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VEGETATION CHANGES WITH FALLING WATER LEVELS IN THE

DELTA MARSH MANITOBA

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ABSTRACT

Quantitative studies have been made on the vegetation of the fresh-water marsh at Delta, Manitoba, under falling water levels, from 1959 to 1961. Twenty widely distributed sites in the 15,000 hectare marsh were studied in detail. Twenty-seven prevalent species were found of which thirteen had a presence rating between 100% and 65%. Included in this group, in diminishing presence order, were: Phragmites communis var. berlandieri, Scolochloa festucacea, Atriplex patula, Chenopodium rubrum, Sonchus arvensis var. glabrescens, Aster brachyactis, Rumex maritimus var. fueginus, Carex atherodes, Hordeum jubatum, Typha latifolia, Scirpus paludosus, Ranunculus sceleratus, and Scirpus validus. Ecological descriptions of these species are given, with particular reference to the part they played in succession, within a season and from one season to the next. Emphasis is placed on those species with the highest presence values, and two groups of 'selective' species are described - those restricted to low and high conductivity sites. Submerged aquatic vegetation is discussed briefly. The soils of the marsh are a complex of Peaty Saline Rego Humic Gleysols and Organo and Saline Regosols. Samples were collected from all the sites and analyzed for pH, conductivity, physical composition, and available cations and anions. Sodium, potassium, calcium, magnesium, carbonates, bicarbonates, sulphates and chlorides were analyzed quantitatively. Topographical relief at Delta is slight but physiographic processes are striking and their influence on the vegetation is discussed.

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SECTION I

INTRODUCTION

This study describes the vegetation of a freshwater marsh at Delta on the southern shores of Lake Manitoba, and the influence upon the marsh of falling water levels as areas denuded of vegetation were exposed.

Water levels in Lake Manitoba undergo periodic fluctuations which effect the marsh. The all-time high of 248.4 m (815 ft) in the lake was reached in 1955 and for three years it was higher than the mean of 247.4 m (812 ft) though it was slowly dropping throughout this period. Water levels were still receding when the major part of this study terminated in 1961.

The marsh covers 15,000 hectares (37,050 acres) and is an intricate network of various sized shallow bays of open water interconnected by channels, and separated by vegetation (Hochbaum, 1944). It is one of the most extensive in the Canadian prairies. Normally, the two most prevalent species in the marsh are Phragmites communis var. berlandieri and Scolochloa festucacea. These communities were described as Phragmition and Scolochloetum by Löve and Löve (1954). During 1958 the vegetation present in the marsh was described quantitatively (Walker, 1959) and the need for continuing the study clearly was indicated in order to follow the seral changes in the vegetation and to determine the role of ecological factors in these changes.

Innumerable studies of freshwater marsh vegetation, particularly of aquatics, have been undertaken by botanists and wildlife biologists. But, with notable exceptions, few of these have presented more than brief qualitative accounts of marsh vegetation, and none has originated in this region. It was in an attempt to fill this gap that the present work was undertaken.

An intrinsic part of vegetation study is concerned with the plants that are associated in communities, the latter having an observable structure and often a definite specific composition. Only the species adapted to a particular habitat will survive under the existing conditions. A full understanding of vegetation therefore draws upon autecological and community studies. Therefore, during 1959, 1960 and 1961 detailed investigations were made in a number of sites to determine the quantitative composition of the emergent plant communities and to describe the seral changes as water levels dropped. Landform is one of the basic influences on vegetation, and, though topographical relief at Delta is slight, physiographic processes are striking, and have an obvious influence on the vegetation.

This thesis has been organized into six sections. The first deals in turn with a description of the general setting of the area, its geology, soils, geography, and climate. Section two comprises descriptions of the vegetation of the Delta Marsh and its changes during falling water levels in selected marsh shores, potholes and sloughs. Also included is a discussion and analysis of empirical data and the resulting ecological descriptions of the most prevalent species. Section three consists of a general discussion of soils found in the marsh and descriptions of the soils from the study areas. Section four is a general discussion of the observations and results. It is followed by a section summarizing the work and a citation of literature. Appendix I gives plant lists and Appendix II the data from chemical analysis.

LITERATURE REVIEW

The study of freshwater marsh vegetation has attracted the attention of two groups of investigators - botanists and wildlife biologists. The majority of their accounts have been qualitative and those of wildlife biologists directed mainly towards management practices. They will be discussed here with no distinction between artificial and natural situations, because both contribute to our knowledge of the dynamics of the freshwater environment.

This review makes no pretense at being complete. It will be divided into the following parts although most of them are inter-related.

- (a) Definitions of the term marsh.
- (b) Studies relating to vegetation at Delta.
- (c) Freshwater marshes
 - (1) quantitative
 - (2) qualitative
 - (3) environmental
 - (i) bottom - soils, sedimentation, texture, catchment areas; (ii) chemical factors; (iii) light; (iv) water depth; (v) fluctuating water levels.
 - (4) dynamics

Literature relating to the prevalent species has been reviewed in the appropriate sections of this thesis. It was thought more meaningful to associate it with the specific topic, than to put it in the main literature review.

(a) Marsh

Many botanists have attempted to define the term marsh; and a selection of definitions was reviewed by Walker (1959). It included the following:

Needham and Lloyd (1916), Penfound (1953), Edelman and Staveren (1958), Tansley (1939) and Dansereau and Segadas-Vianna (1952). To these might be added the E.S.A. R1 and R2 (1935), Weaver and Clements (1938), Weaver (1960), Gorham (1953), Mason (1957), Curtis (1959) and others.

Different authors emphasize different criteria. Dansereau and Segadas-Vianna (1952) used physiography, physical and chemical conditions, vegetation and fauna and their treatment is more exhaustive than any of the others. However, the majority of definitions appear to be modifications of Tansley (1939) which is as follows:

A marsh is "A 'soil-vegetation type' in which the soil is waterlogged, the summer water level being close to, or confirming with, but not normally much above ground level, and in which the soil has an inorganic (mineral) basis. Marsh exists wherever mineral soil is waterlogged, irrespective of its origin, and where the relation of water level to soil level remains approximately stable, marsh may represent an edaphic climax. Marsh vegetation is commonly zoned around or along the edge of any permanent body of water, but if for any cause the soil surface is progressively built up above the water table (or the water table is lowered), so that the root systems of the plants are better aerated, the marsh gives way to a more completely terrestrial type-grassland, scrub or forest - and ultimately to the climatic climax.

Swamp is used for the type in which the normal summer water level is above the soil surface. It is usually dominated by reeds, Phragmites or by other tall grasses, sedges, and rushes".

(b) Studies relating to vegetation at Delta

A brief survey of aquatic plants in the important marsh areas of Manitoba, including Delta, was conducted by Hinks (1936). Hochbaum (1944, 1955) described the Delta Marsh in general terms, and referred to the alternating periods of drought and flooding, as did Sows (1955). Olson (1959) and Dillon (personal communication), made general comments relating to the vegetation of the Delta area. A floristic account of the marsh was provided by Löve and Löve (1954) and the status of its vegetation in 1958 was described by Walker (1959).

There have been few quantitative studies on freshwater marshes, although there are innumerable papers which allude to marsh vegetation. The majority of these has been concerned with aquatic vegetation in lakes and its relationship to the environment. This thesis describes the effects of falling water levels on a freshwater marsh and therefore literature relating to the various aspects of the marsh environment is relevant, even though it seldom draws from directly comparable physiographic conditions.

(1) Quantitative studies

A recent quantitative study relating to emergent aquatic plants was reported by Curtis (1959) in Wisconsin. He indicated the average structure of emergent species in southern cattail marshes by frequency and density and gave the prevalent species. Emergent aquatics were grouped into:

1. those with their optimum in soft water (50 ppm CaCO_3 or less)
2. those with their optimum in medium hard water (50 - 150 ppm CaCO_3)
3. those with their optimum in very hard water (150 ppm CaCO_3 or more)
4. those with no pronounced optimum

A quantitative study of submerged aquatic communities was undertaken at the same time by Natelson (1954) who recorded the frequency of species within uniform conditions of depth, substrate, and shoreline. Each stand was tested for homogeneity by statistical methods, and relationships between soil and water environment were plotted against the stand gradient and the resulting correlations discussed.

Earlier quantitative studies on the larger aquatic plants in various lakes in Wisconsin had been undertaken by Rickett (1921, 1922, 1924), who showed that some species grew better in shallow water, and others in deep water. Also in Wisconsin ecological factors and vegetation were investigated