ISSN (Print) 1225-9918
ISSN (Online) 2287-3406
Journal of Life Science **2017** Vol. 27. No. 3. 301~309 DOI : https://doi.org/10.5352/JLS.2017.27.3.301

River Ecosystem and Floristic Characterization of Riparian Zones at the Youngjeong River, Sacheon-ci, Korea

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Received July 23, 2016 / Revised August 25, 2016 / Accepted August 25, 2016

This study is examined river naturality and vegetative composition of river riparian zones to identify their most important sources of variation. Information on plant species cover and on physical characteristics that occur at upper, medium, and low areas was collected for 30 riparian plots located throughout the Youngjeong River in Korea. The riparian areas of river banks are dominated by mixed sediment and the vegetation is composed of herbs, shrub, and trees. The floristic characterization of riparian at this river during 2015 season was identified with a total of 28 families, 72 genera, 75 species, 13 varieties, 23 associations. The vegetations of low water's edge and flood way at upper region were naturally formed various vegetation communities by natural erosion. Forty plant species were identified around the upper region, where the dominant growth form was mostly trees. The flood way vegetation at middle region was both of natural vegetation and artificial vegetation. Land uses in riparian zones river levee at low region were bush or grassland as natural floodplain. The values of cover-abundance at upper, middle, and low region were total 9.26, 7.24, and 7.56, respectively. Grasses and forbs at the Youngjeong River have similar cover-abundance values. Recent, many riparian areas of this river have been lost or degraded for commercial and industrial developments. Thus, monitoring for biological diversity of plant species of this river is necessary for an adaptive management approach and the successful implementation of ecosystem management.

Key words : Cover-abundance, riparian vegetation, river naturality, Youngjeong River

Introduction

Plants living in wetlands must be able to survive both inundation and drying as water levels may fluctuate greatly seasonally. Other plants are adapted to live predominantly beneath the water's surface (submerging), others float on the surface (floating), while others emerge from water with stiff stems holding the plants leaves above the water (emergent). River bank vegetation, ecologically termed as riparian flora which is highly dynamic, linking terrestrial and aquatic habitat, under the influence of a waterway, such as rivulet banks or riverbanks, represented by a particular type of vegetation that grows along the sides of rivers are called the river's riparian zone [5].

Riparian ecosystems have been defined simply as the corridor of hydrophytic vegetation growing on the banks of streams and rivers and having an annual evapotranspiration level that influences surface and groundwater hydrology [30]. In addition, riparian areas are transitional areas between terrestrial environment and aquatic systems. Thus, virtually all rainwater runoff must pass through the riparian zones before moving into adjacent aquatic/estuarine systems.

It has long been recognized that riparian zones perform important services, including improvement of surface and groundwater quality, provision of high quality habitat, reduction of flood risk and erosion, and increased stabilization of banks [15]. Thus, riparian vegetation is increasingly being recognized for its importance in influencing the hydrology and morphology of fluvial systems [24].

Riparian wetlands, deltas and estuaries are normally seen as highly productive systems that harbor a high number of plant species [17, 29].

Riparian forest, the forest that primarily grows along rivers and streams, is a critical habitat type in the state. Riparian forest provides a buffer that filters runoff into rivers and streams and supports a variety of wildlife species. Riparian zones contain valuable water resources, plant communities, fisheries, and wildlife. Perspectives of riparian

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zones based on isolated components of the terrestrial-aquatic interface are ecologically incomplete and have limited application to understanding of ecosystems [16].

The critical importance of scale of observation for ecological studies has been illustrated by numerous investigations representing many aspects of ecology [21]. These include patterns of species abundance, population density and community composition, and species richness [6, 19]. This wide recognition of the importance of scale has led to a search for an appropriate theoretical framework for studies of spatial scale [1], and specifically to the introduction of the concepts of grain and extent as crucial but separate aspects of spatial scale [18].

The many plants that grow along the banks of this river and her tributaries play an important role in the diverse ecosystems the river supports. Not only do the plants rely on the Youngjeong River for water, but they also play an important role in nutrient and water conservation, and their presence controls soil erosion along the banks. Water can converge on riparian zones from many directions. Precipitation falls on riparian zones. Some precipitation is intercepted by plant foliage and evaporated back to the atmosphere, but most of it reaches the soil. Overland and subsurface runoff from uplands flows laterally across riparian zones to streams. Overland runoff is generated when infiltration is limited by low soil permeability or its saturation. When forests are destroyed, the atmosphere, water bodies and the water table are all affected. Trees absorb and retain water in their roots. A large part of the water that circulates in the ecosystem of rainforests remains inside the plants. Some of this moisture is transpired into the atmosphere. When this process is broken, the atmosphere and water bodies begin to dry out. The watershed potential is compromised and less water will run through the rivers. Smaller lakes and streams that take water from these larger water bodies dry up. Riparian zones of Middle and low regions have been destructed in the Youngjeong River. The local level is where deforestation has the most immediate effect. This disrupts the natural flooding cycles, reduces flows, drains wetlands, cuts rivers off from their floodplains, and inundates riparian habitats, resulting in the destruction of species, the intensification of floods and a threat to livelihoods in the long term [13].

The purpose of this study is to investigate river ecosystem and the flora on the Youngjeong River at three regions. Therefore, this survey recorded material significance for the future appears in the environment to restore or improve the problem may be.

Materials and Methods

Surveyed regions

This study was carried out on the Youngjeong River, located at Yonghyeon-myeon province (upper region: 35°011′014′′N/128°100′014′′E, low region: 35°012′794′′N/128°049′459′′E), Sacheon-ci in Korea (Fig. 1). The river is located to the northern east of the city of Sacheon-ci. The river is approximately 4.85 kilometers in length with a varying width of between 2.1 and 31.6 meters. The flora and vegetation on the Youngjeong River were investigated at three

Fig. 1. Location of the study area and the three detailed internodes at the Youngjeong River.

regions and adjacent areas during four seasons. The upper area of the Youngjeong River, including one reservoir, used to be covered with moderate deciduous forest made up of pine trees and other species. Unfortunately, middle and low regions have now been deforested and heavily cultivated.

Floristic analysis

Sampling with quadrats (plots of a standard size) can be used for most plant communities [3]. Three sectors of the riparian vegetation on the Youngjeong River were chosen to study. At these places, a floristic survey of trees, shrubs, herbs, grass and aquatic species was performed by least count quadrat method. A quadrat delimits an area in which vegetation cover can be estimated, plants counted, or species listed. Quadrats were established randomly, regularly, or subjectively within a study site since plants often grow in clumps, long, narrow plots often include more species than square or round plots of equal area. Each species was collected, mounted, labeled, and systematically arranged in a herbarium. The system of plant classification system was followed by Lee [12]. Naturalized plants were followed by Korea National Arboretum [11]. Abundance and cover degree are usually estimated together in a single combined estimation or cover-abundance scale from Braun-Blanquet [2]. In order to relate the model to the field situation in which usually Braun-Blanquet figures are recorded, the % occupancy figures were transformed in to the ordinal transform scale from 1 (one or few individuals) to 9 (75~100% cover of total plot area, irrespective of number of individuals) [4]. The relative net contribution degree (r-NCD) was obtained by summing up the NCD values for those species belonging to particular taxa under consideration [10].

Index of degree of river structure

The three regions of Youngjeong River were divided by the geographic location with considering length of the river and river morphology. Index of degree of river naturality according to the environment of river was also analyzed according to Table 1. River terminology was followed by Hutchinson [9]. The test for biochemical oxygen demand (BOD) is a bioassay procedure that measures the oxygen consumed by bacteria from the decomposition of organic matter [22]. The method for BOD was used to a standard method of the American Public Health Association (APHA) and is approved by the U.S. Environmental Protection Agency [26].

Biotic indices

Shannon–Weaver index of diversity [23]: the formula for calculating the Shannon diversity index (H′) is

$$H' = -\sum p_i \ln p_i$$

p_i is the proportion of important value of the ith species ($p_i = n_i$ / N, n_i is the important value index of ith species and N is the important value index of all the species).

$$N = e^{H'}$$

The species richness of animals was calculated by using the method, Margalef's index (R) of richness [14].

$$R = \frac{S-1}{\ln(n)}$$

S is the total number of species in a community and n is the total number of individuals observed.

Evenness index was calculated using important value index of species [7, 20].

$$E = \frac{H'}{\ln(S)}$$

Results

Upper region (upstream)

The river width at this region is about 2.1 m. The vegetations of low water's edge and flood way were naturally formed various vegetation communities by natural erosion (sediment exposure) (Table 2). Land use in riparian zones was bush or grassland as natural floodplain. Land uses of flood plains beyond river levee were arable land or artificial vegetation. Transverse direction of artificial structures was one reservoir. The average value of BOD was 2.13 mg/l. The oxygen-demand parameter BOD at upper region was relative clear. The ratio of sleep width/river width was 5-10%. The value for index of degree of river naturality according to the environment factors was a mean of 2.0.

Riparian vegetation provides habitat for many wildlife species (Table 3). At total area, the application of the Braun-Blanquet approach for plant classification in this area is presented in the article. According to the existing phytosociological data, 28 families, 72 genera, 75 species, 13 varieties, 23 associations, and 17 communities have been identified. 40 species was found in this upper region. Transition zones of this section were distributed pine vegetation and chestnut communities (Table 3). Although the river width was relative large and the depth of water was swallow,

Table 1. Index of degree of river naturality according to the environmental factors

Item	Estimated index and scores				
	1	2	3	4	5
The low water's edge vegetation	Naturally formed a variety of vegetation communities	Naturally formed various vegetation communities by natural erosion (sediment exposure) were absent	Natural weeds, shrubs, and mixed	Artificial vegetation composition	Vegetation blocked by stonework etc.
Flood way vegetation	Naturally formed a variety of vegetation communities	Naturally formed various vegetation communities by natural erosion (sand bar) were absent	Both of natural vegetation and artificial vegetation	Artificial vegetation with Parks, lawns, and so on	Remove vegetation artificially
Land use in riparian zones within river levee	Bush or grassland as natural floodplain	Arable land (paddy fields, orchards)	Arable land, urban, residential mixed	About 1/2 urban, residential mixed	1/2 or more urban, residential
Land use in flood plains beyond river levee	State of nature without artificial vegetation, manmade structures	Arable land or artificial vegetation	Artificial vegetation or natural vegetation mixed	About 1/2 park facilities, playground facilities	Impervious man-made structures, parking, etc.
Transverse direction of artificial structures	Absent	Bypass reservoir or slope waterway reservoir	Fish migration reservoir	Reservoir of height 0.3-0.4 m, fish migration difficulty	Fish move completely blocked
Water quality (BOD)	Class 1 (crystal clear)	Class 2 (clear relatively)	Class 3 (tan, the bottom green algae)	Class 4 (blackish brown, the floor is not looked)	Class 5 (an ink color, odor)
Sleep width /river width ratio	20% or more	20~10%	10~5%	5~1%	Less than 1%

Table 2. The degrees of river naturality according to the environmental factors at the Youngjeong River

Region	The low water's edge vegetation	Flood way vegetation	Land use in riparian zones within river levee	Land use in flood plains beyond river levee	Transverse direction of artificial structures	Water quality (BOD)	Sleep width /river width ratio	Mean
Upper	2	2	1	2	2	2	3	2.000
Middle	3	3	1	2	1	2	3	2.414
Low	3	4	1	2	1	3	4	2.571

distributions of aquatic plants did not developed in riparian. Riverbed area was dominated by the distribution of the willow (*Salix gracilistyla*) and *Pueraria thunbergiana* communities. Riverbed area was dominated by *Pueraria thunbergiana* community. Dominant species in flood plains were *Equisetum arvense* and *Trifolium repens.* The survey region was a total of 40 taxa, including 23 families, 36 species, and four varieties. Naturalized plants were six species. The total transformed Braun-Blanquet value and r-NCD at upper area were 83 and 1,038, respectively.

The value of cover-abundance was total 9.26. Grasses and forbs have similar cover-abundance values (2.15 and 2.07, respectively) (Table 4). A Shannon-Weaver index (H´) of diversity was 3.42 across growth forms, varying from 1.77 to 2.37. Although richness indices and evenness indices were different from each other, there were not shown sig-

Table 3. List of vascular plants, Braun-Blanquet's score, and r-NCD at three regions of the Youngjeong River

Family	Species	Region			Invaded plant	r-NCD		
		Upper	Middle	Low		Upper	Middle	Low
Equisetaceae	*Equisetum arvense* L.	4	2	4		50.0	25.0	50.0
Ginkoaceae	*Ginko biloba* L.	1	1	1		12.5	12.5	12.5
Pinaceae	*Pinus densiflora* S. et Z.	3				37.5	0	0
	Pinus thunbergii Parl.	8				100.0	0	0
Cupressaceae	*Juniperus chinensis* var. *kaizuka* Hort.			2		0	0	25.0
Salicaceae	*Salix gracilistyla* Miq.	2	2			25.0	25.0	0
Fegaceae	*Castanea crenata* Sieb. Et Zucc	4				50.0	0	0
	Quercus dentata Thunb. ex Murray	2		1		25.0	0	12.5
	Quercus variabilis Blume	2				25.0	0	0
Moraceae	*Morus alba* L.	1	1			12.5	12.5	0
Cannabinaceae	*Humulus japonicus* S. et Z.	2	4	4		25.0	50.0	50.0
Polygonaceae	*Persicaria blumei* Gross		3	2		0	37.5	25.0
	Persicaria sieboldi Ohki			4		0	0	50.0
	Persicaria thunbergii H. Gross		2			0	25.0	0
	Rumex acetocella L.		2	3	NAT	0	25.0	37.5
	Rumex acetosa L.		2	2		0.0	25.0	25.0
	Rumex conglomeratus Murr.	2	2	2	NAT	25.0	25.0	25.0
	Rumex crispus L.		3	3	NAT	0	37.5	37.5
Chenopodiaceae	*Chenopodium album* var. *centrorubrum* Makino	2	3	3		25.0	37.5	37.5
	Chenopodium ficifolium Smith		2	2	NAT	0	25.0	25.0
Amaranthaceae	*Achyranthes japonica* (Miq.) Pa.			2		0	0	25.0
	Amaranthus lividus L.			2	NAT	0	0	25.0
Phytolaccaceae	*Phytolacca americana* L.	2			NAT	12.5	0	0
Ranunculaceae	*Ranunculus japonicus* Thunb.		2			0	25.0	0
Cruciferae	*Capsella bursa-pastoris* (L.) Medicus		3	3		0	37.5	37.5
	Capsella flexuosa With.		3	2		0	37.5	25.0
	Lepidium apetalum Willd.		2	3	NAT	0	25.0	37.5
	Lepidium virginicum L.		2	2	NAT	0	25.0	25.0
	Rorippa indica (L.) Hiern		2	3		0	25.0	37.5
	Thlaspi arvense L.		3	3	NAT	0	37.5	37.5
Rosaceae	*Potentilla fragarioides* var. *major* Max.	3	2			37.5	25.0	0
	Prunus serrulata var. *spontanea* (Max.) Wils.	1	1	1		12.5	12.5	12.5
	Rubus crataegifolius Bunge	2				25.0	0	0
	Rosa multiflora Thunb.	2	2			25.0	25.0	0
Leguminosae	*Amorpha fruticosa* L.		2		NAT	0.0	25.0	0
	Amphicarpaea edgeworthii var. *trisperma* Ohwi		2	2		0	25.0	25.0
	Kummerowia striata (Thunb.) Schindl.		2	2		0	25.0	25.0
	Pueraria thunbergiana Benth.	4				50.0	0	0
	Trifolium pratense L.	3	4	4	NAT	37.5	50.0	50.0
	Trifolium repens L.	2	5	4	NAT	25.0	25.0	50.0
Aceraceae	*Acer pseudo-sibolianum* (Paxton) Kom.	1	1	1		12.5	12.5	12.5
Oxalidaceae	*Oxalis corniculata* L.	1	2	1		12.5	25.0	12.5
Violaceae	*Viola mandshurica* W. Becker	2				25.0	0	0
Onagraceae	*Oenothera odorata* Jacq.	2	4	2	NAT	25.0	50.0	25.0
Umbelliferae	*Oenanthe javanica* (Bl.) DC.	2	2	2		25.0	25.0	25.0
Oleaceae	*Forsythia koreana* Nakai		2	2		0	25.0	25.0
Plantaginaceae	*Plantago asiatica* L.	2	2	2		25.0	25.0	25.0
Caprifoliaceae	*Lonicera japonica* Thunb.	2				25.0	0	0

Table 3. Continued

Family	Species	Region			Invaded plant	r-NCD		
		Upper	Middle	Low		Upper	Middle	Low
Compositae	*Ambrosia artemisiifolia* var. *elatior* Descourtils		2	2	NAT	0	25.0	25.0
	Artemisia princeps Pampan.	2	4	5		25.0	50.0	62.5
	Artemisia selengensis Turcz.		2	2		0	25.0	25.0
	Aster ciliosus Kitamura		1			0	12.5	0
	Bidens bipinnata L.		2	2		0	25.0	25.0
	Bidens frondosa L.		2	2	NAT	0	25.0	25.0
	Cirsium japonicum var. *ussuriense* Kitamura		1			0	12.5	0
	Cosmos bipinnatus Cav.		3	3	NAT	0	37.5	37.5
	Conyza canadensis L.		4	2	NAT	0	50.0	25.0
	Erechtites hieracifolia Raf.		2		NAT	0	25.0	0.0
	Erigeron annuas (L.) Pers.		2	2	NAT	0	25.0	25.0
	Galingosa ciliate Blake		2		NAT	0.0	25.0	0
	Sonchus asper (L.) Hill		2	2		0	25.0	25.0
	Taraxacum officinale Weber		2	2	NAT	0	25.0	25.0
	Xanthium strumarium L.		1	2	NAT	0	12.5	25.0
Typhaceae	*Typha orientalis* Presl	2	2			25.0	25.0	0
Gramineae	*Agropyron tsukusinense* (Honda) Ohwi	2	2	2		25.0	25.0	25.0
	Alopecurus aequalis var. *amurensis* Ohwi.		2			0	25.0	0
	Avena fatua L.	1	1	2	NAT	12.5	12.5	25.0
	Argostis clavata var. *nukabo* Ohwi.		1			0	12.5	0
	Beckmannia syzigachne (Steud.) Fern.			2		0	0	25.0
	Bromus japonicus Thunb.		2			0	25.0	0
	Cymbopogon tortilis var. *goeringii* Hand-Mazz.		1	2		0	12.5	25.0
	Digitaria sanguinalis (L.) Scop.	2	2	2		25.0	25.0	25.0
	Echinochloa crus-galli (L.) Beauv.		2			0	25.0	0
	Echinochloa crusgalli var. *frumentacea* (Roxb.) W. F. Wight			2		0	0	25.0
	Eleusine indica (L.) Gaertner	3	1			37.5	12.5	0
	Festuca arundinacea Schreb.	2	2	3		25.0	25.0	37.5
	Imperata cylindrica var. *koenigii* Durand et Schinz		2	3		0	25.0	37.5
	Miscanthus sacchariflorus Benth.	2	2	3		25.0	25.0	37.5
	Miscanthus sinensis var. *purpurascens* Rendle	2	4	2		25.0	50.0	25.0
	Phragmites japonica Steud.		6	4		0	75.0	50.0
	Poa sphondylodes Trin.		2	2		0	25.0	25.0
	Setaria viridis (L.) Beauv.	2	2	3		25.0	25.0	37.5
	Zoysia japonica Steud.	3	3	4		37.5	37.5	50.0
Cyperaceae	*Bulbostylis densa* Handel-Mazzetti			2		0	0	25.0
	Cyperus amuricus Max		1	2		0	12.5	25.0
	Cyperus difformis L.	1	1			12.5	12.5	0
	Scirpus triqueter L.	2	3			25.0	37.5	0
Total		83	134	123		1,038	1,675	1,538

NAT: Naturalized plants.

nificant differences (p<0.05).

Middle region (middle-stream)

The river width at the region is about 17.5 m. The riparian areas of both the river banks are dominated by mixed sediment and the vegetation is composed of herbs, shrub, trees, climbers and macrophytes (Table 3). The low water's edge vegetation was natural weeds, shrubs, and mixed. The flood way vegetation was both of natural vegetation and artificial vegetation. Land uses in riparian zones river levee were bush or grassland as natural floodplain. Land use in flood plains beyond river levee was arable and artificial vegetation. Transverse direction of artificial structures was absent. The average value of BOD was 2.88 mg/l. The oxygen-demand parameter BOD was relative clear. The ratio of sleep width/river width was 5-10%. The value for index of degree of river naturality according to the environment factors was a mean of 2.414.

Left and right riparian areas were distributed Polygonaceae vegetation (*Persicaria blumei*, *Persicaria thunbergii, Rumex acetocella*, *Rumex acetosa, Rumex conglomeratus,* and *Rumex crispus*) and Cruciferae vegetation (six species including *Capsella bursa-pastoris*) (Table 3). Land use in flood plains beyond river levee was dominated Gramineae vegetation (*Zoysia japonica*). Other phyla were occasionally recorded in low densities. The survey region was a total of 70 taxa, including 21 families, 59 species, and 11 varieties. Naturalized plants were 21 species. The total transformed Braun-Blanquet value and r-NCD at middle area were 134 and 1,675, respectively.

The value of cover-abundance was total 7.24 (Table 4). A Shannon-Weaver index (H´) of diversity was 4.02 across growth forms, varying from 0.69 to 3.45. For the community as a whole, richness of trees was very low (0.46).

Low region (downstream)

The river width at the region was about 31.6 m. The low water's edge vegetation was natural weeds, shrubs, and mixed (Table 3). The flood way vegetation was artificial vegetation with Parks, lawns, and so on. Land uses in riparian zones river levee were bush or grassland as natural floodplain. Land use in flood plains beyond river levee was arable and artificial vegetation. Transverse direction of artificial structures was absent. The average value of BOD was 3.52 mg/l. The oxygen-demand parameter BOD was within acceptable levels. The ratio of sleep width/river width was 1-5%. The value for index of degree of river naturality according to the environment factors was a mean of 2.571.

Riverbed area was dominated by the distribution of the Polygonaceae communities. The left area in the river was a waterfront park and right areas were roads and residential villages. There were occurred in *Equisetum arvense*, *Juniperus chinensis* var. *kaizuka*, *Humulus japonicas, Persicaria sieboldi*, *Trifolium repens, Oenothera odorata, Phragmites japonica*, *Artemisia princeps,* and *Zoysia japonica* (Table 3). They dominated over the other phyla and were mainly recorded in high densities during summer and autumn. The survey region was a total of 59 taxa, including 20 families, 51 species, and 8 varieties. Naturalized plants were 20 species. The total transformed Braun-Blanquet value and r-NCD at middle area were 123 and 1,538, respectively.

The value of cover-abundance was total 7.56 (Table 4).

Table 4. Mean cover-abundance of species and diversity indices at the Youngjeong River

Growth form	No. species (%)	Mean cover-abundance of species	Diversity (H′)	Diversity (N)	Richness	Evenness
Upper						
Trees	7 (17.5)	3.29	1.77	5.85	1.40	0.91
Shrubs	8 (20.0)	1.75	1.86	6.42	1.59	0.89
Grasses	13 (32.5)	2.15	2.37	10.67	2.50	0.92
Forbs	12 (30.0)	2.07	2.07	7.91	2.27	0.83
Total	40 (100)	9.26	3.42	30.58	6.51	0.93
Middle						
Trees	2 (2.9)	1.0	0.69	1.99	0.46	0.99
Shrubs	6 (8.6)	1.75	1.71	5.52	1.62	0.95
Grasses	22 (31.4)	2.09	2.87	17.65	4.28	0.93
Forbs	40 (57.1)	2.41	3.45	31.62	7.18	0.94
Total	70 (100)	7.24	4.02	55.93	11.54	0.95
Low						
Trees	3 (5.1)	1.0	1.03	2.80	0.67	0.94
Shrubs	3 (5.1)	1.50	1.06	2.88	0.59	0.96
Grasses	17 (28.8)	2.59	1.69	5.43	1.39	0.87
Forbs	36 (61.0)	2.47	3.41	30.36	6.67	0.95
Total	59 (100)	7.56	3.68	39.48	8.35	0.95

A Shannon-Weaver index (H´) of diversity was 3.68 across growth forms, varying from 1.03 to 3.41. For the community as a whole, richness of trees was very low (0.46).

Discussion

A riparian buffer zone is a vegetated strip of land along the margins of a waterway. Healthy native forest riparian vegetation usually consists of a canopy of large trees accompanied by a thick undergrowth of shrubs and grasses [27]. River bank health is a term can be used to illustrate the ecological condition of a river bank or riparian zone. Generally, a river bank is healthy if it is competent enough to protects the river bank from erosion, can satisfy the sustaining need of human. A healthy riverbank could be described as one in which the environment is viable, habitable and sustainable; the economy is equitable, sustainable and adequately wealthy; and the community is habitable, equitable and hospitable. The majority of site at upper region of the Youngjeong River are in good condition, which a high diversity of native species and relatively few introduced compared with other riparian communities.

The Youngjeong River is started at the low mountains and ends at the Pacific Ocean. Welcomme [28] defined three major types of riparian landscapes: fringing, which are the linear riparian corridors, internal deltas, where topographic plains may flood from a combination of precipitation and over-bank flow from the river, and the coastal deltaic floodplains. The Youngjeong River is classified in fringeless type than fringing type because it is not developed many tributaries or streams. In addition, this river does not have wide basin areas. Although riparian area at upper region of the Youngjeong River is not wider than those of middle and low regions, many species are distributed in this region. The vegetations of low water's edge and flood way were naturally formed various vegetation communities by natural erosion (Table 2). Whereas, many cement blocks at middle and low regions of the Youngjeong River were creating instead river grasslands by the Direct-stream Rivers Project because of most rain falling period between June and August. This artificial action reduced the water's natural filtration action and eliminated the habitat of many animals. Humans are affected on rivers directly or indirectly by changing land use in river morphology. They also simultaneously accelerate and decelerate fluxes of water, sediments, and nutrients on a scale that exceeds natural filtration action [25]. Awareness of current conditions and relationships between land uses and resource goals is essential for successful restoration of riparian systems.

Overall this community is common and widespread, with many local area species thriving in the various environments that they occupy within the study area. To a large extent introduced weed species have become naturalized within this complex, but without apparent effect on its functioning. Many exotic plants adapted or partly saturated soils in riparian areas and may potentially become problematic if not managed or eradiated. For example, red clover (*Trifolium pratense*) can take over large areas of strand and sandbars in flood runners, spreading rapidly by stoleniferous rhizomes through the soils [8]. It regenerates quickly from these rhizomes bot after flood or soil sliding, and also seeds profusely.

Riparian zones are major determinants of both the food resources and habitats of aquatic vertebrates in streams and rivers [16]. In headwater segments of drainages, riparian zones control allochthonous and autochthonous food resources for invertebrate consumers, which are the food base for predaceous fish. Furthermore, riparian zones directly control the food resources of herbivorous and detritivorous fishes [16].

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초록 : 사천시 용정천에서 하천 생태계와 하안단구 지역의 수변식물상

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본 연구는 경상남도 사천시 용정천에서 하천의 건강도와 식생 구조를 평가하기 위해 하천의 상, 주, 하류에서 물리적 구조와 30곳의 방형구에서 식물 피도를 조사하였다. 2015년 이 하천의 전체 수변식물상은 28과 72속 75종 13변종이었다. 상류 제방의 식생은 초본, 관목, 교목의 혼합 군락이었다. 상류지역의 하안단구 식생은 자연 침식으로 형성된 식물상이었다. 상류에서는 40종의 식물이 동정되었고 우점 군락은 교목이었다. 중류 지역에서 홍수터는 자연식생과 인공식생이 혼재하였다. 제외지는 초지가 우세하였다. 상, 중, 하류의 피도-풍부도(cover-abundance)는 각각 9.26, 7.24, 7.56이었다. 잎이 좁은 초본과 잎이 넓은 광엽 초본의 피도-풍부도는 유사한 비율을 나타내었다. 최근 이 지역의 하첨 주변은 상업 및 산업 시설이 설치되어 제외지 등에서 많은 하천변 식생이 훼손되었다. 따라서 이 하천의 지속 가능한 유지를 위해서는 생물종 다양성에 대한 모니터링이 필요하다고 사료된다.