized in Table 4.

Table 3: Topography, Surficial Geology and Soil Type Representation in the Gully Lake Study Area and Existing Wilderness Areas

The study area contains examples of seven climax ecosystems typical of natural landscape 23. More than 50% of the study area consists of a well-drained sugar maple-yellow birch-beech hill ecosystem. This ecosystem is primarily developed on the rounded hill tops and slopes characterized by well-drained loams developed on thin, stony tills, which occur above the crystalline rocks in the north and central part of the study area as well as west of the Salmon River. Most of this ecosystem is in an undeveloped state. The largest developed portion occurs west of the Salmon River, in the southwest part of the study area. The most recent cutting in this area is estimated to have occurred about 1990.

A second ecosystem consisting of the same shade-tolerant hardwoods, as well as an element of red spruce, occurs in the undulating-to-rolling terrain of the flatter hilltop areas of the northeastern part of the study area, in the transition zone between the Salmon River and River John watersheds. The soils in these areas are similar to, but not as rapidly drained as, the soils underlying pure hardwoods. An extensive portion of this ecosystem within Pictou County is under forest management and is roaded and planted in conifers.

Other ecosystems of landscape 23 which are represented in the study area are imperfectly-to-poorly drained, black or red spruce flats-to-undulating terrain, and poorly drained black spruce flats. These occur surrounding wetlands and lakes within linear gullies defined by the watercourses which drain them, at the transition point between the River John and Salmon River watersheds. Other ecosystems represented, but without extensive land area, are lake, river, and fen ecosystems.

In landscape 23, wetland ecosystems, imperfectly-to-poorly drained red spruce-black spruce undulating-to-flat terrain ecosystems, and poorly drained black spruce flats, are absent or only moderately well-represented in the existing protected areas. These ecosystems are moderately common in the Gully Lake study area. However, they represent only a minor proportion of the study area.

Landscape 26 contains the ecosystems listed in Table 5. The incidence of these ecosystems in the landscape is shown, as well as their degree of representation in existing wilderness areas, and incidence in the study area.

The largest landscape ecosystem of landscape 26 represented in the study area is well-drained sugar maple-yellow birch-American beech-red spruce on undulating-to-rolling terrain, developed on imperfectly drained soils, that are generally finer-grained than those of landscape 23 and have developed over sedimentary rocks. While this ecosystem occupies 13% of the study area, it dominates the mid-slope parts of the landscape 26 portion of the study area.

Map 6: Gully Lake Study Area - Landscape Ecosystems

Table 4: Representation of Landscape Ecosystems in the Cobequid Hills Natural Landscape (#23)

Table 5: Representation of Landscape Ecosystems in the Central Rolling Hills Natural Landscape (#26)

The other areally-extensive ecosystem which is represented in the study area within landscape 26 is a rapidly drained, mixed climax forest on flat-to-undulating terrain in the Salmon River Valley, developed on thick deposits of stratified, unconsolidated glacio-fluvial and fluvial sediments. A small portion of this area consists of abandoned farmland.

4.2 Discussion of Representation Value

4.2.1 Value of Gully Lake Block for Representation of Landscape 26

In the current system of Parks and Protected Areas in Nova Scotia, the Central Rolling Hills Natural Landscape (#26) is considered to be inadequately represented. Inadequate representation is defined as "Few to no protected areas, with major ecosystems and elements missing."

There are no existing parks, wilderness areas, or other types of protection which provide representation of ecosystems or landscape elements in this landscape. An area of Crown land in landscape 26 along Calvary River, south of the study area, has been proposed as a candidate nature reserve. The ecosystem present on this site, a canyon containing old-growth coniferous forest, is rare in landscape 26. If protected, Calvary River would provide good representation of the coniferous canyon ecosystem and outstanding old forest values, but not representation of the major ecosystems of landscape 26.

The ecosystem which occupies the Salmon River Valley (Map 6) in the study area has geological and other physical characteristics not represented in Economy River or Portapique River Wilderness Areas, as described in Section 4.1.1. The forest type developed in the valley is also unique to the study area compared to the existing protected areas. It consists of a mixed climax forest in a patchy mosaic developed on the rapidly drained, terraced, stratified, glaciofluvial deposits and overlying soils.

Based on air photo analysis, the present main channel of the river, as well as ribbons of what are possibly paleochannels of the main river course and its tributaries, are dominated by softwood. In places these softwood ribbons appear to dissect well-drained knolls dominated by shade-tolerant hardwood species. The distribution of vegetation appears to have been influenced by Holocene-to-recent fluvial processes which have cut through the glacio-fluvial deposits and modified the river course over time. Field work is required to further test this, as well as to determine spruce species and assess the degree of past human disturbance in the vegetation cover of the valley bottom, where farming and related activities are likely to have been concentrated in the past.

The valley bottom may be particularly significant in a regional context. Most if not all river valleys in the region are heavily settled and developed, including mining of the sands and gravels such as on the North River and farther downstream along the Salmon River. Floodplain habitats often support plant species which do not survive in other habitats, and because of the development of other river valleys, these habitats are becoming rare. Field work is required to examine the plant species present in the Salmon River valley bottom and floodplain and determine

their significance. The value of this habitat for fish should also be assessed.

The well-to-imperfectly drained, tolerant hardwood-red spruce, rolling-to-undulating terrain ecosystem of landscape 26 (Map 6) is a common ecosystem in the rest of the landscape. While this area is relatively small, it is significant because it is part of a contiguous larger natural area. It is likely one of the best remaining opportunities to provide some measure of representation of this landscape ecosystem.

4.2.2 Value of Gully Lake Block for Representation of Landscape 23

The ecosystems of landscape 23 are considered to be satisfactorily represented by the Economy River and Portapique Wilderness Areas. Satisfactory representation is defined as "One or more large contiguous protected area with only a few major landscape ecosystems and elements missing."

4.3 Replication Value

As discussed in the section on fragmentation, small remnant natural areas are known to have significant limitations in their ability to support populations of some species over the long term. Replication of suitable protected habitat in more than one area increases the chances of long-term maintenance of species diversity, by supporting multiple populations of species susceptible to fragmentation effects. The principle of replication of natural systems and features is recognized in Nova Scotia's Parks and Protected Areas Systems Plan, and was accepted by the provincial government as a recommendation of the report of the Public Review Committee for the systems plan (NSDNR, 1995).

One of the key concepts behind representative protected areas is that the full range of natural processes within and between these ecosystems should continue, and thereby provide protection for both known and unknown species. Ecosystems are dynamic, not static, systems. The natural processes which characterize healthy ecosystems include movement and interaction of individuals of the same and different species throughout a landscape, and through and between different areas of suitable habitat.

The smaller an area of habitat, the less viable its dependent populations are likely to be. Species which have highly specific habitat requirements (habitat specialists) for late-successional, naturally evolved habitats, or large, undisturbed patches, depend on remnant patches of that habitat, such as can exist or develop in protected areas, and may not find suitable intervening habitats in a landscape that is altered from the natural condition to any great extent.

As human activity in the landscape continues to permanently modify and simplify ecosystems to suit human needs, the probability of specialist species continuing to persist both outside and inside protected habitat is reduced. The distances to be travelled over unsuitable habitat can become too great for some species to have sufficient success in interaction between sub-populations in suitable

habitat patches. In such scenarios even populations within protected areas can become isolated and at greater risk of extinction.

Therefore, replication or multiple examples of particular ecosystems, large enough to support viable sub-populations of dependent species, and located closely enough or connected to one another to permit interaction of those sub-populations, contributes significantly to long-term viability of the natural processes and ecosystems that are critical elements of the biodiversity of a landscape.

4.3.1 Value of Gully Lake Block for Replication in Landscape 23

The Gully Lake block provides replication of eight of the nine landscape ecosystems of Landscape 23. If, as expected, landscape 23 continues to be fragmented and the forest ecosystems altered by human intervention, replication in protected areas of the hardwood hill ecosystems of landscape 23 may be critical to preservation of species that depend on these habitats in the long run.

5.0 Watershed Integrity Value

5.1 Watershed Description

The Gully Lake Crown land block area straddles the watershed boundary between the Salmon River of Truro, which flows into Cobequid Bay of the Bay of Fundy, and River John, which flows through Pictou County into the Northumberland Strait (Map 7). Roughly one-sixth of the block, in its northeastern extremities, falls within the River John watershed. Much of the Crown land in the study area within the River John watershed area is converted to a tree plantation and developed in roads, with associated drainage modifications. In addition, the study area is a very small percentage of the River John watershed. Because the study area does not contribute much to the integrity of the River John watershed, but 5/6 of the block is within the Salmon River watershed, the following discussion focuses on the Salmon River watershed.

The Salmon River flows through the Village of Bible Hill and the Town of Truro before it empties into Cobequid Bay. The North River joins the Salmon River just below Bible Hill. The watershed area above the bridge between Bible Hill and Truro is a complete sub-watershed (1DH-6; MRMS, 1980) of the entire Salmon River watershed, and is a major contributor to floodwaters which affect the area on an annual basis. The following pertains to 1DH-6, the sub-watershed above the bridge.

The Gully Lake Crown land block is about 10 percent of watershed 1DH-6. The study area completely contains two subdrainages (Map 7: 1DH-6N and 1DH-6M), a majority of two others (1DH-6L, 1DH-6K), and a major portion of 1DH-6P. Roughly 75 percent of the remainder of watershed 1DH-6 is private land. The watershed contains extensive areas of agricultural lands as well as lands cleared for residential development and other types of land-extensive, urban-related

developments, like golf courses and industrial sites. The developed land area of these is expanding as the greater Truro area grows. Residential development occurs in strips along many of the more rural roads. A considerable area is also devoted to highways, roads, utility corridors, and other linear features with associated cleared land, many of which have also been expanded in the past ten years, including twinning and construction of new sections of the Trans-Canada Highway to Cape Breton through the Kemptown area.

The majority of the land base in the watershed is still in a forested state, but much of it is extensively disturbed. Large areas have been subject to forest cutting for many decades or consist of abandoned farmland. In 1998 an upsurge in the Tussock Moth population in Riversdale Crown block, which makes up about 15% of the watershed area, resulted in widespread defoliation and death of commercially valuable softwood trees. Building of an extensive new road network and intense 'salvage harvesting' by Irving Forest Products has been occurring for the past year or more in the Riversdale block. A substantial proportion of the lands in the watershed are owned by Kimberly-Clark and are managed for pulpwood supply.

5.2 Discussion of Watershed Value

Healthy, undisturbed forest ecosystems can play an important role in regulating and protecting water quality and quantity within watersheds. The relationship between vegetation cover and water flows in a watershed has been well documented. Removal of tree cover generally causes increases in total flow and flood-flow volumes in streams, and longer low-flow periods. This is due primarily to the reduction in the uptake of water by vegetation, so that instead of water being released into the atmosphere by evapo-transpiration, it is released directly into streams. In addition, soils which have been deforested, even temporarily, can be less permeable, which inhibits percolation into groundwater, and results in increased loss of water through runoff (Freedman, 1989) and a lowered water table. Recent studies have documented increases of between 50% and 110% in average or peak stream flows, following harvesting using clear-cut methods in different forest types, compared to both pre-harvest or control watershed conditions, in temperate forests developed on glacial soils (Huser *et al*. 1996; Rosen *et al*. 1996).

Impacts of hydrological changes known to result from deforestation can include increased height and frequency of floods, channel migration and erosion, channel shallowing and widening, decreased water quality, damage to fish habitat, floodplain habitat damage, increased water temperature, and increased stream flow following rain events. Channel shallowing and widening contributes to ice accumulation in winter which exacerbates downstream flooding problems (R. MacLellan, N.S Department of Environment and Labour, pers. comm).

As a relatively intact forested area in the Salmon River watershed, incorporating the headwaters of several tributary streams, the Gully Lake block has significant value to the stability of water flows in the Salmon River. Retention of natural drainage and vegetation patterns within this block presently helps to mitigate the effects of land-use patterns in other parts of the watershed on the river's peak flows by retaining the natural water regulation functions related to the intact forest.

The importance of this service and the consequences of removing it will be magnified in future by the intensive land use which is continuing to expand in other parts of the watershed, such as development of the suburban areas surrounding Truro, intensive forestry road development, and shortened forest rotations.

Map 7: Gully Lake Study Area - Watershed Boundaries

6.0 Outstanding Values

Because this study is preliminary, it was not possible to conduct extensive field work for the purpose of identifying outstanding natural features. Features like rare or uncommon flora and fauna, small unique habitats only visible from the ground due to tree cover, interesting landforms or rock outcrops, and old individual trees or forest stands, are best identified through systematic field assessments. The features identified in this section have either been interpreted from air photographs, recorded from pre-existing sources of information, or inferred based on knowledge of similar areas in close proximity to the Gully Lake block. Field visits by Protected Areas Branch staff to parts of the study area confirmed the presence of several ephemeral spring flowering plants which are fairly common in rich deciduous woods. However detailed field work, which would be necessary to identify rare species, has not been conducted.

6.1 Significant Ecosites

A significant ecosite is a small, physical land unit with an associated characteristic or obligate biotic community, dissimilar to the larger ecosystem matrix in which it is embedded, and is generally a unique, rare or outstanding landform-vegetation complex (NSDNR, 1997). Significant ecosites have biological value as distinctive habitat for a variety of floral and faunal communities, are often biologically rich, and may provide habitat for rare or vulnerable organisms. They are of a scale which is mappable on 1:10,000 air photos.

The Gully Lake block contains several examples of significant ecosites. Gully Lake itself is surrounded by a fairly large wetland complex (Map 8) which is uncommon in the ecosystems of the Cobequid Mountains. The study area also has a number of very small ephemeral ponds within tolerant hardwood forest stands, and one within a deciduous-dominated mixed-wood stand. Most of these are too small to appear on Map 8. The conditions in ephemeral ponds vary from standing water to dry throughout the year. They are especially important habitats for amphibian populations (NSDNR, 1995); see Section 6.3 for discussion of amphibious species in the study area.

6.2 Significant Old/Unique Forests

As described in Section 3.2.1, one red spruce stand of "Significant Old/Unique Forest" has been identified by queries of the Department of Natural Resources' forest inventory, using 17-metre height and climax-species-criteria developed by the Protected Areas Branch. Forest stands identified in the forest inventory as "uneven-aged" and dominated by climax species should be assessed to clarify their origin and age, as should climax stands with estimated ages approaching 80 years which may in fact have older stand initiation ages (MacKinnon *et al,* unpublished), as discussed in Section 3.2.1, "Forest Condition at Gully Lake."

6.3 Habitat for Species at Risk, Rare Species, and Species of Concern

Little field work has been undertaken in the Gully Lake block for the purpose of identifying habitats for or occurrences of species at risk or other rare or uncommon species. There are no known COSEWIC-listed species within the study area. However, several species of flora and fauna considered to be rare or uncommon in Nova Scotia are known to occur near the study area, as noted below, and should be checked for within the study area.

6.3.1 Flora

The Nova Scotia Museum of Natural History has not conducted any field inventories of flora within the study area (Marian Zinck, NS Museum of Natural History, pers. comm). Museum representatives have, however, expressed interest in the area because of its high potential for hosting additional populations of intervale flora.

Wild leek (*Allium tricoccum*), an uncommon plant with very local distribution in Nova Scotia, has been found near Kemptown, on the Salmon river just south of the study area (Zinck, 1998). Its habitat is rich hardwood forests and intervales. Blue cohosh (*Caulophyllum thalictroides*) has also been documented on the Salmon River near Kemptown. This species, found in rich intervale deciduous forests, is considered rare in Nova Scotia (Pronych and Wilson, 1993).

Foamflower (*Tiarella cordifolia*) is a rare plant in Nova Scotia that has been documented in several localities in the Earltown area, just north of the study area (Pronych and Wilson, 1993). Its habitat is deciduous forests and intervales.

All of these plants might be found within the Gully Lake study area. Blue cohosh has been reported as "scattered in hardwoods a few miles north" of the Kemptown site, which would correspond with Gully Lake study area (Roland and Smith, 1983). The presence in the mixed hardwoods of the Gully Lake block of species like hobblebush (*Viburnum alnifolium*; ColchesterYMCA, 1993), dog's tooth violet (*Erythronium americanum*), Dutchman's breeches (*Dicentra cucullaria*), dwarf ginseng (*Panax trifolius*) and spring beauty (*Claytonia caroliniana*) (Lynds, 2000), all indicative of rich deciduous woods, also support the potential occurrence of rarer plants which require these environments.

Fragrant fern (*Dryopteris fragrans)* is a rare plant reported from the Cobequids between Earltown and Parrsboro (Roland and Smith, 1983). It prefers cliff crevices along streams and near waterfalls. Areas of outcropping rock along streams in the study area might provide suitable habitat.

6.3.2 Fauna

There are no known rare fauna species found within the study area. The only known occurrences of uncommon fauna in the vicinity are for blue-spotted salamander (*Ambystoma laterale*), which

have been documented in the North River watershed (Fuller, 1998); and the erythristic (all red) phase of the eastern red-backed salamander (*Plethodon cinereus cinereus*), found in the Upper Mount Thom area just to the east of the study area (Fuller, 1998). The erythristic phase is limited in distribution to elevations above 200 metres, and has only been found to date in deciduous forest dominated by yellow birch and sugar maple with large amounts of coarse woody debris. Field work is required to determine whether the erythristic phase is present in the tolerant hardwood stands of the Gully Lake block at elevations above 200 metres.

6.4 Significant Earth History Features

A systematic inventory of significant earth history features was undertaken for Colchester County by the Parks and Recreation Division of DNR in 1995, using existing map-based data. Two significant earth history features were identified in the Gully Lake study area (Map 8).

On Gully Lake Brook, there is exposure in a bedrock outcrop of an intrusive contact between a diorite unit and a granitic body which underly the northern and western part of the study area. The outcrop demonstrates the age relationship between the two units, with granite intruding the diorite (Donahoe and Wallace, 1982) and therefore younger. This may provide a good opportunity for natural history education and interpretation.

Other bedrock outcrops occur along the streams in the study area, including exposure of the late-Carboniferous Boss Point Formation along Juniper Brook. Outcrops of all other Carboniferous units described in section 4.1.1 are also exposed in streams, according to regional map records (Donahoe and Wallace, 1982; Keppie, 2000). The quality of exposure and related interpretative opportunities should be checked in the field.

Mapping of surficial geology (Stea and Finck, 1988) indicates that there is a short segment of esker adjacent to the Salmon River, just north of the confluence of Matheson Brook on the west side of the river (Map 8). An existing trail on this side of the river appears to have taken advantage of the esker as a well-drained linear surface. Good interpretive opportunities may be available related to the esker as well as other glacial and post-glacial landforms and evidence of fluvial processes.

Map 8: Gully Lake Study Area - Outstanding Values and Recreational Opportunities

7.0 Wilderness Travel / Nature Tourism Value

Opportunities for outdoor recreation and nature tourism are in growing demand in Nova Scotia. The growth of the tourism sector, as well as an appreciation for nature and the importance of undisturbed wilderness among Nova Scotians, combine to make demands on existing outdoor recreation opportunities which can only be expected to grow in future. The outdoor aspects of Nova Scotia are becoming a point of emphasis for provincial tourism marketing programs.

The *Wilderness Areas Protection Act* identifies, as a secondary objective to protection of native biodiversity and natural landscapes, provision of opportunities for wilderness recreation. Evaluation of the quality and characteristics of such opportunities must be done in a regional context, with reference to the variation in natural landscapes which provide variation in the types of opportunities (e.g., seacoast versus inland hill hiking versus inland water recreation), and to existing opportunities within the full range of demand for outdoor experiences.

7.1 Significant Recreation Features

The undeveloped portion of the Gully Lake study area is significant for its wilderness recreation opportunities, based on its relatively roadless, forested condition, an existing network of trails (Map 8), ease of access due to proximity to settled areas in Colchester and Pictou Counties and major tourist routes like the Trans-Canada Highway, and existing uses for various forms of outdoor recreation.

One possible day or overnight hike, using the existing informal trail network, is described in the publication "Hiking Trails of Nova Scotia" (Haynes, 1995). Access to this hike begins at a driving distance of only 18 kilometres from the Town of Truro (Haynes, 1995), which has an urban population of 12,000.

Colchester County YMCA published an "Observation / Trail Guide" to the Gully Lake area as part of a youth environmental education project (Colchester YMCA, 1993). A number of trail routes are described, including segments following the river, and branch trails climbing uphill parallel to tributary streams.

The main qualities of the hiking experiences currently available are proximity to the Salmon River, exposure to a diversity of forest types, including open hardwood stands, a variety of terrain that is mostly easy hiking, and choices of day hiking or short, overnight trips.

7.2 Existing Recreational Use

While hikers and cross-country skiers use the Gully Lake Crown block, no concrete data are available on the level of recreational use. Haynes (1995) describes the abandoned logging roads and tracks which lace through the area as "well travelled and easy to find." Anecdotal evidence from sources in the Department of Natural Resources and elsewhere suggests that the area is also

used by hunters. All-terrain vehicle riders apparently maintain some small bridges over tributaries to the Salmon River (Haynes, 1995). The area presently hosts a formally designated snowmobile trail (Map 8) managed by the Snowmobile Association of Nova Scotia (SANS), under an agreement with the Department of Natural Resources. The agreement with SANS is a pilot project and is in effect for the period 1999 to 2002 (D. Howard, NSDNR Parks Division, pers. comm).

7.3 Recreational Value in a Regional Context

Relatively few formal opportunities for outdoor recreation on public land are available in the region of mainland Nova Scotia adjacent to and north of the Trans-Canada Highway.

The Economy River Wilderness Area is presently the best available site in the north-central part of Nova Scotia, for day and overnight wilderness hiking opportunities. It is located in western Colchester County, about 1 1/4 hours west of Truro. From the Northumberland Strait areas of Pictou, Colchester and western Antigonish Counties, driving time to the Economy area is 2 to 2.5 hours, which limits its attractiveness as a destination in support of tourism and outdoor recreation for those based in the Northumberland region.

The Portapique River Wilderness Area is located near Bass River, approximately 45 minutes west of Truro. However its accessibility to the residents and tourists in the Northumberland strait area is similarly limited, and opportunities are more restricted due to its relatively small size.

Most existing provincial park properties in Pictou, central Colchester and western Antigonish Counties emphasize “the coastal resource”, particularly beaches. As demonstrated in Table 6, existing inland parks are mainly small picnic parks. Even the largest ones have limited capability to provide substantial hiking opportunities. Trails have been built on abandoned railway lines in northern Colchester and Pictou Counties recently, filling a certain niche of hiking demand. However, these trails cannot provide a wilderness experience because they generally run through settled areas, have no associated wilderness land base, and are linear, flat, and developed to a high degree. There is no significant publicly-provided wilderness hiking available in this area at present, except through informal use of areas like Gully Lake and other Crown blocks.

The undeveloped portion of the Gully Lake block presently provides the best remaining opportunity for formal establishment of a wilderness recreation area on public land, in the north Colchester-Pictou County area.

Table 6: Existing Provincial Parks in North-central Mainland Nova Scotia

8.0 Summary

This preliminary assessment establishes that, based on existing information, the Gully Lake study area possesses significant ecological and wilderness recreation values.

The undeveloped portion of the study area is a relatively large, unfragmented natural forest area which stands out because of the increasing ecological fragmentation and disturbance in the surrounding landscapes. The area provides comparatively intact natural habitat of various types which are in decline due to human development elsewhere. Climax species dominate the forest cover, and will begin to develop old-growth characteristics within the next 50 to70 years if not disturbed.

The surrounding landscapes are dominated by young managed forest, including plantations, and are heavily fragmented by roads. Regionally, only a few widely separated fragments of older forest remain, and are too small to preserve their ecological function. Species which require large tracts of interior old forest habitat are being increasingly fragmented into small isolated habitat patches and their long-term persistence is threatened.

The study area is partially within the Cobequid Mountains Natural Landscape (#23), and partially within the Central Rolling Hills Natural Landscape (#26). The area is dominated by relatively undeveloped, well drained, tolerant hardwood hills and tolerant hardwood - red spruce hills. The portion within landscape 23 provides good potential to meet replication principles within the Parks and Protected Areas system of Nova Scotia. The part within landscape 26 contains two relatively undeveloped landscape ecosystems which are currently not represented in the system. The Salmon River valley area is a rare example of an undeveloped, forested river valley on Crown lands.

Five-sixths of the Gully Lake study area is in the watershed of the Salmon River of Truro. The study area is largely forested with little recent cutting and therefore significantly regulates the water flows of the Salmon River, partially mitigating the effects on downstream areas of increased peak and post-rain stream flows and shallowed summer flows which result from development and extensive cutting elsewhere in the watershed.

The Gully Lake area has a number of known outstanding values, including uncommon habitats, stands of larger, climax species-dominated old forest, and interesting bedrock and surficial geological features with interpretation potential. It may host examples of rare species and threatened habitat types. Field work during appropriate seasons is required to assess the occurrence of rare species.

The undeveloped portion of the study area provides regionally significant opportunities for outdoor recreation in a wilderness setting. A network of well-used trails has already been documented. Elsewhere in the region there is a shortage of opportunities for public land wilderness recreation. Parks are generally small and primarily focused on the coastal lands along

the northern shore of Colchester and Pictou Counties, or are small roadside areas serving the travelling public. There is presently no reliable base of public land on which the tourism industry can meet demand for wilderness ecotourism opportunities.

Based on this preliminary assessment, the undeveloped portion of the Gully Lake study area merits consideration as a candidate for protection.

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Table 2: Representation of Bedrock Geology in the Gully Lake Study Area and Existing Wilderness Areas. Shaded units are better represented in study area than in existing wilderness areas.

Geological Unit	Degree of Representation in Gully Lake Study Area		Degree of Representation in Economy River WA		Degree of Representation in Portapique River WA	
	Presence	Exposure relative to extent of unit	Presence	Exposure relative to extent of unit	Presence	Exposure relative to extent of unit
pre-Avalonian Proterozoic Gneisses	no	not represented	yes	good	yes	good
Avalonian supracrustal sequences	no	not represented	no	-	yes	
Avalonian Diorite-Gabbro Suite	yes	good	no	not represented	yes	present
Silurian, early Devonian fossiliferous marine sediments	no	not represented	yes	good	yes	good
Devono-Carboniferous volcanics	no	not represented	yes	good	yes	good
Carboniferous granitoids	yes	good	yes	good	yes	good
early Carboniferous Horton Group	yes	good	no	not represented	no	not represented
early to late Carboniferous Mabou Group	yes	good	no	not represented	yes	good
late Carboniferous Cumberland Group (Boss Point Formation)	yes	good	no	not represented	no	not represented
late Carboniferous Cumberland Group (Parrsboro Formation)	no	not represented	yes	not exposed	yes	not exposed

Table 3: Topography, Surficial Material and Soil Type Representation in the Gully Lake Study Area and Existing Wilderness Areas. Shaded blocks show physical topics for which there is good representation in the study area, which are lacking in existing wilderness areas.

Physical Topic		**Degree of Representation in Gully Lake Study Area**	**Degree of Representation in Economy River WA**	**Degree of Representation in Portapique River WA**
Topic	**Type**			
Topography	gently rounded to flat-topped hills	good	good	moderate
	elevated, rolling terrain	good	good	poor
	narrow river canyon	good	good	good
	terraced, flat-bottomed river valley	good	absent	absent
Surficial material	thin gravelly/sandy ground moraine	good	good	good
	thick sandy ground moraine with silty pockets	good	poor	good
	ice-contact stratified drift	good	absent	moderate
	fluvial sand and gravel	moderate	absent	absent
Soil Type	rapidly-to-well drained gravelly-to-sandy loams	good	good	good
	well-to-imperfectly drained gravelly sandy-to-silty loams	good	moderate	moderate
	imperfectly-drained to poorly-drained gravelly sand loam to gravelly clay loam	poor	good	poor
	rapidly-drained gravelly sand	good	absent	moderate

Table 4: Representation of Landscape Ecosystems in the Cobequid Hills Natural Landscape (#23). Italics demonstrate landscape ecosystems for which representation in study area is better than in existing wilderness areas in the landscape.

Ecosystem Types of Landscape 23	Incidence in Landscape	Representation in Existing Protected Areas (relative to Landscape)	Incidence in Study Area (relative to Landscape)	Area (ha) & percentage of Study Area
Well-drained sugar maple-yellow birch-beech hills	Abundant	Well	Abundant	2504 ha (53%)
Well-drained sugar maple-yellow birch-beech-red spruce undulating-to-rolling terrain	Scattered	Well	Scattered	735 ha (16%)
Well-drained red spruce canyon	Scattered	Well	Absent	na
Well-to-imperfectly-drained red spruce undulating terrain	Common	Well	Scattered (no discrete area)	na
Imperfectly-to-poorly-drained red spruce-black spruce flat-to-undulating terrain	Scattered	*Moderate*	*Common*	*336 ha (7%)*
Poorly-drained black spruce flat	Uncommon	*Absent*	*Scattered*	*58 ha (1%)*
Wetlands (Bogs and Fens)	Uncommon	*Moderate*	*Common*	*24 ha (0.5%)*
Rivers	Uncommon	Well	Well	na
Lakes	Uncommon	Well	Scattered	na

Table 5: Representation of Landscape Ecosystems in the Central Rolling Hills Natural Landscape (#26)

Ecosystem Types of Landscape 26	Incidence in Landscape	Representation in Existing Protected Areas (relative to Landscape)	Incidence in Study Area (relative to Landscape)	Area (Ha)& percentage of Study Area
Non-Forested Ecosystems:				
1) stream	Scattered	nil	Common	na
Climax Forested Ecosystems:				
2) Well-drained tolerant hardwood-red spruce (eastern hemlock) hill with gap-forming natural disturbance regime	Uncommon	nil	Absent	0
3) Well-drained red spruce (eastern hemlock) undulating-to-rolling terrain	Common	nil	Absent	0
4) Well-drained red spruce canyon	Uncommon	nil	Absent	0
5) Well-drained sugar maple-yellow birch-American beech-red spruce undulating-to-rolling terrain	Common	nil	Common	610 ha (13%)
6) Imperfectly-drained red/black spruce (eastern hemlock) undulating terrain with gap-forming/infrequent stand-initiating natural disturbance regime	Common	nil	Absent	0
7) Rapidly-drained mixed climax forest, flat-to-undulating terrain (associated with fluvial/glaciofluvial deposits)	Scattered	nil	Common	422 ha (9%)

Table 6: Existing Provincial Parks in North-central Mainland Nova Scotia

Park	Class[1]	Area (ha)	Recreational Opportunities
Arisaig	wayside	27.5	short trail, picnic, interpretation
Balmoral Mills	historic	8.4	historic interpretation, picnic
Bayfield	wayside	3.6	beach
Beaver Mtn.	outdoor recreation	133	picnic, 6 km trails
Caddell Rapids Lookoff	wayside	0.5	interpretation
Caribou- Munroes Island	natural environment	251.4	picnic, beach, coastal hiking
Greenhill	wayside	9.3	picnic
Londonderry	historic	0.4	interpretation
MacElmons Pond	wayside	5.7	picnic, short trail
Melmerby Beach	outdoor recreation	101.2	beach
Powells Point	wayside	27	picnic
Rushtons Beach	wayside	25.5	beach, picnic
Saltsprings	wayside	27.3	picnic, camping
Shubenacadie	wildlife	114	wildlife viewing (zoo), picnic
Tatamagouche	wayside	5.7	picnic
Waterside Beach	outdoor recreation	94.7	beach