Discharge Zones Riparian Vegetation: Domains and Characteristics

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Abstract - **Riparian areas are unique and of high importance ecosystems because they are adjacent to surface freshwater bodies such as streams, rivers and lakes. They are the semi-aquatic transitional zones (ecotones) between terrestrial and aquatic ecosystems. Water, soil and vegetation are the three main characteristics that differentiate them compared to other ecosystems. In the study area there are three major riparian habitat types (domains) that occur under the influence of groundwater flows. Recorded a total of 65 species of plants belonging to 26 families distributed to these riparian zones. Abundant species are herbaceous plants belonging to families Asteraceae and Poaceae that covers hydroriparian up to mesoriparian areas. On the average occurrence families such as Amaranthaceae, Cyperaceae, Fabaceae, Selaginellaceae, Malvaceae, Meliaceae, Phyllanthaceae and Hydrocharitaceae have a moderate dispersion from one zone to another. Comparing the three zones, mesoriparian is the most populated in terms of vegetation consisting of herbaceous plants while the same pattern of vegetation can be observed in xeroriparian areas. Most of the hydrophilic plants inhabited along edge of the streams extended to baseflow of river channel. Submerged plants were also observed.**

Keywords - **Discharge Zone, Riparian Vegetation, Riparian Domain, Vegetation Characteristics**

I. INTRODUCTION

In most undisturbed watersheds, a majority of the water flows into riparian areas and streams as groundwater rather than as runoff. The resulting groundwater moves relatively slowly underground through soil particles/ bedrocks until it reaches riparian areas and associated streams. Plants in riparian areas filter ground and surface water moving into streams (Cohen, 1997). They are able to absorb, hold, and use such of the water that flow off from these sources and able to chemically and biologically bind or detoxify contaminants contained. However, even the healthiest riparian area will be unable to absorb and filter large volume of water, nutrients and contaminants flowing through it when land management practices across watershed soil conservation and water resources are not manage properly. Under healthy watershed conditions water filtration across the landscape results in minimal run0ff and erosion reaching riparian areas.

Health riparian areas have dense growth vegetation that catches any eroded sediments and prevents it from entering streams. They also have a diversity of plants that facilitate water infiltration and take up many nutrients carried into riparian areas by runoff and groundwater. Riparian areas also have a unique sediment/ soil environment that provides favorable conditions for the chemical and biological degradation of many soil contaminants. And thus, a health riparian system can be characterized by a thick growth of vegetation representing a diversity of grasses, herbs, shrubs, and trees, covers the

stream banks and provides shade over the stream. However, the assessment procedure used in this study relies heavily on vegetative characteristics because they reflect and interact with the effects of soils and hydrology that form, and operate in, riparian areas. Plants and their characteristics are analyzed to interpret indication of riparian health, and helping to understand the successional trend on a site to which it measures the effectiveness of the vegetation in performing the key ecological functions of riparian areas. In addition looking at the vegetative features, this assessment also considers physical factors for both ecological and management reasons. Changes in soils or hydrology can have major effects on riparian function and may be more difficult to remedy than changes in vegetation. There is an interrelationship between physical and vegetative features. Reaches with significant hydrological and soil changes most likely will show changes in plant community structure and potential. Changes in vegetation, the "glue" of riparian systems, may have a rebounding effect on hydrologic and soil features. The health of a riparian reach is most often a result of what has happened or is happening upstream. Sometimes health can be affected by what occurs downstream, too. Health can often be linked directly to current management on the site or the effects of previous management (Fitch, et al., 2009: 12).

Several classification systems based on riparian vegetation patterns use plant community type as the fundamental classification unit (Ellenberg, 1988, Naiman, 1998). Plant community type is defined either by the present floristic composition (actual vegetation) or the potential natural vegetation (Swanson et al., 1988; Chytry, 1998). Stratification of community types is based primarily on the over-story or on a combination of over-story and under-story vegetation, although the over-story or canopy vegetation is a better integrator of long-term patterns at the landscape scale (Forman, 1995; Harris, 1999). One effective classification scheme for natural riparian areas combined natural plant community types and geomorphologic features in order to delineate distinctive stream-vegetation valley types (Harris, 1988).

II. METHODS

Following what has been done in this field for assessing riparian zone; identification of water flow types in riparian areas was used as indicator to identify vegetation by zone. Riparian vegetation is often important in highlighting the distinctiveness of three hydrographically very different stream types, perennial, intermittent and ephemeral, which have long been mapped and inventoried in relation to stream ecosystem types (Leopold, 1994; Gordon et al., 2004).

Perennial streams have visibly flowing surface water throughout the year. Intermittent streams are more variable and are typically without water in the drier months. Water appears on the streambed only during the wetter season or for prolonged periods after precipitation events. This occurs because underground water is sufficiently close to the soil surface to rise above the surface after being recharged by precipitation. Therefore, intermittent streams have an important connection with ground water; in contrast, ephemeral streams usually do not. This creates distinct hydrological and vegetation characteristics that usually help in distinguishing intermittent streams from ephemeral streams. In most cases, only perennial and intermittent streams can support riparian vegetation that behaves as functioning riparian vegetation communities. Although water does flow down ephemeral streams (e.g. storm water), the water table is usually not sufficiently close to the soil surface to allow hygrophilous vegetation to access the greater quantity of water it needs to grow. Vegetation growing along ephemeral streams may be more densely structured, or grow more vigorously, but generally there are no dramatic differences in composition compared to the surrounding upland vegetation. There are exceptions to this, as has become evident from many relative studies (Radabaugh et al., 2004) which lead to the conclusion that the distinction between ephemeral and intermittent

streams should be primarily based on the hydrological regime and secondarily on the vegetation. In a seasonally-arid climate where Dry Land Rivers dominate, the duration of surface water flow usually sets the level of environmental harshness (Giller and Malmqvist, 1998), so this distinction is important and usually plays an extremely important role in the riparian zone's natural vegetation composition.

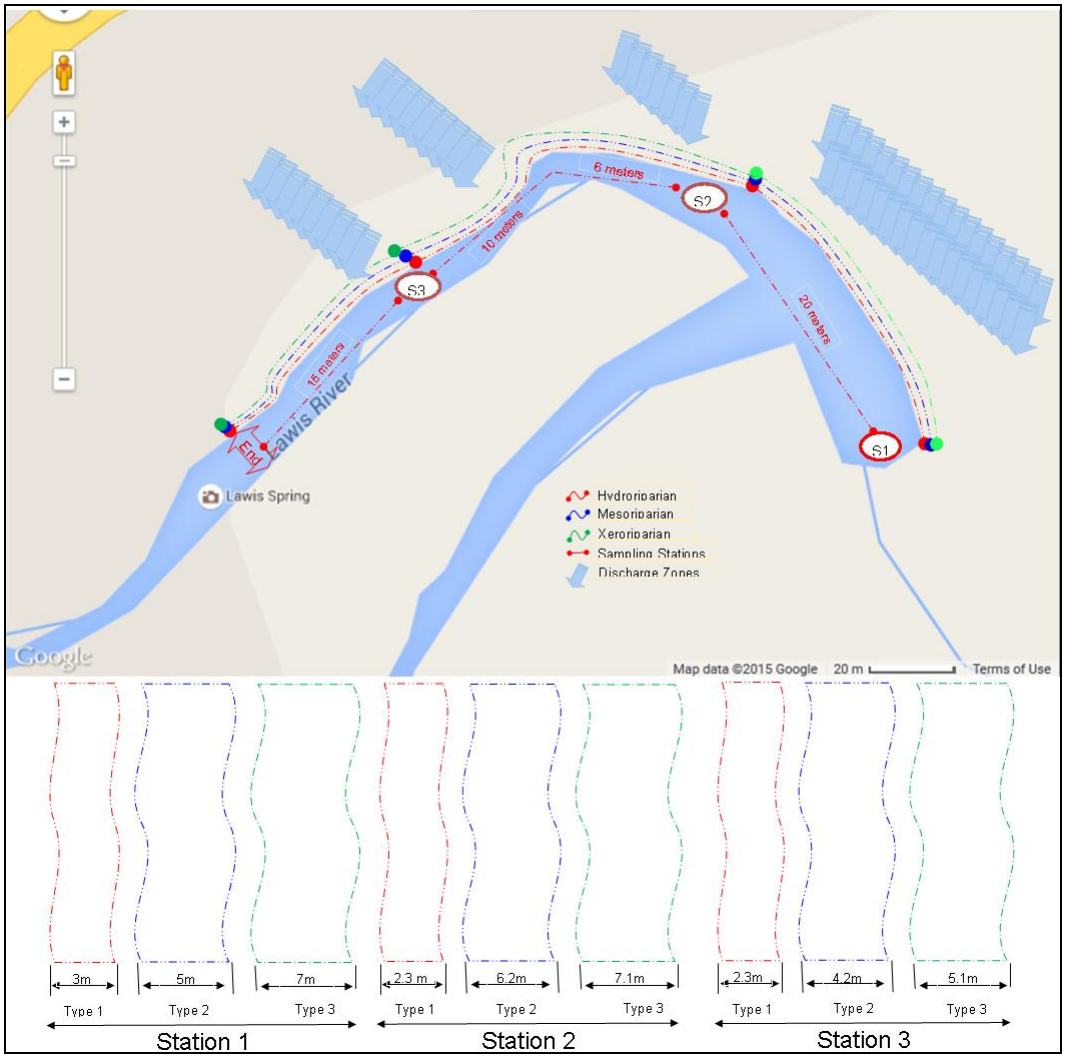

Fig 1. Sampling Diagram of Reach Boundaries by Riparian Zone Type

Johnson et al., 1984 characterized riparian areas based on the low conditions of the stream or river (Fig. 1). Specifically, they examined the presence of lowing water in the channel and the connectivity of the stream low to the groundwater. Hydroriparian areas are associated primarily with perennial streams or rivers. The soils are hydric or have substrates that are never dry or are dry for short periods. Their vegetation consists primarily of obligate and preferential riparian plants. Mesoriparian areas are associated with intermittent streams or rivers. The soils are non-hydric and have substrates that are seasonally dry. Vegetation consists of a mixture of primarily preferential and facultative riparian, but also obligate riparian and non-riparian plants. Xeroriparian areas are typically associated with ephemeral streams or rivers. Soils are non-hydric and dry most of the year. Their average annual soil moisture is higher than the surrounding uplands, but only during or shortly after rainfall events. These events enhance the storage and accumulation of water in the

stream channel and its banks. This higher available soil moisture at the xeroriparian areas leads to a much denser vegetation than the adjacent terrestrial uplands. Plant species that are present are typically facultative riparian and nonriparian plants, while in some cases there are preferential riparian plants. In contrast, at the hydroriparian and mesoriparian areas the groundwater provides consistent moisture to the vegetation year around, in addition to any circumstantial surface moisture during local rainfall events that leads to a greater presence of obligate and preferential riparian plants.

III. RESULTS AND DISCUSSION

Healthy riparian vegetation captures water and facilitates water infiltration into the soil. Riparian areas that include a diversity of plant species are most effective in slowing the flow of water and storing it for future use. These species are not arranged in a random manner. Rather, they are organized in a natural structure consisting of three roughly parallel ecosystem bands, each consisting of species adapted to survive in the specific moisture regime of that area and able to perform specific ecological functions.

Johnson et al., 1984 classified the plant species based on their occurrence in riparian areas into three distinct riparian zones. Starting at the edge of the water it could be found the first band of vegetation is made of water-loving plants / hydrophytes / hydrophilic (rushes and sedges). These plants have deep, strong roots that stabilize streambanks against erosion and are critical for promoting water recharge and water table height (Clark, 1998; Martin and Chambers, 2001). The first band is the most ecologically important and requires the greatest protection from degradation. This zone serves as an indicator of riparian health since it is the most sensitive. Common riparian species found belonging to families such as Fabaceae, Haloragaceae, Hydrocharitaceae, Apiaceae, Asteraceae, Araceae, Caryophyllaceae, Cyperaceae, Melastomataceae, Nephrolepidaceae.

TABLE I
THE MAJOR TREE, SHRUB, VINE AND HERBACEOUS SPECIES THAT ARE PRESENT IN THREE DISTINCT RIPARIAN HABITAT TYPES IN LAWIS BURUUN, ILIGAN CITY

Hydroriparian (Type-1)	Mesoriparian (Type-2)	Xeroriparian (Type-3)
Hydrophilic (submerged)		
[12]*Myriophyllum spicatum* [13]*Vallisneria spiralis* [13]*Elodea Canadensis* [13]*Hydrilla verticillata*		
Shrubs		
	[10]*Macaranga sp.*	[1] *Sanchezia speciosa*
Vine		
[2] *Centella asiatica* [3] *Sphagneticola trilobata* [3] *Wedelia trilobata* [11]*Alysicarpus sp.* [8] *Commelina benghalensis* [7]*Drymaria cordata* [5]*Colocasia spp.*	[11]*Alysicarpus vaginalis* [23]*Polypodiaceae*	[20]*Passiflora foetida*

Herbaceous		
[6]*Blechnum sp.*	[25]*Selaginella sp*	[9]*Cyperus kyllingia*
[9] *Scirpus sp.*	[3]*Synedrella nodiflora*	[9]*Fimbristylis sp.*
[5]*Alocasia sp.*	[12]*Sida rhombifolia*	[3]*Pseudelephantopus spicatus*
[18]*Medinilla sp.*	[21]*Phyllanthus amarus*	[3]*Bidens pilosa*
[25]*Selaginella sp.-*	[21]*Phyllanthus sp.*	[12]*Corchorus olitorius*
[19]*Nephrolepis hirsutula*	[10]*Euphorbia heterophylla L*	[21]*Phyllanthus urinaria*
	[4]*Alternanthera sessilis*	[4]*Amaranthus viridis*
	[4]*Alternanthera paronychioides*	[3]*Bidens discoidea*
	[4]*Alternanthera philoxeroides*	[22]*Eragrostis capillaris*
	[3]*Tridax procumbens*	[22]*Spartina pectinata*
	[3]*Chromolaena odorata*	[22]*Saccharum spontaneum*
	[3]*Elephantopus scaber*	[22]*Chrysopogon sp.*
	[3]*Mikania cordata*	[22]*Eleusine indica*
	[3]*Spilanthes acmella*	[11]*Mimosa pudica*
	[22]*Imperata cylindrical*	
	[22]*Paspalum conjugatum*	
	[14]*Lygodium circinnatum*	
	[24]*Pityrogramma calomelanos*	
	[26]*Pouzolzia zeylanica*	
	[0]*Asplenium tenerum*	
Trees		
	[15]*Hibiscus tiliaceus*	[16]*Lansium domesticum*
		[16]*Swietenia macrophylla*
		[17]*Ficus septica*

***Note**: [0]Aspleniaceae, [1]Acanthaceae, [2]Apiaceae, [3]Asteraceae, [4]Amaranthaceae, [5]Araceae, [6]Blechnaceae, [7]Caryophyllaceae, [8]Commelinaceae, [9]Cyperaceae, [10]Euphorbiaceae, [11]Fabaceae, [12]Haloragaceae, [13]Hydrocharitaceae, [14]Lygodiaceae, [15]Malvaceae, [16]Meliaceae, [17]Moraceae, [18]Melastomataceae, [19]Nephrolepidaceae, [20]Passifloraceae, [21]Phyllanthaceae, [22]Poaceae, [23]Polypodiaceae, [24]Pteridaceae, [25]Selaginellaceae, [26]Urticaceae*

Away from the water edge the second band of vegetation starts in the wet ground, usually near the edge of the bank. This band consists of shrubs, trees, moisture-loving grass, and water-tolerant broad-leaved plants (Huel, 1998). Majority are herbaceous species belonging to families Aspleniaceae, Phyllanthaceae, Selaginellaceae, Urticaceae Pteridaceae, Poaceae, Euphorbiaceae, Haloragaceae, Asteraceae, Amaranthaceae.

The third band of vegetation is a mixture of riparian and upland plant species. It is found in the drier soil where the riparian zone merges with the uplands (Huel, 1998) mostly found in the wet ground near the edge of the bank, consists of shrubs, trees, moisture loving grasses, and water-tolerant broad-leaved plants (Huel, 1998). This area is covered by herbaceous species belonging to families Asteraceae, Amaranthaceae, Cyperaceae, Haloragaceae, Fabaceae, Phyllanthaceae, Poaceae.

Plants in the first band are water-loving and have deep, strong roots that stabilize streambanks against erosion (Clark, 1998). Plants in the second and third bands catch water and facilitate its absorption. They also take up nutrients transported into the area by runoff and groundwater and provide habitat for terrestrial animals. If land management practices reduce the riparian zones to only one or two of these bands, some or all of the environmental and habitat benefits of these areas will be lost. The first zone is both the most ecologically important and requires the greatest protection against degradation.

The dominance of water-loving plant species in the first zone serves as an indicator of riparian health. These plants are critical for promoting water recharge and increasing water table height (Martin and Chambers, 2001). It is not essential for native plant species to dominate in riparian areas for these areas to provide environmental benefits. But hydrophytes that provide functions similar to native species need to be present.

Further, plants in the second and third band also play a critical role. They catch water and facilitate its absorption. They also take up nutrients and provide habitat for wildlife. Native plants do not have to dominate these bands to provide environmental benefits. To provide functions similar to native species, water-loving plants must be present. Exotic species that are water-tolerant tend to grow aggressively and are less palatable to grazing animals. Under this competition, native species suffer and tend to die out. In this way, exotic species decrease the ability of riparian areas to maintain high water table levels, retain stream stability, provide forage for livestock, and support wildlife habitat (Huel, 1998).

The natural vegetation does differ depending on the location of the riparian area. Grass vegetation dominates streambanks developed from sediments; while trees and shrubs dominate steep, rocky banks of more rapidly moving and narrower headwater streams. This provides stabilization for stream channels against the forces of erosion while protecting the growth of water-loving grasses, sedges, rushes, and forbs (Elmore and Beschta, 2000). The herbaceous plants then stabilize streambanks with their thick, deep roots, while their stems trap sediment carried by runoff water and stream-scouring floodwaters (Sovell et al., 2000. The types of vegetation that naturally dominate in riparian areas differ across locations. Grassy vegetation is more important for holding together streambanks developed from sediments, while trees and shrubs dominate on the steep, rocky banks of more rapidly moving and narrower headwater streams (Sovell et al., 2000). However, water-tolerant or water-loving plants are more effective for holding streambanks in place than are plants more adapted to upland conditions, because they have deeper and stronger root systems.

Thus, these plants often serve as indicators of disturbed or degraded riparian areas. Similarly, trees that are not water tolerant do not develop as extensive root systems in riparian areas as do water tolerant species. As a result, these trees are unable to effectively stabilize streambanks and are likely to be undercut and fall into streams. Recent research indicates that for a riparian buffer zone to effectively act as a habitat corridor, a minimum width of 30 meters, and up to 100 meters in some cases, is desirable, in order to achieve the full range of plant communities needed for a range of species and to link effectively with adjacent terrestrial ecosystems. Grasses and understory plants are most effective in achieving this ‘buffer zone effect, with most research indicating that a buffer zone of at least 20 meters from the top of the bank is required to achieve effective pollutant and nutrient stripping, and the wider the buffer zone is the more effective it is. Buffer zones are also more effective when the flow is shallow and steady.

IV. CONCLUSION

The current riparian areas of the sampling site contain a combination of wet and dry soil zones that facilitate a variety of biological and chemical reactions. These reactions reduce the availability of some nutrients and decrease the toxicity of some contaminants. Riparian areas are well-vegetated have highly permeable soils and high stream banks. They have a water table that extends underground and outward from the streambanks and provides a large amount of groundwater storage. And thus, suggest that the occurring riparian system is still in good condition.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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PDF | Riparian vegetation corresponds to all vegetation units along river networks, regardless of their physiognomy or origin, and is functionally | Find, read and cite all the research you need on ResearchGate.Â which riparian vegetation is identified, named, delineated and studied. From a functional perspective, the delineation needs to be adapted to the functions targeted. The riparian zone is characterized by both its proximity to water and by the plants and animals present. In terms of location, the riparian zone is always directly adjacent to a moving body of water such as a stream, river, or estuary. Depending on the latitude of the river, the riparian zone may be reduced as the temperature gets colder.Â 1. Which of the following is NOT a characteristic of riparian areas? A. Has very little vegetation B. Contains a large amount of biodiversity C. Supports large trees. Answer to Question #1. A is correct. The large amount of water present in a riparian area allows many plants to thrive. This, in turn with the tempering effects of the vegetation, allows a great many animals to survive as well.