

## **Phytodiversity of Raiganj Wildlife Sanctuary (Kulik Bird Sancturay) of Uttar Dinajpur District in West Bengal, India**

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**Abstract:** The present paper represents the ecosystem along with the Phytodiversity of angiospermic plants occurring in and around Raiganj Wildlife Sanctuary (Kulik bird Sanctuary) with potential ecological significance at Raiganj, Uttar Dinajpur, West Bengal. The area of the place revealed 224 species of angiosperms through extensive survey since 1999 to 2014 with full potential of screening and examinations. It also includes Cycadaceae and Pteridophytes in different aspects. This type of work may be regarded as the pioneer work for further more elaborate studies of Angiosperms for documentation or studies in different aspects in the field of Biology. This means that, it has its ecological meaning and environmental significance, because complete works regarding diversity of plants have not yet been published for crucial analysis previously.

**Keywords:** Kulik-Uttar Dinajpr, Species of Plants and Birds, Cronquist's Classification, Nature and Natural Resources.

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### **I. Introduction**

Raiganj Wildlife Sanctuary is popularly called Kulik Bird Sanctuary in West Bengal. Kulik forest is a forest under Social forestry of this area mainly dominated by Pituli, Jarul, Hijal, Chhatim and Kalkasunda along with flagship species like Bat and Pakur. Kulik forest, situated on National Highway 34, is only 2 km away from the Raiganj Central Bus Stand. It was established and working mainly for the conservation of birds of migratory kind. The government of West Bengal gave it as a full form of Sanctuary on the 11<sup>th</sup> day of April 1985 under Govt. Order (G.O/No. 1901-FOR 86/82). The sanctuary is situated in Bhattardighi, Abdulghata and on Sohari Mouzas of Raiganj block, Uttar Dinajpur and near the side of National Highway No. 34. River Kulik bound it at the northeast to partially the southeast. The sanctuary is situated in between 25<sup>o</sup> 37' N latitudes to 88<sup>o</sup> 12' E longitudes. Chanditala and Kamarpara villages in the east of Sanctuary Kulik, on the west it is bounded by Poliapara, in south by Munipara and Manirpur in the north. The sanctuary is spread over an area 1.30 square kilometer in which 1.16 square kilometer is buffer area (286.23 acre) and 0.14 square kilometer (35 acre) is core area (Anonymous). It is situated under Karnajora Range of Raiganj Social Forestry Division. The site is diverse because, so many wild medicinal plants as well as shrubby plants of different types available with high density even other types like bryophytes, pteridophytes, fungi, algae and nematodes of different types boost there with typical association. A large no of tree species found here along with some exotics like Eucalyptus and Cassias available with high degree of consociations. Rare plants of potential conservational values also found which share the dignity of this paradise for exotic birds of migratory kind. It also provided with enormous water bodies filled up by the water of Kulik River in which core area is located at the centre surrounded by water. Common predators available here are wildcat, Jackal, Lizard, Bat, Spider, Serpentine snake, mouse, rat, squirrel, mole etc. The yellow monitor lizard, the rare species of reptiles are also found here and there. The main attraction of this site is for the birds. The native have their permanent address in this sanctuary are the bulbul, dove, sparrow, crow, vulture, eagle, parakeet, owl, woodpecker, kingfisher, duck, drongo and cuckoo. The migratory birds like night heron, cormorant, little cormorant, egrets, and open-billed storks visit since end of May to 1<sup>st</sup> week of July in each year from South Asia and from Coastal Points. According to Basu and Sah (2013), the open-Billed storck comes in the last week of June at the Kulik Bird Sanctuary stays there for 5-6 months and leaves the place in the month of December of every year. According to the report of forest guard of the same range, the departure

time of migratory birds begin in the mid December and extended up to the end of the January each year. With in the short period of time they lay eggs, which is July to August in each year. They choose bushy trees for nesting. Species involved for nesting at Kulik found are *Ficus benghalensis* (Bat), *Anthocephallus cadamba* (Kadamba), *Alstonia scholaris* (Chhatim), *Barringtonia acutangula* (Hijal), *Ficus glomerata* (Dumur), *Terminalia arjuna* (Arjun), *Dalbergia sissoo* (Sissoo), *Lagerstroemia speciosa* (Jarul), *Streblus asper* (Seora), *Trewia nodiflora* (Pituli), etc. (Basu and Sah, 2013). The materials they need for nesting collected from nearby environment. The nest building materials contained of fragments of old branches of trees, some soft green leaves and grasses. These branches helped in strengthening and the leaves and grasses helped in softening of the nest (Pramanik *et al.*, 2009). A large number of twigs with green leaves of *Eucalyptus* they collect for the purpose of nesting are due to their medicinal or anti-germicidal values. The mean temperature of this site is 26 degree Celsius. Rainfall is more or less 1100 mm whereas the relative humidity is 89 %.

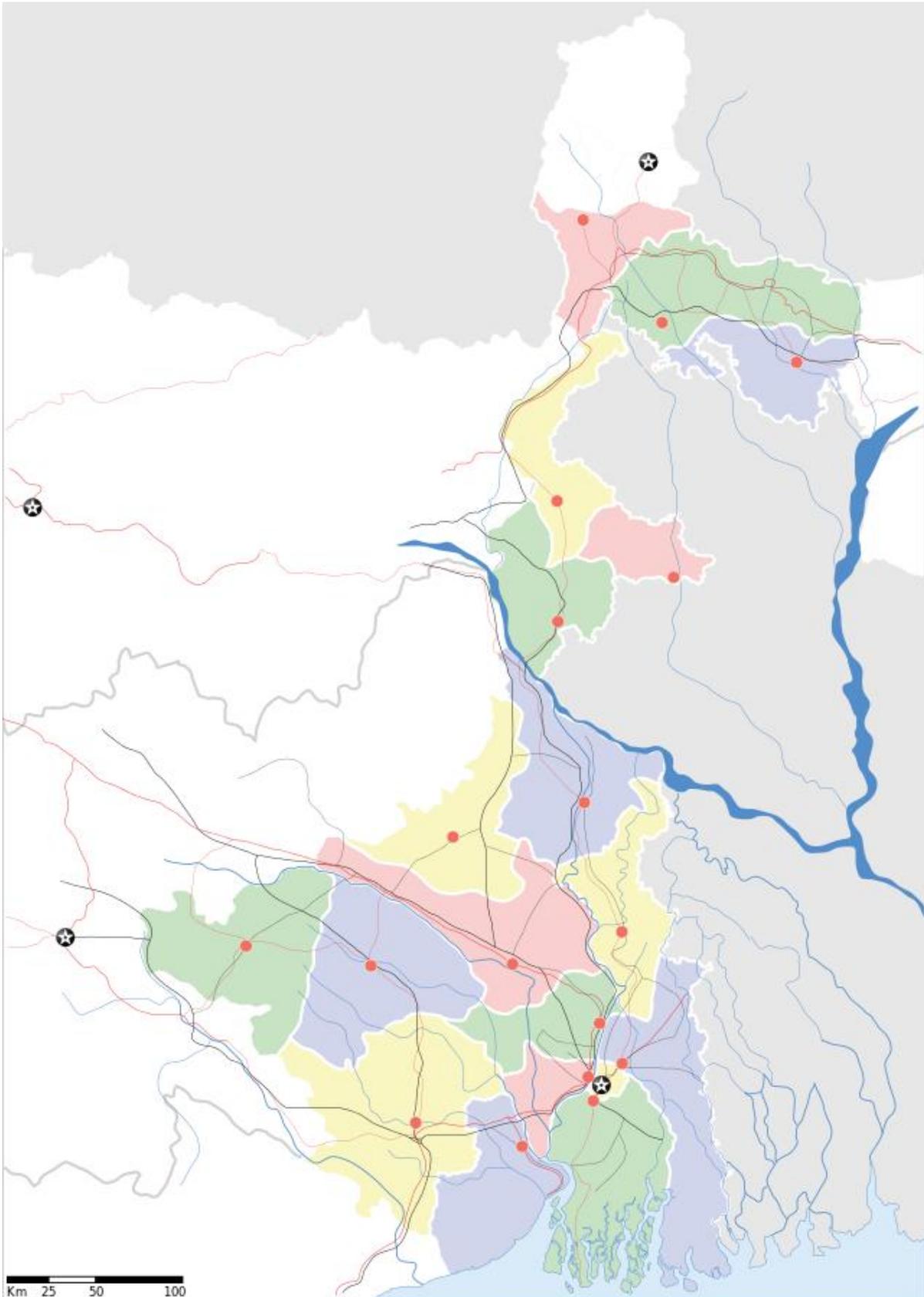
The interactions between plants and birds are unique because they need food, nesting materials and shelter which comes from plants of the sanctuary and nearby. So, uniqueness is diversity and pattern is mosaic which are interacting cyclic phases year after year for the liveliness and their protection in and around nature. In addition to local birds other birds available here are migratory one.

The open- Billed storks comes in the last week of June at the Kulik Bird Sanctuary stays there for 5-6 months and leave the place in the month of December of every year. The similar pattern is observed in Ghoragata of Howrah District where three trees are the temporal habitats for the same bird species. Other places are Bagnan, Santragachi, Sankrail which found in the same district for temporal stay of birds including the open billed stork. In Kendua village of Jamboni block in Jhargram of Paschim Medinipur district the same pattern of temporal habitats of migratory birds have been observed. Tentul trees (*Tamarindus indica*) and Khiris trees (*Samanea saman*) are the habitats of the birds at Jamboni area. The birds choose special types of plants for nesting. Here, Species involved for nesting found are *Ficus benghalensis* (Bat), *Anthocephallus cadamba* (Kadamba), *Alstonia scholaris* (Chhatim), *Barringtonia acutangula* (Hijal), *Ficus glomerata* (Dumur), *Terminalia arjuna* (Arjun), *Dalbergia sissoo* (Sissoo), *Lagerstroemia speciosa* (Jarul), *Streblus asper* (Seora), *Trewia nodiflora* (Pituli), etc. (Basu and Sah, 2013). The habitat for the specific purpose they opt for the protection as well as for health conjugal environment. In connection of the above kinds other parameters they used for the association in which they feel association. The site is diverse with medicinal Plants which boosts nature made conservatory. The naturally occurring plants along with plantation stands are found in the social forestry site with admixed *Eucalyptus*, *Trewia* (Pitali) along with *Lagerstroemia* plant (Ghosh, 2004).

Vegetation is a composition of plant species. So, before going to study the vegetation, taxonomy and species inventory study is essential for any site. Remembering the theme, Dennis and Ruggiero (1996) suggested four possible approaches for orienting an inventory namely-(1) Survey of major elements; (2) Identification of key stone species and indicator elements; (3) Identification of target elements, such as threatened species, and (4) Comprehensive assessment of all other important elements, such as exotic or alien species/invasive species, flagship species, and economically useful taxa. The purpose and orientation of an inventory is always for the raise of data to enrich data bank for proper management of ecosystem and some of the good data over the old one are called indicator data which helps to study the quality health of an ecosystem. The inventory, therefore will determine the choice of material and methods, which on other hand will influence the completeness of the inventory in terms of taxonomy, community, ecosystem dynamics, strategies of development, fluctuation of elements over time and space, geographical space, seasonal variations of the occurrence, temporal representation, stability and functioning etc. (Das, 2014; Solbrig, 1991; Stohlgren and Quin, 1991). Remembering the theme in mind the present study has been taken for consideration to fulfil the first two objectives as a whole. Therefore, the present phytodiversity studies in connection with the ecosystem have been taken.

## II. Study Area

The study area is Kulik at Raiganj of Uttar Dinajpur District. The district is surrounded by Dakshin Dinajpur in the southeast, by Bangladesh in the East, by Malda in the south, by Kishanganj of Bihar in the west and Purnia in the southwest part. The community development block in which it is situated is Raiganj. The nearest Railway station is Raiganj and the headquarter is situated at Karnajora of West Bengal (Map 1,2). Study area is social forestry site including some villages nearby which having mesophytic vegetation along with some agricultural varieties and horticultural species. River Kulik partially surrounding the area with some water bodies which boost luxuriant growth of various weeds as well as some aquatic plants of economic importance.



**Map 1.** Map of West Bengal, Courtesy: Wikipedia



Map 2. Map showing Kulik at Uttar Dinajpur (U/D) District, courtesy: [WWW.wikipedia](http://WWW.wikipedia)

### Climate

The area is mixed humid type with alluvial soil best for cultivation. Soil is fertile due to older alluvium deposited which is falls under the basin of Rajmahal hills on the east. The main composition is rainfall and humidity with variable temperature. The altitude is almost about 30 mt. above mean sea level (MSL). Temperature maximum 25 degree and minimum 21 degree centigrade. During winter the maximum and minimum temperature is 23 and 9 degree centigrade respectively. Rainfall is about 155 cm (July to Sep.) round a year (wiki information).

### Vegetation

Here vegetation is mixed deciduous type with some plantation sites. Species of economic types are *Cocos nucifera*, *Artocarpus heterophyllus*, *Olea* sp., *Dalbergia sissoo*, *Gmelina arborea*, *Anthocephalus cadamba*, *Terminalia chebula*, *Albizia lebbeck*, *Samanea saman*, Flagship species found here are *Ficus benghalensis*, *F. hispida*, *F. glomerata*, *F. cunea* etc. Weeds of exotic types in aquatic bodies are species like *Tillanthera* and *Eichhornia* sp. along with *Salvinia* and *Azolla* sp., whereas in the bundh or semi-aquatic bodies the most promising species are *Veteveria zizanoides* and *Impereta cylindrica*. Weeds of fallow land are *Jussia* sp., *Ludwigia* sp., *Mimosa* sp., *Eupatorium* sp., *Alysicarpus* sp., *Evolvulus* sp., *Tephrosia* sp., *Sonchus* sp., *Spilanthes* sp., *Achyranthes* sp., *Spermacoce* sp., *Oldenlandia* sp., *Phylla* sp., etc. In waste land the species like *Hibiscus vitifolius*, *Leonotis nepetifolia*, *Anisomeles indica*, *Hyptis suaveolens*, *Daemia extensa*, *Sida acuta*, *Sida cordata*, *Melochia corchorifolia*, *Clerodendrum* sp., *Parthenium* are common along with *Solanum* sp. Other species found here are *Cuscuta* sp., *Dendrophthoe* sp., as plant parasite. Some orchids of epiphytic kind are also available here. Trees found here are *Terminalia bellerica*, *T. chebula*, *T. catappa*, *Bombax ceiba*, *Holarrhena antidysenterica* (= *H. pubescens*), *Cassia fistula*, *Lagerstroemia indica*, *Aegle marmelos*, *Semecarpus anacardium*, *Butea frondosa* etc. Woody climbers found here are *Tiliocora racemosa*, *Hemidesmus indicus*, *Ichnocarpus pubescens*, *Bauhinia vahlii*, *Spatholobus roxburghii*, *Aganosma dichotoma*, *Cephalandra indica*, *Trichosanthes pameeta*, *Jasminum dispersum*, *J. sambac*, *Dalbergia stipulacea*. Species producing wood of commerce are *Samania saman*, *Albizia lebbeck*. Other species found are *Cereus hexagonus*, *Opuntia* sp., which found in dry and open land habitats. *Aristolochia indica*, *Curculigo orchioides*, *Diospyros tomentosa*, *D. sylvatica*, *Clerodendrum indicum* etc. are medicinal plants. *Dillenia indica*, *Mangifera indica*, *Ficus religiosa*, *F. benghalensis*, *F. hispida*, *Gelonium multiflorum*, *Glochidion lanceolarium*, *Annona squamosa*, *A. reticulate*, *Zizyphus rugosa*, *Flacourtia ramaontchii*, *Pterospermum acerifolium*, *Tectona grandis*, *Borassus flabellifer*, *Phoenix sylvestris*, *Cassia occidentalis*, *Calotropis procera*, *C. gigantean*, *Leonotis nepetifolia*, *Martynia annua*, *Tribulus terrestris*, etc are common available here and there. Plantation sites include species like *Eucalyptus*, *Acacia*, *Anacardium*, *Simarouba*, *Disoxylum*, *Anthocephalus*, *Phyllanthus*, *Couripita guanensis*, *Mesua* sp. etc. along with a lot of Bamboos. Ornamentals available here are *Caesalpinia* sp.,

**Delonix sp., Alamanda sp., Thunbergia sp., Ixora sp., Gardenia sp., Musa sp., Ravenala sp., Heliconia sp., Cammellia sp., Hibiscus sp., Salvia sp., Croton sp, Jasminum sp., Polyanthes sp., Rosa sp., Tagetes sp., Dahlia sp., Chrysanthemum sp. etc.**

### **People**

Main composition of the human resource in the said area is filled by backward classes. The area comprises people who speak Bengali, Urdu, Hindi and Maithili languages. The specific backward communities are more but a common group available here are Polia and Rajbanshi.

### **Cultivars**

The soil is alluvial type due to great deposition of old alluvium from Rajmahal hills. Therefore, cultivated crops of dominant types are Rice, Jute, Mesta and Sugarcane. Other underground tuberous and corm like cultivars are Alocasia, Colocasia, Zinger and Amada. Nearby sericulture range have been found which producing **Morus** plants.

### **Medicinal Plants**

The area has good potential of medicinal plants. These are species like **Cassia fistula, Cissus quadrangularis, Pongamia pinnata, Achyranthes aspera, Acorus calamus, Allium sativum, Andrographis paniculata, Vitex negundo, Tinospora cordifolia, Withania somnifera, Rauvolfia serpentina, Rauvolfia tetraphylla, Morinda citrifolia, Mimosa pudica, Kalanchoe pinnata, Hemidesmus indicus, Tylophora asthmatica, Gymnema sylvestre, Euphorbia nerifolia, Datura metel, Ocimum sanctum, Ocimum gratissimum, Calotropis procera, C. gigantean, Azadirachta indica, Solanum indicum, Amorphophalus bulbifera, Streblus asper, Alstonia scholaris, Aristolochia indica, Stephania hernandifolia, Cissus adnata, Curculigo orchioides, Polygala crotalarioides, Zizyphus jujuba, Z. rugosa, Zornia diphylla, Adhatoda vasica, Mollugo pentaphylla, Enhydra fluctuens, Wedelia calandulacea, Vernonia cinerera, Solanum trilobatum, Solanum nigrum, Solanum xanthocarpum, Ipomoea carnea, I. aquatic, Glenus lotoides, Moringa oleifera, Morinda citrifolia, Agave Americana, Spondias dulcis, Scoparia dulcis, Averhooea carambola, Meyna spinosa etc.**

### **Exotic floral Species**

The most promising exotic species found here are **Lantana camara, Chromolaena odorata, Hyptis suaveolens, Parthenium hysterophorus**, etc. which is naturalized in the said area unlikely covers most of the areas and cause threat to local flora.

### **Fauna**

As the forest is under social forestry so, numbers of local kinds of wild animals are available here less in number, maximum are residential from other side as they posses temporal stay. The good example is Storks and Cormorants. So, other faunal members are Porcupine, Snakes, Lizards, Butterflies, Insects, Ants, Spider, monitor and common birds. Birds available here are Sparrow, kingfisher, Crane, Crow, Raven, Dove, Parrot and Parakeet, Mayna, white breasted water hen etc. Pigeon and Drongos are available here in the area where cultivated crops are common.

## **III. Materials and Methods**

Study was made in three seasons *i.e.* summer, monsoon and in winter round the year for analysis of vegetation since 1999 till date including phyto-diversity study. In this particular region three seasons namely monsoon (July-October), winter (November-February) and summer (March-June) are well perceived. During study some plant specimens were collected and Herbarium specimens were prepared as per the methods of Rao and Sharma, 1990. The specimens were collected and processed for presentation as herbarium specimens and for identification using botanical and ecological standard. Specimens were carefully studied, critically examined and cross checked with the specimens housed in the CAL herb, BSI, Shibpore, Howrah. For conformity of specimens, local floras were consulted (Prain, Vol-I-II, 1903; Hains, Vol-I-III, 1921, Hooker, 1892-1897). To consult some publications, Taxonomy and similar research papers from website have been downloaded and followed by Ghosh, 2014; Das and Das, 2014; Ghosh and Das, 2014, Das, 2014b. Some books published by West Bengal Forest Directorate, Research Wing (Anonymous 2005, 2010), BSI, Kolkata (Anonymous 1997) have also been consulted to analyze the report along with our collections that the plants are either medicinal or not. Methodology used for abundance study followed by Groom *et al.*, (2006) along with the thesis of Das (2007). Relevant literature have been collected and consulted for the preparation of the manuscript. The voucher specimens were housed in our custody. For birds study paper made by Pramanik et al. (2009), Sharma (2007)

have been consulted which gave us a comprehensive idea about the ecosystem diversity of birds in connection with the floral elements.

#### **IV. Results**

##### **Systematic Enumeration of Taxa made as per Cronquist (1988):**

**Magnoliopsida: (Dicotyledons) :**

**Sub Class: I Magnoliidae**

**Family: 8. Annonaceae**

**Species: Annona reticulate L., A. Squamosa L., Artabotrys hexapetalus (L. F.) Bhandari; Polyalthia longifolia Benth. & Hook.f.; Polyalthia longifolia var. Pendula (Thw.) Sonn. Polyalthia simiarum Benth. & Hook.f.**

**Order: 3. Piperales**

**Family: Piperaceae**

**Species: Piper longum L.; Piperomia pellucida (L.) HB&K.**

**Order: 4. Aristolochiales**

**Family: Aristolochiaceae**

**Species: Aristolochia indica L.**

**Order: 6. Nymphaeales**

**Family: Nymphaeaceae**

**Species: Nymphaea rubra Roxb. ex Salisb.;**

**Family: Ceratophyllaceae**

**Species: Ceratophyllum demersum L.**

**Order: 7. Ranunculales**

**Family: Ranunculaceae**

**Species: Clematis gouriana Roxb. ex DC.; Ranunculus sclerus L.**

**Order: 8. Papaverales**

**Family: Papaveraceae**

**Species: Argemone maxicana L.;**

**Sub-Class: II Hamamelidae**

**Order: 6. Urticales**

**Family: Ulmaceae**

**Species: Holoptelea integrifolia (Roxb.) Planch.; Trema orientalis (L.) Bl.**

**Family: Cannabinaceae**

**Species: Cannabis sativa L.**

**Family: Moraceae**

**Species: Artocarpus integrifolia L. f.; Artocarpus lakoocha Roxb.; Ficus benghalensis L.; Ficus cunea Ham.; Ficus elastic L.; Ficus hispida L.f.; Ficus religiosa L.; Streblus asper Lour.**

**Family: Urticaceae**

**Species: Laportea interrupta (L.) Chew; Pilea microphylla (L.) Liebm.; Pouzolzia zeylanica (L.) Benn.**

**Order: 11. Casuarinales**

**Family: Casuarinaceae**

**Species: Casuarina equisetifolia J.R. & G. Forst.**

**Sub-Class III Caryophyllidae**

**Order: 1. Caryophyllales**

**Family: Nyctaginaceae**

**Species: Boerhaavia diffusa L.;**

**Family: Cactaceae**

**Species: Opuntia vulgaris Mill.**

**Family: Amaranthaceae**

**Species: Achyranthes aspera L.;**

**Family: Molluginaceae**

**Species: Mollugo pentaphylla L.**

**Order: 2. Polygonales**

**Family: Polygonaceae**

**Species: Polygonum hydropiper L.;**

**Order: 2. Plumbaginales**

**Family: Plumbaginaceae**

**Species: Plumbago zeylanica L.**

**Order: 3. Malvales**

**Family: Tiliaceae**

**Species: Corchorus aestuens L.; Triumfetta rhomboidea Jacq.**

**Family: Sterculiaceae**

**Species: Abroma augusta L.; Buettneria herbacea Roxb.; Melochia corchorifolia L.**

**Family: Bombacaceae**

**Species: Bombax ceiba L.; Ceiba pentandra (L.) Gaertn.**

**Family: Malvaceae**

**Species: Abutilon indicum Sweet; Hibiscus ros-sinensis L.; Hibiscus vitifolius L.; Malachra capitata L.;**

**Sida acuta Burm.f.; Sida cordata Bross.; Sida cordifolia L. Urena lobata L.**

**Order: 4. Lecythidales**

**Family: Lecythidaceae**

**Species: Barringtonia acutangula (L.) Gaertn.;**

**Order: 6. Violales**

**Family: Flacourtiaceae**

**Species: Flacourtia indica Merr.**

**Family: Cucurbitaceae**

**Species: Coccinia grandis Voigt.; Trichosanthes cucumerina L.**

**Order: 8. Capparales**

**Family: Capparaceae**

**Species: Capparis sepiaria L.; Cleome gynandra L.; Cleome viscosa L.; Crateva nurvula Buch.-Ham.**

**Family: Brassicaceae**

**Species: Rorippa indica Hiren.;**

**Family: Moringiaceae**

**Species: Moringa oleifera Lamk.**

**Order: 12. Ebenales**

**Family: Sapotaceae**

**Species: Mimusops elengi L.;**

**Family: Ebenaceae**

**Species: Diospyros sylvatica Roxb.; Diospyros montana Clke., D. embryopteris Pers., D. paniculata Dalz.**

**Sub-Class V. Rosoidae**

**Order: 1. Rosales**

**Family: Crassulaceae**

**Species: Bryophyllum calycinum Salisb.**

**Order: 2. Fabales**

**Family: Mimosaceae**

**Species:** *Acacia auriculoformis* A. Cunn.; *Acacia nilotica* L.; *Acacia farnesiana* (L.) Willd.; *Albizia lebbek* Willd.; *Leucaena glauca* Benth.; *Mimosa pudica* L.; *Pithecellobium dulce* Benth.; *Samanea saman* Merr.

**Family:** Caesalpiniaceae

**Species:** *Bauhinia variegata* L.; *Cassia alata* L.; *Cassia fistula* L.; *Cassia occidentalis* L.; *Cassia siamea* Lamk., *Cassia sophera* L.; *Cassia tora* L.; *Delonix regia* Raf.; *Peltophorum pterocarpum* Baker ex Heyne

**Family:** Fabaceae

**Species:** *Abrus precatorius* L.; *Alysicarpus vaginalis* DC; *Crotalaria pallid* Aiton; *Desmodium gangeticum* DC.; *Desmodium triflorum* DC.; *Glericidia sepium* Kunth ex Steud; *Zornia gibbos* Span.

**Order:** 6. Myrtales

**Family:** Lythraceae

**Species:** *Lagerstroemia speciosa* Pers.; *Lawsonia inermis* L.

**Family:** Myrtaceae

**Species:** *Callistemon linearis* DC.; *Eucalyptus maculate* (Hook.) Baily; *Psidium guajava* L.; *Syzygium cumuni* Skeels

**Family:** Onagraceae

**Species:** *Ludwigia adscendens* Hara; *Ludwigia perrenis* L.

**Family:** Combretaceae

**Species:** *Terminalia arjuna* Wt. & Arn.; *Terminalia crenulata* Roth

**Order:** 12. Euphorbiales

**Family:** Euphorbiaceae

**Species:** *Acalypha indica* L.; *Chrozophora rotleri* Juss.; *Croton bonplandianum* L.; *Euphorbia hirta* L.; *Euphorbia prostate* W. Ait.; *Phyllanthus fraternus* Webster; *Phyllanthus reticulates* Poir.; *Ricinus communis* L.; *Trewia nudiflora* L.

**Order:** 13. Rhamnales

**Family:** Rhamnaceae

**Species:** *Ventilago denticulate* Willd.; *Zizyphus mauritiana* Lamk., *Zizyphus oenoplea* Mill.

**Family:** Rhamnaceae

**Species:** *Leea macrophylla* Roxb.

**Family:** Vitaceae

**Species:** *Ampelocissus latifolia* Planch.; *Cayratia trifolia* Domin; *Vitis quadrangularis* Wall.

**Order:** 16. Sapindales

**Family:** Sapindaceae

**Species:** *Allophyllus serratus* Radlk.; *Cardiospermum helicacabum* L.

**Family:** Anacardiaceae

**Species:** *Mangifera indica* L.; *Lannea coromandelica* Merr.

**Family:** Simaroubiaceae

**Species:** *Ailanthus excels* Roxb.;

**Family:** Meliaceae

**Species:** *Azadirachta indica* L.; *Melia azedaracth* L.; *Swietenia macrophylla* King.

**Family:** Rutaceae

**Species:** *Citrus decumana* L.; *Muraya koenigii* Spreng.

**Family:** Zygophyllaceae

**Species:** *Tribulus terrestris* L.

**Order:** 18. Apiales

**Family: Apiaceae**  
**Species: Centella asiatica Urban.**

**Sub-Class VI. Asteridae**  
**Order: 1. Gentianales**  
**Family: Loganiaceae**  
**Species: Strychnos nux-vomica L.**

**Family: Gentianaceae**  
**Species: Canscora diffusa R. Br. Ex Roem. & Schult.**

**Family: Apocynaceae**  
**Species: Alstonia scholaris R.Br.; Ichnocarpus frutescens R. Br.; Tabermontana divericata R. Br. Ex Roem. & Schult.**

**Family: Asclepiadaceae**  
**Species: Calotropis gigantean R. Br.; Cryptolepis buchanani Roem. & Schult. ; Gymnema sylvestre R. Br. Ex Schult.; Hemidesmus indicus R. Br.; Tylophora indica Merr.**

**Order: 2. Solanales**  
**Family: Solanaceae**  
**Species: Nicotiana plumbaginifolia Viv.; Solanum indicum L.; Solanum nigrum L. ; Solanum sisymbriifolium Lamk.; Solanum surattense Burm. f.; Solanum torvum Swartz**

**Family: Convolvulaceae**  
**Species: Evolvulus nummularius L., Ipomoea fistulosa Mart. Ex Cho. isy; Ipomoea obsura Ker-Gawl.**

**Family: Cuscutaceae**  
**Species: Cuscuta reflexa Roxb.**

**Order: 3. Lamiales**  
**Family: Boraginaceae**  
**Species: Colderia procumbens L.; Heliotropium indicum L.; Heliotropium strigosum Willd.; Heliotropium ovalifolium Forsk.;**

**Family: verbenaceae**  
**Species: Clerodendrum indicum O. Ktze.; Clerodendrum viscosum Vent.; Duranta repens L.; Gmelina arborea Roxb.; Phylla nodiflora Greene**

**Family: Lamiaceae**  
**Species: Hyptis suaveolens Poit.; Leucas cephalotes Spreng.; Leucas lavendulifolia Nees.; Ocimum gratissimum L.; Ocimum sanctum L.**

**Order: 6. Scrophulariales**  
**Family: Scrophulariaceae**  
**Species: Lindernia antipoda Alst.; Lindernia ciliate Pen.; Lindernia oppositifolia Mukherjee; Mazus pumilus Steenis; Scoparia dulcis L.**

**Family: Acanthaceae**  
**Species: Adhatoda vasica Medic.; Andrographis paniculata Nees.; Dipteracanthus prostrates Nees; Hemigraphis hirta T. Anders; Justicia genderussa Burm. f.; Justicia simplex D. Don.; Rungia pectinata Nees.**

**Order: 8. Rubiales**  
**Family: Rubiaceae**  
**Species: Adina cordifolia Hook. f. ex Bran.; Anthocephalus cadamba Miq.; Dentella repens J.R. & G. Forst.; Meyna spinosa Roxb.; Morinda tomentosa Heyne ex Roth.; Oldenlandia corymbosa L.**

**Order: 11. Asterales**

**Family: Asteraceae**

**Species:** *Ageratum conyzoides* L.; *Blumea lacera* Burm.; *Chromolaena odorata* King & Robin.; *Eclipta alba* Hassk.; *Elephantopus scaber* L.; *Emilia sonchifolia* DC. Ex Wt.  
*Gnaphalium luteo-album* L.; *Launea asplanifolia* Hook. f.; *Spilathes achmella* (Burm.f) DC.; *Tridax procumbens* L.; *Vernonia cinerera* Lees.; *Xanthium strumarium* L.

**Class: Liliopsida (Monocotyledons)**

**Sub-Class II Arecidae**

**Order I Arecales**

**Family: Arecaceae**

**Species:** *Borassus flabellifer* L.; *Cocos nucifera* L.; *Phoenix sylvestris* Roxb.

**Order: 4. Arales**

**Family: Araceae**

**Species:** *Alocasia indica* Schoot; *Caladium bicolor* Schoot; *Colocasia esculenta* Schoot; *Typhonium trilobatum* Schoot

**Sub-Class: III. Commelinidae**

**Order 1. Commelinales**

**Family: Commelinaceae**

**Species:** *Commelina bengalensis* L.; *Cyanotis tuberosa* Schult.; *Murdania nudiflora* (L.) Brenan

**Order 5. Cyperales**

**Family: Cyperaceae**

**Species:** *Cyperus kyllinga* Endl.; *Cyperus rotundus* L.; *Scirpus articulatus* L

**Family: Poaceae**

**Species:** *Bambusa nana* Roxb.; *Cynodon dactylon* Pers.; *Dendrocalamus strictus* Nees; *Desmostachya bipinnata* Stapf.; *Eragrostis sinoseurides*.....; *Oplismenus burmanni* P.Beauv.; *Paspalum flavidum* A. Camus; *Vetiveria zizanioides* Nash

**Sub-Class: IV. Zingiberidae**

**Order: 2. Zingiberales**

**Family: Musaceae**

**Species:** *Musa paradisiaca* L.; *Ravenala madagascariensis* Sonnerat

**Family: Costaceae**

**Species:** *Costus speciosus* J.E.Smith

**Family: Cannaceae**

**Species:** *Canna indica* L.

**Sub-Class: V. Liliidae**

**Order: Liliales**

**Family: Liliaceae**

**Species:** *Aloe vera* Burm. f.; *Asparagus racemosus* Willd.

**Family: Smilacaceae**

**Species:** *Smilax zeylanica* L.

**Family: Dioscoreaceae**

**Species:** *Dioscorea pentaphylla* L.

**Order: 2. Orchidaceae**

**Family: Orchidaceae**

**Species:** *Vanda roxburghii* R. Br.

**Gymnosperms**

**Family: Cycadaceae**

**Species: *Cycas circinalis* L.; *Blota* sp.; *Microcycas* sp.**

**Pteridophytes**

**Family: Ophioglossaceae**

**Species: *Helminthostachys zeylanica* Kaulf**

**Family: Polypodiaceae**

**Species: *Lygodium flexosum* Sw.; *Pteris* sp.;**

**Family: Adiantaceae**

**Species: *Adiantum caudatum* L.;**

**Family: Salviniaceae**

**Species: *Salvinia natans* Hoffm.**

**Family: Azollaceae**

**Species: *Azolla imbricate* R. Br.**

**Family: Marsileaceae**

**Species: *Marsilia quadrifoliata* L.**

**V. Discussion**

A statistical analysis of the plants reported from the sanctuary Kulik and its surroundings reveals that there are in total, 234 plant species of which 224 species under angiosperms whereas, 10 are under Gymnosperms and Pteridophytes. Out of total species studied, there are 78 families comprising of 64 dicots and 14 monocots (Table 1). There are a total number of 215 genera in which 184 belong to dicots and 31 to monocots. There are total 224 angiosperm species in which 192 dicots and 32 monocots. The ratio of monocot to dicot is 1:6. Among the families studied, dominant dicot families are Asteraceae (13 genera and 13 species), Euphorbiaceae (7 genera and 9 species), Mimosaceae (6 genera and 8 species). Similarly, monocot families of Poaceae (8 genera and 8 species), Araceae (4 genera and 4 species) are dominant one (Table 2). The species like *Caladium*, *Ravenala*, and *Heliconia* are ornamental elements in the Garden and found in front of the guesthouse of Sanctuary. The medicinal plants in the sanctuary available are *Aristolochia indica*, *Boerhavia diffusa*, *Achyranthes aspera*, *Plumbago zeylanica*, *Abroma augusta*, *Abutilon indicum*, *Sida cordata*, *Crateva nurvula*, *Abrus precatorius*, *Terminalia arjuna*, *Phyllanthus reticulatus*, *Azadirachta indica*, *Tribulus terrestris*, *Centella asiatica*, *Strychnos nux-vomica*, *Alstonia scholaris*, *Ichnocarpus frutescens*, *Gymnema sylvestrae*, *Hemidesmus indicus*, *Tylophora indica*, *Solanum surattense*, *Cuscuta reflexa*, *andrographis paniculata*, *Hemigraphis hirta*, *Eclipta alba*, *Globba bulbifera*, *Costus speciosus*, *Dioscorea pentaphylla*, etc. The fern *Helminthostachys zeylanica* under the family Ophioglossaceae is rare and interesting element observed here.

**Table 1. Statistical analysis of Flora of Kulik and its vicinity, Raiganj, Uttar Dinajpur**

Plant Types	Study site is in and around Kulik			
	Class	Families	Genera	Species
	(1)	(2)	(3)	(4)
Angiosperm	Dicots	64	184	192
Angiosperms	Monocots	14	31	32
<b>Total :</b>	02	78	215	224
Gymnosperms		1	3	3
Pteridophytes	-	6	7	7
<b>Total:</b>		85	225	234

**Table 2. Statistical Analysis of number of Genera and species in the study area with 5 dominant families**

Families	Genera	Species	Position
Asteraceae (Dicots)	13	13	I
Euphorbiaceae (Dicots)	07	09	II
Mimosaceae (Dicots)	06	08	III
Poaceae (Monocots)	08	08	IV
Araceae (Monocots)	04	04	V
<b>TOTAL: 5</b>	38	42	

Figure 1. Pie diagram showing families, genera and species available in the study area.

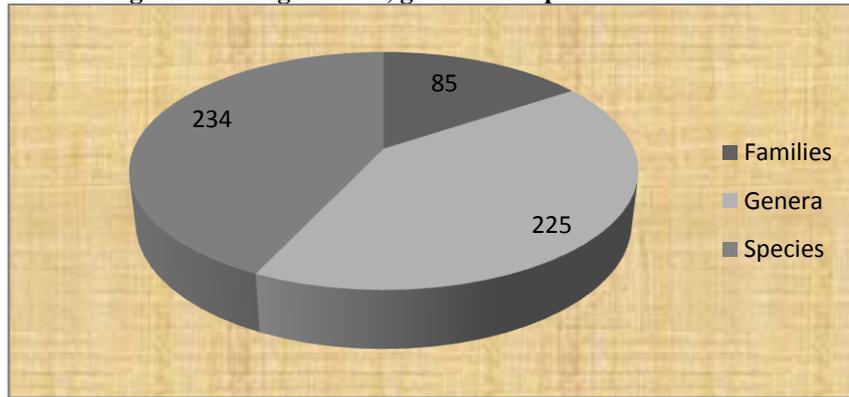
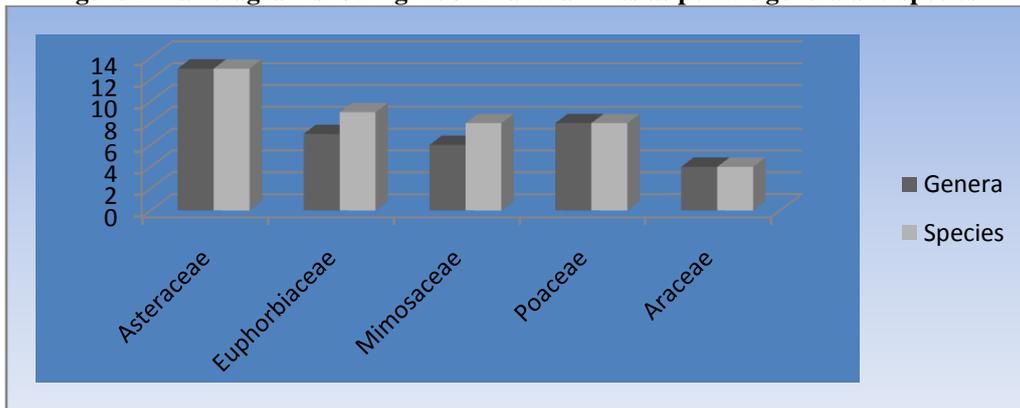


Figure 2. Bar diagram showing 5 dominant families as per the genera and species.



## VI. Photo Plates 1-13 (Figures 1-30)

### Plate-I





**Photo (1-3)** : Site marked for Sanctuary, Gate way of Sanctuary, Kulik Sanctuary surrounded by River Kulik from Raiganj towards Siliguro, lefthand side of the road NH-34, at Uttar Dinajnpur District, West Bengal, India

**Plate-II**



Photo 4: Flagship species *Ficus benghalensis* (Bengali Name Bat)



Photo 5.: Underground vegetation dominated by *Glycosmis pentaphylla* (Bengali Name : Banlebu)



Photo 6. : Tree species like *Cassia siamea* of Caesalpinaceae at Social Forestry site, Kulik

**Plate-III**



Photo 7.: *Terminalia arjuna*-the Arjun tree



Photo 8.: Open Bill Storks in Resting State on *Trewa nodiflora* Tree (Family: Euphorbiaceae)



Photo 9.: Open Bill Storks in Resting State on *Lagerstroemia speciosa* Tree (Family: Lythraceae)

**Plate-IV**



Photo 10. Hatching state of birds on Jarul tree



Photo 11. Gliding of Bird



Photo 12. Working in the nest for hatching eggs.

**Plate-V**



Photo 13. Pair of Birds in a nest during hatching



Photo 14: Open Bill Storks in Resting State on *Barringtonia acutangula* Tree (Family: Lecythidaceae)



Photo 15: Gliding of Open Bill Stork in the open sky and some are sitted on the Banyan tree (Family: Moraceae)  
**Plate-VI**



Photo 16: Relasing old feathers for refreshment on Banyan tree



Photo 17: Habit picture of birds at special habitat on tree

**Plate-VII**



Photo 18: Association of migratory birds on big tree species



Photo 19: Wetland with *Trapa bispinosa* of Trapaceae a source of income for local inhabitant.

**Plate-VIII**



Photo 20: *Canna indica* of Cannaceae as ornamental one in nearby village



Photo 21: *Citrus decumana* of Rutaceae-locally called “Batabi”

**Plate-IX**



Photo 22: Huts near Kulik



Photo 23: River Kulik , an old bridge a gateway of Kulik from Raiganj, Uttar Dinajpur, West Bengal, India

**Plate-X**



Photo 24: Old women carrying fallen twigs and litter for fuel purpose.



Photo 25: Canopy cover of Vegetation along the NH-34 at Kulik, Raiganj.

**Plate-XI**



Photo 26: Tourist Lodge at Raiganj, U/Dinajpur a special habitat with big trees



Photo 27: Temple of Lord Shiva (Bengali :Shiv Mandir) at Kulik, Uttar Dinajpur (U/D)

**Plate-XII**



Photo 28: Full picture of an Open Bill Stork (Front face)



Photo 29: Full picture of an Open Bill Stork (Lateral view)

**Plate-XIII**



Photo 30: Storks are in Standing and resting position on Hijal tree

## VI. Summary and Conclusion

In and around Kulik, 5 dominant plant families are Asteraceae, Euphorbiaceae, Mimosaceae, Poaceae and Araceae are well perceived. Among them, co-interaction takes place in between families Asteraceae and Poaceae which are cosmopolitan in distribution. The study is not confined because more crucial efforts should be given to study as a whole, because invasiveness gradually increasing so, study in connection with monitoring is required even to need the study of structure, function and dynamics of vegetation in and around Kulik. This is time consuming even expensive, so funding is required and more critical study through department must be involved. Not only that, there should be one herbarium which will be enriched through thorough study by different workers time to time. At a glance it must be dynamic through the passing of time, so more and more researchers will come to the spot to study more in a common platform to study the diversity of plants, animals as well as culture for the same site.

### Legends:

**Graph 1. Pie diagram** represents Families, Genera, and species of plants at a glance found in Kulik Bird Sanctuary, Raiganj, U/D.

**Graph 2. Bardigram** represents dominant plant families in terms of species composition available at Kulik Bird Sanctuary, Raiganj, U/D.

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