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Floristic diversity of major river systems in Zamboanga del Norte

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ABSTRACT

Riparian ecosystems are biologically diverse and ecologically important, yet floristic inventories remain limited in many Philippine river systems. This study assessed the diversity, composition, conservation status, and economic uses of riparian flora in the seven major river systems of Zamboanga del Norte, Philippines. A field survey was conducted from May to December 2021 using a descriptive quantitative biodiversity assessment with a quadrat-based sampling design. Fifty-four sampling stations were established across upstream, midstream, and downstream sections of the rivers. Trees were inventoried using 10 × 10 m quadrats, while shrubs, herbs, and weeds were assessed within 1 × 1 m nested subplots. Species diversity was evaluated using the Shannon–Wiener Diversity Index (H′), while relative abundance, dominance, and Importance Value Index (IVI) were calculated to determine species ecological significance. A total of 152 plant species representing 63 families and 3,388 individuals were documented, including 133 angiosperm species and 19 pteridophyte species. *Cocos nucifera* exhibited the highest Importance Value Index in most river systems, indicating its ecological dominance. The study identified one endangered species (*Shorea astylosa*) and four vulnerable species (*Dracontomelon dao*, *Shorea contorta*, *Diospyros discolor*, and *Pterocarpus indicus*). Approximately 46% of the recorded species possess economic value as sources of timber, food, medicine, fuelwood, raw materials, and feed supplements. These findings provide essential baseline data for biodiversity monitoring and highlight the need to strengthen riparian conservation, ecological restoration, and sustainable land-use management to protect threatened plant species and maintain the ecological integrity of Zamboanga del Norte's major river systems.

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INTRODUCTION

The Philippines is recognized as one of the world's megadiverse countries because of its exceptional biological wealth and high level of species endemism. Despite its relatively small land area, the country harbors one of the highest concentrations of biodiversity per unit area worldwide, making it a global conservation priority (Aquino-Gayao, 2014). According to the Biodiversity Management Bureau, the Philippines supports hundreds of endemic mammals, birds, reptiles, amphibians, and thousands of native plant species, many of which occur nowhere else on Earth (BMB, 2024). However, biodiversity continues to decline because of habitat degradation, land conversion, climate change, invasive species, unsustainable resource extraction, and weak environmental governance, emphasizing the urgent need for updated biodiversity inventories and conservation planning (Convention on Biological Diversity [CBD], 2022; BMB, 2024). This study focuses on documenting the floristic diversity, species composition, conservation status, and economic uses of riparian vegetation in the major river systems of Zamboanga del Norte as baseline information for biodiversity conservation and sustainable resource management.

Previous studies have consistently demonstrated that riparian ecosystems are among the most biologically diverse and ecologically significant terrestrial habitats. They function as ecological corridors that maintain habitat connectivity, stabilize riverbanks, regulate nutrient and sediment transport, improve water quality, and provide habitat for diverse plant and wildlife communities (Naiman, 2005). More recent studies in the Philippines further emphasize that riparian vegetation is highly vulnerable to anthropogenic disturbance and landscape modification, making periodic floristic assessments essential for ecosystem monitoring and restoration (Alderite and Ventura, 2024; Replan, 2026). Likewise, the updated Philippine Biodiversity Strategy and Action Plan identify biodiversity assessment and long-term ecological monitoring as national priorities to support evidence-based conservation and sustainable development (BMB, 2024).

Despite the growing body of research on Philippine biodiversity, comprehensive floristic inventories of riparian ecosystems remain scarce, particularly in the major river systems of Zamboanga del Norte. Most existing studies have focused on protected forests, mountain ecosystems, or localized river sections, leaving significant gaps in information on species composition, diversity patterns, conservation status, species dominance, and the economic importance of riparian plant communities across the province. Furthermore, limited baseline ecological data restrict the ability of local government units and environmental managers to develop science-based conservation strategies, restoration programs, and biodiversity monitoring initiatives for these increasingly threatened river ecosystems (Alderite and Ventura, 2024; Replan, 2026).

To address these gaps, this study will conduct a comprehensive floristic assessment of selected major river systems in Zamboanga del Norte by determining the species composition, diversity, relative abundance, dominance, and importance values of riparian vegetation, while also documenting their conservation status and economic uses. The resulting database will provide much-needed baseline information for long-term biodiversity monitoring, habitat conservation, ecological restoration, and sustainable community-based resource management.

MATERIALS AND METHODS

Sampling area

The areas sampled are the major river systems of Zamboanga del Norte. Fig. 1 shows the map of the province of Zamboanga del Norte and the cities and municipalities where these river systems are located. For each sampling site (Table 1), the species of plants and animals were identified, collected, and photographed.

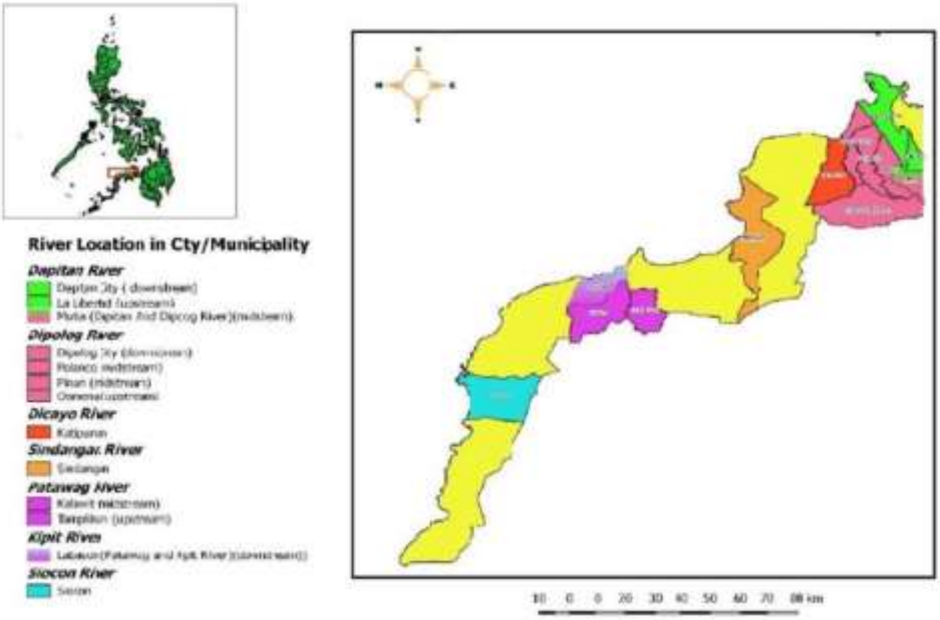

Fig. 1. Map of the study area

Table 1. Description of the study sites

River	Site	Coordinates
Dapitan River	Downstream	8° 32' 16"N ; 123° 28' 48"E
	Midstream	8° 26' 40" N ; 123° 32' 16"E
	Upstream	8° 23' 54" N ; 123° 32' 50"E
Dipolog River	Downstream	8° 35' 39" N ; 123° 20' 44"E
	Midstream	8° 18'13" N ; 123 °30' 39"E
	Upstream	8° 24' 46" N ; 123° 25' 25"E
Dicayo River	Downstream	8° 30' 59" N ; 123° 17' 43"E
	Midstream	8° 25' 47" N ; 123° 16' 41"E
	Upstream	8° 21' 55" N ; 123° 17' 8"E
Sindangan River	Downstream	8° 13' 5" N ; 123° 0' 40"E
	Midstream	8° 12' 57" N ; 123° 3 ' 40"E
	Upstream	8° 11' 10 N" ; 123° 7' 9"E
Patawag River	Downstream	8° 5' 47" N ; 122° 37' 13"E
	Midstream	8° 1' 48" N ; 122° 38' 12"E
	Upstream	8° 0' 39" N ; 122 °41' 45"E
Kipit River	Downstream	8° 4' 17" N ; 122° 28' 19"E
Siocon River	Downstream	7° 41' 34" N ; 122° 7' 41"E
	Midstream	7° 42' 42" N ; 122 °8' 18"E

Sampling design

The study was conducted from May 2021 to December 2021 across the seven identified river systems in the province. A total of 54 sampling stations were established to assess the riparian vegetation. The locations of the sampling stations were determined using a Global Positioning System (GPS), which was also used to record the geographic coordinates and distribution of plant species within the study area.

Sample collection and analysis

The study employed the quadrat sampling method to assess the composition, structure, and diversity of riparian vegetation. At each sampling station, a 20 m × 500 m (1-ha) plot was established parallel to the river, with consecutive sampling sites located at approximately 1-km intervals along each river system. Each 1-ha plot included a section of the river and its adjacent riparian vegetation.

Within each 1-ha plot, 10 m × 10 m quadrats were systematically established at 10-m intervals along the transect line for tree inventory. All trees within each quadrat were identified to species level, counted, and measured. Data collected included species identity, stand density, diameter at breast height (DBH), merchantable height (MH), and other relevant vegetative characteristics. These data were used to determine species composition, density, dominance, importance value, and diversity indices.

The shrub, herb, and ground vegetation layers were assessed using 1 m × 1 m subplots established within each 10 m × 10 m tree quadrat. All plant species within the subplots were identified, counted, and recorded. The collected data were used to compute species richness, relative abundance, and other vegetation parameters following standard ecological methods.

Plant species were initially identified in the field using available taxonomic references, including Salvosa (1963), Quisumbing (1978), and Umali *et al.* (1986). Specimens that could not be identified on-site were collected, preserved, and brought to the laboratory for further taxonomic verification using additional botanical references and expert consultation when necessary.

RESULTS AND DISCUSSION

General plant species composition

A total of 152 plant species representing 63 families were documented within the 5,400 m² sampled across the riparian zones (Table 2). This corresponds to an estimated 2.23 species per 100 m², indicating a high level of species richness within the study area. The findings suggest that the riparian ecosystems support a diverse plant community and contribute significantly to local biodiversity. Compared with the study of Lubos *et al.* (2016) conducted along the Cagayan de Oro River, which recorded 97 species belonging to 52 families, the present study documented substantially greater species richness. Of the 152 species identified, 133 were angiosperms, while 19 were pteridophytes, reflecting the predominance of flowering plants in the riparian vegetation.

The composition and diversity of riparian vegetation are strongly influenced by land use changes, which can consequently affect river water quality and ecosystem integrity. Changes in land use often alter the structure and composition of plant communities, leading to shifts in biodiversity within riparian ecosystems. The floristic assessment conducted across the major river systems of the province identified eight dominant plant families. Among these, Poaceae was the most species-rich family, with 24 species, followed by Fabaceae (12 species), Moraceae (8 species), Euphorbiaceae (7 species), Meliaceae (6 species), Athyriaceae (6 species), Cyperaceae (5 species), and both Araceae and Pteridaceae, with 4 species each (Table 3). The dominance of these families reflects their ecological adaptability to riparian habitats and their important role in maintaining the structure and function of riverine ecosystems.

Table 2. Total number of families and species in the major river of Zamboanga del Norte

Plant Groups	Families	Species
Angiosperms	54	133
Gymnosperms	0	0
Pteridophytes	9	19
Bryophytes	0	0
Total	63	152

Species richness, number of individuals and species diversity

The recorded vegetation was further classified into trees, shrubs, herbs, and weeds. A total of 3,388 individual plants were documented across the seven major river systems (Table 4). Species richness varied among the sampling sites, with the Dipolog, Dapitan, and Dicayo Rivers exhibiting the highest richness of tree species within their riparian zones. This high species richness may be attributed to the relatively intact riparian vegetation, characterized by well-established tree communities and riverbanks densely covered with shrubs and grasses. In contrast, the Sindangan and Patawag Rivers exhibited lower species richness, which can be associated with disturbances and alterations of the riparian habitat. Human activities such as quarrying, agricultural expansion, and residential development have contributed to the degradation and fragmentation of riparian vegetation, resulting in reduced plant diversity.

Table 3. Species composition of dominant families in the major river of Zamboanga del Norte

Family	No. of species tallied	Remarks
Athyriaceae	6	Athyriaceae are a family of terrestrial ferns.
Cyperaceae	5	Cyperaceae are grass-like appearances such as sedges and rushes.
Euphorbiaceae	7	Euphorbiaceae are clustered flowering plants that contain milky latex.
Fabaceae	12	The Fabaceae are also known as the Leguminosae and are agriculturally important flowering plants.
Meliaceae	6	Meliaceae is a flowering plant family of mostly trees and shrubs.
Moraceae	8	Moraceae is a family of mostly tropical trees characterized as having milky or watery latex.
Poaceae	24	Poaceae is known as the grass family, the most abundant and important source of food.
Pteridaceae	4	Pteridaceae are ferns growing on soil or on rocks.

Table 4. Species richness, number of individuals, and species diversity of trees and shrubs in the major river systems in Zamboanga del Norte

Sampling site	Trees				Shrubs			
	Family	Species Richness	Ind.	H'	Family	Species Richness	Ind.	H'
Dapitan River	21	37	453	2.82	23	40	153	3.40
Dipolog River	23	42	545	2.62	20	35	192	2.94
Day River	20	33	356	2.86	18	40	151	3.25
Sindangan River	16	20	337	2.15	17	43	167	3.38
Patawag River	14	19	318	2.11	13	28	185	2.84
Kip River	17	21	146	1.81	12	24	44	2.98
Siocon River	19	22	231	1.59	14	25	83	2.94
Total			2413				975	

These findings are consistent with the observations of Harding *et al.* (1998), who reported that land use changes significantly influence the species richness and composition of riparian vegetation.

Tree species diversity across the seven major river systems ranged from very low to moderate. The Dapitan, Dipolog, and Dicayo Rivers exhibited moderate tree species diversity, while the Patawag and Sindangan Rivers had low diversity. In contrast, the Kipit and Siocon Rivers recorded very low tree species diversity. The relatively low diversity observed in Kipit and Siocon Rivers may be partly attributed to the limited number of sampling sites established because of security constraints, which may have reduced the representation of the existing vegetation.

In comparison, the understory vegetation composed of shrubs, herbs, and weeds exhibited relatively higher diversity than the tree layer. High species diversity was observed in the Dapitan, Dicayo, and Sindangan Rivers, whereas the Dipolog, Patawag, Kipit, and Siocon Rivers showed moderate diversity. The greater diversity of understory vegetation may be associated with its rapid regeneration capacity and adaptability to varying environmental conditions and levels of disturbance within riparian ecosystems.

Tree species with the highest importance value index

The three most ecologically important tree species for each sampling site, based on their Importance Value Index (IVI), are presented in Table 5. Among the recorded species, *Cocos nucifera* exhibited the highest importance values in the Dapitan, Dicayo, Sindangan, Patawag, Kipit, and Siocon Rivers. This finding is not unexpected, as coconut is one of the major agroforestry crops in the Province of Zamboanga del Norte and is widely cultivated along riverbanks and adjacent agricultural landscapes. Its widespread occurrence reflects both its ecological adaptability and its economic importance to local communities.

In the Dipolog River, *Gmelina arborea* recorded the highest Importance Value Index (IVI) of 40.22. This species is well adapted to a wide range of soil types and climatic conditions and thrives in tropical and subtropical environments. It is recognized for its rapid growth, high-quality timber, and medicinal properties. Owing to its multipurpose uses, fast growth rate, and high economic return, *G. arborea* is widely planted by farmers and is highly valued by the wood processing industry, which explains its dominance within the riparian zone of the Dipolog River.

In the Dicayo River, *Macaranga tanarius* (Family Euphorbiaceae) was among the dominant tree species, recording an Importance Value Index of 24.86. This native Philippine species commonly occurs along riverbanks and is recognized as an effective pioneer species for reforestation because of its rapid growth and ability to provide shade that suppresses competing weeds and facilitates the establishment of other tree species. Its high IVI indicates its ecological dominance in terms of relative density, frequency, and dominance within the study area. The prevalence of *M. tanarius* is consistent with the observations of Pahlevani and Akhani (2011), as cited in Paclibar and Tadiosa (2021), who reported that members of the Euphorbiaceae are frequently dominant in disturbed and heavily grazed landscapes because of their adaptability and resilience to environmental disturbances.

Table 5. Important plant species with highest importance value indices (IVI) per river

Site	Most important species	IVI
Dapitan River	*Cocos nucifera*	27.32
	Ficus balete	22.26
	Gmelina arborea	18.34
Dipolog River	*Gmelina arborea*	40.22
	Swietenia mahagoni	15.97
	Paraserianthes falcataria	15.95
Dicayo River	*Macaranga tanarius*	24.86
	Cocos nucifera	20.92
	Pterocarpus indicus	20.22
Sindangan River	*Cocos nucifera*	44.14
	Leucaena leucocephala	37.14
	Gmelina arborea	22.97
Patawag River	*Ficus balete*	64.64
	Cocos nucifera	48.67
	Swietenia mahagoni	17.94
Kipit River	*Cocos nucifera*	26.79
	Rhizophora apiculata	21.03
	Sonneratia caseolaris	19.75
Siocon River	*Cocos nucifera*	59.33
	Ceiba pentandra	49.43
	Tectona grandis	11.55

Conservation status assessment

Table 6 presents the plant species arranged alphabetically by family, together with their corresponding conservation status based on Department of Environment and Natural Resources (DENR) Administrative Order No. 2017-11(DENR, 20217), Updated National List of Threatened Philippine Plants and Their Categories. Of the 152 plant species identified in the study, only one species, *Shorea stylosa*, was classified as Endangered. This species, locally known as yakal, belongs to the family Dipterocarpaceae and is endemic to the Philippines. Its occurrence within the riparian zones highlights the ecological importance of these habitats as refuges for threatened native flora.

Four species were classified as Vulnerable, namely *Dracontomelon dao*, *Shorea contorta*, *Diospyros discolor*, and *Pterocarpus indicus*. According to DENR Administrative Order No. 2017-11 (DENR, 20217), vulnerable species are those that are not yet classified as Critically Endangered or Endangered but are considered at risk due to continuing habitat degradation and other adverse factors. Without appropriate conservation measures, these species are likely to qualify for a higher threat category in the future.

The remaining plant species recorded during the survey were categorized as Other Wildlife Species, indicating that they are not currently listed as threatened under DENR Administrative Order No. 2017-11 (DENR, 20217). Nevertheless, these species play important ecological roles in maintaining the structure, function, and biodiversity of riparian ecosystems and therefore warrant continued protection and monitoring.

Table 6. Taxonomic listing of plants arranged alphabetically by family and its conservation status based on DENR AO No. 2017-11 list of threatened Philippines plant species and their categories

Family name	Scientific name	Conservation status
Acanthaceae	*Odontonema strictum*	OWS
Acanthaceae	*Justicia gendarussa*	OWS
Alismataceae	*Syngonium podophyllum*	OWS
Amaranthaceae	*Amaranthus spinosus*	OWS
Anacardiaceae	*Mangifera indica*	OWS
Anacardiaceae	*Dracontomelon dao*	VU
Annonaceae	*Annona muricata*	OWS
Annonaceae	*Cananga odorata*	OWS
Apocynaceae	*Alstonia scholaris*	OWS
Araceae	*Colocasia esculenta*	OWS
Araceae	*Colocasia esculenta antiquorum*	OWS
Araceae	*Alocasia macrorrhizs* (L.)G. Don	OWS
Araliaceae	*Polyscias nodosa*	OWS
Asclepiadaceae	*Asclepias curassavica Linn.*	OWS
Asteraceae	*Sphagneticola trilobata*	OWS
Asteraceae	*Blumea balsamifera*	OWS
Asteraceae	*Chromolaena odorata*	OWS
Asparagaceae	*Dracaena sanderiana*	OWS
Aspleniaceae	*Asplenium nidus*	OWS
Athyriaceae	*Athyrium filix-Femina*	OWS
Athyriaceae	*Diplazium esculentum*	OWS
Athyriaceae	*Lygodium circinnatum*	OWS
Athyriaceae	*Cyathea cooperi*	OWS
Athyriaceae	*Claytonia Osmunda*	OWS
Athyriaceae	*Aglaomorpha splendens*	OWS
Avicinniaceae	*Avicinnia officinales*	OWS
Begnoniaceae	*Spathodea campanulata*	OWS
Bombacaceae	*Ceiba pentandra*	OWS
Cannabaceae	*Trema Orientalis*	OWS
Caricaceae	*Carica papaya*	OWS
Combretaceae	*Terminalia catappa*	OWS
Convulvulaceae	*Ipomoea aquatica*	OWS
Convolvulaceae	*Ipomoea pes-caprae* L.	OWS
Clusiaceae	*Garcinia mangostana*	OWS
Cucurbitaceae	*Melothria pendula*	OWS
Cyperaceae	*Cynodon dactylon* L.	OWS
Cyperaceae	*Cyperus iria* L.	OWS
Cyperaceae	*Cyperus odoratus*	OWS
Cyperaceae	*Pycreus flavescens* L.	OWS
Cyperaceae	*Cyperus esculentus*	OWS
Davalliaceae	*Davalliaceae solida*	OWS
Dipterocarpaceae	*Shorea contorta*	VU
Dipterocarpaceae	*Shorea astylosa*	EN
Ebenaceae	*Diospyros discolor*	VU
Euphorbiaceae	*Macaranga tanarius*	OWS
Euphorbiaceae	*Hevea brasiliensis*	OWS
Euphorbiaceae	*Excoecaria agallocha*	OWS
Euphorbiaceae	*Ricinus communis*	OWS
Euphorbiaceae	*Phyllanthus urinaria*	OWS
Euphorbiaceae	*Euphorbia hirta* Linn.	OWS
Fabaceae	*Gliricidia sepium*	OWS
Fabaceae	*Pterocarpus indicus*	VU
Fabaceae	*Leucaena leucocephala*	OWS
Fabaceae	*Samanea saman*	OWS
Fabaceae	*Cyperus esculentus*	OWS
Fabaceae	*Erythrina Orientalis*	OWS
Fabaceae	*Paraserianthes falcataria*	OWS
Fabaceae	*Mimosa pudica*	OWS

Fabaceae	*Mimosa* spp.	OWS
Fabaceae	*Chryssopogon aciculatus*	OWS
Fabaceae	*Cyperus esculentus*	OWS
Fabaceae	*Cassia alata*	OWS
Flacourtiaceae	*Pentium edule*	OWS
Graminae	*Piper abbreviatum*	OWS
Lamiaceae	*Gmelina Arborea*	OWS
Lamiaceae	*Tectona grandis*	OWS
Lauraceae	*Persea Americana*	OWS
Lecythidaceae	*Barringtonia acutangula*	OWS
Leguminoseae	*Albizia saponaria*	OWS
Lygodiaceae	*Lygodium circinnatum*	OWS
Lythraceae	*Sonneratia caseolaris*	OWS
Malvaceae	*Theobroma cacao*	OWS
Malvaceae	*Durio zibethinus*	OWS
Malvaceae	*Urena lobata* L.	OWS
Meliaceae	*Swietenia mahagoni*	OWS
Meliaceae	*Lansium domesticum*	OWS
Meliaceae	*Sandoricum koetjape*	OWS
Meliaceae	*Melia azedarach*	OWS
Meliaceae	*Melia dubia*	OWS
Meliaceae	*Acacia mangium*	OWS
Moraceae	*Artocarpus heterophylla*	OWS
Moraceae	*Artocarpus odoratissimus*	OWS
Moraceae	*Artocarpus blancoi*	OWS
Moraceae	*Ficus nota*	OWS
Moraceae	*Ficus minahassae*	OWS
Moraceae	*Ficus septica*	OWS
Moraceae	*Ficus balete*	OWS
Moraceae	*Indigofera hirsuta*	OWS
Moringaceae	*Moringa oleifera*	OWS
Musaceae	*Musa sapientum*	OWS
Myrtaceae	*Psidium guajava*	OWS
Myrtaceae	*Syzygium samarangense*	OWS
Nephrolepidaceae	*Nephrolepis cordifolia* L.	OWS
Nephrolepidaceae	*Nephrolepis hirsutula*	OWS
Palmae	*Cocos nucifera*	OWS
Palmae	*Nypa fruticans*	OWS
Palmae	*Caryota cumingii*	OWS
Pandanacea	*Pandanus tectorius*	OWS
Piperaceae	*Piper abbreviatum*	OWS
Poaceae	*Paspalum dilatatum*	OWS
Poaceae	*Paspalum conjugatum*	OWS
Poaceae	*Portulaca oleracea* Linn.	OWS
Poaceae	*Imperata cylindrica*	OWS
Poaceae	*Lantana camara* L.	OWS
Poaceae	*Saccharum caducum Tausch*	OWS
Poaceae	*Chloris gayana*	OWS
Poaceae	*Cyperus rotundus*	OWS
Poaceae	*Cyperus esculentus*	OWS
Poaceae	*Eleusine indica* Gaertn.	OWS
Poaceae	*Stachytarpheta indica* C.B. Clarke (Vahl).	OWS
Poaceae	*Sida acuta*	OWS
Poaceae	*Leucas Aspera* Spreng.	OWS
Poaceae	*Saccharum spontaneum*	OWS
Poaceae	*Stachytarpheta indica* C.B. Clarke (Vahl).	OWS
Poaceae	*Bambusa* sp.	OWS
Poaceae	*Ageratum conyzoides*	OWS
Poaceae	*Arundarbor arundinacea*	OWS
Poaceae	*Axonopus compressus* Sw.	OWS
Poaceae	*Cynosurus indicus*	OWS
Poaceae	*Echinochloa crus-galli* L.	OWS
Poaceae	*Festuca* spp.	OWS
Poaceae	*Bambusa vulgaris*	OWS
Polypodiaceae	*Drynaria querciflora*	OWS
Pontederiaceae	*Eichhornia crassipes*	OWS
Pteridaceae	*Acrostichum ureum*	OWS
Pteridaceae	*Pityrogramma calomelanos*	OWS

Pteridaceae	*Pteris mutilata*	OWS
Pteridaceae	*Pteris vitata*	OWS
Rhamnaceae	*Ziziphus jujuba*	OWS
Rhizophoraceae	*Rhizophora apiculata*	OWS
Rubiaceae	*Nauclea orientalis*	OWS
Rutaceae	*Citrus maxima*	OWS
Sapotaceae	*Chrysophyllum cainito*	OWS
Selaginellaceae	*Selaginellaceae involves*	OWS
Selaginellaceae	*Selaginella* sp.	OWS
Solanaceae	*Datura stramonium*	OWS
Solanaceae	*Capsicum frutescens*	OWS
Sonneratiaceae	*Sonneratia caseolaris*	OWS
Sterculiaceae	*Kleinhovia hospita* L.	OWS
Thelypterideae	*Macrotheypeteris* sp.	OWS
Thelypteridacea	*Christella dentate*	OWS
Zingerberaceae	*Curcuma zedoaria*	OWS

(Critically Endangered- CR; Endangered= EN; Vunerable= VU; Other Threatened Species= OTS; Other Wildlife Species= OWS)

Economic uses of plant species

Approximately 46% of the plant species recorded within the sampling areas possess recognized economic value. Although this proportion is lower than that reported by Lubos *et al.* (2016), who found that 63.3% of the plant species documented along the Cagayan de Oro River had economic importance, the results nonetheless demonstrate the substantial contribution of riparian vegetation to local livelihoods and resource utilization.

Among the economically important species identified in this study, 20 species are valued as sources of timber and construction materials. Most of these timber species were found in the upstream sections of the Dapitan, Dipolog, Dicayo, and Sindangan Rivers, where riparian vegetation remains relatively intact because of minimal human disturbance and the absence of quarrying activities. In addition, 17 species were identified as fruit-bearing trees. Several of these, including mango (*Mangifera indica*), marang (*Artocarpus odoratissimus*), lanzones (*Lansium parasiticum*), and mangosteen (*Garcinia mangostana*), are economically important crops in the province and are marketed to neighboring cities and provinces.

The survey further identified 19 species that serve as important sources of fuelwood and 31 species that provide raw materials for food products, furniture, handicrafts, thatching materials, and traditional herbal medicines. Additionally, 24 species were documented as edible plants suitable for human consumption, while 27 species possess medicinal properties and are commonly utilized in traditional healthcare practices. Furthermore, 20 species were recognized for their ornamental value because of their attractive flowers, foliage, or distinctive growth forms. These include several species of ferns, bamboos, African tulip trees, and other ornamental plants that enhance the aesthetic and ecological value of riparian landscapes.

Overall, these findings emphasize the ecological and socioeconomic importance of riparian vegetation, highlighting its significant role in supporting biodiversity, sustaining local livelihoods, and providing a wide range of ecosystem goods and services.

CONCLUSION

The major river systems of Zamboanga del Norte support a rich and diverse assemblage of riparian plant species. A total of 152 plant species representing 63 families and 3,388 individual plants were recorded during the study. Of these, 133 species were angiosperms, while 19 species were pteridophytes, indicating the predominance of flowering plants within the riparian ecosystems. Several tree species with high Importance Value Index (IVI) belonged to the Dipterocarpaceae family, highlighting their ecological significance in maintaining the structure and stability of these habitats.

Approximately 46% of the recorded plant species possess recognized economic value, serving as important sources of timber, lumber, fuelwood, food, raw materials, medicinal products, livestock feed supplements, and other livelihood resources for local communities. Tree species diversity across the seven major river systems ranged from very low to moderate, whereas the understory vegetation composed of shrubs, herbs, and weeds exhibited moderate to high diversity.

The findings emphasize the ecological and socioeconomic importance of the riparian vegetation in Zamboanga del Norte. To conserve and enhance these valuable ecosystems, it is recommended that comprehensive conservation, restoration, and reforestation programs be implemented. Such initiatives should prioritize the protection of native and threatened plant species, rehabilitation of degraded riparian habitats, sustainable land-use practices, and active participation of local communities to ensure the long-term conservation of biodiversity and the continued provision of ecosystem services.

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