

Coastal Medinipur of West Bengal And Its Ecological Problems on Vegetation

Dr. Debabrata Das¹, Manika Das²

¹Associate Professor, Dept of Botany

¹Govt. General Degree College, Lalgarh, Jhargram, West Bengal, 721516

²Vidyasagra University, Midnapore, Paschim Medinipur, 721102

Abstract- Purba Medinipur is a part of erstwhile district along the coast of Bay of Bengal in West Bengal. It includes many land forms from agricultural type to coastal marine land and inland fisheries filled with regularly moving brine water (3.5 % to 11%) that regulates water flow. During monsoon flooded land mass release water to sea and sometimes during high tide receives sea water through dykes and canals. A regular phenomenon of land mass loss near the seashore loosing the soil and vegetation become fragile that losses the ground vegetation along with some faunal as well as microbial load of the said ecosystem. People use plants and animal resources to earn money and use the resource for their daily purpose which is diminishing day by day. Human population rise and resource depletion with high rate is due to unscientific means cause harmful effects on ecosystem day by day. Unethical policy and wrong anti-people policies make faster rate of eco-degradation which could lean the balance in near future. Agricultural, and horticultural development including huge use of resource depleting ecosystem pattern and land use type that is harassing natural vegetation too. The present study reflects some aspects of eco-degradation on vegetation particularly on medicinal plants of Purba Medinipur district. Here, medicinal plants, invasive species interaction, grazing, illegal use and havoc change pattern of ecosystem have been reflected that may be a point of research in details for future generations.

Keywords- Purba Medinipur, Coastal belt, vegetation, medicinal plants, conservation ethics.

I. INTRODUCTION

Coastal area of Purba Mednipur is unique for its nature with diverse floral and faunal composition (Das and Das, 2019c). Coastal Purba Medinipur comprised of Haldia and Contai sub-divisions in Purba medinipur district in West Bengal that is a long coast line from Digha near Odisha to Nandigram of Haldia part. It consists of Digha-Mohana, Ramnagar, Chalti-Basantia, Dadnpatrabar, Petuaghat, Rasulpur, Khejuri and Nadigram site. During study at Coastal Purba Medinipur for medicinal plant research, interesting information came to our knowledge that is related to salinity

which directly affects growth and development of medicinal plants mainly medicinal vegetable plants. Many kinds of conservation strategies have been noticed since time immemorial but nursery is a new point of views that play a key role to conserve species. People of local area conserve propagules in various indigenous ways but basic principle is salt avoiding type. During high salinity condition they keep propagules in quite good position and after dilution the soil salt they place the same in their garden or in field. Gardens are free from high tide but in major cases, they prepare seedlings in nursery and place the plant after preparation of land with organic manures. Within a short period of time they harvest the yield from the plant. Not only plants of garden other sites with good potential of medicinal plants. The field of saline marsh and low lying ponds show aquatic fern and aquatic medicinal pants. Forest department planting *Avicennia alba*, *Avicennia maritima*, *Bruguiera gymnorrhiza* and *Casuarina equisetifolia* that are available on high level ridge near coastal mud flats. On ground seeds of some species are germinated and then placed on poly propline bags and on poly pots for long term establishment of seedlings or saplings. After attaining a certain height they place the plants directly to the ground. The interesting episode of halophytes is to change the succession stages of common mud communise that available there and dominated by *Acanthus ilicifolius* (Fig. 1). After successful establishment of these species a few species of halophytic associates are there and the ground is covered by huge aerial roots so called pneumatophores. Faunal establishment is due to new communities and rich leaf litter deposition that support the required feed of crustaceans. In general, halophytes and similar kind of medicinal, ornamental and economic plants grow here with high potential adaptations that can fight against different salinity conditions. So, in terms of re-vegetation around the site people can raise shelter belt, wind break and green belt to cope various disasters and can mitigate the stress and could get yield of maximum volume at the end of each rotation. Not only that potential, it had its own value based point of attraction which serves the green environment and centre of attraction of many people. People planted plantlets on their own ground or land and get benefit after 8-10 years later. The valuable timber line species namely *Dalbergia sissoo*, *Gmelina arborea*, *Tectona grandis*,

Terminalia arjuna, *Acacia auriculiformis*, *Pterocarpus marsupium*, *Anthocephalus cadamba*, *Milletia pinnata*, *Grivelia robusta*, *Pinus roxburghii* etc. support the plantation view of farmers and villagers who have common idea on plantation on their own land. The land based property and the utility value of ornamentals have similar attractions. People of coastal area use large scale plantation of *Citrus aurantifolia*, *Psidium guajava*, *Artocarpus heterophyllus*, *Phyllanthus emblica* and *Santalum album*. This means that there is a tenacity to use various plants of economic importance along with ornamentals like *Portulaca grandiflora*, *Michelia champaca* var. *alaba*, *Polyalthia longifolia* and *Polyalthia longifolia* var. *pendula* and *Anthurium* sp. In each and every cases, the problem is soil and water salinity that is a problem along with fragile ecosystem near the coast which change land use pattern. Remembering the theme in mind the present study was taken to record the various aspects of conservation strategies for medicinal and economic plant and their strategies of management in near future. Her, case study on private nurseries, government nurseries and plantation on public land have been included to collect data on the basis of information which have been raised to commemorate the balance nature in coastal region with special reference to develop eco-restoration programme. Hope that it could develop managerial strategies to cultivate land of high salinity conditions using salt tolerant species with organic manure.

II. MATERIALS AND METHODS

Ten study sites at Coastal Purba Medinipur were taken in to account. Ecological surveys were done at the 10 coastal stations of Purba Medinipur during last 6 years study. In this year some surveys were made on nursery and coastal fields to know the present status of cultivation of medicinal plants and the indigenous practice they adopted. Survey was conducted in four ways. Field study was done at village boundary, coastal roads, canal boundary, road sides, and rice field boundary, edges near wet lands, wastelands, and open field and in the public garden and government gardens of the coastal Medinipur to study medicinal plants and pockets of vegetation for halophytes. Study was made with quadrat method seasonally. In domestic purpose people use medicinal plants so house hold study for medicinal plant conservation and broad use value was done. Data sheet was made earlier and house survey was done with a key person from each study site. In each site 5 members were selected randomly and in such a way 5% sampling was done successfully to know the present status of use value of medicinal plants along with other medicine used by them for their treatment upon ailments. The loss or depletion of medicinal plants and the need of urgency of conservation on those sites and all were discussed among people and in some study sites discussions were made with

women who were very intelligent about the loss of land mass near the coast. They feed cattle in field and use medicinal vegetables from field round the year.

During survey it was interesting that some sites showed public and government nurseries along the coastal areas of the coastal belt. The study sites rose for specific plantations as well as to raise seedlings on some species along with medicinal plants and ornamental plants. Keeping these in mind, we have selected some governmental nurseries to know the status of medicinal plants as well as plants raised on halophytes. Camera, pen pencil, data sheet, GPS was used along with earlier references. Dry parts of fruits, seeds, barks, roots etc were preserved with naphthalene balls. Plant identification was done with the help of standard literature (Duthie, 1960; Hooker 1892-1897, Haines, 1921-1925; Prain, 1963; Das 2007, Anonymous, 1997, 2005, 2010, 2012, 2017) Names of the plant species were crossed checked following Bennet, 1987. Publications consulted for last few years were Chakraborty *et al.* 2012; Das and Das, 2014; Das, 2013; Das, 2015. Wetland plant species were indentified with the help of fresh water vegetation of Rimer, 1984. The specimens of medicinal plants were indentified with the help of museum specimens and herbarium specimens of CAL. Herbarium specimens were prepared as per the methodology of Jain and Rao, 1977. To study use pattern of medicinal plants, different books of Government sections have been consulted. But for general consideration, the common book used was Kirtikar and Basu, 1918. Herbarium specimens were collected as per the manual published by Rao and Sharma, 1990. Halophytic species have been identified with the help of manual on mangroves in India (Banerjee *et al.* 1986). Other literature used were Blasco (1975), Banerjee (1987), Dwivedi *et al.* (1974), Mukherjee (1978), Naskar *et al.* (1978), Rao *et al.* (1972), Sanyal *et al.* (1984), Sidhu (1960), Thothatri (1981), Wahead Khan (1959), Walson (1928), Gul and Khan (1995), Subhanian *et al.* (2010), Jha *et al.* (2011), Ahmed *et al.* (2011), Das and Ghosh (2017, 2018), Das and Das (2019a,b) and Das and Das(2019, c). All references are tagged ¹⁻⁴⁴ as record references. Cross checking of plant's name were done with the help of taxonomist from BSI and Institutions along with literature available in forest range office as well as housed plantation journal in beat offices under Tamluk Forest Divisional office, Purba Medinipur.

III. RESULTS AND DISCUSSION

Habitats of medicinal plants available along the coast of Purba Medinipur are very interesting. This is due to high and low tide round the year. Here, people use medicinal plants dawn to dusk for their own purpose as these are ready remedies for curing ailments. Present study revealed 63

herbaceous species identified from coastal study site in Purba Medinipur which are under 34 families. Plants are ornamental, medicinal, agricultural and wild but all have medicinal properties (Table 1). Similarly the same study site revealed 38 shrubby species under 23 families (Table 2). Maximum species are medicinal though some are ornamental too. *Gloriosa superba* is endangered species and the frequency is very low which is also available in private nurseries of the same site. In the same study site study revealed 47 medicinal tree species under 28 families (Table 3). Plants of various kinds used widely by people. As the plants are important so the nursery men and forest departments prepare seedlings in their nurseries and distribute among people. Governmental nurseries in Purba Medinipur area are found in the study sites like Khejuri, Hijli, Nandigram or Jellingham and Sankarpur under Tamluk forest Division (Das and Das, 2019 c). Here staff members in the nursery; prepare stocks on various plants under the category namely medicinal, economic, ornamental, halophytes and some extent wood producers. Private nurseries are available in Contai, Nandigram and in Khejuri sites. Almost all people from the study sites use their home made propagules and conserve these in their own way. Turmeric is planted during May to June when the rhizome is ready. They use own rhizome and after the harvest of rhizome, they place the same on mud and place the dried rhizome under tree shade. During April, May almost all rhizomes germinate and produce vegetative bud. Then it becomes ready for field plantation. Zinger and *Colocasia* show similar trends as the species are valuable and also economical. The same author in their earlier research revealed that, Nandigram forest nursery develops seedlings and or stocks of 9 plant species (Das and Das, 2019c). Among them, *Bruguiera gymnorhiza* (Beng.-Kankra, Eng.-Black mangrove) and *Sonneratia apetala* (Beng.- Keora, Eng.-Mangrove apple) are true halophytes. Along the shore line all halophytes are planted and kept in nursery for further readymade use if required (Table 1). Here, *Portulaca grandiflora* and *Mirabilis jalapa* are ornamentals though large scale use of *Polyalthia longifolia* and *Casuarina equisetifolia* have been used by people to decorate landscape.

Similarly, Khejuri shows 9 important plants which are raised in nursery by forest department. Here, we see *Bruguiera gymnorhiza* an important halophytic plant (Table 3). *Casuarina equisetifolia* and *Bruguiera gymnorhizai* are used for degraded land restoration. Here, medicinal plants like *Abroma augusta*, *Alstonia scholaris* and *Azadirachta indica* are used for medicinal purpose. Wood producing species like *Acacia auriculiformis*, *Dalbergia sissoo* and *Tectona grandis* are used widely by the people for commercial purpose. In the study sites public as well as Govt. nursery play a significant role to raise the seedlings. Previous study showed that at Sankarpur 14 important plant species are available in nursery

nurtured by forest department. Here, we see *Bruguiera gymnorhiza* an important halophytic plant (Table 3). *Casuarina equisetifolia* and *Bruguiera gymnorhizai* are used for restoration of degraded land in coastal area. Other plant species found in nursery are *Acacia auriculiformis*, *Alstonia scholaris*, *Anthocephalus cadamba*, *Artocarpus heterophyllus*, *Azadirachta indica*, *Dalbergia sissoo*, *Milletia pinnata*, *Phyllanthus emblica*, *Pterocarpus marsupium*, *Pterocarpus santalinus*, *Santalum album* and *Tectona grandis*.

Similarly at Nursery of Nijkasba, Hijli area 21 important plant species are raised and nurtured by forest department. Here, we see *Avicennia officinalis* and *Bruguiera gymnorhiza* as important halophytic plants (Table 3). *Casuarina equisetifolia* and *Bruguiera gymnorhizai* are used broadly to fill the ground cover and make vegetation in low lying areas. Other plant species found in nursery are *Acacia auriculiformis*, *Alstonia scholaris*, *Anthocephalus cadamba*, *Artocarpus heterophyllus*, *Azadirachta indica*, *Dalbergia sissoo*, *Ficus benghalensis*, *Milletia pinnata*, *Phyllanthus emblica*, *Pterocarpus marsupium*, *Pterocarpus santalinus*, *Santalum album* and *Tectona grandis*. Medicinal plants raised in nursery are *Alstonia scholaris*, *Azadirachta indica*, *Terminalia arjuana* and *Pterocarpus santalinus*. *Citrus aurantifolia* is used in orchard area and the demand is high as commercial plant (Table 3).

Study revealed that highest species found in Hijli Govt. nursery and lowest in Nandigram (Jellingham) and Khejuri dually. As a whole the study area has high potentiality to raise nursery seedlings particularly halophytes though seeds are not available here. The great Sunderban of Indian part supply large scale propagules to raise nursery seedlings and manage the nursery a true one for future conservation. In some private nursery people develop halophytes and mountain species like Pine and Oak which could be a centre of resource to vegetate the land as a whole.

It also revealed that the study site exhibits more herbaceous species (Bar graph 1) than trees than shrubs (<60, <40<30 respectively). Among the species recorded here, tree species show more importance than shrubs than herbs. Locally the medicinal vegetables are available in market which is demand based so more and more studies on that area are required.

Table 1. List of herbaceous species in study sites of Coastal Purba Medinipur District

Sl. No.	Scientific Name	Family Name
1.	<i>Abrus precatorius</i> L.	Fabaceae
2.	<i>Achyranthes aspera</i> L.	Amaranthaceae
3.	<i>Aeluropus lagopoides</i> (L.) Thwaites	Poaceae
4.	<i>Alacasia macrorrhizas</i> ((L.) G. don	Araceae
5.	<i>Amaranthus spinosus</i> L.	Amaranthaceae
6.	<i>Amarphaphalus paeoniifolius</i> (Dennst.) Nicolson	Araceae
7.	<i>Andragaphis paniculata</i> (Burm.f.) Nees	Acanthaceae
8.	<i>Aristolochia indica</i> L.	Aristolochiaceae
9.	<i>Bacopa monnari</i> (L.) Pennell	Plantaginaceae
10.	<i>Barleria lupulina</i> Lindl.	Acanthaceae
11.	<i>Blumea lacera</i> (Burm. f.) DC.	Asteraceae
12.	<i>Boerhaavia diffusa</i> L. nom. Cons.	Nyctaginaceae
13.	<i>Bulbostylis barbata</i> (Rottb.) C.B. Clarke	Cyperaceae
14.	<i>Caladium bicolor</i> Vent	Araceae
15.	<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae
16.	<i>Centella asiatica</i> (L.) Urban	Apiaceae
17.	<i>Cissus quadrangularis</i> L.	Vitaceae
18.	<i>Clitoria ternatea</i> L.	Fabaceae
19.	<i>Cocculus hirsutus</i> (L.) Diels	
20.	<i>Codariocalyx gyroides</i> (Link) Hassk.	Fabaceae
21.	<i>Commelina benghalensis</i> L.	Commelinaceae
22.	<i>Costus speciosus</i> (J.Koenig) Sm.	Costaceae
23.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae

24.	<i>Cyperus rotundus</i> L.	Cyperaceae
25.	<i>Datura metel</i> L.	Solanaceae
26.	<i>Desmodium triflorum</i> (L.) DC.	Fabaceae
27.	<i>Dioscorea alata</i> L.	Dioscoreaceae
28.	<i>Eclipta prostrata</i> (L.) L.	Asteraceae
29.	<i>Euphorbia hirta</i> L.	Euphorbiaceae
30.	<i>Gisekia pharnaceoides</i> L.	Aizoaceae
31.	<i>Gloriosa superba</i> L.	Liliaceae
32.	<i>Hedyotis diffusa</i> Willd.	Rubiaceae
33.	<i>Heliotropium curassavicum</i> L.	Boraginaceae
34.	<i>Heliotropium indicum</i> L.	Boraginaceae
35.	<i>Hemidesmus indicus</i> (L.) R. Br.	Asclepiadaceae
36.	<i>Hemigraphia hirta</i> (Vahl) T. Anderson	Acanthaceae
37.	<i>Ipomoea pes-caprae</i> (L.) R. Br.	Convolvulaceae
38.	<i>Launaea sarmentosa</i> (Willd.) Sch. Bip. Ex Kuntze	Asteraceae
39.	<i>Marsilea quadrifolia</i> L.	Marsileaceae

40.	<i>Mentha spicata</i> L.	Lamiaceae
41.	<i>Mollugo spargula</i> L.	Molluginaceae
42.	<i>Nicotiana plumbaginifolia</i> Viv.	Solanaceae
43.	<i>Ocimum americanum</i> L.	Lamiaceae
44.	<i>Ocimum sanctum</i> L.	Lamiaceae
45.	<i>Oxalis corniculata</i> L.	Oxalidaceae
46.	<i>Pedaliium murex</i> L.	Pedaliaceae
47.	<i>Pergularia daemia</i> (Forssk.) Chiov.	Asclepiadaceae

48.	<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae
49.	<i>Phyllanthus fraternus</i> G.L. Webster	Phyllanthaceae
50.	<i>Polygonum plebeium</i> R. Br.	Polygonaceae
51.	<i>Porteresia coarctata</i> (Roxb.) Tateoka	Poaceae
52.	<i>Rungia pectinata</i> (L.) Nees	Acanthaceae
53.	<i>Salicornia europea</i> L.	Amaranthaceae
54.	<i>Scoparia dulcis</i> L.	Scrophulariaceae
55.	<i>Sesuvium portulacastrum</i> (L.) L.	Aizoaceae
56.	<i>Solanum nigrum</i> L.	Solanaceae
57.	<i>Spermacoce hispida</i> L.	Rubiaceae
58.	<i>Spinifex littoreus</i> (Burm. f.) Merr.	Poaceae
59.	<i>Suaeda maritima</i> (L.) Dumort. (Fig. 1)	Amaranthaceae
60.	<i>Tragia involucrata</i> L.	Euphorbiaceae
61.	<i>Tribulus terrestris</i> L.	Zygophyllaceae
62.	<i>Tridax procumbens</i> L.	Asteraceae
63.	<i>Tylophora indica</i> (Burm f.) Merr.	Asclepiadaceae

Note: 34 families

Table 2. List of shrubby species in study sites of Coastal Purba Medinipur District

Sl. No.	Scientific Name of the shrubby plant species	Family Name
1.	<i>Abramo augustum</i> (L.) L. f.	Malvaceae
2.	<i>Acanthus ilicifolius</i> L.	Acanthaceae
3.	<i>Bauhinia acuminata</i> L.	Fabaceae
4.	<i>Calotropis gigantea</i> (L.) Dryand.	Asclepiadaceae
5.	<i>Capparis zeylanica</i> L.	Capparaceae
6.	<i>Carissa spinarum</i> L.	Apocynaceae
7.	<i>Cascabela thevetia</i> (L.) Lippold	Apocynaceae
8.	<i>Chromolaena odorata</i> (L.) R.M.King&H.Rob.	Asteraceae
9.	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae
10.	<i>Clerodendrum inerme</i> (L.) Gaertn.	Lamiaceae
11.	<i>Clerodendrum viscosum</i> Vent.	Lamiaceae
12.	<i>Croton bonplandianum</i> Baill.	Euphorbiaceae
13.	<i>Flacourtia indica</i> (Burm.f.) Merr.	Salicaceae
14.	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae
15.	<i>Guilandina bonduc</i> L.	Fabaceae
16.	<i>Holarrhena pubescens</i> Wall. ex G. Don	Apocynaceae
17.	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae
18.	<i>Justicia adhatoda</i> L.	Acanthaceae
19.	<i>Lantana camara</i> L.	Verbenaceae
20.	<i>Lawsonia inermis</i> L.	Lythraceae
21.	<i>Lippia alba</i> (Mill.) N.E.Br.ex Britton &P.Wilson	Verbenaceae
22.	<i>Melastoma malabathricum</i> L.	Melastomataceae
23.	<i>Nerium oleander</i> L.	Apocynaceae
24.	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae
25.	<i>Opuntia stricta</i> (Haw.) Haw.	Cactaceae
26.	<i>Pandanus odorifer</i> (Forssk.) Kuntze	Pandanaceae
27.	<i>Parkinsonia aculeata</i> L.	Fabaceae
28.	<i>Pluchea indica</i> L.	Asteraceae
29.	<i>Prosopis juliflora</i> (Sw.) DC.	Fabaceae
30.	<i>Psidium guajava</i> L.	Myrtaceae
31.	<i>Rauvolfia tetraphylla</i> L.	Apocynaceae
32.	<i>Ricinus communis</i> L.	Euphorbiaceae
33.	<i>Senna occidentalis</i> (L.) Link	Caesalpiniaceae
34.	<i>Smilax zeylanica</i> L.	Smilacaceae
35.	<i>Tabernaemontana divaricate</i> R. Br. ex Roem. &Schult.	Apocynaceae
36.	<i>Tecoma stans</i> (L.) Juss. ex Kunth	Bignoniaceae
37.	<i>Vitex negundo</i> L.	Lamiaceae
38.	<i>Zizyphus aenoplia</i> (L.) Mill.	Rhamnaceae

Note: 22 families

Table 3. List of tree species in study sites of Coastal Purba Medinipur, West Bengal

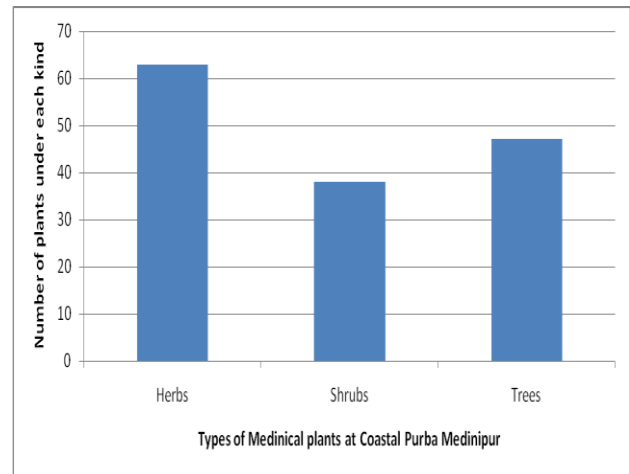
Sl. No.	Scientific Name of the tree species	Family Name
1.	<i>Abramo augustum</i> (L.) L. f.	Malvaceae
2.	<i>Acacia auriculiformis</i> A.Cunn.ex Benth.	Fabaceae
3.	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Fabaceae
4.	<i>Aegle marmelos</i> (L.) Correa	Rutaceae
5.	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae
6.	<i>Anacardium occidentale</i> L.	Anacardiaceae
7.	<i>Areca catechu</i> L.	Arecaceae
8.	<i>Averrhoa carambola</i> L.	Oxalidaceae
9.	<i>Avicennia alba</i> Blume	Acanthaceae
10.	<i>Avicennia marina</i> (Forssk.) Vierh.	Acanthaceae
11.	<i>Avicennia officinalis</i> L.	Acanthaceae
12.	<i>Azadirachta indica</i> A. Juss.	Meliaceae
13.	<i>Borassus flabellifer</i> L.	Arecaceae
14.	<i>Bruguiera gymnorrhiza</i> (L.) Savigny	Rhizophoraceae
15.	<i>Calophyllum inophyllum</i> L.	Calophyllaceae
16.	<i>Cassia fistula</i> L.	Fabaceae
17.	<i>Casuarina equisetifolia</i> L.	Casuarinaceae
18.	<i>Cinnamomum tamala</i> (Buch.-Ham.) T. Nees & C.H. Eberm.	Lauraceae
19.	<i>Citrus maxima</i> Marr.	Rutaceae
20.	<i>Cocos nucifera</i> L.	Arecaceae
21.	<i>Dalbergia sissoo</i> Roxb.	Fabaceae
22.	<i>Dolichandrone spathacea</i> (L.f.) Seem.	Bignoniaceae
23.	<i>Elaeocarpus ganitrus</i> Roxb. ex G. Don	Elaeocarpaceae

24.	<i>Eucalyptus globules</i> Labill.	Myrtaceae
25.	<i>Excoecaria agallocha</i> L.	Euphorbiaceae
26.	<i>Ficus benghalensis</i> L.	Moraceae
27.	<i>Ficus racemose</i> L.	Moraceae
28.	<i>Grevillea robusta</i> A. Cunn. ex R.Br.	Proteaceae
29.	<i>Litsea glutinosa</i> (Lour.) C.B. Rob.	Lauraceae
30.	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Magnoliaceae
31.	<i>Mangifera indica</i> L.	Anacardiaceae
32.	<i>Millettia pinnata</i> (L.) Panigrahi	Fabaceae
33.	<i>Mimusops elengi</i> L.	Sapotaceae
34.	<i>Moringa oleifera</i> Lam.	Moringiaceae
35.	<i>Phoenix Sylvestris</i> (L.) Roxb.	Arecaceae
36.	<i>Phyllanthus acidus</i> (L.) Skeels	Phyllanthaceae
37.	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Fabaceae
38.	<i>Polyalthia longifolia</i> Sonn.	Annonaceae
39.	<i>Pterocpermum acerifolium</i> (L.) Willd.	Malvaceae
40.	<i>Shorea robusta</i> Roth.	Dipterocarpaceae
41.	<i>Streblus asper</i> Lour.	Moraceae
42.	<i>Strychnos nux-vomica</i> L.	Loganiaceae
43.	<i>Swietenia mahagoni</i> (L.) Jack.	Meliaceae
44.	<i>Syzygium cumini</i> (L.) Skeels.	Myrtaceae
45.	<i>Tectona grandis</i> L.f.	Lamiaceae
46.	<i>Terminalia arjuna</i> (Roxb.) Wight & Am.	Combretaceae
47.	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae

Note: 28 families

Discussion:

The study sites are far remote and no general information available for the common people around the nursery that might be a negative draw back except departmental plantation. People centric idea must be made and year wise plan thoroughly to be distributed among interested feeder group round the year not only for a 'Arany Saptaha' programme. Schools, Colleges, Institutions along with NGOs and other government sectors should be incorporated in a web based integrated programme to distribute more sapling in almost all places except a specific site. Scientific study, research, extension and other people centric training must be conducted round the year by the government departments for the community people. It would generate interest among people and that will generate idea to make public nursery to grow more seedlings at the distal corner of the village even in remote place where the communication is too bad.



Graph 1 Medicinal Plant species of economic importance at Coastal Purba Medinipur, West Bengal, India

IV. CONCLUSION

The study site is under fragile ecosystem which is diminishing species due to heavy threat. This is the cause to diminish species or extinction of species locally which must be checked or controlled under special management scheme in the same area. People should take training from organization that could be applied to check the species loss locally.

Huge area should be planted using valuable economic plants like *Curcuma longa*, *Curcuma amada*, *Centella asiatica*, *Mollugo spargula*, *Bacopa monneiri*, *Dioscorea alata* and *Aloe vera*. The valuable nursery should be protected from high tide and nursery plantlets should be kept free from high salinity or high water logging condition after devastating flood.

During summer watering to nursery must be made from surface water so rainwater harvesting is the best practice though some people use pond water but others use shallow water.

Research on salinity and drought stress on some medicinal plants and their biochemical changes must be studied before going to cultivate in field.

High yielding disease resistant and stress resistant crop species must be used but it should be incorporated after market study based on demand and supply.

Mechanical ploughing and mechanical watering should be incorporated even if possible harvesting also.

Early and late varieties may be used but in low lying land better is rice cultivation. Therefore, salt stress, drought

stress and water logging stress on rice varieties must be made following standard agricultural methods.

Tree species and orchard species should be raised based on demand and the space between two rows, rhizomatous and cormy vegetables (Ginger, turmeric and elephant yam) may be planted to get special benefit.

Ecologically the site is eco-fragile so special protection must be made using high ridge or high path to protect high tide during monsoon or after. Fishery and poultry may be made along with duckery and nursery also to get special advantage round the year.

Photographs: (1 to 34)

Plants of potential importance at Coastal Purba Medinipur district of West Bengal



Fig. 1 *Suaeda maritima* near coastal Purba Medinipur, Fig. 2 Large mangrove vegetation at Khejuri coast, Fig. 3 Grazing land near Coastal area filled with *Casuarina* plantation.



Fig. 4 Women are discussing on ecological problems at Khejuri, Fig. 5 High tide causing abnormal bole formation on halophytes, Fig. 6 Leaf litter deposition on saline ground which is a food source of molluscs.

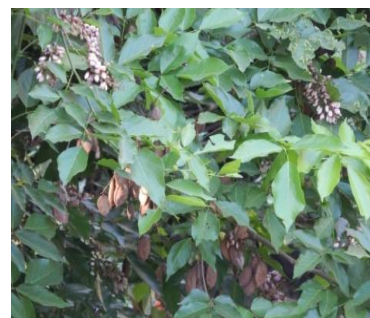




Fig. 7 *Acanthus ilicifolius* at Nandigram in Purba Medinipur,

Fig. 8 *Millettia pinnata* (= *Pongamia pinnata*) at Chalti-Basantia of Contai sub-division in Purba Medinipur, Fig. 9 Gregarious growth of *Parthenium hysterophorus* at Mohana



Fig. 13 *Cinnamomum tamala* in nursery, Fig. 14 Private nursery growing lemon, Fig. 15 *Cascabela thevetia* seedlings at Nursery.



Fig. 10 *Volkameria inermis* (= *Clerodendrum inerme*) at Coastal Mandarmani, Fig. 11 *Vitex negundo* from Dadnpatrabar, Fig. 12 Rasulpur ferry ghat an eco-degraded area.



Fig. 16 *Mimusops elengi* in nursery, Fig. 17 *Alocasia macrorrhizos*, Fig. 18 Pine (*Pinus* sp.) at nursery.



Fig. 19 Margosa saplings in Nursery, Fig. 20 Siver oak (*Grevillea robusta*) saplings at Nursery, Fig. 21 Papaya (*Carica papaya*) seedlings at Nursery



Fig. 22 Huge demand of Seedlings growing at nursery, Fig. 23 *Acacia auriculiformis* in nursery, Fig. 24 *Michelia champaca* var. *alba* in nursery (White flowered champaca)



Fig. 25 *Anthurium* sp. (white) in nursery, Fig. 26 Net house of Private nursery, Fig. 27 *Elaeocarpus ganitrus* at Nursery.



Fig. 31 *Caladium bicolor*, Fig. 32 *Andrographis paniculata*,
Fig. 33 *Cocculus hirsutus*



Fig. 28 *Amorphophalus paeoniifolius* Fig. 29 *Lantana camara*, Fig. 30 *Petalium murex*



Fig. 34 *Tragia involucrata*, Fig. 35 *Gloriosa superba* L., Fig. 36 Degraded coastal site at Sankarpur after Aila (A special storm).



V. ACKNOWLEDGEMENTS

Authors acknowledge Dr. Prof. R. K. Bhakat, Department of Botany & Forestry, Vidyasagar University, Midnapore, Paschim Medinipur, West Bengal, for his inspiration to study halophytic plants and plant associates in coastal Purba Medinipur. We acknowledge Sri Sandip Das, Guest Teacher, G. G. Sikshaniketan, Nandigram; Benu Mandal, Assistant Teacher, G.J. Sikshaniketan from Mukundapur, Contai; Krishna Gopal Das, field assistant, Champakray Chack; Milan Kumar Barik, Assistant Teacher, G. G. Sikshaniketan; Arjama Das, Henria, Purba Medinipur; Sri Biman De, Assistant Teacher, G. G. Siksha Niketan, from Sankarpur; Range and Beat officers from Khejuri, Hijli,

Nandigram (Jellingham) and Sankarpur for their cordial help as and when required. We acknowledge Head, Department of Botany & Forestry, Vidyasagar University and Principal, K.D. College of Commerce & General Studies, Midnapore, West Bengal for their time based inspiration to make it complete. Special thanks go to local people who helped us during field study. Librarians of institutions are acknowledged for their help.

REFERENCES

- [1] Ahmed, M.Z., Gilani, S.A., Kikuchi, A.; Gulzar, S.; Khan, M.A. and Watanabe, K.N (2011). Population diversity of *Aeluropus lagopoides*: A potential cash crop for saline land, *Pak. J. Bot.*, 43(1):595-605.
- [2] Anonymous (1997). Flora of West Bengal, Vol.-1, Flora of India, Series -2, BSI, Kolkata.
- [3] Anonymous (2005). Medicinal Plant resources of south West Bengal, Vol.-I, Research Wing, Directorate of forests, Govt. of West Bengal.
- [4] Anonymous (2010). Medicinal Plant Resources of South West Bengal, Vol.-II, Research Wing, Directorate of forests, Govt. of W.B.
- [5] Anonymous (2017). Medicinal Plant Resources of South West Bengal, Research Wing, Directorate of forests, Govt. of W.B.
- [6] Anonymous (1987). Mangrove in India: Status Report, Government of India, Ministry of Environment & Forests, New Delhi.
- [7] Anonymous (2012). Medicinal plant Resources of Kolkata, A Photo Guide, Research Circle, Forest Directorate, Govt. of West Bengal, pp.1-200.
- [8] Arun, A.B., Beena, K.R., Raviraja, N.S and Sridhar, K.R., (1999). Coastal sand dunes-a neglected ecosystem, *Current science*, 77:19-22.
- [9] Bandyopadhyay, K B. (2009). Amader Rajya (Bengali Version for West Bengal), Kishore Gyan Vigyan Prakashani, Spectrum Offset, Kolkata-37, pp. 76.
- [10] Banerjee, L.K. (1987). Ecological studies on the mangals of Mahanadi estuarine delta, Orissa, *Trop.Ecol.*, 82:117-125.
- [11] Banerjee, L.K. (1994). Conservation of coastal plant communities in India, *Bull.Bot.Suvr. India*, 36(1-4):160-165.
- [12] Banerjee, L. K; Sastry, A. R. K. and Nayar, M. P. (1989). Mangroves of India-Identification Manual, BSI, Kolkata-1.
- [13] Banerjee, L.K., Rao, T.A., Sastry, A.R.T. and Ghosh (2002). Diversity of Coastal Plant Communities in India, *Bot.Surv.India*, Kolkata, pp. 233-237 & 319-320.
- [14] Bennet, S. S. R. (1987). Name changes in Flowering Plants of India and Adjoining Regions, Triseas Publishers, Dehra Dun.
- [15] Blasco, F (1975). Mangroves of India, Inst. Francais, Pondicherry, *Trav. Sect. Sci. Tech.*, 14 : 117-125.
- [16] Chakraborty, S.K. (2010). Coastal Environment of Midnapore, West Bengal : Potential Threat and Management, *Jour.Coast. Env.*, 1(1): 27-40.
- [17] Chakraborty, T., Mondal, A.K. and Parui, S (2012). Studies on the Phytoresources of Coastal Dune Flora at West Bengal and adjacent Orissa, India, *Int., Jour. of Sc. and Nature*, 3(4) : 745-752.
- [18] Corre Jean-Jacques (1991). The Sand dunes and their vegetation along the Mediterranean coast of France. Their likely response to climate change, *Landscape Ecology* 6(1&2):65-75.
- [19] Das, D. (2013). *Pedalium murex* L. (Pedaliaceae)—A New Record of Purba Medinipur District to the state of West Bengal, *IOSR Journal of Business and Management*, 13(4) : 54-56.
- [20] Das, D. and Ghosh, R.B. (1999). Mangroves and other phanerogams growing at Nayachar, Haldia, Midnapore, West Bengal, *Environment and Ecology*, 17(3): 725-727.
- [21] Das, D and Das, M. (2014). Vegetation ecology of coastal belt of Khejuri area of Purba Medinipur District with special reference to Hijli coast, West Bengal, India, *IOSR Journal of Pharmacy* 4(2):56-77.
- [22] Das, D.C, Pati, M., Mahato, G. and Das, M. (2015). Study of tidal vegetation of Purba Medinipur district of West Bengal, India, *International Journal Of Bioassays*, 4(5): 3915-3921.
- [23] Das, D.C., Mahato, G., Das, M. and Pati, M.K. (2015). Investigation of Ethnomedicinal plants for the treatment of Carbuncles from Purulia District of West Bengal, *International Journal of Bioassay*, 4(5) : 3896-3899.
- [24] Desai, K.N. (2000). Dune vegetation: Need for a reappraisal, *Coastain: A Coastal Policy Research Newsletter*, 3:6.
- [25] Dey, M.K., Hazra, A.K. and Chakraborty, S.K. (2010). Functional Role of Microarthropods in nutrient cycling of Mangrove- estuary ecosystem of Midnapore coast of West Bengal, India, *Int. Jour. of Environment Technology and Management*, 12(1): 67-84.
- [26] Duthie, J. F. (1960). Flora of Upper Gangetic plains, Vol. I, II, Botanical Survey of India, Calcutta.
- [27] Haines, H. H. (1921-1925). The Botany of Bihar and Orissa, Vol. I-IV, BSI, Calcutta.
- [28] Hooker, J. D. (1892-1897). Flora of British India, Vol. 1-7, BSI, Calcutta.

- [29] Jain, S. K. and Rao, R. R. A.(1977). Hand book of Field Herbarium Methods, Oxford and IBH Publishing Company, New Delhi.
- [30] Jha ,B.,Gontia,I. and Hartmann,A.(2011). the roots of halophytes *Salicornia brachiata* are a source of new halotolerant diazotrophic bacteria with plant growth – promoting potential, *Plant Soil* , Regular article, 1-13.
- [31] Kirtikar, K. R. and Basu, B .D. (1918). Indian Medicinal Plants, I-IV, International Book Distributors, Dehra Dun.
- [32] Mandal,M.,Dandapath,P.K. and Bhusan,S. (2013). Digha Sankarpur Littoral Tract – A Geographical case study, *Int.J. Applied & Humanities and Social Science Invention*, 2(4) :46-54.
- [33] Mukherjee, B.B. and Mukherjee,J.(1978). Mangroves of Sunderbans, India, *Phytomorphology*, 28(2): 217-229.
- [34] Naskar, K and Guha Bakshi, D. N. (1987). Mangroves swamps of the Sunderbans, Naya Prakash, Calcutta.
- [35] Prain, D (1963). Bengal Plants (Vol-I , II), Bishen Singh and Mahendra Pal Singh, Dehradun. Revised Edn, BSI, Kolkata
- [36] Rao,T.A.,Sastry , A.R.K. (1974). An Ecological approach towards classification of Coastal Vegetation of India –II, Estuarine vegetation , *ibid.* 100:438-452.
- [37] Rimer, D .N. (1984). Introduction to Fresh water vegetation, AVI Publishing Company, INC, Westport, Connecticut.
- [38] Sanyal , P. Banerjee,L.K. and Chowdhury,M.K. (1984). Dancing Mangals of Indian Sunderbans , *Jour. Ind. Soc. Coastal Agri. Res.* 2(1): 10-16.
- [39] Waheed Khan ,M.A. (1959). Ecological studies on the mangrove forests in India, In. Proc. Mangs. Symposium, Faridabad, 97-113.
- [40] Das, D and Ghosh, P (2017). Some important Medicinal Plants used widely in Southwest Bengal, *IJESI*, 6(6): 28-50.
- [41] Das, D and Ghosh, P (2018). Ecosystem study on some plants of Coastal Purba Medinipur, *IJSART*, 4(11): 102-106.
- [42] Das, M and Das, D (2019a). Medicinal plants of home gardens in Hijli coast of Purba Medinipur in West Bengal, *IJSART*, 5(5): 840-846.
- [43] Das, M and Das, D (2019b). Study of phyto diversity and conservation aspects on private nursery at coastal Purba Medinipur, *IJSART*, 5(6): 621-629.
- [44] Das, M and Das, D (2019c). Study of Government gardens at Forest beats in Coastal Purba Medinipur of West Bengal, *IJSART*, 5(7): 67-75.