INTRODUCTION

The calcareous fens of South Park, are one of the most important wetland resources in Colorado. These wetlands contain some fifteen state rare or endemic plant species, eleven rare invertebrate species and three regionally endemic vegetation types (Sanderson and March 1996). The fens form rich islands of biodiversity and unique habitat in the short grass steppe that surrounds them and perform important environmental functions such as water quality improvement and water storage. Fens take centuries to form and their losses are essentially irreparable. In recognition of these facts, the US Fish and Wildlife Service has elevated fens to a the most protected "Resource Category 1" and the US Army Corps of Engineers has exempted fens from the Nation Wide 26 permit coverage. Our knowledge of these systems is significantly disproportionate to their important in the ecosystem. This is primarily due to our recent discovery of the significant role that fens play on the landscape.

Fens are a type of peatland; that is, a wetland which accumulates undecomposed organic matter, called peat. Peat accumulates due to anaerobic conditions brought about by a high water table. There are two types of peatlands, bogs and fens. Bogs only receive moisture and nutrients from precipitation and dust. They are therefore termed ombrotrophic ("rain-fed"). Due to their ombrotrophy, they are extremely nutrient poor. Bogs are also highly acidic because of the chemical processes of the Sphagnum mosses which dominated their biota. Bogs have a low species richness resulting from these unamenable combination of factors. Although poor in species, bogs are rich in coverage, blanketing more of the worlds surface than any other ecosystem type except steppe. Most of these bogs occur in the boreal and arctic regions of the world where countries, such as Norway, can be more than 50% covered by these peatlands (Gore 1983).

Fens are peatlands whose vegetation is in contact with groundwater. The term for this condition is minerotrophic. Fens in the semi-arid west are further dependent on ground water as their primary water source. In South Park, without significant ground water inputs, fens could not exist.

Colorado's peatlands have been referred to using a number of different terms such as bogs, swamps, marshes. Technically speaking all of Colorado's peatlands are "fens"; therefore "fen" and "peatland" are often times used interchangeably in our region. No extensive bogs have ever been found in Colorado due to insufficient precipitation, but it has been proposed that large peat hummocks can form areas environmentally equivalent to miniature bogs in peatlands which are otherwise fens (Johnson 1996).

In Colorado, fens are found above about 2600 m (8500 ft.), but are most common in the subalpine zone and above (> 2750 m). Subalpine fens are generally found in valley bottoms and mountain parks. They may also be associated with river systems, usually occurring at slope breaks such as where valley sides or terrace shoulders intersect relict floodplains. In general, fens can occur anywhere in the subalpine zone where enough ground water emerges to perennially saturate the soil. A shallow grade also helps to increase the residence time of the discharged water and aids in soil saturation. Many such locations occur in the mountains of Colorado, and fens are not uncommon. Subalpine fens are generally small and easily damaged, however. The exact extent of fens in Colorado is not known precisely, but it seems to certainly be less than one percent of the total land area.

The character of ground water entering a fen is heavily influenced by the regional geology. Ground water flowing though granitic parent material is very nutrient poor and slightly acidic (pH ~ 6.5). Ground water flowing through calcareous or dolomitic parent material on the other hand tends to be rich in nutrients, especially calcium and magnesium, and is basic (pH > 7.5). The nutrient concentration of groundwater is a major determinant of fen vegetation. As such, fens have been classified according to their nutrient richness, which is in turn reflected in the species composition present. The most common fen divisions are poor, moderate, rich, and extremely-rich fens (Du Rietz 1949).

The calcareous fens of South Park are classified as rich to extremely-rich fens. These fen types are the most uncommon in North America, and maybe the world. In North America, extremely-rich fens have been found in only three or four areas besides South Park and near Hudson Bay in Canada (Sjörs 1961, Lesica 1986, Fertig & Jones 1992). Elsewhere in the world, extremely-rich fens are found in the British Isles and Scandinavia (Wheeler 1980, Sjörs 1948).

While scientists have only recently discovered the peatlands of South Park, these sites have been of interest to ranchers and developers since the 1800's. Historically, these wetlands were ditched and drained so they could be converted to “productive land” and to prevent cattle from becoming bogged down in their soft soils. More recently, miners have discovered the value of peatlands as a source of horticultural “peat moss”. Compared to other peatlands in the state, those of South Park readily lend themselves to peat mining, since they are relatively expansive, flat and have easy access. Due to such land use practices, a large percentage of South Park’s fens have been negatively impacted – many have been completely obliterated.

The uniqueness and fragility of these fens is in direct conflict with such practices. Mining strips away the peat, leaving a foreign substrate with new chemical and hydrological properties. The environment created in the wake of mining is so dissimilar to that of the native fen, sites mined several years in the past remain nearly devoid of vegetation (Johnson, pers. obs.). Dewatering a fen through ditching changes the fundamental hydrologic properties of the wetland, impacting every facet of the wetland’s ecology. Even more threatening to these systems is the prospect of ground water development projects. Such projects have the potential to usurp the ground water flow into the wetlands – a situation which would utterly and irrevocably destroy these sites.

This project was initiated to study the ecology and environmental functions performed by the calcareous fens of South Park, CO. It is an extension of a pilot study carried out in 1995, by this author working in conjunction with the Park County Department of Environmental Health. Due to the initial success anc compelling results of that study, the current project was designed to expand and complement it. Three calcareous fens were used as study sites. Each site had both intact sections as well as areas that had been impacted by peat mining or ditching.

This project had the goal of investigating the environmental functions performed by fens in South Park, CO. It accomplished this goal by: (1) Characterizing fen vegetation and the most important factors influencing plant species composition; (2) Describing their hydrology; (3) Characterizing the fens' water and soil chemistry: and (4) Evaluating the impact that land use practices such as peat mining or ditching have on wetland functionality. All of this information is placed in the context of developing a reference data set for use in the Hydrogeomorphic (HGM) Approach to wetland functional evaluation. It is intended that this information be used towards development of a regional slope wetland HGM guidebook.

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