Experimental Economic Evaluation of Offset Design Options for Alberta: A Summary of Results and Policy Recommendations

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Executive Summary

In 2009 the Government of Alberta commissioned a study to conduct an analysis of conservation offset options for Alberta. The objective of the study was to evaluate a suite of design options in terms of their ecological and economic impacts, and institutional feasibility. The purpose of the analysis is to provide a deeper understanding of the impact of different offset design options on policy goals, and demonstrate through a proof of concept how different policy options could work in a scaled up regulated offset market. The analysis is comprised of three components:

- Policy review to clarify the current regulatory framework for implementing an offset program and identification of potential opportunities for an offset policy;
- Economic/ecological impacts modeling to illustrate the implications of alternative offset rules including the effects of like-for-like rules and eligibility criteria on economic and ecological outcomes;
- Identifying the market complexities associated with offset trading and testing alternative market designs using lab experiments.

The study focuses on forested public lands (primarily boreal forest) in Alberta and addresses impacts from oilsands development. Many of the recommendations from the analysis carry over to private lands which provide a simpler implementation context. The study addresses the broad objective of using offsets to improve ecological outcomes on working landscapes. The issues of zoning and use of offsets to increase the amount of permanent protected area are outside the scope of this analysis.

The analysis provides five recommendations in three areas:

- Recommendations on ecological objectives and equivalence metrics
- Recommendations on market design and the conservation exchange
- Recommendations on policy development and next steps

I. Ecological Objectives and Equivalence Metrics

RECOMMENDATION 1: Use the Alberta Biodiversity Monitoring Institute (ABMI) ecological intactness index to define tradable "stewardship units" for quality adjusted hectares based on changes in ecological condition. The index should be used in conjunction with any additional measures to address biodiversity outcomes defined through a regional planning or other process.

Ecological equivalence, or balancing ecological losses with ecological gains, is fundamental to offset design. The Alberta Boreal Offsets Advisory Committee as well as the Alberta Conservation Association have recommended that an offset system be simple and avoid complex rules (Alberta Boreal Offsets Advisory Committee 2009; Croft et al. 2011). There are three components to ecological equivalence: (1) ecological condition, or the capacity of a site to maintain ecological function; (2) similarity and representation of key features of the impact and offset site including distribution of species or other special features; and (3) timing and risk associated with when the benefits of conservation actions will be realized.

We use an index of ecological intactness developed by the Alberta Biodiversity Monitoring Institute (ABMI) to equate impact and offset sites in terms of ecological condition. The index can be used **in conjunction** with any other ecological constraints or criteria required to meet biodiversity outcomes including matching by eco-site as recommended by the Alberta Conservation Association, or species specific habitat requirements. The intactness index can account for the quality and change in condition of any site within any other constraint. A first version of the index has been mapped for the province and can be calculated for any site based on an equation. The calculation can be refined over time as better data becomes available.

Incorporating the intactness index in the equivalence metric provides the following benefits:

- The index simplifies each ecologically heterogeneous hectare of land to homogeneous and fungible quality adjusted hectares which can be easily traded;
- The index is capable of accounting for changes in condition on any site and is suitable for evaluating the impacts of incremental changes on a site given the level of existing disturbance.
- The index is suitable to measuring changes from temporary offsets;

- The index is based on transparent and scientifically validated models;
- The index can be scaled providing a direct link between site level impacts and regional ecological and biodiversity outcomes that are being monitored by ABMI.

II. Market Institution and Conservation Exchange

RECOMMENDATION 2: Over the next 5-10 years develop a centralized conservation exchange and clearinghouse with electronic trading platforms to support smart markets for offsets

Two very different views of offset exchange institutions have been proposed by stakeholders. The Alberta Boreal Offset Advisory Group recommends that offset trades be coordinated through a centralized conservation exchange. This recommendation can be contrasted with that of the Alberta Conservation Association which would like to see offsets be negotiated between companies, land trusts, and private landowners. While bilateral trading may be appropriate for the current scale of offset activities, the approach may impose unacceptable financial and ecological risks to buyers, sellers, and the public in large scale regulatory programs.

Companies will need to find equivalent offsets of the right size and duration over a potentially large range of impacts and projects. This means that companies will want a range of contracting options, from annual to multi-year contracts to permanent easements. In this study, an experimental evaluation of market institutions shows that centralized trading supported by an electronic combinatorial auction is most efficient. A combinatorial auction allows participants to place bids on combinations of discrete items, or "packages," rather than just individual items. The discrete items traded in the experiments are conservation contracts of different size, duration, and vintage (e.g. current and future). Package bidding reduces exposure to future price and project risk, and allows companies to benefit from economies of scale. A centralized market will aggregate the most trades and address potential problems associated with market thinness, particularly where the offset market is highly segmented by ecological criteria and constraints. The exchange should include a clearinghouse for settling transactions, acting as a

counterparty to minimize contract risk, and providing transparent data on trades, prices, and positions in order to monitor the market.[1]

The centralized conservation exchange provides the following improvements over bilateral negotiation:

- Ability to simultaneously run markets for current and futures contracts and reduce exposure to price and project risk through package bidding;
- Mechanisms to minimize counterparty risk;
- Increased transparency and economic efficiency;
- Provision of valuable market information to help proponents plan for projects;
- Reduced administrative costs.

III. Policy Recommendations and Next Steps

RECOMMENDATION 3: Implement the biodiversity strategy and disturbance management plan for the Draft Lower Athabasca Regional Plan (LARP) by developing an offset program based on tradable credits (either temporary or permanent) for reclamation and avoided disturbance on public and private lands that provides a security against a company's future reclamation requirement.

Given the level of disturbance anticipated from development of gas and bitumen over the next 50 years, it will be necessary to have a robust reclamation program to manage disturbance levels within a limit. The LARP identifies a number of strategies and outcomes that are suited to an offset market. These include the biodiversity strategy and the related disturbance management plan which are currently being developed for 2013. To meet anticipated disturbance thresholds and address outcomes in the biodiversity strategy it will be necessary to reclaim disturbed land in a timely, progressive and aggressive manner. Therefore we recommend developing a program initially focussed on tradable reclamation credits on public

[1] Counterparty risk is the risk that one party in a contract will not live up to the contract's obligations. A clearinghouse reduces this risk by becoming the counterparty to all parties, therefore pooling default risk across contracts.

land and tradable credits for reclamation and avoided disturbance on private land. Since permanent offsets are not feasible on public lands, temporary offsets must be considered. Since future reclamation is already a regulatory requirement, the credits should be counted as securities against future reclamation liabilities along with other financial securities.

Tradable reclamation credits would be additional to existing regulation in that conservation benefits would be shifted from the uncertain future to the present, improving ecological risk management. Linking the offset policy to reclamation requirements would also addresses a number of weaknesses in the current reclamation policy which have led to under-funded reclamation liabilities and a legacy of abandoned footprint. The focus of the recommendations is on the boreal forest area, but the principles could also be applied to other regions such as the South Saskatchewan Region for specific ecological objectives.

The ecological-economic analysis leads to a strong endorsement of using project delay and conserved lands as offsets to reduce the costs of an offset program. However given challenges such as defining baselines, potential for strategic behaviour, and legal and tenure issues, there is a need for further analysis of this option on public lands before deciding to adopt it. Given the role of avoided disturbance in reducing the overall costs of an offset program, we recommend that this option be pursued on private lands assuming that all private land is at risk of permanent clearance.[2] Even though it is difficult to prove additionality in all cases, some additionality will be achieved, and without the conservation option, the costs of an offset program may be prohibitive.

RECOMMENDATION 4: Adopt the policy roadmap and recommendations for offset pilots

A policy roadmap is proposed to facilitate development of the offset policy. The roadmap includes recommendations for short, medium, and long term actions. The most critical of these is the recommendation for a **short term 5 year pilot phase from 2011-2016** to take advantage of opportunities to pilot offsets in both the South Saskatchewan and Lower Athabasca Region. Priority next steps for phase 1 include:

[2] Baseline risks of private land conversion could also be estimated (e.g. Government of Canada 2011).

- Immediate action to assemble interested stakeholders and clarify offset pilot project objectives and the information gaps that will be addressed in the pilots.
- Establish agreement on the geographic area(s) for the offset pilot(s) and how pilots will be monitored and evaluated.

The pilot phase would be followed by a **medium term implementation phase from 2016-2021** during which the offset pilots would be evaluated in order to make a decision about whether to move forward with a regulated offset program.

- Actions to further develop a regulated offset program would include the development of decision support tools to assist companies in designing projects to meet offset requirements, and in reporting and meeting compliance.
- During this phase an exchange and clearinghouse for settling offset contracts may be developed.

Finally the **long term market integration phase** will take place over 10-15 years. The outcomes of the last phase involve:

- Evolution of the exchange to incorporate smart markets.
- Integration of conservation offsets with other environmental markets such as carbon, wetlands, and water.

RECOMMENDATION 5. Specific Government of Alberta commitments including a lead department and allocation of human and financial resources should be obtained to develop an offset program.

- Hold an offset policy workshop with key government departments and selected stakeholders to identify and map the linkages to potential policy drivers for offsets.
- Develop an education strategy for ensuring key Government decision makers understand implementation options for offsets.
- Assign a lead agency with responsibility and clear accountability for the program. The lead

agency should be a department(s) responsible for an offset policy driver. For example, if the biodiversity strategy is the policy driver, the SRD could be a lead agency; if reclamation policy is the driver the AENV could be the lead agency.

- Identify key partners within Government and mechanisms (such as cross ministry working groups) to secure their ongoing support and participation in development of an offset program.
- Establish a stakeholder advisory group for communication and consultation with important external stakeholders to foster buy-in for policy recommendations as the policy evolves.

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1. Context and Scope of Work

Conservation offsets are compensatory actions that address the ecological losses arising from development. Offsets allow companies to manage ecological risks from development, and mainstream conservation considerations into decision-making. Offsets address one of the leading causes of ecosystem degradation, which is that markets and policies currently do not value biodiversity and natural systems. Offsets are used in a number of jurisdictions particularly in the U.S. and Australia. For example, in the US species banking and wetland banking are allowed under the Endangered Species and Clean Water Acts to mitigate the unavoidable negative consequences of development. Similarly Biobanking in New South Wales Australia is used to meet threatened species requirements under the Environmental Planning and Assessment and Threatened Species Conservation Acts. In the State of Victoria, offsets are required for any clearing of native vegetation under the Native Vegetation Act.

Over the last decade there has been increased attention on offsets for mitigating the impacts of oilsands development. Alberta's Oil Sands Plan (Government of Alberta 2009) and the Energy Resource Conservation Board Joint Review Panel (Government of Alberta 2011) support the use of offsets to address cumulative effects from oilsands development. Conservation organizations such as Pembina Institute and the Canadian Boreal Initiative also advocate the use of offsets (Dyer et al. 2008; Dyer et al. 2011). A number of companies are already using offsets on a voluntary basis in Alberta (Dyer et al. 2008). For example in 2006 Albian Sands Energy committed $4 million over 10 years to partially offset the terrestrial effects associated with their Muskeg River Mine expansion project through private land acquisition and restoration (Shell/Albian Inc. and OSEC 2006; Dyer et al. 2008). Similarly since 2003 the Alberta Conservation Association (ACA) has worked with oilsands companies to secure 1965 hectares of private land (Croft et al. 2011). However many stakeholders argue that voluntary offsets are insufficient to address cumulative effects which require coordinated actions from all companies (Dyer et al. 2008). In 2009 the ad-hoc Alberta Boreal Offsets Advisory Group recommended

establishing a regulated offset requirement for all disturbances[3]. More recently the Alberta Conservation Association also recommended a regulated offset requirement for disturbance from oilsands development (Croft et al. 2011).

The overarching driver for terrestrial offsets in Alberta is the 2008 Land-use Framework. The framework calls for the development of regional plans for seven land use regions to set economic, environmental and social outcomes, and identifies offsets as a potential tool for achieving these outcomes. To date planning has been initiated in the Lower Athabasca and South Saskatchewan Regions. In the Lower Athabasca a draft plan (LARP) has been submitted to Cabinet for approval. In the South Saskatchewan Region (SSR), recommendations are out for public comment. The LARP identifies a number of strategies that are suited to terrestrial offsets including a requirement for integrated management of industrial activities to reduce disturbance; timely and progressive reclamation of disturbed lands; and limits to land disturbance. These strategies will be driven by a biodiversity management framework to be developed by 2013 which will set targets for selected biodiversity indicators (e.g. vegetation, aquatic, and wildlife) and address caribou habitat needs. The framework includes a regional disturbance plan which will set disturbance limits differentiated by areas of importance for economic and biodiversity outcomes. The SSR recommendations include exploring financial incentives and market opportunities for the energy sector to provide ecological goods and services on agricultural and forest lands, and protecting biodiversity through market based tools. However unlike the LARP the SSR recommendations lack tangible implementation strategies that could be tied to regulated offsets.

In December 2009, enabling legislation for offsets was passed under the Alberta Land Stewardship Act (ALSA). The legislation includes general terms for where an offset might be applied, as well as provisions for accountability including monitoring and compliance, and sets the rules for trading and defining an offset in regulations. ALSA defines activities that could qualify as offsets including conservation and protection, restoration or reclamation, and creation or enhancement. ALSA also includes provisions for a Conservation Exchange to facilitate

[3] The Advisory Group was a collaboration of industry, conservation organizations and First Nations partners interested in the development of conservation offsets.

the trading of offsets. However specific policy and regulations for conservation offsets have not been developed.

To assist the development of an offset policy the Government of Alberta commissioned this study to evaluate a suite of offset design options in terms of their ecological and economic impacts, and institutional feasibility. The outcome of the analysis is a deeper understanding of the impact of different offset design options on policy goals, and to provide a "proof of concept" for how a scaled-up regulated offset market could work. The analysis is comprised of three components:

- Policy review to clarify the current regulatory framework for implementing an offset program and identification of potential opportunities for an offset policy;
- Economic-ecological impacts modeling to illustrate the implications of alternative offset rules including the effects of like-for-like rules and eligibility criteria on economic and ecological outcomes;
- Identification of market complexities associated with offset trading and experimental testing of alternative market rules.

The project focuses on forested public lands (primarily boreal forest) in Alberta. This choice was based on the availability of data and modeling capacity as well as the ability to address public land issues which are more complex than private land issues. The boreal forest contains Alberta's oilsands deposits which are a critical environmental and political driver for an offsets policy. In addition the LARP provides the greatest opportunity for implementation of a regulated offset policy. Many of the recommendations from the analysis carry over to private lands in the SSR which provide a simpler implementation context. It is important to note that we are not evaluating offsets as a way to increase the level of permanent protection within a protected areas strategy. This report only addresses the issue of how to provide improved conservation on working landscapes. The issue of the size and zoning of protected versus working areas is outside the scope of this analysis.

The analysis provides recommendations in three areas:

- Recommendations on offset rules including offset metrics for Alberta;

- Recommendations on market rules and the conservation exchange;
- Recommendations on policy development and next steps.

The remainder of the report is structured as follows. In Section 2 we provide a summary of offset design issues. In Section 3 we summarize the results of the economic-ecological analysis of offset rules and in Section 4 we summarize the results of our analysis of market rules and roles for the conservation exchange. In Section 5 we develop policy recommendations including a policy road map and next steps. We also elaborate on the need for pilot projects including issues to be addressed (e.g., administration, monitoring, enforcement, legal and tenure issues, etc.) through the pilots.

2. Offset Design Issues

Design of an offset policy involves numerous choices including the definition of equivalency and the metric used to calculate offset credits; administration of the market and market rules; and offset requirements and eligibility rules including additionality and baselines. These choices involve important tradeoffs between environmental effectiveness, economic efficiency, and institutional feasibility. The latter encompasses a suite of administrative issues including administrative burden, revenue implications, policy alignment and harmonization, and transparency. We review the key elements of offset design below.

Voluntary versus Regulatory

Offsets may be purely voluntary or driven by regulation. In the case of regulated programs, offsets could either be a mandated requirement, or just one of a suite of compliance options to acquire an approval, i.e., voluntary with a regulatory driver. An example of the mandated option is the State of Victoria's offset program for native vegetation, where offsets are required for compliance under the Native Vegetation Act. An example of a voluntary option with a regulatory driver is Alberta's carbon offset program where emitters covered under the Specified Final Emitters Regulation can reduce emissions, purchase offsets, or pay a $15/tonne fee for emissions. Determining whether a regulated offset should be mandatory or voluntary depends on the policy goals.

Purely voluntary efforts are usually driven by anticipation of a regulation or by considerations over social license to operate. The problem is that voluntary efforts may be costly but insufficient to meet objectives, particularly when the environmental objective is a cumulative outcome dependent on the actions of other firms. The ecological uncertainty associated with voluntary offsets in this context will have a negative impact on participation, particularly if public focus is on the environmental performance of the sector overall. The goals of a regulated approach are to set a level playing field for all entities with impacts on biodiversity; introduce clarity and legal certainty on the rights and responsibilities of entities on the landscape; and achieve a greater and a more consistent biodiversity outcome than what would occur through a

voluntary approach. A regulated approach will increase public confidence in the credibility of the offset system.

Equivalence

The issue of equivalence or balancing ecological losses with ecological gains is fundamental to offset design. Generally there are three components to equivalence: (1) ecological condition, or the capacity of a site to maintain ecological function; (2) similarity and representation of key features of the impact and offset site including distribution of species or other special features; and (3) timing and risks associated with when the benefits of conservation actions will be realised. Equivalence involves defining the offset program's goals and selecting suitable metrics to measure losses and gains. Since goals such as biodiversity are difficult to measure, metrics involve the selection of surrogates which are considered representative of diversity and overall ecological capacity of the land.

Since biodiversity in one place is never exactly the same as biodiversity in another, defining equivalence metrics is often an exercise in categorising elements of biodiversity into classes within which exchange will be permitted with or without mitigation ratios. Mitigation ratios (or exchange rates) address risks such as lack of scientific understanding and measurement error, or to compensate for differences in similarity, condition, and timing. The tradeoff is that while high resolution classification with many types can provide a closer match between the losses and the gains, there is a reduction in flexibility making it more difficult to locate matching offsets, and increasing the overall cost. Simple approaches often rely on exchange rates to equate impacts and benefits for different types of sites however exchange rates often have no scientific validity and are just negotiated on a cost basis (Crowe and ten Kate 2010). Without modeling there is no way to determine whether the ratios are more or less onerous than could be justified.

Eligibility

Eligibility refers to the range of actions that qualify as offsets. These actions may be direct or indirect. Direct offsets involve improvement of habitat or landscape values and include the long term protection, reclamation or restoration of existing habitat typically secured through land acquisition or a conservation easement.[4] Indirect offsets are management actions not specifically related to land improvement that result in improved conservation and may include implementation of recovery plans, contributions to research, or other on-going species management activities. Many species objectives require indirect offsets, particularly for species at risk. For example, In Alberta there may be a need for predator control in combination with reclamation for caribou recovery (Schneider et al. 2009). In this case a payment into a management fund could be part of an offset package in combination with direct offsets. In lieu payments are also sometimes used as a safety valve if no offset can be found, or if the cost of offsets passes a threshold.

Additionality and Baselines

The principle of additionality requires that activities that generate offsets be over and above the regulatory baseline, or what would have been done anyway under business as usual. This is important, since without additionality there is no biodiversity gain and the offset program can lead to net loss. Additionality is difficult to measure for avoided disturbance since it requires private information about whether conservation lands that count as offsets were actually at risk of development in the first place. For private land it is often assumed that all land is at risk because of a landowner's right to conversion (Government of Canada 2011). However, leakage can occur if habitat secured in one place leads to a non-compensated increase in the extent or intensity of development in another. Additionality is also an issue for reclamation activities. Since reclamation is a regulatory requirement for a wide range of industrial activities in Alberta the primary scope for additionality is from reclaiming abandoned footprint, and accelerating the timing of reclamation beyond some baseline which would have to be established.

Timing and Risk

[4] For simplicity in the remainder of the document reclamation will refer to both restoration and reclamation activities.

Due to time lags between conservation actions and ecological benefits, it is not always possible for the benefits from offsets to be established at the time of impact. One option to address the time lag in conservation benefits is to approve offsets based on expected benefits rather than actual benefits. However, this option introduces ecological risk since future benefits are uncertain, and the liability must be addressed. With no buyer or seller liability the risk would default to the public or the ecosystem, resulting in a moral hazard since neither buyers nor sellers would have adequate incentives to ensure offset success. Since seller liability is a barrier to providing offsets, some jurisdictions pass liability on to buyers who are required to find a replacement offset if the original offset fails. Other jurisdictions handle risk by increasing mitigation ratios (i.e., demanding higher offset requirements as a "buffer") or using "in lieu" fees during the initial phases of an offset program to help establish larger future offset projects that have a higher probability of success. Finally, either buyer or seller risk could be passed on to a third party who could underwrite the liability.

Duration/Permanence

Permanence of ecological benefits is an important offset principle. To ensure permanent benefits, many programs require offsets to be secured through either land purchase or a deed restricting mechanism. However, there are practical difficulties in securing permanent offsets. First, private landowners may be reluctant to restrict development in perpetuity and the potential for uptake may be insufficient to meet the scale of development. On public lands, where the vast majority of reclamation opportunities exist there is no mechanism to permanently secure land. There is also an equity consideration in that setting public land aside in perpetuity to manage the externalities of current development may be unacceptable to future generations. While permanence of the offset is desirable in the case of irreversible land conversion, temporary offsets can yield permanent benefits for temporary disturbances as long as they meet the test of additionality. Temporary offsets could be held until land was certified as reclaimed to an appropriate ecological standard and the offset contract could be re-sold for the ecological value of the reclaimed land or terminated. Temporary offsets have been explored extensively for forest carbon, and options that work for forest carbon can be applied to conservation offsets.

The variation in contracts creates an interesting market design challenge which is addressed further below.

Public Lands

Alberta's forested area is primarily public land. Although there are substantial opportunities for habitat protection and improvement on public land, regulatory changes would be required to enable an offsets market. First there are legal and incentive issues with allowing offsets for delay or cancelation of projects on public lands. Public land dispositions in Alberta have limited transferability between uses and do not entitle companies to be compensated for not using the rights. In order to address ecological objectives in the land use plans there may be instances in which the government would want to give *existing* lessees an opportunity to cancel a project and be compensated through an offset. With respect to *new* leases, however, the question is whether the Government should grant leases in the first place if conservation is insufficient. One reason is that governments have less information about the future value of underlying resources than developers, and markets for leases and offsets will reveal the least cost arrangement of offsets. However, rules would have to be carefully constructed to ensure that companies do not speculate on energy leases for the purpose of capturing rents from selling offsets. Secondly, there is no tenure allowing third parties to sell credits from reclamation activities on public land. Both of these issues could be dealt with if there was a separate auction for rights to create and sell offsets on public land.

Scale and Aggregate Costs and Benefits

The availability and cost of offsets as a regulated requirement is a key consideration in setting objectives, and evaluating offset design options. The cost and availability of offsets from private lands is not clear given the scale of development that could occur from oil and gas activities over the next 50-100 years, particularly if offsets are permanent. In particular, offset opportunities may become increasingly scarce over time if the length of time that features remain on the landscape increases on average, and as more private lands are secured through permanent easements. In Section 3, we examine the impact of offset rules on aggregate costs and benefits

of an offset program. This information can be used to establish objectives for the program, and to identify design options.

Market Institutions and Trading Rules

The ALSA provides enabling legislation for a Conservation Exchange which could serve as a marketplace for trading offsets. Offset markets are different from ordinary commodity markets. There are numerous costs to participating in offset markets including acquisition of information; finding trading partners; bargaining and negotiation; registering and verifying contracts; and insurance and contract enforcement. Exchanges provide a range of services to address these needs. Bilateral negotiation at the current scale of voluntary offset demand may be relatively straightforward, but it is not clear that this model is the best for achieving environmental effectiveness and minimizing costs in a scaled up program. For a given development some impacts may be short lived with short term offset requirements while others may be long lasting requiring multi-year or permanent offsets. This means that buyers, particularly large companies, will require a portfolio of contracts for managing current and future offset obligations, and that timing and duration (annual, multi-year, or permanent) are distinguishing features of the offset contracts. The need to match requirements between impacts and offsets in terms of size, similarity, quality, timing, and duration, would make it difficult for efficient transactions to take place autonomously. The role of market design is to facilitate efficient transactions between buyers and sellers.

Market institutions vary in terms of their level of organization, ranging from completely uncoordinated search and negotiation to centralized exchanges where current and future offset contracts are traded. For example, Climate Change Central operates the Alberta Emissions Offset Registry which is a bulletin board market for offsets where buyers and sellers post bids and offers but negotiate bilaterally. At the other end of the spectrum is the Victoria Native Vegetation Exchange (NVX) which uses which uses an electronic platform for listing, searching, and price negotiation to match vegetation clearings with offsets according to specific equivalency requirements under the Native Vegetation Offset Program. Exchanges such as NVX facilitate multi-party contracts (trades between multiple buyers and sellers or multi-lateral

trades) resulting in substantial efficiency gains over bilateral trades in complex settings. It is estimated that the NVX increased the economic efficiency of the offset market by approximately 150%, and is also seen as easy to use (Nemes et al. 2008).

Government Revenue Implications

The market institution for trading offsets will determine how rents from resource development are distributed between developers and offset providers. Resource rents are defined as the difference between resource values and normal rates of return after accounting for payments to labour and capital, and arise due to differences in resource quality and location. Governments traditionally try to capture resource rents to generate a fair return on publicly owned resources. For example, in Alberta royalty payments and bonus bids on Crown oil and gas leases are important instruments for collecting energy rents and contribute about 25% to Alberta's annual revenues. A concern arises if offset providers are able to capture some of these energy rents (that is, returns over and above the actual labour and capital costs of providing the offset) for themselves because of poor market signals, imperfect information, and weak competition. The importance of royalties and resource rents as a source of Government revenue in Alberta highlights the need to consider market design at the outset of developing an offset policy.

3. Ecological-Economic Evaluation of Offset Options

In this section we summarize the results of the analysis of ecological and economic tradeoffs from offset policy options. The details of the research are provided in Weber et al. (2011). The offset options were generated through discussions with a Project Advisory Committee consisting of representatives from government, industry, and conservation organizations. Based on input from the Advisory Committee we developed a suite of hypothetical offset policy scenarios that were selected to highlight key drivers of offset policy outcomes. The main features of the scenarios are outlined below:

Geographic Scope: The analysis is confined to the boreal forest region of Alberta which is primarily public land.

Sectors Analyzed: The analysis is confined to the forestry and energy sectors (the primary users of public forest land).

Eligible Activities for Offset Credits: Offsets are modeled as annual or multi-period contracts. Permanent offsets can be incorporated within this framework but were not explicitly considered in the analysis. Offsets are created by contracts for reclamation activities on either private or public lands (referred to hereafter as ***reclamation offsets***). They may also be created by delaying or cancelling projects attached to leases and tenures on public lands, or through setting aside private lands (referred to as ***conservation offsets***). We consider two scenarios for the timing of crediting benefits. Full benefits from reclamation were **credited** after either 5 years (immediately) or 20 years (a medium term scenario). Note that both of these scenarios are optimistic and don't correspond to the actual time lag for ecological benefits. Costs will increase with increase in the crediting period.

Offset Requirements: We assume forestry and energy companies are required to hold offsets for all impacts. For forestry companies this includes impacts from harvest. Note that this policy is not consistent with existing rights. However for the purpose of the analysis we abstract from the issue of baseline rights in order to highlight the total economic costs and benefits of

alternative policies, and to understand which sectors are best positioned to deliver conservation benefits. All activities on public land are assumed to be temporary, although they may occur over several years or decades. The duration of the offset obligation is also temporary, until an area is reclaimed and a reclamation certificate is issued. Contracting issues are addressed in a separate analysis of market rules.

Equivalency Rules: Ecological condition for each offset and impact site was measured using a measure of ecological intactness developed by the Alberta Biodiversity Monitoring Institute (Alberta Biodiversity Monitoring Institute 2008).

In total we ran seven offset scenarios which are summarized in the Figure 1 in the highlighted column 1 and row 3.

Figure 1 Offset Rules Analyzed

	Offset Rules			
Eligibility Rules	No net loss of ecological Condition (In-tactness)	No net loss Intactness within LUF Regions	No net loss intactness within Natural Subregions	No net loss of intactness within Natural Subregions + Grizzly Habitat
Conservation Off-sets Only	**X**			
Reclamation Off-sets Only (5 year lag)	**X**			
Conservation and Reclamation Off-sets (5 year lag)	**X**	**X**	**X**	**X**
Conservation and Reclamation off-sets (20 year lag)	**X**			

Methods

The relevant economic cost of an offset policy is the indirect (opportunity) cost associated with ***foregone*** development opportunities that could result from delay or cancelation of projects as well as the direct cost associated with reclamation. Opportunity cost is captured by the net present value of development opportunities, which is the value of land in development. The net

present value is the return on investment after payments have been made for all other inputs. It is important to distinguish economic costs, which are based on opportunity cost, from business costs. For example, a lessee that cancels or delays a project in order to sell an offset is not worse off from the transaction since the cost is recovered or compensated by payments from another developer. However, this transaction results in a cost to society which loses the value of the development. The economic burden of the loss falls on the developer that pays for the offset. The opportunity costs are offset by gains in conservation. Evaluation of the tradeoff between conservation gains and opportunity costs (i.e. determining the right balance of conservation and development) is beyond the scope of this study.

The offset cost model was developed using TARDIS, a dynamic spatially explicit optimization model which maximizes the net present value (NPV) of forestry and energy sector activities. TARDIS generates schedules of the optimal timing of forestry, conventional oil and gas, and bitumen extraction activities for Alberta Township System sections at five year intervals over thirty years. TARDIS also estimates the net present value for each scheduled activity. Because NPV is maximized, these values represent the maximum opportunity cost of setting aside or delaying an activity. The schedules and net present values were exported into an EXCEL spreadsheet model where supply and demand curves for offsets under different offset policies were generated by ranking eligible sites by net present value or 'cost' per offset unit weighted by each site's quality score. Reclamation costs were also included for scenarios with reclamation offsets. For each policy scenario high value development projects are matched to low cost offsets until offset demand is equal to offset supply. The aggregate opportunity cost under each offset rule is then calculated, along with changes in ecological condition. The intactness index was used to calculate a quality adjusted hectare score to compare ecological losses and gains between impact and offset sites. The score shows *changes* in ecological condition from site improvements or degradation, and can be applied to any site no matter what stage of development it is in.

The intactness index summarizes site specific information on location, species, vegetation, soils, and existing footprint, simplifying each ecologically heterogeneous hectare of land to homogeneous and fungible quality adjusted hectares. Additional species or ecosystem

requirements such as matching according to eco-site can be introduced although in some cases this may introduce additional complexity. The index can be used in conjunction with any other ecological constraints or criteria to evaluate the condition of any site. We demonstrate how additional habitat constraints could be incorporated to address individual species needs by adding no net loss of grizzly habitat as a constraint in one of the scenarios. We also considered no net loss constraints on natural sub-regions and land use planning regions.

Results

1. Reclamation offsets alone are costly. The research suggests that options on offsets for avoided disturbance should be further investigated.

Under most policy scenarios considered, the offset system was not expensive relative to the total economic value of development or potential net present value. The total economic cost ranged from 0.2% - 1.5% of maximum net present value in scenarios which allowed "conservation" offsets. The 0.2% cost is from a scenario combining reclamation and conservation offsets, while the 1.5% cost is from a program based on a conservation offsets only scenario. The cost of an offset program increases dramatically to 38% of net present value if only reclamation offsets are allowed and the offset constraint is binding immediately. This is because of the significant slow down in activities required at the beginning of the program while developers wait for investments in reclamation to be accredited (5 years). These costs are mitigated by conservation offsets which allow developers to "buy time" while waiting for reclamation benefits. An alternative option would be to reduce the accreditation period for reclamation offsets to zero, however this would increase ecological risk. Under a reclamation only policy, all regions except the Lower Peace experience a decline in ecological condition unless there is no trade between regions. When conservation offsets are allowed, more regions have a net gain in ecological benefits from the offset program.

2. The time lag between reclamation activity and the delivery of ecological benefits has a relatively small impact on costs but a significant negative impact on investment in reclamation.

Increasing the time lag in counting the benefits from reclamation does not have a significant impact on offset program cost however it does affect the compliance strategy for companies. For example, when conservation offsets are allowed then the costs of the offset program are

only 0.2% of NPV if benefits from reclamation are accredited after 5 years compared to 1.5% of NPV for 20 years. With discounting, additional costs from extending the time lag beyond 20 years will be negligible. On the other hand, increasing the time lag significantly reduces the amount of reclamation with almost no reclamation taking place with a 20 year lag.

3. Additional ecological and regional constraints have a negligible impact on costs.

Trading constraints that limit trades to within regional planning areas have a negligible impact on cost. This suggests that cost should not be a factor in considering whether or not to allow trade between regions (however there are still other factors such as market size and competitiveness). Constraints limiting trades to within areas of grizzly habitat or within natural subregions have a larger impact on program costs, but the increases are small relative to the total cost of the program. As in the choice of time lag, the relatively small cost increase (0.02% of NPV) must be judged against the gains in meeting ecological objectives.

4. Forest companies will be the primary offset providers and energy companies will be the buyers.

The analysis suggests that the majority of the "offset" opportunities will come from forest companies however this assumes that companies could receive credits for reclaiming cut-blocks which is already a regulatory requirement. While there will be fewer reclamation offset opportunities if cut-blocks are removed, the level of baseline ecological intactness will also be higher so less reclamation may required to address residual changes in intactness. This highlights the need to examine the impact of baselines in setting biodiversity objectives and offset requirements. Additional analysis is also required to understand how offsets could be sold from forest tenures.

Gaps

Within the scope of this study it was impossible to test the full suite of relevant policy resulting in a number of important gaps:

Evaluation of the Effect of Regulatory Rules on Costs and Outcomes

The costs presented in the analysis are based on a theoretical benchmark assuming that all lands would be eligible for either development or offset activities. The analysis ignores the issue of what activities require offsets, and baselines for activities and lands are available as offsets. The former depends on the regulatory requirement. Given the importance of conservation offsets in reducing offset program costs, further analysis to establish the costs of specific activity requirements and baselines for counting eligibility for avoided disturbance on public land is required. A number of stakeholders expressed concern about forest companies providing offsets from their leases since they are already responsible for ecological management through their Forest Management Agreements even though there is some recognition that the costs of ecological management may be increasing. This is an important issue since the economic and ecological modeling results suggest that forest companies will be primary offset providers. However, given the Government's position on forest companies providing forest carbon offsets it is unlikely that forest companies will be eligible to provide offsets under their agreements.

Improved Data for Scenarios

The economic and ecological model has a number of limitations which should be examined in future research. First, the time horizon of thirty years may be too short to understand fully the ecological impacts and availability of offset opportunities given the likely duration and impact of some activities related oilsands in-situ and mining projects. Secondly the analysis was based on very crude assumptions about reclamation costs and success. Costs were differentiated on soil disturbance only, and a recovery time of five to twenty years was assumed. These assumptions could be quite unrealistic for some impacts and the estimated costs could change significantly depending on the level of error. However the cost and benefit drivers identified in the analysis are unlikely to change.

Further Examination of Ecological Targets

While industry, NGO and government stakeholders support the use of the ABMI intactness index for the boreal, this index was not viewed as sufficient for the Southern Alberta agricultural context because of the extent of fragmentation and threatened species. In addition, species specific targets may also be identified in under the LARP biodiversity strategy. The cost of adding grizzly habitat constraints to the model was relatively low because the habitat was not

particularly rare. We do not address a number of other target species in the boreal, particularly caribou which represent an important environmental liability for companies. Systematic conservation planning could also be used to target conservation actions into high priority areas (e.g. Schneider 2011). The point is that tradeoff analysis demonstrates how different offset constraints lead to different regional outcomes in terms of biodiversity loss, reclamation activity, and economic losses. The development of additional offset rules and constraints must be undertaken for the whole boreal region in order to understand how activities are substituted between regions under different rules, and the effect on regional economic and ecological outcomes.

The intactness index used in this analysis is based on aggregate information about the success of individual species at each site. However this information can also be disaggregated to understand the condition or value of sites for specific species if desired. Therefore the data collected by ABMI can also be used to develop measures of similarity based on the abundance of species at different sites. The development and testing of species based similarity metrics from ABMI data for use in an offset program is something that could be considered in future research.

4. Experimental Evaluation of Market Design Options and Role of the Conservation Exchange

Market design is an area of economics devoted to the design of real world markets for unique situations (Milgrom 2011). Examples of "designer" markets include: labour market clearinghouses, auctions for spectrum (band-width) licenses, and electric power forward contracts. In the environmental domain there is the Chicago Climate Exchange for greenhouse gas emissions and carbon offsets, the Clean Air Act national SO2 market, and various water quality and quantity trading programs such as the Virginia Nutrient Credit Exchange. An offset program in Alberta will have unique market design challenges. In this analysis we test a suite of market rules using lab experiments and draw preliminary conclusions on offset market design and the role of a conservation exchange. A full description of the experimental analysis can be found in the technical report by Weber et al. (2011).

Two different views of offset market institutions have been proposed by stakeholders. The Boreal Offset Advisory Group recommends that offset trades be coordinated through a centralized conservation exchange. This recommendation can be contrasted with that of the Alberta Conservation Association, which would like to see offsets be negotiated between companies, land trusts, and private landowners. Although trades in carbon offsets are assisted by brokers and bulletin boards, almost all conservation contracting that occurs in Alberta is through bilateral negotiation. Bilateral trading *seems* appealing because it is "simple", but it is not always desirable. It can be time consuming and costly for companies to find suitable offsets. Currently they pay land trusts to broker these opportunities. While this arrangement may be appropriate for the current scale of offset activities, bilateral trading may impose unacceptable financial and ecological risks to buyers, sellers, and the public in large scale regulatory programs.

The experiments highlight exposure issues associated with finding offset contracts. In particular, companies are exposed to the risk that offset prices may increase over time, and they are also exposed to the risk that they may not find an offset. The experiments were conducted with student subjects at the University of Alberta from February 22nd to March 17th, 2011 and are described in detail in Appendix 2. Market institutions were compared based on the efficiency of market outcomes, price volatility, and distribution of the trade surplus between buyers and

sellers. For the purposes of this discussion we focus on efficiency criteria. An efficient market is one that realises the full potential value of the market and minimizes the cost of the offset program. Below we identify some of the challenges in an offset market that make it difficult to achieve efficient outcomes autonomously.

Market Design Issues

Ecological Complexity

The quality and amount of biodiversity varies by location and over time. The use of the intactness index simplifies each ecologically heterogeneous hectare of land to homogeneous and fungible units. However additional species or ecosystem specific requirements may introduce heterogeneity. Sites may also have multiple ecological values – for example, there may be both upland and wetland features and different species assemblages within the same site.

Synergies

Synergies arise when the costs or benefits of packages of offsets (i.e. bundles of contracts of different vintage, duration and type) exceed the costs or benefits of buying and selling offsets separately. Positive benefits for both buyers and sellers come from reductions in up-front contracting costs (e.g. legal fees, registration fees and insurance). Another source of synergies for sellers is increased environmental benefits over time. For example, a site may take awhile to establish but then site benefits may grow exponentially until a site is mature. There may also be negative synergies. For example, sellers may have to be paid a premium to enter multi-year contracts due to loss of flexibility and option value on the land.

Duration and Timing Issues

Companies need to find equivalent offsets of the right size and duration over a potentially large range of impacts and projects. For some activities such as building forest access roads the ecological footprint may be short-lived (e.g. 5-years). On the other hand, infrastructure for in-situ bitumen extraction may persist on the landscape anywhere from 10 to 60 years. In addition, while many impacts may ultimately be reclaimable or restorable, some may be irreversible. This means that companies will want a range of contracting options, from annual to multi-year

contracts to permanent easements. Thus the period (or 'vintage') and duration (annual, multi-year, or permanent) will be important features of the commodity being traded.

Indivisibilities

Indivisibilities occur because the scope to adjust the size and type of an offset requirement is limited by the needs of the development. Buyers' needs may be 'indivisible' in size and type in the sense that they may face "all or nothing" requirements that they have limited ability to adjust due to location of the resource and fixed land input requirements. Sellers may also be constrained in the amount of land they can make available for offsets due to the size of the tenure or land holding, or the amount of suitable area for an offset. Indivisibilities make it difficult to exactly match one buyer's needs to one seller's offset.

Results

Upfront requirements to obtain offsets prior to development introduce exposure for buyers since they may not be able to find suitable offsets. This problem can be addressed in different ways, depending on whether society prefers to accept ecological risk or economic risk. In Queensland, developers can pay into a fund if they can't find a suitable offset, demonstrating a willingness to accept ecological risk. In Victoria, there is no safety valve if an offset can't be found. Instead the government reduced economic risk by using market design to develop the NVX to help developers find suitable offsets. In this study we test the impact of market rules on the ability of buyers and sellers to make efficient trades. The results from the experiments demonstrate the effect of market design. The most complex market tested resulted in the highest realised level of economic value and efficiency even though there were more constraints and challenges to address. The corollary is that reducing the complexity of the offset policy in order to have a "simpler" market does not lead to lower costs, or greater efficiency. This result clearly illustrates the importance of market design developing the offset policy.

1. Multilateral Trading

If offset requirements are highly segmented (many types) due to numerous ecological criteria and constraints single buyers are unlikely to demand all of the features within a single offset site while offsets may not meet all of a single developers needs. As a result, buyers may end up

purchasing more offsets than they need to make sure they have all habitat types required. Similarly, sellers may not receive the full value for all types of habitat on their site if the site can only be sold to a single buyer. Due to indivisibilities it is also unlikely that offset size requirements will match exactly between a single buyer and single seller. Buyers and sellers would benefit if they could sell the unused components of offsets (a form of credit stacking), or if the market could execute multilateral trades that match multiple buyers to multiple sellers. Multi-lateral trading maximizes the value of a sale to the seller, and also minimizes costs for buyers since they don't have to pay for anything "extra" beyond what they need. Allowing sellers to split offsets into multiple segments for different buyers (credit stacking) eases but does not eliminate the efficiency problems in bilateral trading. Resale also allows buyers to dispose of excess offset credits. However, resale and splitting are not as efficient as multi-lateral transactions, and there are additional transactions costs.

2. Futures Market and Package Bidding

For projects of long duration a future contract market reduces the exposure of buyers to price risk (risk that offsets become more expensive over time) and to project risk (risk that offsets are not available in a specific period and the project cannot proceed). Buyers may wish to obtain a portfolio of offset contracts all at once to meet current and future project needs and to minimize price risk and project risk. Combinatorial bidding allows buyers and sellers to express their preferences for a single offsets as well as for packages of offsets of different vintage (year), duration, and type. Buyers and sellers can fashion 'all-or-none' offers for a package of items. This feature prevents buyers (sellers) from the possibility of buying (selling) only one offset when a package is required, and not being able to buy (sell) the rest. The experiments demonstrate that buying and selling packages improves the efficiency of the market. Smart markets that do not allow partial execution of offset requirements (i.e. that do not allow buyers to purchase some but not all of what they need) as a built in rule are the most efficient and reduce the rents captured by sellers because buyer exposure is minimized which increases the competitiveness of buyer bidding.

3. Role of the Conservation Exchange

Commodity exchanges around the world are characterised by large numbers of buyers and sellers. Initially 'open outcry' and later electronic exchanges formed as institutions to facilitate negotiation and transactions between large numbers of buyers and sellers. The exchange may also (but does not have to) have a clearinghouse. A clearinghouse is responsible for clearing trades and settling accounts as well as collecting collateral and margin monies to provide counterparty risk mitigation. In bilateral trading, parties are directly and indirectly exposed to each other, whereas in a clearinghouse, the clearinghouse is the counterparty to all parties. The clearinghouse pools and spreads risk, and insures transactions by requiring parties to post collateral. Clearinghouses can also provide centralized trade reporting and transparency thus reducing opportunities for fraud. The efficiency of trading commodities and financial contracts in an exchange can be compared to bilateral negotiation where buyers and sellers have to find each other, negotiate prices and contracts, and so on. The complexities of the Alberta offset market described above demonstrate the value of a **centralized** exchange where all trades are routed through one market with no competing market. A centralized exchange would reduce potential problems from market thinness and maximize the number of contracts being matched at once, increasing competitiveness and efficiency. Call markets suffer from the drawback of being periodic since offsets are not necessarily available 'on demand'.

4. Trading Platform – Double Auction versus Call Auction

There are two distinct auctions that could be run by a conservation exchange: double auctions and call markets. In a double auction all bids and offers in the market are made known to market participants. Transactions may be initiated by any participant (either a buyer or seller) and take place anytime when an acceptable contract is found. Transactions prices vary depending on who is in the market at a given time and how distinct the auctioned items are. A call market is different from a double auction in that the market is periodic and bids may either be open or sealed. The bi-weekly auction for petroleum and natural gas leases in Alberta is an example of a call market. Until the end of the call the system may display a "market clearing" or "provisional price", and offers may be revised or removed. The provisional price is the price which maximizes the number of commodities that can be traded given who is in the market.

When the market is called, successful buyers and sellers are determined as well as the price at which they will exchange the commodities.

Double auctions are a very efficient form of exchange in many settings. However, if there are not very many buyers and sellers the efficiency of the double auction can be compromised, particularly if the market is highly segmented due to ecological criteria and constraints. For package auctions, the efficiency of the double auction can depend on the order in which trades are executed. One reason that the call market might outperform the double auction is that the call market aggregates all market participants simultaneously whereas the double auction matches trades sequentially which could be a problem since there is no guarantee that the right trades get executed first. Although re-sale could eventually lead to the most efficient combination of contracts, this imposes additional transactions costs.

5. A caution on funds and in-lieu fees

Some offset programs require payments to be made to a fund which is then used to purchase offsets. For example, Alberta's wetland compensation program requires developers to pay into a fund for wetland compensation which is then carried out by a certified restoration agency. Funds are often favoured by developers because their offset requirements can be resolved quickly and with certainty. However from a societal perspective in-lieu fees may transfer ecological risks from the developer to a third party or the government which does not have full information about the actual costs of acquiring the offsets (since only sellers know these costs). The problem with the fund option is that there is no price discovery mechanism that directly links development decisions with the costs of impacts. If the offset cost is higher than what was paid into the fund, then ecological objectives will be compromised and taxpayers may be on the hook to fund the residual, a problem which has already been identified by Alberta's Auditor General (2009) with respect to the mineable oilsands.

There are instances when payment into a fund is appropriate. For example, the Government may decide that economic risks may be more important than ecological risks, and allow payment into a fund if costs exceed a threshold. The 15/tonne charge for carbon emissions is an example of such a threshold. Alternatively, in-lieu fees may be required for management actions

that do not involve habitat improvement such as predator control and access management. If a fund is used, then the objectives of the fund must be transparent and clearly stated, and the fund must be adequate to meet stated objectives.

Gaps

The experimental analysis provides preliminary evidence of how key features of market design will affect the efficiency of the offset market, however there are a number of issues that must be further tested:

- Although the call market looks promising, additional experiments are required to compare the double auction and call auction as we were unable to control for all of the relevant parameters in the markets tested;
- The impact of additional segmentation and an in-lieu fee option to address caribou management should also be explored once specific species targets for the offset program are established;
- Finally, a number of strategic questions must be addressed to ensure that the offset market is competitive, and that the offset market can't be manipulated to restrict competition or capture rents in primary markets (i.e. oil and gas markets).

5. Policy Recommendations and Next Steps

This section provides recommendations on offset policy development, including opportunities to implement offsets within existing regulations and emerging strategies related to regional land use plans. The recommendations are based on a policy review as well as interviews and discussions with key government and non-government stakeholders. The strengths, weaknesses, opportunities and threats of the recommendations are summarized in Table 1 below. The recommendations are followed by a policy roadmap with short, medium and long term actions required to establish an offset market within a conservation exchange, as well as recommended next steps.

Opportunities for offsets in the Boreal Forest Natural Region

The LARP contains a number of important objectives and strategies that offsets can support. These include progressive and accelerated reclamation, the biodiversity strategy, disturbance thresholds, and a requirement for integrated land management. The LARP points to an opportunity to develop a program based on tradable credits for reclamation and avoided disturbance which could be used to achieve objectives identified in the biodiversity strategy and meet disturbance targets in the Lower Athabasca Region. Since permanent offsets are not feasible on public lands, temporary offsets must be considered.

Stakeholders expressed concern over how an offset requirement will interact with existing requirements for reclamation, and in particular whether offsets should be tied to residual harm or replace existing requirements. One problem with tying offsets to residual impacts is that they would have to be calculated against existing reclamation requirements which require returning the landscape to equivalent condition at some future date. Therefore the residual impacts seem largely related to timing and risk between the impact and reclamation. Given the close tie to reclamation requirements, we recommend embedding offsets within the reclamation policy. In particular, since offsets are simply advanced reclamation they should count as a security against future reclamation. Reclamation of a site in the future would allow the resale of the net difference between the original offset and the new offset created by the future reclamation.

Opportunities in Southern Alberta

The preliminary recommendations for the South Saskatchewan Region include exploring financial incentives and market opportunities for the energy sector to provide ecological goods and services on agricultural and forest lands, and protecting biodiversity through market based tools. However the Regional Advisory Council recommendations for the SSRP lack tangible implementation strategies that could support a regulated offset program. In the meantime, a voluntary offset program for the South can still be developed building on the recommendations for the boreal region to address species at risk or other ecological goals.

Strengths

An offset program based on reclamation credits is a win for Government, industry, and the environment. From industry's perspective, a regulated requirement will prevent free-riding of other companies on the conservation actions of industry leaders. In addition systems and capacity for site reclamation and certification are already in place. There may be an opportunity to expand these systems for certifying offset credits. Offsets will provide industry with a tool to address cumulative effects which are outside the scope of their own impacts. Offsets may also provide a common approach to managing similar issues for gas in Northeast B.C., and across the Western Sedimentary Basin.

From the Government's and public's perspective the offset program could address a number of weaknesses in the current reclamation policy. First, the link between equivalent capability at a site level and equivalency at the landscape level is missing from current reclamation criteria, and there is room to incorporate more explicit cumulative effects objectives into reclamation through equivalency rules for the offsets. Secondly, the securities provided for oilsands reclamation have been criticized in several reports including the 2010 Royal Society report on the Environmental and Health Impacts of Canada's Oil Sands Industry (Gosselin et al., 2010) , and in 2009 Report of the Auditor General of Alberta. Offsets could provide a security against future impacts along with financial securities that would still be required to address uncertainties associated with reclamation technologies.

Weaknesses

The economic analysis suggests that there is a shortage of immediate reclamation opportunities at a scale large enough to support future development trajectories. Baselines on for the timing of reclamation would have to be established in order to determine whether a credit could be given for "accelerated" reclamation. There are also risks if offset prices are not high enough to provide sufficient incentives for future reclamation. Therefore offsets would have to be accompanied with additional financial securities.

Threats

There are a number of threats associated with developing an offset program. These include the foreclosure of attractive opportunities for embedding offsets in emerging policies because of lack of coordination and communication between government departments on offset policy options, and because of insufficient understanding of how to implement offsets within key government departments. This threat can be addressed by education of key decision makers, and through communication within committees established to support the development of an offset policy. Another threat is that industry may not support the policy because the costs may be seen as too high and/or environmental risks may not be sufficiently reduced. Industry stakeholders suggest that policy harmonization will be critical for acceptance of an offset program. In particular, it will be necessary to show how offsets will fit within existing requirements for Integrated Land Management, reclamation, and timber damage assessment to ensure that there is not cost duplication.

A change in leadership or government may result in loss of support for the Land Use Framework and the ALSA. However, an offset program is not dependent on either the framework or ALSA, since the government has other tools (e.g. reclamation requirements; environmental impact assessment) to manage for cumulative effects on public lands that could be supported by an offset program. In future there may be low support from NGOs for developing a centralized conservation exchange to facilitate offset transactions as this institution would change the business model for organizations that are currently developing turn-key offsets through bilateral arrangements.

Table 1 SWOT Summary of the Recommendations

Recommendation 1 – Develop an offset market in the boreal based on credits for reclamation and avoided disturbance			
Strengths	**Weaknesses**	**Opportunities**	**Threats**
Systems and capacity for site reclamation and certification are already in place	Potential shortage of reclamation opportunities relative to demand	Opportunity to link to evolving ecological requirements for reclamation	Loss of support for regional planning, Land Use Framework or ALSA due to change in leadership or government
Reclamation costs understood by industry	Difficulty in establishing baselines for and validating avoided disturbance	Opportunity to tie offsets to security requirements for reclamation	Government policies evolve without consideration of offsets and foreclose attractive opportunities for offsets
Provides incentives for progressive and accelerated reclamation, as well as integrated land management			
Provides ecological benefits while development occurs	Difficulty in establishing new tenures for rights to provide offsets and potential interactions with other resource dispositions	Opportunity to link to LARP disturbance management plan and biodiversity management framework	Loss of support from industry because of lack of trust from industry or concern about additional regulatory burden
Opportunity to fund reclamation of legacy disturbance and to increase incentives for future reclamation	Redistribution of resource rents from energy sector to offset providers		Lack of support from NGOs because market model changes the business model for organizations that are developing turn-key offsets through bilateral arrangements

Roadmap for Offset Policy Development

Figure 2 and Table 2 below summarize recommendations for short, medium, and long term actions to further develop an offset policy.

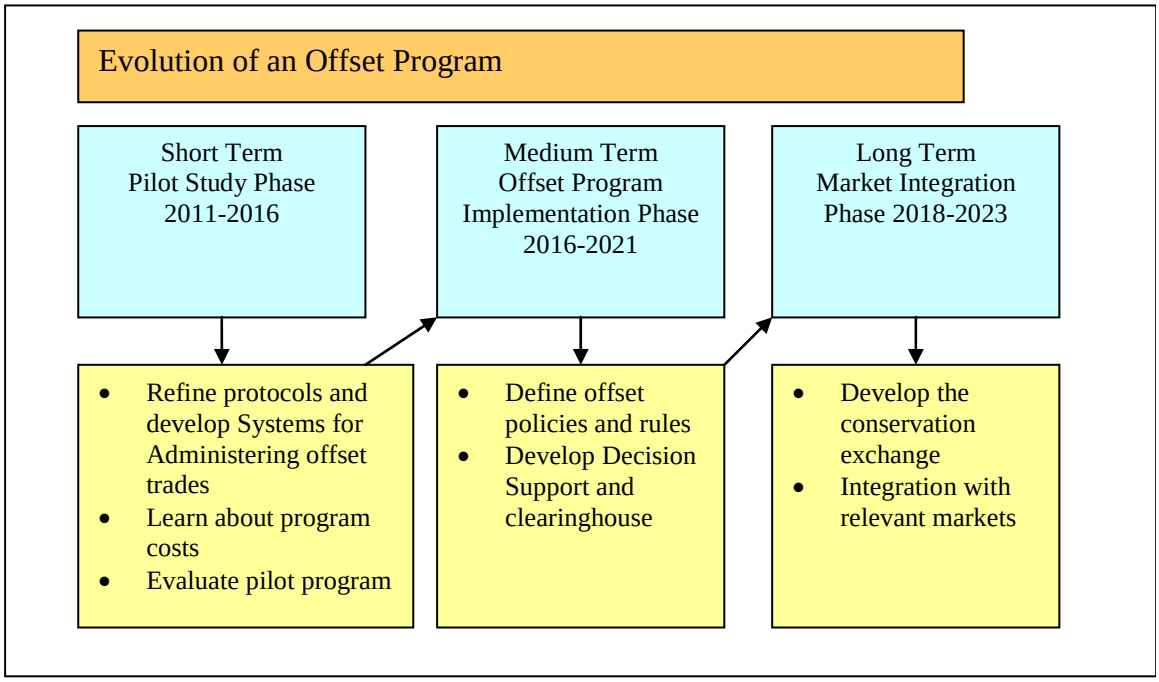

Figure 2 Offset Policy Roadmap

Short Term Pilot Phase 2011-2016

Phase 1 is the pilot study phase. Interviews with Government and non-government stakeholders suggest that there are opportunities to pilot offsets in both the South Saskatchewan and Lower Athabasca Region. An **immediate action** is to assemble interested stakeholders and clarify offset pilot project objectives and the information gaps that will be addressed in the pilots. Protocols for monitoring the pilots should also be established. A second **immediate action** in the short term is to develop an education program targeted at key decision makers within Government as well as industry to ensure that opportunities to use offsets to cost effectively support regional planning objectives are not foreclosed, and that the offset policy is appropriately implemented.

Pilot studies provide an opportunity to evaluate the potential costs, benefits, and acceptability of a scaled up offset program, as well as to understand how a scaled up offset program could be administered. Pilot projects should be encouraged over the next 5 years to address key information gaps in establishing an offset market. These gaps include:

1. Clarifying the ecological goals and refining the biodiversity indicators, metrics, and measurement protocols (including baselines) that will be used to quantify offsets.
2. Developing the administrative systems for verifying, certifying, monitoring and auditing offsets, including understanding whether and to what extent existing systems for certification of reclamation systems can be built upon, and options for managing offset risk.
3. Understanding transactions costs and identifying preferences for contracting and managing contract risk.
4. Understanding how to create a competitive market including developing systems for sharing information about offset transactions and pilot testing market mechanisms for trading offsets such as reverse auctions, double auctions, and call auctions.
5. Developing systems for understanding baselines and granting rights to provide offsets on public lands;
6. Understanding how to align offsets with broader Government of Alberta policies and strategies and developing buy-in and support for offsets within Government.

The ABMI has developed tools to quantify changes in ecological condition that can be used as part of a measure of equivalence for offset pilots. However ecological condition is just one factor in establishing equivalency. Additional metrics and equivalence rules would have to be developed based on goals for the offset pilot, and protocols would have to be developed for quantifying offsets. One of the benefits of using the intactness index in the pilot projects is that it can be deployed across the province, and also links directly to long term monitoring of ecological objectives. The offset pilots should also address the role of in-lieu fee payments and ensure that the key environmental liabilities facing industry including caribou are addressed.

The CCX - Example of a Multi-Firm Voluntary Pilot with Binding Commitments

It is important that offset pilots provide information to guide the evolution of efficient market institutions. The Chicago Climate Exchange (CCX) carbon market provides an example of how a centralized trading scheme could work as a pilot. The CCX was initiated as a voluntary tradable permit program for reducing greenhouse gas emissions. Companies signed legally binding agreements to reduce emissions of greenhouse gases by 4% from their 1998-2001 baselines by

2006. The figure was reached through consensus of founding members. The offsets were anonymously traded using a web based system regulated by the National Association of Securities Dealers (Farleigh 2003). The CCX began with companies already engaged in bilateral trades for emissions. The motivation for companies to participate in the CCX was to learn about efficient mechanisms for emissions trading in anticipation of a scaled up regulated cap and trade program for green house gas emissions. During the 8 year pilot, standardized systems were developed for verifying emissions reductions and developing compliance procedures. Protocols were developed for helping companies calculate and report on emissions, setting baseline emission levels and reporting emissions data. The voluntary carbon market eventually closed in December 2010 when it became evident that the U.S. would not be capping greenhouse gas emissions. One of the criticisms of the CCX was lack of transparency of the protocols and market operations.

There are a number of incentives that could be used to encourage participation in a voluntary multi-firm pilot project with binding targets. These include streamlining of approvals, use of offsets as a security for reclamation, and recognition for early action in any new requirements that emerge from the biodiversity strategy and disturbance management plan. Uncertainty about future policy direction will reduce or eliminate interest in pilot projects, so it is important that the key policy drivers for offsets be identified and that the government departments responsible for those policies take ownership of the development and implementation of an offset program to achieve specific policy objectives. At the same time that the pilots are being undertaken, a number of outstanding research gaps could be addressed including more detailed economic and ecological analyses of baselines, offset requirements for specific activities, and monitoring and enforcement options.

Medium Term Implementation Phase 2016-2021

After a 5 year pilot period, the offset program may be evaluated in order to make a decision about whether to continue offsets on a voluntary basis, or move forward with a regulated offset program.[5] In either case (voluntary or regulatory) policy will be required to support offset

[5] The timelines for the pilot and key decisions are for illustration. It may be necessary to extend some phases of the program development or possible to shorten others.

trading, particularly when offsets are generated on public lands. Assuming that there is a decision to proceed with a regulatory program, during the medium term decision support tools can be developed to assist firms in reporting and meeting compliance. In addition an exchange and clearinghouse for settling offset contracts may be developed.

Long Term Market Integration Phase 2018-2023

Much of what will happen over the long term will be determined by the outcome of the pilot phase and implementation requirements. Given what has been observed in water quality and other offset markets, over the long term the exchange will evolve and decision support tools will be designed to facilitate competitive and efficient electronic transactions that meet offset obligations while minimizing effort of participants. If offset contracts are complex, the exchange may require support in the form of decision support tools that help match buyers and sellers efficiently.

Over the long term firms may be required to, or have options to, comply with a suite of environmental regulations using market based approaches. Issues around credit stacking and market integration will need to be addressed. In addition, offset markets will have implications for revenue streams from development and may affect other transactions such as bids for petroleum and natural gas leases. In the long term, the integration between the offsets market, other environmental markets, and resource auctions must be addressed.

Table 2 Evolution of Offset Market Development

Time Frame	Priority Actions	Information Gaps Addressed
Short Term Pilot Study Phase 2011-2016	Assemble stakeholders and define terms for acceptable "government sanctioned" pilot studies	Establish goals and objectives for pilot studies and monitoring and reporting requirements for filling key information gaps
		Define eligible actions and remove legal barriers
	Work with government departments to clarify policy linkages	Determine how offsets will meet requirements in existing and emerging policy and regulatory structures such as reclamation policy, disturbance management plan, and biodiversity strategy
		Define how offsets created during pilot phase will be credited within existing regulations or new regulations
		Establish baselines and eligibility criteria and identify reform options for tenure and other institutional barriers
	Develop offset metrics	biodiversity indicators and protocols for measurement defined
	Monitor pilot offset projects	Identify management actions required to maintain offset site and length of time appropriate for certification; learn about offset costs
	Develop information systems to validate, register, and certify offsets	Learn about administrative costs of an offset system and potential roles for Government and Non-Government agencies
	Develop bulletin board market for posting offset opportunities	Learn about transactions costs, contracting risk, market participation, and price behaviour
	Evaluate pilot phase 1	Stakeholder feedback on offset program options
		Determine feasibility of regulated offset program
Medium Term Offset Program Implementation Phase 2016-2021	Develop regulations and policy to support offset program whether it is voluntary or regulatory	Understand market and refine market design
	Develop decision support tools to quantify offsets and ensure compliance	
	Develop clearinghouse for offset contracts	
	Monitor and Evaluate Program (5 year intervals) and revise if necessary	Understand linkages to other environmental markets
Long Term Market Integration Phase 2018-2023	Develop and test electronic exchange and integrate with other markets (leases, carbon, water, etc.)	

Next Steps

In order for the policy on offsets to evolve it will have to find a "home" department which will take ownership of the development and implementation of the policy. A number of strategies are being developed for the regional plans that could be supported by an offset program. However, without coordination and leadership the opportunity to tie offsets to these strategies will be lost, resulting in increased ecological risk and largely ineffective voluntary conservation investments by industry. One point raised in the interviews is that companies are currently motivated to participate in pilot projects because they anticipate further policy and/or regulation to address cumulative effects; and offsets can also address liabilities around caribou and Species at Risk. However this momentum needs to carried forward through specific Government of Alberta commitments including human and financial resources to develop an offset program. Therefore we recommend the following next steps.

- Hold an offset policy workshop with key government departments and selected stakeholders to identify and map the linkages to potential policy drivers for offsets. The workshop should identify feasible opportunities for integration of offsets into policy.
- Develop an education strategy for ensuring key Government decision makers understand implementation options for offsets.
- The opportunities should be vetted by a cross ministry group (e.g. the Landuse Framework Integration Team) which should adopt one or more of the recommended opportunities and assign a lead agency with responsibility and clear accountability for developing the program. For example, if the biodiversity strategy is the policy driver, then Sustainable Resources Development could be the lead agency.
- Identify key partners within Government and mechanisms (such as cross ministry working groups) to secure their ongoing support and participation in development of an offset program.
- Establish a stakeholder advisory group for communication and consultation with important external stakeholders to foster buy-in for policy recommendations as the policy evolves.

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