Phytological Study of Freshwater Wetland Ecosystem of Bajwat Area

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PHYTOLOGICAL STUDY OF FRESHWATER WETLAND ECOSYSTEM OF BAJWAT AREA

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ABSTRACT

Freshwater wetlands are individual ecosystems that support a variety of wildlife, vegetation and microscopic life. The type of plants that exist in these areas describe the physico-chemical characteristics of their locality and vice-versa. This study was carried out at Marala wetlands in Bajwat Game Reserve. The study found 39 species of higher plants in the areas of the wetland and its associated terrain. The total species were arranged into 5 vegetation types, named on the basis of the dominant plant species, with their own composition of the species and present in different habitat conditions. The vegetative community Phragmites karka constituted an association of 8 plant species; Juncellus laevigatus had 10, Typha angustata had 13, Aeluropus lagopoides and Cyprus comylomeratus had 9 species each.

Keywords: Acacia nilotica, Aloe vera, vegetation, freshwater, wetland

INTRODUCTION

Various aspects of wetland plants have been previously studied. Most studies however, revolve around the trace element uptake of plants in wetland areas (Weis and Weis, 2004; Zayed et al., 1998; Zhu et al., 1999). Freshwater wetlands are individual ecosystems that support a variety of wildlife, vegetation and microscopic life. The type of plants that exist in these areas describe the physico-chemical characteristics of their locality and vice-versa. The a-biotic factors influence the type and population size of the flora existing near the wetland area (Dawson, 2003). Beecher (1942) found a correlation between physical characteristics of wetlands vegetation and aquatic birds.

MATERIALS AND METHODS

This study was carried out at Marala wetlands in Bajwat Game Reserve from October, 2000 to September 2001. Three rivers (River Jammu Tawi, River Chenab and Manawar Tawi) were focused. River Jammu Tawi, with associated marshes, supports extensive reed beds and an abundant growth of submerged and floating vegetation, and in the first river, while going towards Bajwat. The marshy area of River Chenab in the study had aquatic and riverine forest vegetation. The Manawar Tawi is full of aquatic vegetation floating, submerged and riverine forest.
RESULTS

Table 1. Distribution of different plant species between vegetation types identified at Bajwat area during 2000-2001 (A=Jammu Tawi, B=Chenab, C=Manawar Tawi)

| Species                  | Phragmites karka | Juncellus laevigatus | Typha angustata | Aeluropus lagopoides | Cyperus conglomerates |
|--------------------------|------------------|----------------------|-----------------|----------------------|-----------------------|
|                          | A    | B    | C    | A    | B    | C    | A    | B    | C    | A    | B    | C    |
| Oryza sativa             | +    | +    | +    |       |       |       |       |       |       |       |       |       |
| Panicum colonum          | +    | +    |       |       |       |       |       |       |       |       |       | +    |
| Cymbopogan citratus      |       |       |       | +     |       |       |       |       |       |       |       |       |
| Launia nodicoulis        |       |       |       |       | +     |       |       |       |       |       |       |       |
| Heliochloa schenoids     |       |       |       |       |       | +     |       |       |       |       |       |       |
| Juncellus laevigatus     |       |       |       |       |       |       | +     |       |       |       |       |       |
| Convolvulus arvensis     |       |       |       |       |       |       |       | +     |       |       |       |       |
| Phragmites karka         | +    | +    | +    | +    |       |       |       |       |       |       |       |       |
| Muestbia laevis          |       |       |       | +    | +    | +    |       |       |       |       |       |       |
| Cyperus                  |       | +    | +    | +    |       |       |       |       |       |       |       |       |
| conglomratus             |       |       |       |       | +    | +    |       |       |       |       |       |       |
| Alhagi mourorum          |       | +    | +    | +    |       |       |       |       |       |       |       |       |
| Cynodon dactylon         |       |       |       |       | +    | +    |       |       |       |       |       |       |
| Triticum indicum         |       |       |       |       |       |       | +     |       |       |       |       |       |
| Andropogan sorghum       |       | +    | +    |       |       |       |       | +     |       |       |       |       |
| Trifolium species        |       |       |       |       |       |       |       |       | +     | +     |       |       |
| Typha latifolia          |       |       |       |       |       |       |       |       |       |       | +    |       |
| Typha angustifolia       |       |       |       |       |       |       |       |       |       | +     | +    |       |
| Pistia stratiotes        |       |       |       |       |       |       |       |       |       | +     |       |       |
| Caren aleneria           |       |       |       |       |       |       |       |       |       |       |       | +    |
| Cyperus difformis        |       |       |       |       |       |       |       |       |       |       |       |       |
| Cynodon dactylon         |       |       |       |       |       |       |       |       |       |       | +    |       |
| Saccharum arundinaceum   |       |       |       |       |       |       |       |       |       | +     | +    | +    |
| Name of Species                  | Phragmites karka | Juncellus laeviagatus | Typha angustata | Aeluropus lagopoides | Cyprus conglomerates |
|----------------------------------|------------------|-----------------------|----------------|---------------------|---------------------|
|                                  | A     | B     | C     | A     | B     | C     | A     | B     | C     | A     | B     | C     |
| Saccharum munja                  | +     | +     | +     |        |        |       |        |        |       |        |        |       |
| Nelumbium speciosum              | +     | +     | +     |        |        |       |        |        |       |        |        |       |
| Nelumbium nucifer                |        |        |       |        |        |       |        |        |       |        |        |       |
| Nymphaea lotus                   |        |        |       |        |        |       |        |        |       |        |        |       |
| Dicanthium annulatum             | +     |       |       |        |        |       |        |        |       |        |        |       |
| Cynoglossium sp.                 |        | +     | +     |        |        |       |        |        |       |        |        |       |
| Heliotropium sp.                 |        | +     | +     | +     |        |        |        |        |       |        |        |       |
| Scirpus meritimus                | +     |       |       |        |        |       |        |        |       |        |        |       |
| Arena sativa                     | +     |       |       |        |        |       |        |        |       |        |        |       |
| Seleria cereal                   |        |        |       |        |        |       |        |        |       |        |        |       |
| Melilotus parriflora             |        |        |       |        |        |       |        |        |       |        |        |       |
| Euphorbia prustrata              | +     | +     | +     |        |        |       |        |        |       |        |        |       |
| Dicanthium annulatum             |        | +     | +     | +     |        |       |        |        |       |        |        |       |
| Alhagi maurorum                  | +     |        |       | +     |        | +     |       |        |       |        |        |       |
| Avena sativa                     | +     | +     |       |        |        |        |        |        |       |        |        |       |
| Pennisetum typhoidicum           |        |        |       |        |        |        |        |        |        |        |        |       |
| Setereta italica                 |        |        |       |        |        |        |        |        |        |        |        |       |
Table 2. Relative abundance of different plant species observed at Jammu Tawi during different seasons (Months)

| Season | Winter | Spring | Summer | Autumn |
|--------|--------|--------|--------|--------|
|        | Nov    | Dec    | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    |
| Cynodon dactylon  | +  | +  | +  | ++  | +++  | +++  | +++  | +++  | +++  | +++  | +++  | +++  |
| Dicanthium annulatum  | -  | -  | -  | +  | +  | +  | +  | +  | -  | -  | -  | -  |
| Acacia nilotica  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  |
| Alhagi morurum  | +  | +  | -  | +++  | +++  | +  | +  | ++  | +++  | ++  | +++  | ++  |
| Cyprus conglomeratus  | +  | +  | -  | +++  | +++  | +  | +  | ++  | +++  | ++  | +++  | ++  |
| Euphorbia prostrata  | ++  | ++  | ++  | ++  | ++  | -  | -  | +  | ++  | ++  | ++  | ++  |
| Mnesthia laevis  | +  | +  | -  | +  | +  | +  | +  | +  | +  | +  | +  | +  |
| Aeluropus lagopoides  | +  | +  | +  | +  | +  | +  | +  | +  | ++  | +  | +  | +  |
| Heliotropium sp.  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  |
| Phragmites karka  | +  | +  | +  | ++  | ++  | -  | -  | +++  | +++  | +++  | +++  | ++  |
| Juncellus lavigatus  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  |
| Arundo donan  | ++  | -  | -  | ++  | ++  | ++  | +++  | +++  | +++  | ++  | ++  | ++  |
| Aloe vera  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  |
| Ashpodelus tenufolms  | +  | -  | -  | +  | +  | +  | -  | +  | +  | +  | +  | +  |
| Typha angustata  | +  | ++  | +++  | +++  | ++  | +  | +  | +  | +  | +  | +  | +  |
| Typha latifolia  | ++  | +  | -  | ++  | ++  | ++  | ++  | ++  | ++  | +++  | +++  | +++  |
| Typha angustifolia  | +  | +  | -  | -  | -  | -  | ++  | ++  | ++  | ++  | ++  | ++  |

| Season | Winter | Spring | Summer | Autumn |
|--------|--------|--------|--------|--------|
|        | Nov    | Dec    | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    |
| Arum macudatum  | +  | +  | -  | -  | +  | +  | -  | -  | +  | +  | +  | +  |
| Arisaem helliborifolium  | +  | +  | -  | -  | +  | +  | -  | -  | +  | +  | +  | +  |
| Plant Species          | Winter | Spring | Summer | Autumn |
|------------------------|--------|--------|--------|--------|
|                         | Nov    | Dec    | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    |
| *Pistia stratiotes*    | ++     | ++     | +      | +      | +      | +      | +      | -      | +      | +      | +      | +++    |
| *Carex alenaria*       | ++     | ++     | +      | +      | +      | +      | ++     | +++    | +++    | +++    | +++    | +++    |
| *Cyperus difformis*    | +      | -      | -      | -      | ++     | +++    | -      | -      | -      | -      | -      | +      |
| *Avena sativa*         | -      | ++     | ++     | +++    | +++    | -      | -      | -      | -      | -      | -      | -      |
| *Atriplex vulgare*     | +      | +      | -      | -      | ++     | +++    | +      | +      | +++    | +++    | +++    | +++    |
| *Oryza sativa*         | +++    | -      | -      | -      | -      | +      | +++    | +++    | +++    | +++    | +++    | +++    |
| *Paricurus colanum*    | ++     | ++     | -      | -      | ++     | +++    | +      | +++    | +++    | +++    | +++    | +++    |
| *Calamagrostis epigeios* | +      | +      | +      | +      | ++     | +++    | +      | +      | +++    | +++    | +++    | +++    |
| *Saccharum arundinaceum* | +     | +      | +      | +      | ++     | +++    | +      | +      | +++    | +++    | +++    | +++    |
| *Setaria italica*      | -      | ++     | ++     | +++    | +++    | ++     | -      | -      | -      | -      | -      | -      |
| *Cymbopogon citratus*  | +      | +      | ++     | ++     | ++     | +      | -      | -      | +      | +      | +      | ++     |
| *Agave americana*      | +      | -      | -      | -      | ++     | ++     | -      | ++     | ++     | ++     | ++     | +      |
| *Cannabis sativa*      | -      | -      | -      | -      | -      | +      | +++    | +++    | +++    | +++    | ++     | ++     |

| Season    | Winter | Spring | Summer | Autumn |
|-----------|--------|--------|--------|--------|
| *Urtica dioica* | +      | +      | -      | -      |
| *Euphorbia prostrata* | +      | +      | +      | +      |
| *Euphorbia rogleana* | +      | +      | +      | +      |
| *Euphorbia heliscolia* | +      | +      | +      | +      |
| *Jatropha curcos*    | +      | -      | -      | -      |
| *Croton tiglium*     | +      | +      | -      | -      |
| Plant Species          | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *Dalura alba*          | ++  | ++  | ++  | ++  | ++  | ++  | -   | -   | ++  | ++  | ++  | ++  |
| *Convolvulus arvensis* | ++  | ++  | ++  | -   | -   | ++  | ++  | ++  | +++ | +++ | ++  | ++  |
| *Cardia dictiotoma*    | +   | +   | +   | +   | ++  | +++ | +++ | +++ | ++  | +   | +   | +   |
| *Calolropis procera*   | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  |
| *Taraxacum Officinale*| -   | -   | -   | ++  | ++  | ++  | -   | -   | -   | -   | -   | -   |
| *Canthanus oxycantha*  | ++  | +   | +   | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  | ++  |
| *Nelumbium speciosum*  | -   | -   | -   | -   | -   | -   | +   | +++ | +++ | +++ | ++  | ++  |
| *Nelumbium nucifera*   | ++  | -   | -   | -   | -   | -   | ++  | +++ | +++ | +++ | +++ | +++ |
| *Nelumbium lotus*      | ++  | -   | -   | -   | -   | -   | ++  | +++ | +++ | +++ | +++ | +++ |
| *Triticum indicum*     | +   | ++  | +++ | +++ | ++  | ++  | ++  | ++  | -   | -   | -   | -   |

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| Plant Species       | Winter | Spring | Summer | Autumn |
|---------------------|--------|--------|--------|--------|
| **Urtica dioica**   | +      | +      | +      | -      | +      |
| **Trifolium species** | +++    | +++    | +++    | ++     | -      | -      | -      | ++    |
| **Erianthus murya** | +      | -      | -      | ++     | ++     | +++    | +++    | +++    | ++    |
| **Saccharum spontaneum** | ++    | +      | -      | ++     | +++    | +++    | +++    | ++     |
| **Vallisneria spiralus** | +   | +      | -      | +      | +      | +      | +      | +      | ++    |
| **Hydrilla verticillata** | ++    | +      | -      | +      | +      | +      | +      | +      | ++    |
| **Lamina minor**    | ++     | ++     | ++     | ++     | ++     | -      | -      | -      | -     | ++    |

Key: +:- Present ++:- Common +++:- Abundance

Table 3. Relative abundance of different plant species observed at Chenab during different seasons (Months)
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| Plant Species         | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *Lounia nodicanlis*   | +   | +   | -   | -   | -   | +   | -   | -   | -   | +   | -   | -   |
| *Ashpodelus tenuifolius* | +  | -   | -   | -   | -   | +   | +   | -   | +   | +   | +   | +   |
| *Typha lotifolia*     | ++  | +   | -   | -   | +   | ++  | ++  | +++ | +++ | ++  | +++ | +++ |

**Season**

| Plant Species         | Winter | Spring | Summer | Autumn |
|-----------------------|--------|--------|--------|--------|
| *Typha angustifolia*  |         |         | +      | +      |
| *Carven alenaria*     | +++    | +      | +      | +      |
| *Cyperus difformis*   | +      | -      | -      | +      |
| *Avena sativa*        | -      | +++    | +++    | +      |
| *Arundo donan*        | +      | -      | +      | +      |
| *Setaria cereale*     | -      | +      | +      | +++    |
| *Saccharum arundinaceum* | +++ | -      | -      | +++    |
| *Saccharum munja*     | ++     | -      | +      | +++    |
| *Cymbopogan citrates*| +      | +      | -      | +++    |
| *Agave Americana*     | +      | +      | +      | +++    |
| *Cannabus saliva*     | +      | -      | -      | +      |
| *Urtica dioca*        | +      | +      | -      | +      |
| *Jatropha curcas*     | +      | -      | -      | +      |
| *Crotum tiglium*      | +      | -      | -      | +      |
| *Amaranthus viridis*  | +      | +      | -      | +      |
| *Achyranthis aspera*  | ++     | +      | +      | ++     |

**Season**

| Plant Species         | Winter | Spring | Summer | Autumn |
|-----------------------|--------|--------|--------|--------|
| *Lounia nodicanlis*   | +      | +      | -      | -      |
| *Ashpodelus tenuifolius* | +  | -      | -      | -      |
| *Typha lotifolia*     | ++     | +      | -      | -      |
| Species                  | ++ | ++ | ++ | ++ | ++ | +  | -  | -  | -  | -  | ++ |
|-------------------------|----|----|----|----|----|----|----|----|----|----|----|
| *Clunopodium album*     |    |    |    |    |    |    |    |    |    |    |    |
| *Chenopodium murale*    | ++ | ++ | ++ | ++ | ++ | +  | -  | -  | -  | -  | ++ |
| *Verbascum thapsus*     | +  | +  | +  | ++ | ++ | ++ | ++ | -  | -  | +  | +  |
| *Solanum sp.*           | ++ | +  | +  | ++ | +++ | +++ | ++ | +++ | ++ | ++ | ++ |
| *Datura alba*           | ++ | ++ | ++ | ++ | ++ | ++ | -  | -  | -  | -  | ++ |
| *Calotropis procera*    | ++ | ++ | ++ | ++ | ++ | ++ | +++ | +++ | +++ | +++ | ++ |
| *Taraxacum officinale*  | -  | -  | -  | +++ | ++ | ++ | -  | -  | -  | -  | -  |
| *Cichorium intibus*     | +  | +  | -  | -  | +  | +  | +  | -  | -  | +  | +  |
| *Nelumbium speciosum*   | -  | -  | -  | -  | -  | -  | +  | +++ | +++ | +++ | ++ |
| *Nelumbium species*     | ++ | +++ | +++ | +++ | +++ | ++ | +  | -  | -  | -  | -  |
| *Trifolium species*     | ++ | +++ | +++ | +++ | +++ | ++ | -  | -  | -  | -  | -  |
| *Oryza saliva*          | +  | -  | -  | -  | -  | -  | -  | -  | ++ | +++ | +++ | +++ | ++ |
| *Andropogon sorghum*    | +  | +  | -  | +  | +  | +  | -  | -  | -  | +  | +  | +  |
| *Pistia stratiotus*     | +++ | ++ | +  | +  | +  | -  | +  | ++ | ++ | +++ | +++ | +++ |
| *Triticum indicum*      | +  | ++ | ++ | +++ | ++ | ++ | +  | -  | -  | -  | -  |
| *Juncellus larvigalus*  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  | +  |

Key: +: Present  ++: Common  +++: Abundance
Table 4. Relative abundance of different plant species observed at Manawar Tawi during different seasons (Months)

| Season | Winter | Spring | Summer | Autumn |
|--------|--------|--------|--------|--------|
| Plant Species | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct |
| Alhagi maurorum | - | - | - | +++ | +++ | - | - | ++ | +++ | +++ | +++ | +++ |
| Cyprus conglomerates  | - | - | - | +++ | +++ | - | - | ++ | +++ | +++ | +++ | +++ |
| Mnasthia laevis | + | + | + | + | + | + | + | + | + | + | + | + |
| Acacia nilotica | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
| Juncellus lavegatus | + | + | + | + | + | + | + | + | + | + | + | + |
| Cynodon dactylon | + | + | + | + | + | + | + | + | + | + | + | + |
| Trianthema crystalina | - | + | - | + | + | + | + | + | - | - | + | - |
| Heliotropium sp. | - | - | - | + | + | - | - | - | + | - | - | + |
| Heliotropium sp. | - | - | - | + | + | + | - | - | + | - | - | + |
| Heliochloa schenoides | + | - | - | + | + | + | - | + | + | + | + | + |
| Phragmites karka | ++ | +++ | +++ | +++ | + | - | - | - | - | + | + | + |
| Brassica campestris | - | +++ | +++ | +++ | + | - | - | - | - | ++ | - | + |
| Cynoglossium sp. | - | +++ | +++ | +++ | + | - | - | - | - | +++ | + | + |
| Typha angustata | + | + | + | + | + | + | + | + | + | + | + | + |
| Aeluropus lagopoides | + | + | + | + | + | + | + | + | + | + | + | + |
| Dicanthium annulatum | - | + | - | + | + | + | + | + | + | + | + | - |
| Trianthema monogyna | - | - | - | - | - | - | + | +++ | +++ | + | + | + |
| Zizyphus mauritiana | + | + | - | + | + | + | + | + | + | + | + | + |
| Antrogrophis pancreolata | ++ | +++ | +++ | +++ | + | + | + | + | + | + | + | + |

| Season | Winter | Spring | Summer | Autumn |
|--------|--------|--------|--------|--------|
| Plant Species | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct |
| Aloevera sp. | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Asphodelus tenuifolius | + | + | - | ++ | ++ | - | - | ++ | ++ | ++ | ++ | + |
| Plant Species                  | Winter     | Spring    | Summer    | Autumn    |
|-------------------------------|------------|-----------|-----------|-----------|
| **Commilina benghalensis**    | +          | +         | -         | -         |
| **Tradescantia virginia**     | +          | +         | -         | -         |
| **Typha latifolia**           | +          | +         | -         | -         |
| **Arum maculatum**            | +          | +         | -         | -         |
| **Arisaem helliborifolium**   | +          | +         | +         | +         |
| **Psitia striatiotes**        | +          | +         | +         | +         |
| **Caren alenaria**            | +          | -         | -         | -         |
| **Cyperus difformis**         | -          | +         | +         | +         |
| **Aicena sativa**             | +          | -         | +         | +         |
| **Arundo donax**              | +          | -         | -         | -         |
| **Jatropha curcus helinobia**  | +          | -         | -         | -         |
| **Saccharum arundinaceum**    | +          | +         | +         | +         |
| **Setaria ceareale**          | +          | +         | +         | +         |
| **Setaria italica**           | +          | -         | +         | +         |
| **Saccharum munja**           | -          | -         | -         | -         |
| **Cannabis sativa**           | -          | -         | +         | +         |
| **Urtica dioica**             | +          | +         | +         | +         |
| **Season**                    | Winter     | Spring    | Summer    | Autumn    |
| **Nov**                       | +          | +         | +         | +         |
| **Dec**                       | +          | +         | +         | +         |
| **Jan**                       | +          | +         | +         | +         |
| **Feb**                       | +          | +         | +         | +         |
| **Mar**                       | +          | +         | +         | +         |
| **Apr**                       | +          | +         | +         | +         |
| **May**                       | +          | +         | +         | +         |
| **June**                      | +          | +         | +         | +         |
| **July**                      | +          | +         | +         | +         |
| **Aug**                       | +          | +         | +         | +         |
| **Sep**                       | +          | +         | +         | +         |
| **Oct**                       | +          | +         | +         | +         |

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| Plant Species                  | Winter | Spring | Summer | Autumn |
|-------------------------------|--------|--------|--------|--------|
| **Euphorbia sp.**             | +      | +      | +      | +      |
| **Jatropha curcus helinobia**  | +      | -      | +      | +      |
| Species                     | +   | +   | +   | -   | +   | +   | -   | -   | +   | +   | +   | +   |
|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Crotam tiglium              |     |     |     |     |     |     |     |     |     |     |     |     |
| Zizyphus nummularia         | -   | -   | -   | -   | -   | -   | +   | +   | +++ | +++ | +++ | ++  |
| Picinus communis           | +++ | +++ | +++ | +++ | +++ | +++ | -   | -   | -   | -   | -   | -   |
| Achyranthus aspera         | +++ | +   | +   | +   | +   | +   | +   | +   | +++ | ++  | ++  | ++  |
| Amarantus viridis          | +++ | +++ | +++ | +++ | +++ | +++ | -   | +   | +++ | +++ | +++ | ++  |
| Viten negundo              | +   | -   | -   | ++  | ++  | ++  | +   | -   | -   | -   | -   | ++  |
| Verbascum thapsus          | -   | +++ | +++ | +++ | +++ | +++ | +   | -   | -   | -   | -   | -   |
| Solanum sp.                | +++ | +   | +   | +++ | +++ | +++ | +   | +   | +++ | ++  | ++  | ++  |
| Capucium annum             | -   | -   | -   | +   | +   | +   | +   | +   | +++ | +++ | +++ | -   |
| Datura alba                | +++ | +++ | +++ | +++ | -   | -   | -   | +   | +++ | ++  | ++  | ++  |
| Cardia dictiotona          | +   | +   | +   | +   | +++ | +++ | +++ | +++ | +   | +   | +   | +   |
| Calotropis proceroides     | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++  | ++  | ++  |
| Taranacum officinale       | -   | -   | -   | +   | +   | +   | +   | +   | -   | -   | -   | -   |
| Cichorium intibus          | +   | -   | -   | +   | +   | +   | -   | -   | +   | +   | +   | +   |
| Canthanus oxycantha        | ++  | ++  | -   | -   | ++  | ++  | -   | -   | -   | +   | +   | +   |
| Nelumbium speciosum        | -   | -   | -   | -   | -   | +   | +++ | +++ | +++ | ++  | ++  | ++  |
| Nelumbium nucifera         | +++ | -   | -   | -   | -   | +   | +++ | +++ | +++ | +++ | +++ | +++ |
| Nelumbium lotus             | +++ | -   | -   | -   | -   | -   | +   | +++ | +++ | +++ | +++ | +++ |
| Cardia obliqua              | +   | +   | -   | -   | +   | +   | +   | +   | +   | +   | +   | +   |

Key: +:- Present  ++:- Common  +++:- Abundance
DISCUSSION

The data on the prevalence of different species of higher plants has been presented in the Table 5 (the total data on seasonal prevalence of these species has been presented in the appendix-B). The results suggest that a total of 39 species of higher plants were present in the areas of the wetland and its associated terrain. The total species can be arranged into 5 vegetation types, named on the basis of the dominant plant species, with their own composition of the species and present in different habitat conditions.

**Phragmites karka:** The vegetative community constituted an association of 8 plant species. The community was dominated by *P. karka* which was widely present. The dominant species was associated with 7 other species i.e., *Oryzativa sp.*, *Panicum colonum*, *Cymbopogan citratus*, *Launia nodicoulis*, *Heliechloa schenoids*, *Tuncellus laevigatus* and *Convolvulus arvensis*. The community was present in the shallow water pond area associated with the main river system, and was widely distributed along the main river system.

**Juncellus laevigatus:** The vegetative type represents in association of 10 different plant species where *J. laevigatus* dominated. The dominant species was associated by 8 other plant species, i.e., *Euphorbia prostrata*, *Cynodon dachylon*, *Dicanthium annulatum*, *Alhagi maurorum*, *Avena satira*, *Pennisetum byphadicum*, *Seteria italica* and *S. cereal*. This vegetative type was present in the open terrestrial tracks where the moisture content is comparatively low and was widely present in the open areas associated with the main wetland system.

**Typha angustata:** This vegetative community, apart from the dominant species i.e., *T. angustata*; was represented by 12 more species viz., *Typha lotifolia*, *Typha angustofolia*, *Pistia stiatiotes*, *Caren aletunia*, *Cypercy diffomis*, *Cynodon dactylon*, *Saccharum alundinaceum*, *Phragmites karka*, *Saccharum munja*, *Nelumbium speciosum*, *Nelumbium nucefer* and *Nymphaea lotus*. This vegetative community was present in the comparatively deeper waters and constituted the 1st line after the running water.

**Aeluropus lagopoides:** This community constituted a vegetative association of 9 plant species, where *Aeluropus lagopoides* dominated. The dominant species was associated by 8 other plant species, i.e., *Dicanthium annulatum*, *Heliotropium sp.*, *Cynoglossium sp.*, *Scirpus meritimus*, *Avena satira*, *Seteria cereal*, *Trifolium sp.* and *Melilotus parriflora* which appear in different densities in different tracks. The vegetation type was mainly present in the areas associated with the wetland system with high moisture conditions.

**Cyprus comylomeratus:** The vegetative type was an association between 9 different species where *Cyprus comylomeratus* played a dominant role. The dominant species was associated with 8 more plant species, i.e., *Euphorbia prostrata*, *Cynodon dachylon*, *Dicanthium annulatum*, *Alhagi maurorum*, *Avena satira*, *Pennisetum byphadicum*, *Seteria italica* and *S. cereal*. This vegetative type was present in the open terrestrial tracks where the moisture contents is comparatively low and was widely present in the open areas associated with the main wetland system.

Walker (1968), Jahn and Moyle (1964) and Whitman (1976) attributed decreased habitat heterogeneity, caused by disruption of natural ecological processes, resulting in domination by tall robust hydrophytes, such as, *Scirpus caren*, *Typha salin* and *Phragmites sp.*
Linde et al. (1979) reported that Typha sp. is well adapted to form monotypes. Typha seeds germinate under a wide range of water depths (Weller, 1975) and tolerate a wide range of soil types (Dean, 1933). Typha sp. occurs late in the growing season. This plant is competitive advantage over other species is probably enhanced (Davis and Van der Valk, 1978).

Danell and Sjoberg (1979) reported that various emergent species may decompose at different rates as the result of differences in species composition of macro-invertebrate populations which may remove some of the decompose organisms that could act to maintain or increase vegetative heterogeneity.

CONCLUSION

The study found 39 species of higher plants in the areas of the wetland and its associated terrain. The total species were arranged into 5 vegetation types, named on the basis of the dominant plant species, with their own composition of the species and present in different habitat conditions. The vegetative community Phragmites karka constituted an association of 8 plant species; Juncellus laevigatus had 10, Typha angustata had 13, Aeluropus lagopoides and Cyprus comylomeratus had 9 species each.

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