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THE CHALLENGE OF MANAGING A KEYSTONE ECOSYSTEM: CUMULATIVE IMPACTS IN A PEATLAND-DOMINATED LANDSCAPE IN ALBERTA, CANADA

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SUMMARY

Balancing peatland conservation with appropriate economic development is a significant challenge in Alberta, Canada. Wetlands are extensive in areas where the scale of industrial activity is large. This includes extraction of significant petroleum reserves in the form of oil sands. Little is known of potential cumulative impacts on peatlands, but the effects will potentially be high. This includes climate change impacts. While novel wetland restoration and construction initiatives are being developed, wetland policy and management initiatives have not kept pace with peatland loss and alteration. Peatland conservation could be enhanced through the recognition of wetlands as Alberta's keystone ecosystem, two distinct provincial wetland zones, identification of wetland function and value, and establishment of no-net-loss policy.

KEYWORDS: function, keystone, mines, peatlands, policy

INTRODUCTION:

Wetlands are among the world's least understood environments and most abused resources, subject to political, social, and economical sensitivities (Smardon 2009). Important wetland functions and values are often lost within legislative debate. This is particularly true in regions where industrial development is high, leading to deficient short-term land-use decisions. Alberta, Canada has a region under large scale industrial activity related to rich oil and gas reserves including oil sands deposits (Locky 2011). The region is also rich in peatlands but without an adequate plan for balanced peatland conservation.

I review the state of the science on Alberta's peatlands with the intention of offering science-based recommendations to facilitate balance between peatland conservation and industrial activity. The following questions are addressed:

1. What is the state of Alberta's peatlands, past, present, and future?
2. What is the importance of Alberta peatlands with respect to function and value?
3. How can wetland policy and practice in Alberta provide a balance between industrial growth and peatland conservation?

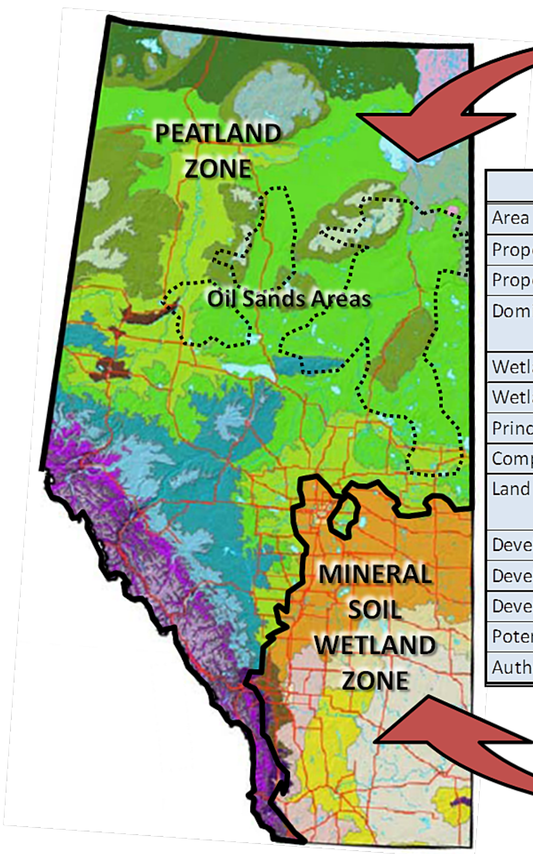
METHODS:

To understand the state of the science on a number of aspects of Alberta's peatlands I utilized a review of the literature, conducted interviews, and formulated management and policy recommendations designed to provide a more efficacious and balanced conservation management plan for peatlands.

RESULTS AND DISCUSSION:

Alberta's peatlands: Past, present, and future

Alberta has 11% of Canada's wetlands, approximately 13,704,000 ha, translating into 21% of the province (NAWCC 1993). Ninety-five percent of these are peatlands (bogs, fens, conifer swamps) in the northern half of the province (Fig. 1). Peatlands are the dominant wetland type in 16 of Alberta's 20 ecoregions. Based on the natural biogeographic aspects of the ecoregions, I propose that Alberta be divided into a Peatland Zone and the Mineral Soil Wetland Zone (Fig. 1).



Attribute	Peatland Zone	MSW Zone
Area of Province	78%	22%
Proportion of Provincial Wetland Area*	~93%	~7%
Proportional Wetland Area by Region	20 - 80%	<5 - 10%
Dominant Wetland Types	fen, bog, conifer swamp	marsh, shallow water, shrub swamp
Wetland Function	Variable	Variable
Wetland Losses to Date	Low	+60%
Principal Ownership	Mostly Crown	Mostly Private
Comparative Population	Low	High
Land Use	Foresty, oil & gas, oil sands, coal	Settlements, agriculture, oil & gas
Development Pressure Past	Low	High
Development Pressure Current	Moderate	High
Development Pressure Future	Moderate-High	High
Potential for Climate Change Impacts	Moderate-High	Moderate-High
Authority for Regulations and Decisions	Provincial	Mostly Municipal

Fig. 1. Proposed Peatland and Mineral Soil Wetland Zones for Alberta, Canada based on biogeographical aspects of ecoregions, with comparison of selected wetland, geographical, and societal attributes. The zones reflect the different wetland management and policy requirements for each type of wetland.

Only since the recent advent of large scale oil and gas activity, oil sands development, and associated logging have the state of peatlands become an issue in Alberta (Locky 2011). Peatland losses are generally unknown but are likely relatively low. However, current and planned developments will lead to significant wetland losses in this region (Schneider and Dyer 2006).

The greatest issue for peatlands in Alberta is cumulative effects related to industrial activities. Peatlands are not typically harvested for timber in Alberta (Locky 2011). However, forest clearance associated with oil and gas exploration and operations accounts for approximately double the amount harvested during forestry (Anielski and Wilson 2001). This is critical given that a significant proportion of the land base is forested fen and most felled timber is unclaimed (Locky 2011).

Oil sands activities in Alberta cover a significant area in the province (Fig. 1). The activities include mining and in-situ extraction technologies. Both potentially impact peatlands through loss (particularly mining) and direct and indirect impairment of function. Oil sands mines in Alberta have been approved for approximately 2,100 km², which is covered by 40 – 60% peatland. This means that over 1000 km² of peatlands need to potentially be replaced or compensated for through reclamation, construction, or other measures. While oil sands mining is the most visible and destructive extraction technology, approximately 80% of the oil sands region is too deep for these mines. Here expensive and challenging *in situ* technologies are employed. These technologies require vast amounts of water and heavily fragment the landscape with extensive infrastructure.

Peatland restoration and construction initiatives have been targeted primarily in formerly mined areas (Locky 2011). Constructed mineral soil wetlands dominate, given the difficulty in constructing peatlands. Some mineral soil wetland projects show promise with novel construction techniques. While no known successfully constructed peatlands in the world exists, two constructed fen research projects are currently underway in Alberta. They are expensive and their success will depend heavily on self-sufficiency over the long-term.

Current climate change models suggest that the existence of a high proportion of Alberta's peatlands is tenuous; many of Alberta's peatlands initiated 6,000 years ago when the climate was much wetter (Zoltai and Vitt 1990). Peatland restoration and construction projects will need to rely on reliable or self-sufficient sources of water, a big challenge in a highly modified mined landscape.

Wetland function and value, keystone ecosystems, and conservation

Wetland function encompasses the science-based 'performance' of a wetland whereas value includes a more socio-economic 'usefulness' factor (Locky 2011). A degree of interchangeability is found here, as value is placed on function. Peatlands are well-known for the great variety of functions and values. This includes carbon and the global climate dynamics. Conservation of peatlands helps to preserve a number of key ecosystem services provided by peatlands. Based on valued functions (Constanza et al. 1997), economic losses related to wetland loss in Alberta were estimated in 1999 to be $5.0 billion (Wilson et al. 2001).

Given the strong linkages between aquatic and terrestrial ecosystems and impact inordinate to their size or distribution on the landscape, wetlands are Alberta's keystone ecosystem (Locky 2011). These are primarily peatlands. Peatland functions and values will become increasingly important with forthcoming industrial development and potential climate change.

Peatland conservation is related to measureable function and estimated value. While rarity is a useful measure often employed by decision-makers, it is independent of function and value as much as function may be independent of value (Fig. 2). Values of function may change over time and new values on latent functions may emerge in time. Thus value judgements made on wetlands today may not reflect future values. Lost wetlands represent a potential lost legacy of function and value. It is recommended that tools to assess wetland function and value be developed and employed through policy in Alberta.

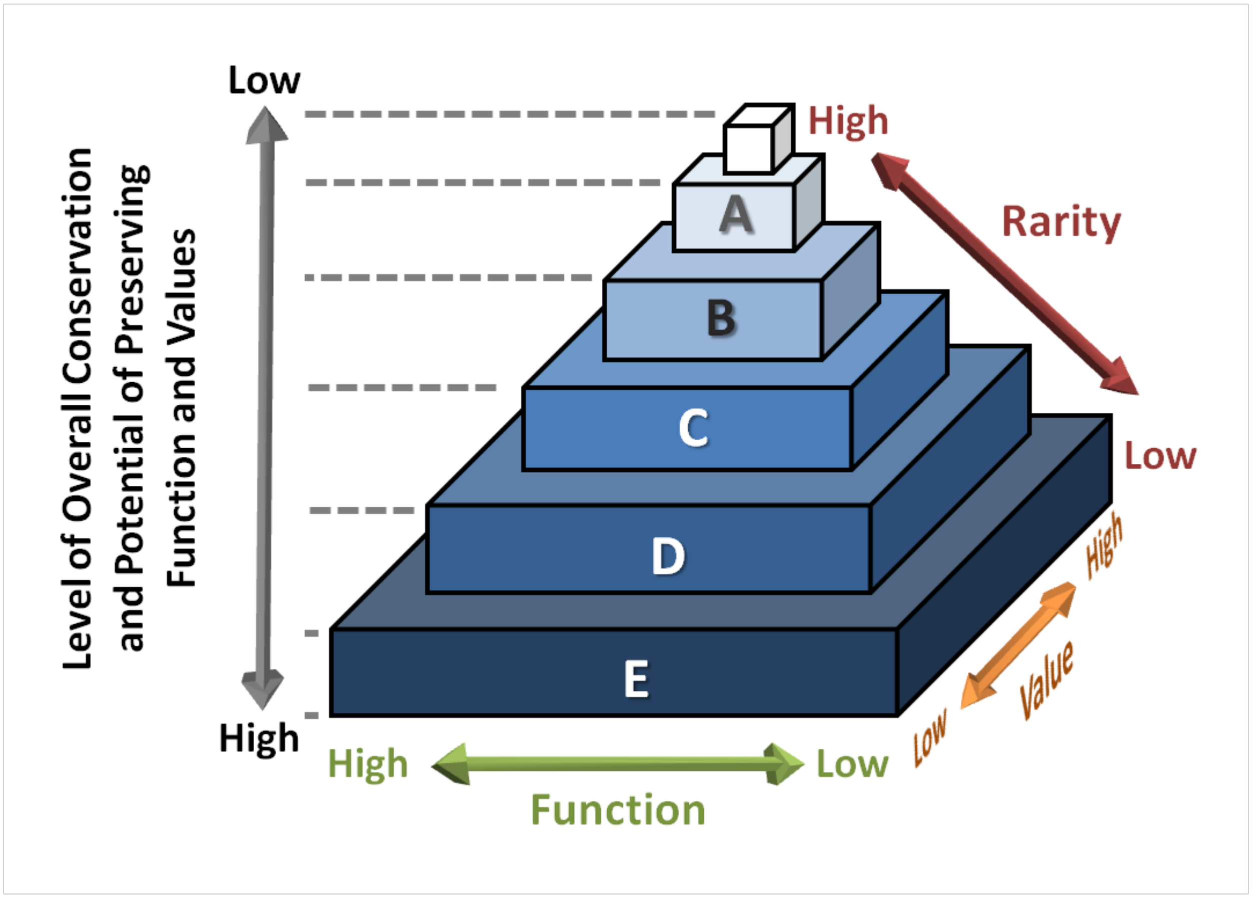


Fig. 2. Level of overall wetland conservation and potential of preserving function and values. A to E represents increasing percent cover on landscape or local to landscape scale. Rarity is independent of function and value. Function and value range from high to low independent of level of rarity. Level of conservation relates to degree retention of function and value from landscape to local levels.

Wetland policy and practice in Alberta: Balance between industrial growth and conservation

In the span of a few decades Alberta evolved from a jurisdiction with no wetland policy to a leader on no-net-loss policy and practice. An initial division of wetlands into mineral soil wetlands and peatland as denoted by economic region was encouraging (Locky 2011). However, a proposed new policy of wetland management by a single zone will significantly hamper peatland management and conservation in the province. In addition to diminished protection, the removal of the no-net-loss option will reduce significant peatland area. The associated development of wetland region-specific policies will acknowledge the strong differences in function and value, and cover and rarity between peatlands and mineral soil wetlands (Fig. 1). Further, a no-net-loss policy developed in conjunction with wetland assessment and evaluation tools will promote efficacious and balanced wetland-specific conservation in Alberta.

RECOMMENDATIONS

- Recognize wetlands as Alberta's keystone ecosystem and identify function and value through the development of a formalized assessment system
- Manage wetlands in Alberta based on the proposed Peatland and Mineral Soil Wetland Zones classification which acknowledges ecoregional biogeographic differences
- Develop policy and manage wetlands based on wetland type based on the proposed Peatland and Mineral Soil Wetland Zones classification
- Develop wetland evaluation tools associated with policy to identify functions and values

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