VEGETATION OF THE FLOOD PLAINS OF RIVER INDUS NEAR ATTOCK KHURD, PUNJAB, PAKISTAN

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Abstract

The unstable sites were dominated by different sets of early colonizers largely depending upon the availability of moisture and the coarser fraction of soil. In moderately wet new alluvial lands, *Saccharum spontaneum* was the leading dominant; on relatively drier sites, *Astragalus graveolens* took the lead over; and in more wet habitats, *Salvia-Polypogon* community dominated the scene. The stable land was dominated by *Cynodon-Imperata* community representing a relatively advanced stage of succession.

Introduction

The erosive force of a stream is directed against the valley sides and in this way flat valley floor begins to develop. In the periodic down-cutting, a portion of the last-formed valley floor is stranded as a shelf-like terrace along the sides and in this way a series of terraces of varied ages but with closely similar habitats are produced. The youngest members in the series are the sand and gravel bars which are deposited at water level on the side of each meander loop. The flood plains are the benches which lie slightly higher but still low enough to be inundated at high water periods. However, some terraces lie above the flood plains. All the members of the physiographic series are of similar mineralogic composition but texture may vary considerably among the different subtending layers. A series of habitats are thus produced which help in formulating a picture of sere originating long ago at the edge of the river when uppermost terrace was but a gravel bar, each successively higher level representing an advance vegetational development;

The vegetation of the flood plain is much influenced by the frequent change between erosion and deposition of land due to flooding and the changing course of the river (Becker, 1980). Tolerance to flood and moisture conditions are the primary sorting factors controlling the distribution of species in a flood plain (Bell, 1980). The vegetation of the flood plains of the rivers has been studied worldover (Bell & Johnson, 1974; Zozulin, 1977; Jackson & Lindauer, 1978; Evans, 1979; Becker, 1980; and Bell, 1980). In Pakistan, the studies have remained solely confined to the flood plains of river Indus. Qadri (1955) studied the riverain forests of Sind; Khan and Repp (1961) and Zeller and Beg (1969) carried out ecological survey of the riverain forests of Hyderabad region and Alizai and Naqvi (1976) undertook the study of

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the flood plain vegetation of river Indus near Dera Ismail Khan. All these studies were made on the sites located considerably downstream in plains. The site of the present study is located at least 240 km upstream from the nearest site studied previously.

The vegetation of flood plains of river Indus near Attock Khurd, located about 1.5 km upsteam from the point where it meets river Kabul, has been studied and reported in this paper. The research site lies at 72° 14′ east longitude and 33° 54′ north latitude in district Attock, Punjab.

Materials and Methods

On the basis of physiognomy of the vegetation, five stands were isolated; four stands are flooded each year, whereas the stand farthest from the main stream and located on a raised land had not been flooded since the last many years. All these stands are located within a span of 3 km on the southern bank of river Indus. The farthest stand was sampled by line intercept technique; whereas quadrat measuring 25 x 50 cm was used for sampling all other stands. The information on different parameters of plant community such as density, coverage and frequency was gathered and importance value of various species was calculated following Cox's method (1967). Daubenmire's technique (1959) was used for studying plant cover. The texture of the soil was determined by hydrometer method (Bouyoucos, 1936).

The nomenclature followed for the plants is that of Stewart (1972). The sampling was done in April, 1985 and 1986.

Results and Discussion

Stands 1, 2, 3 and 4 were purely temporary and their existence depended solely on the extent of flooding. In flood periods they are submerged and the vegetation is completely washed away. The stands differed in the degree of moistness although the soil is predominantly sandy in all the stands (Table 1). These stands supported unstable vegetation largely comprising annuals. Stand 5 is the farthest stand from the main stream and is located on raised land; it supports relatively stable vegetation.

In the vegetational setup 62 species were identified from 57 genera and 33 families. The flora was dominated by the family Compositae which contributed 16 percent of the total species.

Table 1

Characteristics of Stands

Stands	Soil Fractions			Soil type	Status of stand	Flooding frequency
	Sand %	Silt %	Clay %			
1.	82.8	5.6	11.6	Sand	Temporary	Annually flooded
2.	83.2	6.3	10.5	Sand	Temporary	Annually flooded
3.	84.1	5.7	10.2	Sand	Temporary	Annually flooded
4.	68.5	17.6	13.6	Sandy loam	Temporary	Annually flooded
5.	67.8	18.6	13.6	Sandy loam	Stable	Not flooded for 8—10 years

Vegetational Setup

Stand 1 was closest to the main stream and was physiographically a gravel bar comprising gravel, pebbles of varying sizes and a smaller proportion of sand. The site was the first to submerge in flood periods. The land was low-lying and there had been a lot of moisture in the soil. It was dominated by *Saccharum spontaneum* which was found in small clumps accumulating sand around it and was dispersed uniformly (Table 2). *S. spontaneum* was more abundant on the edges of the area possessing thicker deposits of sand. Incidently *S. spontaneum* alongwith *S. bengalense* was found to be a pioneer species in the flood plains of river Indus at Rajri near Hyderabad (Khan & Repp, 1961). It was considered an early colonizer also in the riverain forests of Sind (Qadri, 1955) and in the flood plains of Indus at Dera Ismail Khan (Alizai & Naqvi, 1976). A vast majority of species inhabiting stand 1 were the annuals having waterborne disseminules which are left behind on the surface each year when the flood water recedes. These plants were well at home on this coarse substrate despite its high water table and frequent inundation and thus represented the pioneer stage. Besides annuals, the only woody perennial found growing was *Salix denticulata*; still some other woody species which were very rare were *Ricinus communis*, *Morus nigra* and *Dodonaea viscosa*. *Populus*, an early colonizer of the flood plains of Indus (Qadri, 1955; and Khan & Repp, 1961), was significantly absent either due to severe competition from *S. spontaneum* or lack of seed source in the vicinity.

In all there were 29 annuals which were all very rare.

Stand 2 was low-lying and contained a lot of moisture. The sand fraction in the soil was about 83 percent and the water table was high lying at a depth of 25 cm. It comes under water annually in flood periods and is thus inundated. The area was inhabited by *Salvia-Polypogon*

P. plebejum	+	+	—	—	—
Polypogon monspeliensis	—	105	—	—	—
Prosopis juliflora	—	—	—	—	4
P. spicegera	—	—	—	—	+
Psammogeton biternatum	4	—	—	+	—
Pulicaria crispa	—	—	—	—	+
Ricinus communis	+	—	—	—	—
Rumex dentatus	+	—	—	+	—
Saccharum spontaneum	189	+	70	227	25
Salix acmophylla	—	+	—	—	—
S. denticulata	7	—	—	—	—
Salvia plebeia	+	190	—	+	—
Scirpus maritimus	—	+	—	—	—
Silene apetala	+	—	—	—	—
Solanum xanthocarpum	—	—	—	—	+
Spergula arvensis	—	+	—	—	—
Suaeda fruticosa	—	—	—	+	—
Tamarix dioica	—	—	—	22	35
Thymelaea passerina	—	—	—	—	+
Verbascum thapsus	—	—	—	—	+
Verbena officinalis	+	—	—	26	+
Xanthium strumarium	+	—	—	+	+

+ = very rare ; — = absent.

Stand 3 was located on raised land at a distance of about 200 m from the main stream and was sufficiently dry. The soil comprises 84 percent of sand with a layer of almost pure sand left on top due to erosion of finer fraction by fast blowing wind. The area is sloping and is flooded each year. It was found inhabited by *Astragalus graveolens* and *Saccharaum spontaneum*, the former being the leading dominant. The area was dry and wind-eroded and these two factors had limited the number of inhabiting species. Both the dominant species can withstand drought and have significantly checked the erosion.

Stand 4 was situated on a raised land at a distance of about 800 m from the main stream. The area was sufficiently dry, the water table was low and the soil was sandy loam (Table 1). It is flooded and consequently inundated each year. *Saccharum spontaneum*, a plant common on islands in the streams and along their banks (Stewart, 1972), dominated the site exclusively (Table 2). Most of the plants inhabiting the area possessed long roots. A very small specimen of *Tamarix dioica* measuring about 12 cm above the ground was found possessing a tap root more than 40 cm long. Some 50—90 cm tall plants of *T. dioica* were found growing in a sandy depression on the sloping edges of the area; they seemed to be the relict of the last year's vegetation which escaped ravage by flood water because of their deep root systems. *S. spontaneum* and *Atsragalus graveolens* had effectively checked the erosion which was evinced by the soil accumulated around their bases forming mini-mounds. The roots of *Verbena officinalis* possessed small tubers of the size of pea seed and water oozed out from them when pressed between the fingers and the thumb. The wind-borne disseminules of *Dodonaea viscosa* and *Dalbergia sissoo* were found lying at places.

There were 23 very rare species recorded here.

Stand 5 has not been flooded since the past many years. The sandy loam soil was firmly held by the vegetation and in spite of fastblowing wind almost no erosion occurred. In low water stage and also in low flood periods, the river water flows on either side of this stand. The signs of grazing were evident and the large clumps of *Saccharum spontaneum*, cut at ground lavel, also hinted at human interference.

The site was inhabited by *Cynodon-Imperata* community dominated by *Cynodon dactylon* and *Imperata cylindrica* var. *major* (Table 2). The dominance of the grasses may largely be attributed to the openness of the stand. The two grasses formed an almost complete cover which was only disturbed in places by *Tamarix dioica* and *Prosopis juliflora*. The soil had become considerably stable and the credit for that goes to these two grasses. The habitat was comparatively drier and under these conditions the deep rooted species could only survive. *T. dioica* and *P. juliflora* send out their roots deep to tap the moisture from lower layers of the soil. A few large specimens of *P. juliflora* assuming the stature of tree were found growing in places. The number of very rare species was 28.

Successional Trends

The species composition seems to be governed by a number of factors such as water table, soild texture and the extent and the frequency of flooding. In all stands, except stand 5, the