# 4.0 Ecological Profiling Results

Comprehensive profile sheets and photographs specific to the natural areas assessed within the Subject Area are provided in Appendix A. Ecological and development descriptions are outlined in detail on each profile sheet. The ecological assessments include vegetation, wildlife, physical attributes, contaminants, climate and fire. The developmental assessments include access, community values, infrastructure, policy, education, public use, residential, industrial, commercial, agricultural and economic. Policy recommendations have also been provided.

Ecological data for each site is provided in Appendix B in the form of vegetation and wildlife species list.

Figure 1 illustrates the natural areas assessed within the overall Subject Area and the corresponding site reference number as per the grid. An overall map has been included in Appendix C which illustrates the Subject Area and the habitat types specific to each site.

## 4.1 LANDSCAPE ECOLOGY

The Town of Lacombe exists on a diverse landscape within the Central Parkland Subregion. When viewing the Town of Lacombe from an aerial photograph, several landscape formations can be identified across the Subject Area. These landscape formations exhibit varying degrees of human alteration.

There are three general natural landscape elements identified across the Subject Area; (1) upland/wetland ecosystems, (2) riparian ecosystems and (3) lake ecosystems. Figure 2 illustrates the general landscape elements and potential connectivity corridors.

### 4.1.1 Upland/Wetland Ecosystems

A variety of wetland habitat patches are distributed across the Subject Area. The majority of these habitats are associated with upland forested or grassland habitats. The dominant ecosystem type is the freshwater marsh/aspen forest complex.

The freshwater marsh habitats are characterized by zones of emergent, submergent and aquatic vegetation. Willows, aspen and balsam poplar border the emergent vegetation and extend up slope to the upland forest habitats. Depending on the slope, the forest habitats contained a variety of tree and shrubs species. Pockets of native grassland are interspersed within the upland forest. All but one wetland had

open water for waterfowl and shorebird use. This complex of habitats provided for a high plant and wildlife species diversity.

Natural wetlands are dynamic features on the landscape. The stability offered by upland forest or grassland systems is not present in the wetland habitat. By definition, wetlands are dynamic, transitional and dependent on natural fluctuations. The hydrology of the wetland further defines its characteristics on a day to day, and year to year schedule. The changing water regime regulates the vegetation and structure. The zonation of vegetation in a wetland due to the changing hydrological regime result in a diversity of microsites which offer a multitude of available habitat niches for wildlife habitat.

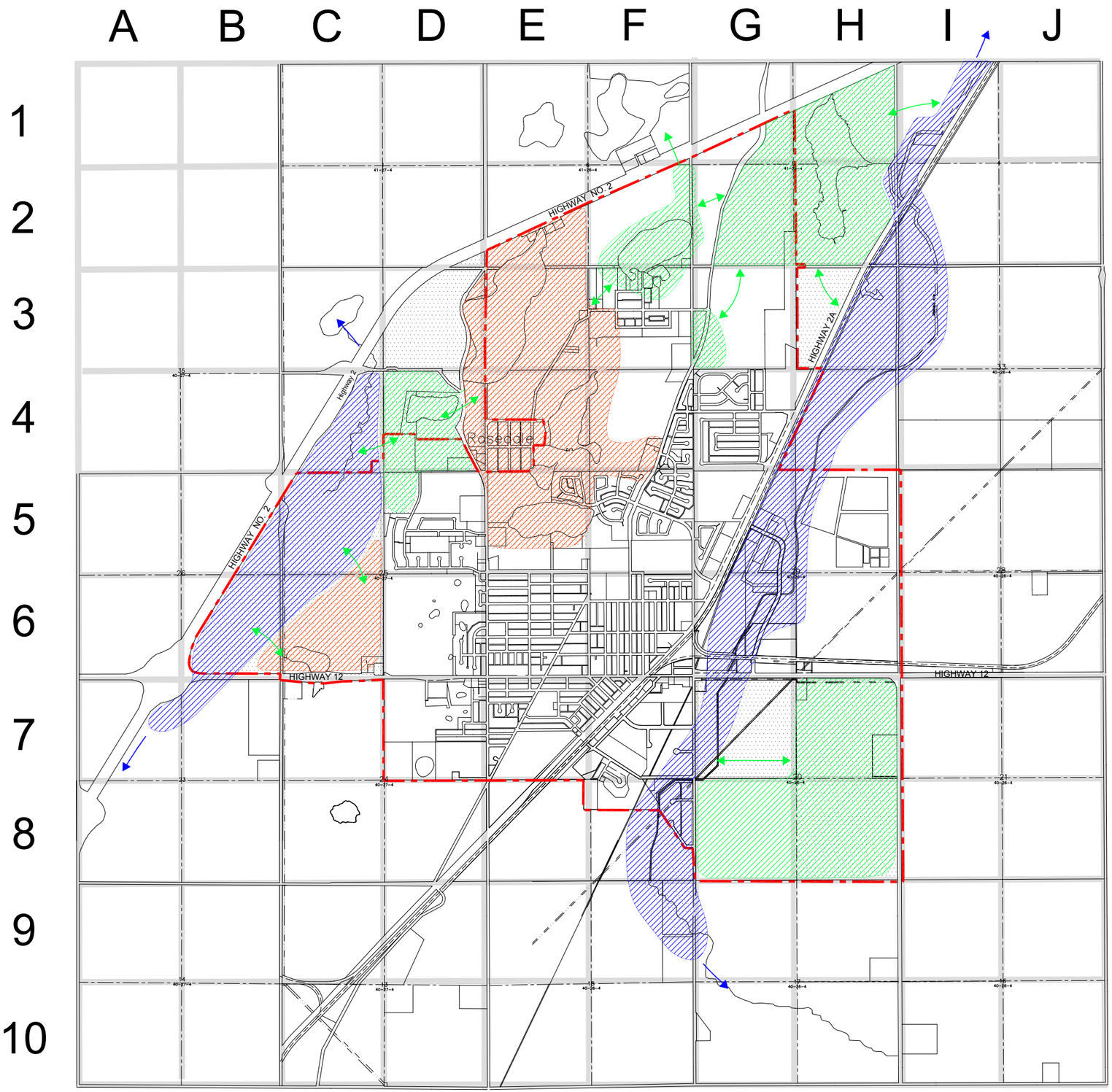
### 4.1.2 Riparian Ecosystems

Two significant riparian ecosystems border the Subject Area to the east and west. Wolf Creek to the east of the Town of Lacombe is a highly modified drainage channel that provides surface water drainage for agricultural, commercial, industrial and rural residential properties which border the length of the riparian area. Due to the pressures of adjacent land uses, the natural drainage channel has been recontoured and the vegetation is dominated by non-native weedy species. Due to the homogeneity of this modified riparian system, wildlife diversity was low. There are few natural area nodes along the length of the creek.

Whelp Creek to the west of the Town of Lacombe is a more natural drainage channel characterized by a well developed riparian zone, native vegetation and wildlife diversity. The majority of the surrounding land use is agricultural; therefore, the primary impact on this ecosystem is vegetation clearing and cattle use. The historic drainage channel remains as a natural meandering system. Of particular importance are the wetland nodes along the length of the creek, specifically the freshwater marsh/wet meadow complex. The upland forest and grassland habitats adjacent to the creek are important wildlife dispersal habitats. Overall, the diversity in landscape, plant and wildlife species is greater than the Wolf Creek riparian area. Of interest is the connection of Whelp Creek to a significant natural wetland area to the north of Highway 2.

### 4.1.3 Lake Ecosystems

There are four distinct lake ecosystems within the Town of Lacombe. From south to north is Crescent Lake, Cranna Lake, Elizabeth Lake and Barnett Lake. The water bodies have been classified as lakes due to the apparent depth and permanency of open water. In addition, the classic undulating shoreline and vegetation zones characteristic to prairie lake ecosystems were observed. Lake Anne, although classified as a freshwater marsh, has been included in the lake ecosystems landscape element due to its proximity to Cranna and Elizabeth Lakes.

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Legend

- Town Boundary
- Study Areas
- Upland/Wetland Ecosystems
- Riparian Ecosystems
- Lake Ecosystems
- Riparian Corridor
- Forest/Grassland Corridor

Client/Project

TOWN OF LACOMBE

Figure No.

**2**

Title

**Landscape of the Study Area**

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November, 2001

In general, a lake ecosystem consists of permanent open water variably bordered by emergent vegetation and/or upland vegetation. The landscape containing the open water areas is topographically diverse. The slope aspect provides a variety of habitats that support aspen/balsam poplar forest, white spruce forest or a mixedwood forest (aspen/birch/spruce). This diversity in forest types directly results in high wildlife diversity.

Pockets of grassland habitats were observed throughout the lake ecosystems. Of particular interest is the native grassland to the south of Elizabeth Lake and the upland grassland located along the top-of-slope to the east of Barnett Lake.

## 4.2 LANDSCAPE MANAGEMENT

Natural landscapes in an unaltered state are relatively rare in human inhabited areas. In these areas, remnant landscape elements are all that persist. In general, the management objective is to maintain or restore the natural landscape as a whole or as individual landscape elements connected through a series of natural corridors. Therefore, the key management issue relates to determining the intensity of human activities and dispersing human activities as inversely proportional to the sensitivity of the landscape element. Animal, plant and water surveys should focus on identifying areas of movement within a landscape, specifically dispersal corridors. Management goals can be geared to avoiding breaks or narrows in the present corridors and maintaining adequate corridor width, nodes and connectivity. In addition, a survey of changes in the landscape over time can identify the roles and locations of natural disturbances (types, sizes and intensity). Landscape heterogeneity and the relative abundance or rarity of all species depend on the natural disturbance regime (Forman and Godron, 1986).

Management of natural landscape elements, specifically remnant patches, involves additional considerations, as these areas will ultimately act as nature reserves. The major problems to be addressed are isolation and human impacts. Isolation generally effects the interior species, as compared to the edge species. Remnant patch size, shape, number and configuration are important. In addition, corridor width and connectivity must be appropriate in order to decrease the impacts of isolation. Human impact from the matrix to the remnant patch must be minimized, either through maximizing edge to encourage wildlife or controlling the landscape surrounding the landscape remnant .

When reviewing the aerial photographs for the Town of Lacombe, it is apparent the natural landscape elements within the Subject Area all show some degree of connectivity, whether through upland corridors (including human settlements areas) or drainage corridors (Figure 2). There is an obvious large scale connection of natural areas from the southwest to the northeast. Isolated natural areas are in fact in relatively close proximity to similar natural areas. Connectivity has been

maintained through transportation right-of-ways, human settlements and modified drainage courses. The two drainage corridors are significant linear landscape elements, whereas the system of lakes and freshwater marsh wetlands are connected through a variety of terrestrial upland areas, specifically forested corridor and grassland patches.

Existing corridors in varying degrees of naturalness occur in the Subject Area and need to be maintained, specifically;

- ➔ upland forest grassland complex connecting Crescent Lake to Whelp Creek and eventually to Barnett Lake; and
- ➔ upland forest corridor connecting Barnett Lake to Elizabeth Lake, Lake Anne and Cranna Lake.

Corridors are required for certain natural areas within the Subject Area, specifically;

- ➔ freshwater marsh habitats in the northeast portion of the Subject Area require increased connectivity with each other, the lakes system and Wolf Creek; and
- ➔ southeast upland forest requires a connection to Wolf Creek.

## 4.3 HABITAT TYPES

The habitat types within the Subject Area are characteristic of the Central Parkland Subregion. The following is a summary of the various types of habitats observed in the Subject Area. In addition, unique attributes specific to each habitat type have been emphasized to elucidate an overall value of the ecosystem on the landscape.

### 4.3.1 Upland Forest

The upland forest ecosystem includes the **Upland Forest** and **Upland Forest Corridor** habitats identified in the Subject Area. The **Upland Forest Grassland Complex** is a complex of Upland Forest and Grassland habitats.

The historical forest vegetation of the Subject Area is aspen parkland. As a transition vegetation zone between the grasslands to the south and the boreal forest to the north, aspen parkland is characterized by fescue grassland interspersed with pockets or bluffs of aspen and boreal forest trees.

Upland forest habitats support diverse vegetation that varies along gradients of soil moisture. The upland aspen forests in the Study Area commonly consist of trembling aspen and balsam poplar trees in the canopy. Native shrub species include snowberry, saskatoon, beaked hazelnut, choke cherry, red osier dogwood, willow,

rose and alder. Native understory species include bunchberry, aster, fireweed, bedstraw, sarsaparilla, vetch and mint. Primary productivity is not as high as wetlands, but the presence of trees and shrubs offer a protective habitat and provide forage for wildlife.

The structural diversity prevalent within the forest canopy results directly in a diversity of wildlife. Common mammal species are white-tailed deer, moose, coyote, porcupine, red fox, red squirrel, skunk, snowshoe hare and white-tailed jack rabbit. Common bird species are a mixture of year-round and seasonal residents. Raptors such as the great horned owl, red-tailed hawk, northern harrier and falcons are common when prey is sufficient. Resident songbirds are abundant, as well as neo-tropical migrant songbirds who require the forest habitats for resting points on their way to the northern boreal forests.

Aspen parkland forest is rare today, as over 80% of this vegetation zone has been destroyed by agricultural practices and human urban development. There are few substantial aspen stands across the landscape, most have been fragmented beyond sustainable sizes and occur in non-urbanized areas. With continued fragmentation of the parkland landscape as a result of agriculture and urban development, the larger mammals and raptors are becoming increasingly rare. The white-tailed deer is the principal ungulate species in the area. White-tailed deer have adapted to human settlements, although their prime habitats are forested natural areas associated with agricultural areas. The predominant large carnivore in the Subject Area is the coyote. The coyote occupies a variety of habitats and appears to be most successful in agricultural areas associated with fragmented forest stands. The red fox occupies forest/grassland habitats and is often abundant in semi-open agricultural areas.

An important aspect of the remaining upland forest habitat patches are the edges. The hard border between the forest habitat and developed land are a classic example of the ecological principle referred to as the “edge effect” (Odum, 1971). The edge effect explains the diversity and abundance of species at the border of one habitat adjacent to another. Plant and wildlife diversity tends to be greatest at the edge or “ecotone” between two distinct ecosystems.

### 4.3.2 Grassland

The Grassland ecosystem includes the **Upland Grassland** habitat identified in the Subject Area. The **Upland Forest Grassland Complex** is a complex of Upland Forest and Grassland habitats.

Grasslands are characterized by a consistency in microclimate, plant species, wildlife species, growth form and physiognomy. Grasslands are herbaceous plant communities dominated by graminoids (grasses, sedges and rushes), but with forbs (non-graminoid herbs) present and seasonally dominant. Trees are generally absent

on the native grassland landscape. An average of four graminoid species usually characterize a grassland site and produce a majority of the biomass. Grasslands are dominated by annual grasses, perennial bunchgrasses or perennial sod-forming grasses. Annual grasses generally dominate dry, overgrazed or disturbed sites. Species from the Composite and Legume families are generally the most numerous forbs. The number of plant species that occur in a grassland increase as the environment becomes moister, where topographic variations are present and where humans have had the least impact.

Native grasses common to the aspen parkland include wheatgrass, rough fescue and june grass. Exotic brome and bluegrass species that have been introduced through agricultural practices have replaced many native species. Smooth brome, Kentucky bluegrass and crested wheatgrass are common non-native species characteristic of disturbed upland aspen forest habitats and associated grasslands.

The major changes in grassland vegetation through succession are primarily associated with grazing and drought, with fire as a secondary disturbance. Heavy grazing or drought may result in a shift in the dynamics of species change, for example a decline in perennial grasses and an increase in annual grasses and forbs. In the absence of natural disturbances, prescribed disturbances have been used to eliminate or suppress undesirable annual grasses, forbs and shrubs. In pristine grasslands, wildfires were common during the fall season. Perennial grasses recover from this disturbance due to their rhizomes and subsurface root crowns, but shrub and tree species are killed. In the absence of fire, or some other natural disturbance, woody shrub and tree species can invade the grassland at a rate of up to 1 m per year. Fire also improves the vigour of the grasses by stimulating productivity and flowering due to removal of litter. The removal of litter allows the soil temperatures to increase, again stimulating plant growth and productivity.

The remnants of native grassland exist in small isolated pockets within the Subject Area and appear to be associated with rough or inaccessible terrain that could not be successfully broken for agriculture. These remnant habitat patches provide diversity to the landscape. Grasslands have important scenic, aesthetic and watershed values and provide forage and habitat for a large number of domestic and wild animals.

### 4.3.3 Wetland

The Wetland ecosystem includes the **Wet Meadow** and **Freshwater Marsh** habitats identified in the Subject Area. The **Open Water** classification refers to the amount of open water in a lake or marsh habitat.

A wetland is actually an ecotone or transition zone between upland terrestrial habitat and deep water aquatic habitat. Defining wetlands is complicated due to their

fluctuating vegetation and water quantity. Water is the determining factor for soil development and associated biological communities. In general, natural wetlands meet one or more of the following conditions:

- ✓ Area supporting vegetation adapted to saturated soils and aquatic conditions;
- ✓ Area characterized by saturated soils which often produce anaerobic conditions that limit vegetation growth; and
- ✓ Area with a substrate that is saturated or covered by shallow water at some time during the growing season.

The Subject Area is within the prairie pothole wetland region of North America. This region is considered the major area of freshwater marshes in the world. Individual prairie potholes are considered small freshwater marshes that have originated in millions of depressions formed by glaciation. These freshwater marshes are considered the most diverse type of wetlands.

A permanent freshwater marsh is characterized by open water and well developed wetland vegetation, dominated by herbaceous emergents. The typical plant species are separated based on their growth habitat and adaptations to water depth. There are four "classic" vegetation zones surrounding a well developed freshwater marsh, including (a) perennial marsh, (b) seasonally saturated marsh, (c) wet meadow, and (d) upland. Perennial marshes are areas which are permanently or semi-permanently flooded and are dominated by tall emergent plant species, such as cattails and bulrushes. Slightly upland seasonally flooded or saturated marsh areas are dominated by sedges and rushes. Further upland are wet meadows which are dominated by grasses and rushes and occur in temporarily or intermittently flooded zones. The upland areas are identified by woody species, such as willow and poplar. Therefore, a well developed freshwater marsh consists of an area of relatively persistent open water surrounded by zones of differing vegetation, based upon the seasonal hydrologic regime.

An intermittent freshwater marsh is characterized as a small shallow depression of glacial origin. Due to the shallow topography, seasonal water levels can be extremely variable. Open water may be present for short periods, but intermittent inundation is a characteristic feature. Marsh vegetation is predominant, although due to seasonal water level fluctuations, developed vegetation zones are not generally present. Typically there is a relatively narrow band of emergent vegetation (cattails and bulrushes), sedges and willow.

Freshwater marshes generally follow a five to twenty-year cycle of drought, reflooding, deterioration and a lake stage (Mitsch and Gosselink, 1993). Freshwater marshes generally have high pH substrates, high available soil calcium, high loading rates for nutrients, high productivity and high soil microbial activity for rapid decomposition, rapid recycling and nitrogen fixation.

The regional prairie pothole wetland is considered one of the most important wetland regions in the world due to its numerous shallow lakes and marshes, rich soils and warm summers. It is well known that 50 to 75 % of all waterfowl produced in North America comes from the prairie pothole system.

It has been estimated that prior to European settlement, 80,000 $km^2$ of prairie potholes existed on the landscape. Since European settlement, more than 51% of the individual wetlands have been converted to other uses, primarily agriculture (Leitch, 1989).

Freshwater marshes are valuable as wildlife islands in the middle of human development, specifically agriculture, and have been used and studied for the assimilation capacities of human domestic waste. Wetlands provide many services and commodities to humans. Wetlands moderate the effects of floods, improve water quality, provide aesthetic and heritage values. Globally they contribute to the stability of levels of available nitrogen, atmospheric sulphur, carbon dioxide and methane (Mitsch and Gosselink, 1993).

Several wetland values have been identified (Stearns, 1978) and include; maintenance or improvement of water quality, flood protection, processing of airborne pollutants, providing a buffer between urban residential and industrial segments to ameliorate climate and physical impact, maintenance of a gene pool, providing examples of complete natural communities, providing aesthetic and psychological support for human beings, production of wildlife, control of insect populations, providing habitats for fish spawning and other food organisms, and production of food, fiber and fodder.

The habitat offered by wetlands is relatively small on the landscape, but the number of wildlife species which utilize the wetland are large and diverse. Similar to wetland vegetation, wildlife species must adapt to survive in this habitat. A common adaptation is mobility that accommodates movement between habitats on a daily or seasonal basis (birds, mammals). Use of the wetland for a part of the life cycle is another common adaptation (reptiles, amphibians and insects). Other wildlife species have evolved to tolerate the dynamic conditions by entering dormant periods during decreased water availability (insects, invertebrates).

### 4.3.4 Riparian

The Riparian ecosystem includes the **Riparian** habitats identified in the Subject Area.

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Riparian ecosystems are characterized by a high water table due to the proximity of an aquatic ecosystem or subsurface water, specifically rivers or creeks. Riparian ecosystems usually occur as an ecotone between aquatic and upland systems and are therefore characterized by a unique complex of vegetation and soils. A riparian

ecosystem can be identified where creeks or rivers occasionally cause flooding beyond the confines of their channel. As an ecotone ecosystem, riparian habitats are unique in that they may contain a combination of high species diversity, high species densities and high productivity. There is a continuous interaction between riparian, aquatic and upland ecosystems through energy, nutrient and species exchange. Due to the riparian interface between aquatic and terrestrial systems, they offer a classic example of the edge effect (Odum, 1971) where the diversity and abundance of species tend to be greatest at the edge between two distinct ecosystems.

The form and function of a riparian ecosystem is unique because of the linear form and transportation of energy and materials from upstream. Riparian areas are considered more productive than adjacent upland forests or grasslands due to the periodic inflow of nutrients, specifically when flooding is seasonal. Flooding of the riparian zone affects soil chemistry, imports and exports organic matter and replenishes nutrients. Plant communities form in response to riparian gradients and are generally productive and diverse.

Riparian ecosystems are occasionally flooded but may be dry for portions of the growing season. The ecosystems are generally conspicuous on the landscape, in contrast with surrounding non-forested vegetation or human development.

Riparian zones are impacted by continental and regional climatic and geological processes, intra-riparian processes along the length of the system (flooding and landform dynamics) and trans-riparian processes across the width of the system (slope gradients, sediment sorting, biotic processes) (Mitsch and Gosselink, 1993). Riparian zones are impacted at the global, regional or local scale by water management practices, clearing/logging and livestock use.

The riparian habitats are valuable to wildlife as refuge, habitat, water supply and migration corridor. This is particularly true in areas where the uplands have been developed and the riparian ecosystems support the only native vegetation in the area.

The ecosystem functions are not well understood, although it is generally accepted that primary productivity is higher than the uplands in the same region and the riparian ecosystems exhibit large fluxes of energy and nutrients. Runoff into riparian ecosystems from the uplands results in a nutrient sink role and therefore as a nutrient transporter for upstream-downstream flows.

Four ecological characteristics of riparian areas that are important for wildlife include (Brinson et al. 1981):

1. The predominance of woody vegetation, including trees and shrubs. Woody vegetation is important in agricultural and developed regions to provide protection

and habitat for wildlife. The vegetation also shades the adjacent water, stabilizes the shore and produces leaf litter, important factors for sustaining aquatic life.

2. The presence of surface water and increased soil moisture. The creek or river is an important source of water and food for wildlife, as well as providing protection and reproduction areas for aquatic wildlife.
3. The presence of diverse habitat features. The riparian zone forms an array of diverse habitats, and coupled with the edge effect, provides for an abundance of wildlife.
4. The presence of corridors for dispersal and migration. The linear form of riparian ecosystems provides protected pathways for wildlife to migrate among habitats.

Three major features that separate riparian ecosystems from other ecosystem types (Mitsch and Gosselink, 1993) are:

1. Linear form due to the proximity to rivers and creeks;
2. Energy and materials converge and pass through this open ecosystem from the surrounding landscape in greater amounts; and
3. Functionally connected to upstream and downstream ecosystems and laterally connected to upslope (upland) and downslope (aquatic) ecosystems.

Gregory et al. (1991) described the landscape scale interactions in riparian systems as:

> *The narrow, ribbon-like networks of streams and rivers intricately dissecting the landscape, accentuating the interaction between aquatic and surrounding terrestrial ecosystems….The liner nature of lotic (moving water) ecosystems enhances the importance of riparian zones in landscape ecology. River valleys connect montane headwater with lowland terrains, providing avenues for the transfer of water, nutrients, sediments, particulate organic matter, and organisms….Nutrients, sediments, and organic matter move laterally and are deposited onto floodplains, as well as being transported off the land into the stream. River valleys are important routes for the dispersal of plants and animals….and provide corridors for migratory species.*