Conversion of Cultivated Lands to Native Perennials in the Parkland (Framework #2)

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and
Alberta Agriculture and Rural Development
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Cover Photo: Native stand seeded in about 2000, dominated by wheatgrasses, in a saline lowland located in the Central Parkland Natural Subregion near Big Valley, Alberta. Photo taken by the author in 2008 shows variable plant response to saline conditions.

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Executive Summary

This framework document is two of four that provide information on sustainable practices for the conversion of cropland to native or tame forage in Alberta. The current document focuses on conversion of cultivated annual cropland to native perennial cover in the Parkland region. The Parkland Region, as used in this document, encompasses all areas where native grassland is dominated by Plains rough fescue or Foothills rough fescue. This includes the Parkland Natural Region (Central Parkland, Foothills Parkland, and Peace River Parkland Natural Subregions) and the Foothills Fescue and Northern Fescue Natural Subregions. The information is intended for all personnel involved with the Alberta Cropland Conversion Protocol (ACCP), including land managers, seed providers, policy-makers, aggregators, auditors, and professionals including rangeland agrologists or biologists. This document is designed to be all-inclusive by providing a general overview. Future documents will be designed for more specific audiences.

Native restoration is more challenging in the Parkland region than in the Dry Prairie, because the moister conditions enhance competition from weeds, and because generational time periods are required for rough fescue to attain mature plant community status. Recommendations are provided on diverse seed mixes that include rough fescue. Information on sustainable management practices for conversion of cropland to native perennial cover is also provided, including development of a restoration plan, preparation of the seed bed, timing, seeding techniques, and pre- and post-seeding weed control and management.

Short-term and long-term verification of the success of management practices will be established by third-party professionals. Short-term verification will focus on stand establishment for a period of two to three years following seeding, and includes a grazing management plan and proof that seeding was conducted. Indicators of short-term establishment include measures of bare ground and soil erosion, plant numbers and diversity, and weed types and density. Long-term verification focuses on range health indicators that compare range sites and plant communities to surrounding areas of native pasture. Detailed long-term grazing management plans can be adjusted based on periodic range health assessments. The proposed minimum 18-year contract length will not permit the development of a late seral rough fescue plant community. Therefore, rough fescue cover should be monitored using all range health indicators, but verification of the “Similarity to Reference Plant Community” indicator will be based on other seeded grasses during early and middle years of the agreement.

Barriers and opportunities for the success of the Alberta Crop Conversion Protocol are discussed, including promotion, remuneration, seed availability, lessons learned from previous native range conservation programs, and consistency with existing programs. The ACCP will target drier areas in the eastern portion of the Parkland region because rough fescue establishment is somewhat less challenging in those areas, and also because the lower human population and moderately high livestock densities make this area ideal for conversion.

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Introduction

Native species extend forage productivity and the growing season from late summer to winter. In addition, native grassland species contribute to biodiversity, reduce invasive species problems, and enhance wildlife habitat (Jefferson et al. 2004). Soil organisms are more active in native grassland biota than in tame forage in the Parkland (LaRade et al. 2012). Native species increase carbon sequestration, and the carbon footprint is also reduced because there is no mechanized haying, baling, transport or feeding. The suggested greenhouse gas budget for native parkland conversion is provided in Table 1.

Table 1. Native Parkland framework summary. (From Janzen and Haugen-Kozyra 2012).

Estimated Net Greenhouse Gas Emission Reduction and Removal (tonnes CO_2 ha^{-1} yr^{-1})	Project Condition			
	Grass Type	**Fertilizer**	**Grazing**	**Haying**
High (1.5 – 2.0)	Native	No	Yes	No

Note: The conversion of t/ha to t/ac is obtained by multiplying 0.445 by the number of t/ha.

The area of native pasture lands in Alberta has not changed significantly during the past five years of census reporting. In 2006, 27,466 farms reported 6.53 million ha, while in 2011, 23,855 farms reported 6.44 million ha, indicating a decrease of approximately 1% in five years (Kirychuk 2012). However, declines in Saskatchewan and Manitoba over the same five year period were 7% and 5%, respectively (Kirychuk 2012).

Four frameworks are being developed to provide information on the conversion of cropland to native grasslands or introduced perennial grass species, in the Parkland region of Alberta. This document is focused on native conversion in grasslands dominated by Plains rough fescue or Foothills rough fescue. This includes the Parkland Natural Region (Central Parkland, Foothills Parkland, and Peace River Parkland Natural Subregions), in addition to the Foothills Fescue and Northern Fescue Natural Subregions. The Parkland Natural Region and Foothills Fescue Natural Subregion correlate with the Black soil zone, and the Northern Fescue Natural Subregion represents part of the Dark Brown soil zone. Throughout this report, the area targeted for cropland conversion to native will be termed the Parkland region.

This framework focuses on sustainable practices for cropland conversion that can be used by land managers, with reporting by third-party professionals, to develop farm-specific action plans for the Alberta Cropland Conversion Protocol (ACCP). In this report, the term “land managers” includes landowners, land renters, or occupants, provided they have a signed agreement with the land manager. This framework is designed as an initial and inclusive document that is a precursor to future specific versions directed to particular audiences. As the ACCP develops, it is expected various user documents will be prepared for land managers, seed providers, verifiers, aggregators, policy-makers, and auditors. Verifiers are professionals including rangeland agrologists or biologists, who provide planning, confirmation of conversion and establishment, and project monitoring. Aggregators take the concept to producers for participation, and potentially include multiple agreements.

The goal for land conversion in the Parkland is forage stands dominated by native grasses that ideally include native legumes. Time must be allowed for a stand to be established and healthy, as indicated by range health assessment. Contracts are recommended to be a minimum of 18 years duration as the establishment and maintenance of native stands is a long-term process.

Native restoration is more challenging in western regions of the Parkland Natural region because the climate is moister, with deep and highly fertile soils that are highly vulnerable to invasive plant species. Native restoration is somewhat less challenging in eastern regions of the Parkland Natural region (E.g., east of Edmonton), where soils are less deep and less fertile, and therefore less vulnerable to invasive species.

Sustainable grazing practices maintain and promote long-term range health. Aspects of grazing that affect range health include intensity, rotational systems, and the timing and duration of grazing and rest periods. Range health assessments provide a valuable indication of grazing management and the potential need for modifications. Fertilizer is not required at any time. Fertilizer is detrimental to native stands as it promotes non-native species. Soil degradation, such as erosion, is possible during the seeding, establishment and management phases; practices must ensure minimal soil disturbance.

Potential participants in the Alberta Cropland Conversion Protocol (ACCP) will be required to sign a contract to receive payments. The following are recommended requirements for each ACCP contract. Each requirement is described in more detail in this report.

- A simple restoration plan.
- Proof of seeding and stand establishment.
- A grazing management plan that meets short- and long-term requirements, which can be adjusted based on periodic range health assessments.
- Short-term verification records, including current and on-going cultivated acres.
- Long-term verification records, including periodic range health assessments.

This framework is divided into three key components: i) land conversion and management practices promoting sustainable establishment of native species; ii) short-term and long-term verification of successful conversion, and iii) potential barriers and opportunities. The framework provides a summary; the references at the end of the document contain more details.

Conversion and Management

This section discusses the "four P's" of native conversion: planning, preparation, planting and patience.

Develop a Restoration Plan

A simple restoration plan is a required component for participation in the native conversion protocol. Planning is particularly imperative for the Parkland region, because rough fescue grassland is challenging to restore and generational time periods are required for success. Potential items for inclusion in the restoration plan are discussed below.

The restoration plan for conversion of cultivated land to native will include a prioritized list of land use goals (NPWG 2001), such as the detailed list provided by Wruck and Hammermeister (2003, Appendix B). Potential objectives are also identified by Gabruch et al. (no year, pg. 3) and by NDGF and NRCS (2005). Land parcels within the property should be prioritized for conversion to native perennials (Wruck and Hammermeister 2003). The plan should recommend restoration practices that will be best suited for the planned area and will minimize potential offsite effects (Sinton 2004). Wruck and Hammermeister (2003, Appendix C) provide a detailed framework for timeline and budget planning. In addition, a valuable flow chart is provided (Gramineae 2012, Figure 7) for planning purposes related to native conversion of large-sized disturbances such as formerly cultivated fields.

Natural resource information is important for successful restoration to native prairie[1]. The area planned for restoration should be characterized, including the identification of potential soil types (Wark et al. 2004), range sites, and plant community types (Wruck and Hammermeister 2003; NDGF and NRCS 2005). Range sites in Alberta are correlated to soils information in range plant community guides for each Natural Subregion (Table 2).

Table 2. Range plant community guides for Natural Subregions pertinent to the Parkland region.

Natural Subregion	Reference for Range Plant Communities
Central Parkland	Burkinshaw et al. (2009)
Foothills Parkland	DeMaere et al. (2011)
Peace River Parkland	Stone et al. (2007)
Foothills Fescue	Adams et al. (2003)
Northern Fescue	Kupsch et al. (2012)

[1] Brad Downey, Alberta Conservation Association (ACA). Personal Communication, June 2012. MULTISAR is Multiple Species at Risk, and reflects its multiple partners: agricultural producers, ACA, Alberta Environment and Sustainable Resource Development, the Prairie Conservation Forum and others. Species at Risk (SAR) is a general term for plants and animals that may be declining or are naturally rare in Alberta.

Field Preparation

Preparation for seeding includes weed management and seed bed preparation (NDGF and NRCS 2005; Wruck and Hammermeister 2003).

Seed Bed. Best results in the Parkland region are typically obtained by seeding into standing annual crop stubble, so that soil erosion and evaporation are minimized.

Successful establishment of native species is promoted by maximum seed-to-soil contact. Topsoil should be loose and friable at the surface, without large clods or debris, and uniform soil texture. The underlying seed bed must be firm, such as obtained by machine rolling. The seed bed is firm if the impression left by an adult footprint does not exceed approximately 3 cm (Gabruch et al. no year). Harrowing after seeding reduces the presence of soil clods (Wruck and Hammermeister 2003).

Poorer surface soil properties promote the invasion of non-native species (Desserud 2011). Potential conversion fields that suffered from soil erosion followed by cultivation, where underlying soil horizons are admixed with shallow topsoil, require physical improvement prior to seeding. The restoration of native species in the Parkland region may be promoted by management in stages (Eslinger 2009). Physical properties of the topsoil can be improved by first planting short-lived and deep-rooted productive grasses. Once they are established the short-lived grasses can be reduced with herbicide application or grazing, to allow the establishment of later seral native species from a follow-up stage of broadcast seeding (Eslinger (2009).

Pre-Seeding Weed Control

Pre-seeding weed control is vital for restoration success. Weed seeds can remain dormant for significant time (EC3 no year), so pre-seeding weed control will require at least one and possibly, more growing seasons (Gabruch et al. (no year). Removal of standing crop through silage or greenfeed harvest can be used effectively to remove introduced plants and weeds, and reduce or eliminate weed seeds before native seeding (Iwaasa and Schellenberg 2005).

Before undertaking weed control, weeds need to be identified and their distribution must be characterized. Weeds may be problematic along former structures, including fence lines, corrals, and storage locations. For cases where weed control is required, herbicide companies employ professionals who can offer free advice regarding the most effective weed control plan, including products, timing and techniques.

Chemical and tillage methods can be used, but tillage reduces soil moisture and increases erosion risk as well as spreading certain rhizomatous weeds. Herbicides are usually the most effective solution to deal with weeds for cropland to native conversion, because weeds typically out-compete native seedlings. Herbicide control is extremely important before seeding of native species, but herbicides can also be used occasionally after seeding (Wruck and Hammermeister

2003). Herbicide application can be done by back-pack sprayers, ATV-mounted sprayers, and agricultural field sprayers (Wruck and Hammermeister 2003). Seeding should be within four days of glyphosate use to optimize competition for weeds remaining in the seedbed (Iwaasa and Schellenberg 2005).

Nurse or Cover Crops

Cover or nurse crops are usually agronomic cereal crops that are planted on a restoration site to protect emerging native seedlings. Cover crops improve the potential for snow-trapping in the winter and they can out-compete weeds, but this often hinders the success of native seedlings. For this reason, the best results in the Parkland region typically do not include the use of a nurse or cover crop. Cover crops are useful during times of drought (Gramineae 2007) or at locations where the potential for soil erosion is high to extreme (Wruck and Hammermeister 2003), such as in areas dominated by coarse textured soils (E.g., Sands range sites).

Native Seed Mixes and Seeding Rates

Rough fescue is the dominant late seral species in the Parkland region, and long time periods are required for successful establishment of rough fescue. Seed mixes have evolved in recent years with the goal of promoting rough fescue grasslands over the long term.

Until recently, reclamation seed mixes in the Parkland used either non-native grasses, or a combination of introduced grasses and native species that are more adapted to the Dry Prairie region. For example, seed mixes used for reclamation in the Rumsey Block (north of Drumheller) from 1983 to 1991 did not typically use rough fescue. The few seed mixes that included rough fescue used a range of 12 to 70% rough fescue by weight (Eslinger 2009).

A typical 1990's native seed mix recommended for the Parkland region of Alberta and Saskatchewan included western wheatgrass, northern wheatgrass, rough fescue (12.5% by weight), Hooker's oat grass, June grass, slender wheatgrass, western porcupine grass, and legumes including purple prairie clover, tufted or smooth fleabane, and three-flowered avens (Morgan et al. 1995). A higher proportion of rough fescue was present in a seed mix used for the reclamation of northern areas of the Express Pipeline in the Central Parkland and Northern Fescue Natural Subregions of Alberta by the mid 1990s (Table 3). The Special Areas Board (2009) recommends 10% rough fescue composition in their seed mix (Table 3).

Table 3. Examples of native seed mixes for the Parkland.

Species	Kestrel and Gramineae (2011)		Special Areas Board (2009)	
	% by Weight	Kg/ha	% by Weight	Kg/ha
Plains rough fescue	33.7	5	10	1.1 to 1.7
Green needle grass	30.5	4.5	20	2.2 to 3.4
Slender wheatgrass	11.2	1.6	20	2.2 to 3.4
Western wheatgrass	6.7	0.9	20	2.2 to 3.4
Streambank wheatgrass	6.6	0.9	0	0.0
Northern wheatgrass	6.1	0.8	25	2.8 to 4.2
June grass	5.2	0.7	----	0.0
Western Porcupine grass	----	----	5	0.6 to 0.8
Total	100%	14.4	100%	11.2 to 16.8

Note 1: Sheep fescue has been removed from the Kestrel and Gramineae (2011) reference because it is a non-native grass that does not promote succession.
Note 2: The conversion of kg/ha to lb/ac is obtained by multiplying kg/ha by 0.8921.

In the northern portion of the Special Areas in east-central Alberta, rough fescue has been seeded at low rates such as 10% by weight in the seed mix (E.g., 2.2 kg/ha) with other grasses, including green needle grass, slender wheatgrass, northern wheatgrass and western wheatgrass.

Recent research has focussed on the importance of rough fescue in the Parkland region. Desserud (2011) investigated the seeding of rough fescue in the Parkland Natural Region, and concluded that rough fescue performs best when seeded as the predominant species, with little or no wheatgrass in the mix, and low rates of other native grasses.

A diverse seed mix will increase the potential for successful native establishment, because species vary in their adaptation to environmental conditions. Other benefits of a diverse stand include a longer grazing season and a higher resistance to stress such as drought. Monocultures provide lesser ecosystem benefits. Monocultures that are dominated by short-lived species such as slender wheatgrass will decline in the first five years, with a gradual increase in forbs (Woosaree and James 2004).

Diverse seed mixes also promote successful establishment because species differ in their rates of establishment. Northern wheatgrass establishes early following seeding and provides dense cover in initial years, gradually declining in subsequent years to cover levels typical of adjacent native prairie (Kestrel and Gramineae 2011). Green needle grass is also aggressive in the establishment years and gradually declines with time. In contrast, western porcupine grass is a late successional species. The seeds of western porcupine grass and green needle grass have hard coats and they may not germinate in the first year unless scarified (Nurnberg 1994). Rough fescue is also a late seral species, providing little cover in early years, and slowly increasing over many years.

The inclusion of legumes and forbs also adds diversity and functionality to Parkland seed mixes. Purple prairie clover is a palatable, drought-resistant, warm-season, nitrogen-fixing legume (Klabi et al. 2010), and it can inhibit the growth of various strains of E coli (Jin et al. 2011; Schellenberg et al. 2012). White praire clover provides high forage quality and is a useful inclusion in a seed mix (Y. Li et al. 2012a; Y. Li et al. 2012b). Forbs such as prairie cone flower can provide more structure and foster native grass recruitment. Forbs such as non-woody sage species (E.g., pasture sage) transfer nutrients from subsoil horizons to the topsoil, resulting in an increase in native shallow-rooted grasses.

Recruitment from surrounding native lands is enhanced if the conversion is located adjacent to native range parcels[2]. Some species can be excluded from Parkland seed mixes because they readily recruit. June grass has a high level of recruitment from adjacent native areas, and does not need to be included in seed mixes. Western wheatgrass can generally be excluded from seed mixes because it can be successfully broadcast in specific locations, such as lowlands, Solonetzic landscapes, or areas that have been prone to spreading foxtail barley[3]. Western porcupine grass is difficult to establish from seed, and it can establish from adjacent native areas as an infill species (Eslinger 2009).

It is recommended for this conversion protocol that the standard mix be composed of at least four native grasses, with at least two long-living species and one native legume. Rough fescue must be included in Parkland seed mixes, with the exception of seed mixes for saline, sandy or subirrigated range sites. Long-lived species suitable for the Parkland include rough fescue, northern wheatgrass, western wheatgrass, western porcupine grass, green needle grass, and Canadian wild rye. Purple prairie clover and white prairie clover are appropriate legumes for Parkland seed mixes. Canadian milk vetch and ground plum could also be included as legumes, although their seed supply is currently limited. Seed mixes could ideally also include forbs such as prairie cone flower or non-woody sage species.

Generic seed mix recommendations can be improved by adjusting the mixes to be more similar to the plant communities in adjacent native parcels, and to be more suitable to the local soil and landscape conditions. Seed mixes ideal for range sites are identified for the Dry Prairie region (Gramineae 2012) but specific recommendations are not currently available for the Parkland. Special Areas Board (2009) identifies specific mixes for various range sites, but these are more applicable to the Dry Prairie region.

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[2] Lorne Cole, Personal Communication. Land Management Specialist, Land Use Operations, Alberta Environment and Sustainable Resource Development. December 2012.
[3] Lorne Cole, Personal Communication. Alberta Environment and Sustainable Resource Development, Land Use. October, 2012.

Seeding rates have evolved over the past 20 years. Seeding rates in the Rumsey Block in the 1990s were typically at 22 kg/ha, and ranged from 14 to 33 kg/ha (Eslinger 2009). A review of more recent seeding rates in the Parkland and Northern Fescue Natural Subregions reported a range of 10 to 18 kg/ha (Woosaree and James 2004, 2006; Gramineae 2007), similar to the rates reported in Table 3. Desserud et al. (2010) recommended that seeding rates for rough fescue should be lower than 15 kg/ha, and Desserud (2011) found that seeding rates of 4 to 8 kg/ha (240 to 480 seeds per m^2) were ideal. A reduced seeding rate, such as 4 to 5 lb/ac (4.5 to 5.6 kg/ha), can promote the infill of non-seeded native species from adjacent parcels.

Timing

Wruck and Hammermeister (2003) discuss seeding considerations for each of the four seasons.

Research by Desserud (2010) in southwestern Alberta indicated that seeding of foothills rough fescue is more successful in the late summer or early fall than in the spring. Seeding in the late fall is not recommended in the Foothills Parkland and Foothills Fescue Natural Subregions, because frequent chinooks and the associated freeze-thaw can dessicate and harm native seedlings.

Late fall seeding is appropriate in east-central Alberta as chinooks are less frequent, and western porcupine grass or needle and thread also prefer fall seeding (Gramineae 2007). Several years of successful late fall seeding of plains rough fescue were obtained in east central Alberta. Seeds were collected in late summer, and seeded in late fall using no-till drills to about 1 cm depth[4].

Techniques and Equipment

It is essential to minimize equipment operations to prevent soil pulverization and reduce the potential for erosion.

Row Seeding

Row seeding requirements include consistent and accurate seed flow rate, accurate and uniform seed placement, and adequate packing for seed to soil contact (Gabruch et al. no year). Seeding can be done with specialized grass seed drills, air drills, and some conventional drills. Recommended row spacing is approximately 15 cm, but can be as much as 25 cm in drier locations (Gabruch et al. no year; Iwaasa and Schellenberg 2005). Wruck and Hammermeister (2003) recommend seeding in two passes perpendicular or diagonally to reduce row prominence, with each pass seeded at half the required rate.

Depth banding, if possible, is recommended (NDGF and NRCS 2005). Gabruch et al. (no year) recommend seed depths of 0.6 to 1.3 cm in medium and fine-textured soils, and 1.3 to 2 cm in

[4] Lorne Cole, Personal Communication. Alberta Environment and Sustainable Resource Development, Land Use. October, 2012

sandy soils. As a rule of thumb, about 5 to 10% of seed should be visible on the surface; otherwise the seeding is too deep. Desserud (2011) used a Brillion seeder and packer with double-disc openers oriented perpendicular to the direction used for previous soil amendment with straw. Seeds were placed at a depth of 1.2 to 1.9 cm.

Native seeding is commonly successful with two seed boxes (one for grasses and one for legumes). NDGF and NRCS (2005) recommend equipment with three seed boxes so that species can be separated into i) large smooth seeds, ii) awned seeds, and iii) small smooth seeds, including wildflowers and a carrier product. Optimal seed flow to prevent bridging in tanks can be maintained by using an agitation system (NDGF and NRCS 2005). Gabruch et al. (no year) state that seed flow can be improved by adding a carrier such as cracked wheat, at a ratio of up to eight parts carrier to one part seed.

Broadcast Seeding

Broadcast seeding is beneficial because once established it provides more cover than row seeding, thus reducing bare soil and providing a closer approximation to natural conditions. However, required seeding rates are about 50% higher than for row seeding. Wruck and Hammermeister (2003) recommend broadcasting at higher rates to account for seed losses to desiccation, insects, birds, rodents and wind. They also note that broadcast seeds should be shallowly harrowed or raked, which can be followed by a packer.

The most common broadcasting equipment is a spin-spreader. In rough terrain, such as moderate to high-relief hummocky landscapes, broadcast equipment such as spreaders or tow-behind broadcasters are recommended (Wruck and Hammermeister 2003).

Amendments

Native grass seedlings, particularly rough fescue, will respond very poorly to nitrogen fertilizer, so fertilizer must not be used in the Parkland region. Manure is also not an acceptable amendment. Not only does it contain weed seeds, but in addition, the nutrients generally cause a dynamic shift in the dominant plant species, which promotes undesirable species (McKenzie et al. 2003). Properly prepared compost does not contain weed seeds. Compost can potentially be used under specific circumstances, such as application to eroded crests and upper slopes within fields that are planned for conversion to native rangelands (Bremer 2009).

In general, the only recommended amendment for native establishment in the Parkland is native thatch crimped into the seedbed. Desserud (2011) had good results when native hay cut from rough fescue grassland was used as mulch for restoring grassland following disturbances. The mulch was applied at a thickness of 2 to 3 cm, and crimped into the soil with shallow disk harrows. However, success with native crimped hay occurs only in years when viable seed production has occurred. Seed testing of the native thatch component is recommended[5].

[5] Steven Tannas. Tannas Conservation Services Ltd. Personal Communication, February 2013.

Desserud (2011) investigated the use of straw at three sites in the Parkland Natural Region to cause soil nitrogen impoverishment, and thus promote rough fescue establishment. Straw was applied about one week before seeding, and at all three sites it resulted in increased biomass, root biomass, leaf length, and cover. High straw rates (1 kg/m^2) were more beneficial than lower rates (0.5 kg/m^2) or no straw. Straw must be weed free. Straw amendment did not increase the response of the most common invader, Kentucky bluegrass (Poa pratensis).

Special Considerations for Saline Conditions

Establishment of native vegetation in saline areas will lower the water table and increase the potential for successful restoration. Saline areas can be seeded with salt tolerant native species such as wheatgrass. Special Areas Board (2009) recommends the following mix for saline soils in both the Parkland and Dry Prairie regions: an even mix of four native species (western wheatgrass, slender wheatgrass, alkali grass and tufted hair grass) at a seeding rate of 11 to 17 kg/ha. A seed mix that is suitable for the dominant range site can then be seeded in non-saline areas of the field. Sprigging can also be used to establish native plants in areas with localized or extensive salinity (Sheley et al. 2011). Sprigging involves planting rhizomes at a depth of 7 to 10 cm. Rhizomes are more salt tolerant than seeds, and are placed below the highest salt concentration in the soil profile. The method requires a rhizome source location and specialized equipment.

Post-Seeding Management

Weed Control

Herbicides must be used carefully after seeding to prevent adverse effects on desirable species Gramineae (2007). Glyphosate application in early spring after seeding of native species will reduce weeds and cool-season grass invaders, including smooth brome and Kentucky bluegrass. However, the cool-season native component may be compromised (NDGF and NRCS 2005. Pre-seeding weed control used by Desserud (2011) included mowing and 2,4-D application for the control of pioneer weeds. Weed control professionals can assist with recommendations on the most effective weed control plan.

Hand-held or mechanical wick applicators can be used for selective weed control, and high mowing can be used to control taller weeds. Mowing also curtails weed seeds (Gabruch et al. no year), but careful timing is critical as some weed species can become major problems if mowed at or near maturity (Sheley et al 2011).

Fire Management

Excessive biomass can sometimes accumulate a few years after native seeding, and this can hinder more sensitive native species, resulting in less complete plant community restoration. Litter quantity could be measured to provide an indication of the need for biomass reduction. For example, a litter quantity that is two times higher than average for that particular ecological range site may indicate the need for litter reduction[6]. Average litter values for selected ecological range sites in various Natural Subregions are provided by Alberta Environment (2010).

Haying, grazing, or burning can be used to remove excessive biomass and reduce weed species. Burning is not socially acceptable in most Dry Prairie areas, due to safety concerns. NDGF and NRCS (2005) discuss careful burning with a well-documented safety plan, and adequate equipment and resources. If burning is conducted, it may need to be followed by weed-wicking in a later season (Wruck and Hammermeister 2003). A burn in mid spring two or three years after native seeding can enhance native plantings, especially those with warm-season grasses (Gabruch et al. no year).

Fire is a valuable tool for the control of invasive species in rough fescue grasslands in northern Parkland areas. Prince Albert National Park has reintroduced a fire regime with three to five controlled burns in a fifteen-year period, burning approximately 1,350 ha of land per year, in order to control invasive plants such as smooth brome, Canada thistle, and aspen (Weir 2011).

Grasshopper Control

Grasshoppers can quickly destroy emerged native seedlings, and control may be required if they reach infestation levels. Grasshopper control using insecticides may be required when grasshoppers reach densities of 8 to 14 per m^2, and control is important at higher densities (Gabruch et al. no year). Grasshoppers may be deterred from invading newly seeded fields by planting a non-preferred crop (E.g., oats) in strips of 30 m wide around the field perimeter; in contrast, rye should be avoided (Wark et al. 2004). Agriculture and Agri-Food Canada is researching grasshopper control, including grasshopper preference for different types of forage species, and the development of biological methods to control grasshoppers.

Verification

Verification is an essential component of the potential land conversion protocol, and includes short-term and long-term indicators. Short-term verification focuses on stand establishment and success, and is conducted in the seeding year and up to two to three years following seeding. For example, Desserud (2011) found that seeded rough fescue requires two to three years to become established in the Central Parkland Natural Region. Long-term verification focuses on sustainable management practices indicative of range health, and is conducted periodically following successful establishment. Verification of stand establishment, sustainable management, and range health will be conducted by qualified professionals including agrologists or biologists.

[6] Barry Adams. Alberta Environment and Sustainable Resource Development. Personal Communication, February 2013.

Short Term Verification (Establishment)

Third-party evaluators will assess the success of seeding and stand establishment using short-term indicators, including verification of the seed mix used, an introductory grazing management plan, and periodic assessments of stand establishment. Short-term verification must account for variations in the time required for stand establishment, and patience is critical. Establishment of native plantings require longer time-frames than do tame plantings.

Seeding and Stand Establishment

Seeding success will be promoted by high seed purity that originates from the general area where it will be used. The use of good-quality seed will facilitate success. Seed mixes must be of high purity with negligible contamination, so that non-native plants such as sheep fescue do not out-compete rough fescue (Desserud et al. 2010; Desserud 2011). Gramineae (2012) provide guidelines on procuring native seed and wild-harvested native plant materials (pp. 52-54), and information on calculating seeding rates and the interpretation of seed analysis reports (Appendix D).

Items that prove seeding was conducted include receipts indicating seed purchase, seed tag labels showing quality and quantity at levels adequate for the indicated area, photographs, and third-party confirmation. Seed certificates should indicate percent ratings for Pure Live Seed, inert component, germination, dormant seed, other crop seed, hard seed, and types and amounts of weed seeds (Wark et al 2004; NRCS 2009a; NRCS 2009b). Copies will be sent to verifiers prior to seeding to confirm that the mix and quality is appropriate.

Verification requirements used in the Conservation Cropping Protocol (Climate Change Secretariat 2012) can be modified slightly for the Native Conversion Protocol. Short-term verification records required for this project include: 1) land title certificate for legal locations being claimed, 2) an agreement between the aggregator and the farm operator, 3) GPS track file for seeding operations, or measurement of the field size, 4) detailed records of the native seeding, including the seed labels and supporting records, 5) evidence of re-seeding events if applicable, and 6) records of current and on-going cultivated acres.

The program will not allow the breaking of other native holdings while being eligible for cropland conversion to natives on other owned lands. Seeded acres of native prairie must not be countered with conversion of existing owned or rented native range to cultivated land. An increase in cultivated annual acres is allowed only if the participant purchases or rents additional cultivated land. Verification tools are required to ensure that participants do not convert native to cultivated, such as an on-going record of cultivated acres, crop insurance records, and/or remote sensing imagery. Remote sensing imagery can also be used to assess stand establishment.

Hecker and Neufeld (2006) identify several parameters that can be used to indicate the success of prairie restoration. Five indicators that are deemed to be most useful as indicators of short-term establishment to this project are listed in Table 4, based on selected items modified from Hecker and Neufeld 2006). The indicators will be assessed at representative field locations using counts or measurements within a 50 x 50 cm frame. For fields with multiple management units (different range sites or topography) each of the management units will be assessed separately.

Table 4. Five recommended indicators of the success of short-term establishment.

Indicator	Typical Assessment Method at Representative Field Locations	Assessment Guidelines
Bare Ground	At representative field locations, and compared to nearby native controls.	Guidelines are provided in Adams et al. (2009, pp 42-44). Bare ground will be high at establishment, but decreases significantly as the native plants in-fill.
Soil erosion	Representative of a field management unit, and compared to nearby native controls.	Guidelines are provided in Adams et al. (2009, pp 39-41). Useful to combine with weather and site history since seeding.
Plant count	Each individual plant is counted.	A plant count of at least 9 plants per ¼ m^2 indicates success[7]. A lower count requires patience and monitoring, and re-seeding will be required if counts remain low for the first few years following seeding.
Plant community similarity	Calculated as the number of established species in the restoration divided by number of species seeded, multiplied by 100.	It is expected that most seeded species will be evident a few years after seeding, even if only in low numbers. It is recommended that a score of ≥50% represents establishment success, as in the 2010 Native Grasslands Criteria of Alberta Environment (2010).
Weed types and density	Rate the density distribution of weeds of each type (problem, noxious, and prohibited noxious). Weed designations are explained in the Weed Control Act (Province of Alberta 2010). Density class information is provided in Fig. 17 (Adams et al. 2009).	The number of allowed weeds is specific for each weed type. There is zero tolerance for prohibited noxious weeds. Noxious weeds must not be present at a class higher than in adjacent control areas, and require control. For problem weeds, any total weed count less than 3 per ¼ m^2 is generally acceptable and more than 14 per ¼ m^2 requires control. Municipal weed designations over-ride provincial designations.

Rough fescue often requires many years to obtain a significant number of plants per square meter. Therefore the plant community similarity indicator in Table 4 must not be contingent on the short-term establishment of rough fescue in the Parkland Region.

Soil erosion is an example of a parameter that is recommended to be reported on a management unit basis within fields. Third party professionals may not have all the skills required for field assessment, and therefore, training will be required to ensure a consistent approach among assessors. Experience indicates that the potential pool of professionals requires training in areas that include the choice of representative sampling locations and the use of density distribution charts.

[7] Agriculture and Agri-Food Canada in Swift Current, SK, also uses this indicator. Alan Iwaasa, Personal Communication, November 2012.

The root system of the seeded stand can also be assessed. The presence of secondary and tertiary tillers (root systems) is an indicator of successful establishment because they are crucial for survival.

Grazing Management Plan

A grazing management plan is required for the duration of each ACCP agreement. Grazing must not occur in the establishment year, and in the year following establishment, grazing must be at sustainable levels. The goal of Alberta's Grazing Lease Stewardship Code of Practice is careful stewardship that maintains healthy functional rangeland ecosystems on public lands for present and future generations. The key management variables that leaseholders must apply to achieve range health goals are stocking rate, stocking density, timing and frequency and duration of grazing (ASRD 2007). Light to moderate grazing, adequate animal distribution, and the use of an effective grazing management system contribute to high forage productivity, high habitat values, and sustainable health for the ecosystems and the forage resource (Bailey et al. 2010). This reference also provides a useful discussion on grazing management, including effective management during drought.

MultiSAR and the Alberta Conservation Association[8] use the principles noted in the ASRD (2007) Grazing Code of Practice, in addition to the following guidelines regarding sustainable grazing management. After establishment of native conversion, grazing is allowed at up to 75% of animal unit months (AUM) for the identified plant community published in the relevant range plant community guide (Adams et al. 2003; Stone et al. 2007; Burkinshaw et al. 2009; DeMaere et al. 2011; and Kupsch et al. 2012). The allowable grazing rate is increased to 100% of AUM as the plant community matures.

Grazing management plans for native grasslands with rough fescue must be consistent with research findings. Moisey et al. (2005) found that the practice of spring skim grazing was harmful to the conservation of rough fescue grassland. Late summer and fall grazing can increase tufted grasses including plains rough fescue, foothills rough fescue and western porcupine grass, because these grasses complete their annual cycle before grazing, and annual hoof activity improves the seed to soil contact for germination in subsequent years (Eslinger 2009).

[8] Brad Downey, Alberta Conservation Association (ACA). Personal Communication, November 2012.

Long-Term Verification (Health)

Third-party evaluation will assess the maintenance or improvement of range health. C. Li et al. (2012) state that soil organic carbon, nitrogen stocks and available nutrients were not reduced by intensive grazing, provided range health is maintained by management practices including limiting erosion and maintaining diversity. Grazing should be in the dormant season, followed by adequate rest. The long-term grazing management plan required for this project will include timing and type of grazing (E.g., rotational or deferred grazing), and must show sustainable practices. Plan factors such as livestock numbers, grazing season and grazing duration can be adjusted based on periodic range health assessments. A documented grazing plan may be provided to the third-party evaluator, or it may be developed and reviewed by the third-party evaluator with the land owner/manager (NDGF and NRCS 2005; Gabruch et al. no year).

The goal of native prairie conversion is to increase the viability of grassland-dependent species, and to move to a plant community that is similar to the surrounding area (Helzer 2011). The long-term success of native restoration can be efficiently evaluated using range health indicators. Range health indicators are used to ensure that grazing practices are not degrading the long-term potential or carrying capacity of the pasture (Moen 1998). Range health assessments are used to make a rapid determination of the ecological status of rangeland (RRMP 2004).

Long-term verification relies on indicators of restoration success and biodiversity. Indicators of rangeland health and the seral stage of plant communities are compared to similar range sites in the surrounding area or in published data. Range health is assessed in different ways by different organizations. Indicators used in range health assessment for areas applicable to the Parkland are shown in Table 5. The indicators used by Adams et al. (2009) (Table 5) are the components recommended for use by third-party professionals for long-term verification of range health within the ACCP. These indicators are listed in the right-hand column of Table 5, with reasons for excluding indicators used by other jurisdictions. The native grassland range health assessment score sheet (Adams et al. 2009, Appendix 1) is to be used in the ACCP by third-party professionals to assess all indicators at a similar time; a score is determined by following the detailed instructions in Adams et al. (2009). Professionals require training and practice to become familiar and experienced with range health assessment. They will then be able to perform more rapid visual assessments that fulfill assessment requirements.

Range Plant Community Guides classify rangeland as non-native when there is 30% or less native species (Stone et al. 2007; Burkinshaw et al. 2009; and DeMaere et al. 2011). If verifiers determine that native seeded parcels or portions within fields have regressed to non-native conditions (>70% non-native), these areas will no longer be eligible as native range. They may qualify for offset credits as tame pasture. Desserud (2011) provides information on state and transition models pertinent to the Northern Fescue and Central Parkland Natural Subregions. This information will be valuable for professionals providing verification under the potential ACCP program.

Table 5. Range health indicators applicable to the Parkland region.

Indicator	SK Hecker and Neufeld (2006)	SK SK PCAP (2008)	AB Adams et al. (2009)	AB Alberta Env. (2010)	BC BC MAFF (2005)	U.S.A. Pellant et al (2005); Herrick et al. (2009a; 2009b)	Recommendations for Long-Term Verification (This Paper)
Similarity to Reference Plant Community	√	√	√	√		√	√
Structural Layers	√	√	√	√		√	√
Invasive/noxious species present	√	√	√	√		√	√
Invasive/noxious species cover	√	√	√	√		√	√
Invasive/noxious species distribution		√	√	√		√	√
Soil erosion	√	√	√	√	√	√	√
Soil movement or loss				√	√		Included in erosion
Bare soil/ground	√	√	√			√	√
Soil compaction				√	√	√	Not relevant
Litter (for hydrologic function; protect soil)	√	√	√	√	√	√	√
Desirable species >50% of total				√	√		Included with Ref. Plant Comm.
Representive age and size of desirable species					√		Included with Structural Layers
Desirable species indicate vigour					√		Difficult to assess for graminoids
Plants per ¼ m^2	√						In plant community similarity
Reproductive capability of perennials						√	Not relevant
Annual production						√	Existing data can be extrapolated to sites
Plant mortality/ decadence						√	Could be used in ungrazed holdings
Browse/hedge overuse on shrubs or trees					√		Could be used in ungrazed holdings

The first indicator in Table 5 (similarity to reference plant community) is difficult to obtain for areas where the goal of native conversion is a stand dominated by rough fescue. This is because seeded rough fescue will require many years to increase to natural levels of observed controls, whereas the ACCP requires indicators that can be assessed after five to ten years. Therefore, rough fescue cover should be monitored using all indicators (Table 5 and Appendix 1) as part of the long-term verification, but verification results must not be contingent on rough fescue in early and middle years of the ACCP agreement. The proposed minimum 18-year contract length will not permit the development of a late seral rough fescue plant community, but rough fescue must attain early seral status and may attain mid-seral succession levels. At locations where the other seeded grasses approximate the reference plant community in early and middle years, rough fescue cover is expected to gradually increase with time, and therefore these locations would be assessed as successful in terms of the “Similarity to Reference Plant Community” indicator.

Rough fescue may affect the range health indicator of “Plant Community Structure”. In the short term rough fescue will act as a short graminoid species, but over the long term rough fescue is tall and broad. Mature and healthy rough fescue has the ability to capture more snow than other grass species because of its structure (Willms and Chanasyk 2006).

In addition to the requirements in Table 5, some records used in the Conservation Cropping Protocol (Climate Change Secretariat 2012) are also required for long-term verification, including:

- Land title certificate for legal locations being claimed,
- An agreement between the aggregator and the farm operator, and
- Records of current and on-going cultivated acres, to ensure that program applicants do not counter seeded acres of native prairie with conversion of other native prairie stands to cultivated annual acres.

Contract renewals must be tied to long-term verification requirements. Alberta Environment suggests contract renewals at six year intervals (Climate Change Central 2011). Claims for offset credits are contingent on verification. Long-term monitoring for the ACCP is recommended to be conducted every three years. The Alberta Conservation Association monitors rangeland health and assesses wildlife at three-year intervals[9].

[9] Brad Downey, Alberta Conservation Association (ACA). Personal Communication, November 2012.

Barriers and Opportunities for Adoption

Published information relating to barriers and opportunities for native conversion is limited. This section focuses on factors that will promote the success of the Alberta Cropland Conversion Protocol, including knowledge gained from previous conversion programs.

Lessons Learned from Previous Conversion Programs

This section provides a brief background regarding completed or on-going conservation programs for native range or pasture in western Canada and the United States. A more detailed analysis of these programs is required so that useful aspects can potentially be used in the Alberta Cropland Conversion Protocol.

Permanent Cover Canada Program

The Agriculture Canada Permanent Cover program (1989 to 1992) provided one-time payments to western Canadian producers for the conversion of annual cropland to pasture land. Remuneration under the Permanent Cover program began at $20 per acre in 1989, and was increased in 1990 to $30 for ten year contracts and to $65 per acre for 21 year contracts.

The Permanent Cover program successfully promoted the conversion of cultivated land to pasture systems in western Canada. More than 585,000 acres (230,000 ha) were converted to pasture under this program (Hilliard et al. 2009). This represented an increase of only about 1% of the previous 55,854,000 acres (21,757,000 ha) of combined natural and hay land in the Prairie Provinces in 1992 (Statistics Canada 2012). The vast majority (90%) of respondents indicated the Permanent Cover program helped their farm operations, according to a survey conducted by Hilliard and Fomradas (2009). Only 4% of the overall total lands enrolled in the program were converted back to annual cropping by 2009. Of the total contracts in Alberta, only 3.9% were liquidated prior to their expiration at 10 or 21 years.

Greencover Canada Program

One component of the Agriculture Canada Greencover program (2003 to 2008) was to provide payments to western Canadian producers for the conversion of annual cropland to pasture land and native cover. Greencover administered ten-year land use agreements, and the youngest contracts expire in 2018 (Climate Change Central 2011). The Land Conversion component of Greencover accounted for approximately 59% of overall program expenditures (AAFC 2008).

Greencover conversion contracts required at least 40 contiguous acres on the same quarter section. At least 75% of the seed mix had to be composed of long-lived perennial species such as native and non-native forages and shrubs. Greencover payments were higher for conversion to native than to non-native cover. Two one-time payments were as follows (AAFC 2008):

- $20 per acre for tame forage or trees; $75 per acre for native species.

- $25 per acre after establishment and inspection of perennial cover, contingent upon signing a ten-year land-use agreement.

An audit of the Greencover program (AAFC 2008, Table 6) found no fiscal issues, and recommended a simplification of the contribution agreements within the Land Conversion component.

Table 6. Audit of Greencover Contracts.

Greencover Land Conversion Program	Number	Total Value	Percentage of Total	Average Value
Contracts Audited	73	$392,100	2.4%	$5,371.23
Total Contracts	3130	$16,181,400	100%	$5,169.78

Other Conservation Cover Programs in Western Canada

Ducks Unlimited Canada currently funds a Rangeland Grazing Incentive Program at $10 per acre.

One goal of the Alberta component of the North American Waterfowl Management Plan (NAWMP) is to convert 1500 acres (607 ha) to upland native cover by 2012, with a total of 7700 acres (3116 ha) converted by 2032 (ANPMC 2008). The main target areas are in the Parkland region, specifically the Pine Lake and Bashaw Uplands.

More than 11,000 producers converted more than 200,000 hectares to perennial cover under Saskatchewan's Conservation Cover Program in 2001. This represented an increase of less than 1% of the 25,728,000 acres of combined natural land and hay in Saskatchewan in 2001 (Statistics Canada 2012). Program applicants also planted perennial forages on an additional 60,000 hectares above those acres eligible under the program.

International Programs

Russillo and Pinter (2009) provide guidance on the design of farm-level programs that provide ecosystem services through producer practices. They recommend that program design should be practical, compensate the farmer for data collection, include simple databases, provide knowledge transfer, and provide threshold values and numerical scoring wherever possible.

Ruto and Garrod (2009) indicate that most farmers prefer short contracts because they increase flexibility. A review of the conservation reserve program in the U.S.A. provided two key findings: i) restoration support should be tied to ecosystem services using science-based models, and ii) agricultural producers favour having varying contract lengths, and this reduces potential liquidation (Khanna and Ando 2009).

NRCS (2011) provide a short list of criteria required to meet native conversion program obligations with the United States Dept. of Agriculture: i) the seeded plant community will consist of at least four native grasses and at least four native forbs; ii) seeding must be done in a properly prepared seed bed as determined by NRCS; iii) fungal and microbial inoculants will be used where appropriate; additional planting conditions may be specified if an ecological site description has been developed; iv) weeds shall be controlled during the establishment phase; v) after establishment, the site will not be grazed or disturbed during the primary nesting or fawning season; and will be deferred from use for up to three years; vi) a grazing plan will be developed and implemented.

Promoting Program Success in the Alberta Parkland Region

Training of Third-Party Professionals

Agrologists or biologists will assist with the design and review of plans for cropland conversion and grazing management, and verify stand establishment and range health. ACCP efficiency will be promoted by providing professional training programs in topics including the choice of representative sampling locations and controls, understanding range site variability, understanding weed designations, recommending seed mixes for parcels, the use of density distribution charts and range plant community guides, imagery interpretation, plant identification, and plant community similarity. Similar training programs have been conducted to improve the professional practice of agrologists and biologists working with the Alberta Reclamation Criteria (Alberta Environment 2010). These programs have been implemented as user pay programs, and training for the ACCP can follow the same model. Training will allow professionals to improve their skill set and therefore be more qualified than competitors who do not take the training.

Turning Barriers into Opportunities

Luciak et al. (no year) identify three barriers for ranching in western Canada. These barriers can potentially be reduced by conversion of cropland to native prairie (Table 7).

Table 7. Ranching barriers and related opportunities related to native prairie conversion.

Barriers for Ranching in Western Canada (From Luciak et al. no year).	Opportunities for Native Prairie Conversion
High winter feeding costs	An increase in native acres may reduce winter feeding costs because native lands have an extended grazing period through the fall and winter, provided protein levels are adequate and snow cover is minimal.
Drought frequency causes a high risk for grazing production, and this sometimes leads to herd downsizing.	Native pastures are less sensitive to drought than tame pastures because native species are adapted to a wider range of conditions.
Cattle inventories are subject to reduction when feed grain prices surge (also in Vaisey et al. 1996).	A payment structure that encourages conversion to native vegetation can offset the risk of high feeding costs.

Promoting Awareness

Once they are established, native stands are a low cost and low maintenance land use with tremendous societal and ecosystem benefits. Promoting awareness of the long-term benefits of converting to native stands will enhance the potential success of the program.

The perception of some in the agricultural community is that seeded introduced species are superior. Institutional changes can promote a wider awareness of the benefits of native range. For example, the term "unimproved land", which is used by organizations such as the Census of Canada, should be replaced with the term "native rangeland".[2] Ranchers will be more amenable to a program promoting the ecosystem benefits of native range than to a program that is solely promoted as greenhouse gas mitigation.

Native prairie is more drought-tolerant than tame forages; crop insurance contracts should apply different risk ratings to account for reference plant communities, modified native plant communities, and tame forage plant communities.[10]

Remuneration for Conversion Costs

Producers require economic incentive for native conversion, because establishment of native range is expensive. The cost in 2008 was calculated as $164.30 per acre (Jones 2011), based on seed and seeding costs. Fencing, including supplies and labour for a four-strand barb wire fence, was estimated to be $3720 per mile (approximately $23.25 per acre if fenced on all four sides) (Saskatchewan Ministry of Agriculture 2009). The conversion to native pasture may also require the cost of water development.

Contracts will require periodic review so that potential adjustments can be made as required, to ensure that program participation does not markedly decline.

Consistency with Existing Programs

This potential program must mesh constructively with other programs currently being discussed, such as payments for ecosystem services. The ACCP should be a "stackable" program as long as the standards of all potential programs are made compatible. A detailed analysis is required to investigate how the currently proposed ACCP may stack with other programs, including the existing Ducks Unlimited program that pays for conversion to native species. Potential remuneration associated with native conversion in the Dry Prairies also requires a modeling analysis, possibly with the expertise of Agriculture and Rural Development (ARD) and Agriculture Financial Services Corporation (AFSC), with input data including conversion costs, price ranges for crops such as canola and wheat, and the valuation of native and tame forage.

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[10] Duane McCartney, retired from Agriculture and Agri-Food Canada, Research Branch. Personal Communication, June 2012, at State & Trends of Canadian Grasslands Workshop, Saskatoon, SK

Promoting Seed Availability

The native seed industry is currently challenged to supply native seed, ecovars, and native plant materials. The current challenge to supply native seed will increase due to the current growth in industrial reclamation. Furthermore, this potential native conversion program could create strong demand that might push native seed prices even higher over the short term. The program provides a potential opportunity for additional producers to be involved in native seed production. Neufeld (2010) reports that some seed buyers have experienced issues with germination and dormancy, and he recommends research to investigate the issues and increase reliability and confidence in seed production and/or seed establishment. Efforts should be synchronized with existing native seed producers, and establishment of a native seed producer organization should be considered. There is a need for communication of the potential native seed demands; the Alberta Native Plant Council (ANPC), the Association of Alberta Co-op Seed Cleaning Plants, and the Association of Alberta Agricultural Fieldmen can all assist in this role.

Selection of Potential Target Areas

An effective program will target locations most amenable to native conversion. Alberta Environment estimated that the proposed perennial conversion protocol would be applicable to only 0.1 to 0.2 M ha (0.25 to 0.50 M ac) of annual cropland per year in Alberta, with a target period of 18 years (Climate Change Central 2011). The target area for this framework will be the drier areas in the eastern portion of the Parkland region, for several reasons.

Firstly, native rough fescue grasslands establish more readily in the drier areas than in the moister areas such as the Central Parkland between Edmonton and Calgary, and the Foothills Parkland. The moister areas are characterized by deep and highly fertile soils that are highly vulnerable to invasive plant species. Native restoration is less challenging in the Northern Fescue Natural Subregion because it is drier and topsoils are generally shallow, making them less fertile and therefore less vulnerable to invasive species. Eastern regions of the Parkland region (E.g., east of Edmonton) are also drier than western regions, and therefore also a potential target area for native conversion.

Secondly, the risk of soil salinization is somewhat higher in eastern portions of the Parkland, making it more ideal for native conversion. Almost 80% of land managers who responded to a survey for the Permanent Cover program conducted by Agriculture and Agri-Food Canada from 1989 to 1992 identified soil degradation issues (erosion or salinity), or poor crop production (Hilliard and Fomradas 2009) as their reason for enrollment.

Thirdly, eastern portions of the Parkland region are characterized by higher transport costs for annual crops and a risk of occasional droughts for annual crop production.

Fourthly, the lower human population, low population growth rate, and moderately high livestock densities of the eastern Parkland region also make this area more ideal for the ACCP participation. Ruto and Garrod (2009) found that areas with limited rural development and relatively low growth are target areas for programs that focus on the provision of ecosystem services. Municipalities targeted for native conversion in the eastern portion of the Parkland region include the northern portion of Special Areas, the County of Paintearth, and the M.D. of Provost in the south, through Flagstaff County and the M.D. of Wainwright, to the County of Minburn in the north.

The Nature Conservancy of Canada has prioritized three provincial ecodistricts as priority areas for cropland conversion to native: the Edgerton-Ribstone Plain, the Lower Battle River Plain, and Black Diamond Foothills (Riley et al. 2007). The Edgerton-Ribstone Plain corresponds to the M.D. of Wainwright, and the Lower Battle River Plain corresponds to Flagstaff County. Development pressures and land prices in the Black Diamond Foothills mean that this area has a low feasibility for native conversion, except in cases where cultivated land is gifted to land trust or conservation organizations.

The Nature Conservancy of Canada also identified ecodistricts with a high probability to remain in annual crop production, including the Olds, Red Deer, Leduc and Vermilion Plains (Riley et al. 2007). The east-central Alberta target for this project differs from the NAWMP target of the Pine Lake and Bashaw Uplands (ANPMC 2008), which is seeking a mix of upland and wetland habitat in areas of strongly hummocky topography, where there are significant risks for annual crop production.

Uncertainties Posed by Climate Change

Climate change and unpredictable weather patterns pose a challenge for the conversion to native lands. Most climate change models predict an increase in warm season grasses and a decline in cool season grasses, and they do not account for the carbon fertilization effect associated with climate change. It is speculated that the CO_2 fertilization effect will somewhat offset the effect of a drier climate[11]. Some climate change models also predict an increase in shrubs. Shrubs will have ecosystem benefits but they may not contribute significantly to forage production.

Climate change models indicate the potential for the Parkland area to expand to the north. However, it will be difficult to convert to the Parkland seed mixes identified in Table 2, because soils that occur to the north are developed under forest cover, and they are therefore not conducive to the establishment of prairie grasses. Most climate change models predict an increased risk of prolonged drought (Bailey et al. 2010).

[11] Jeff Thorpe, Saskatchewan Research Council, Personal Communication, June 2012, at State & Trends of Canadian Grasslands Workshop, Saskatoon, SK.

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Appendix 1

Native Grassland Range Health Assessment - SCORE SHEET

(From Adams et al. 2009)

Site ____________________ Observer ________________ Date _________________

LSD ___ Quarter ___ Section ___ Township ___ Range ___ Meridian ___ Photo#______

GPS Coord (NAD 83) Lat. ________ Long. _______

Estimated usable forage production ________________

Special Observations (climate, changes in management) __________________________

SCORING (circle appropriate values and add their sum to the Score box)

Dominant Species

Grasses & Grasslikes	Cover %	Forbs	Cover %	Shrubs	Cover %	Trees	Cover %

Plant Community Name (code)____

1. What kind of plants are on the site? What is the plant community?

1a 40 27 20 15 0 1b 15 8 0	Comments	Score

2. Are the expected plant layers present?

10 7 3 0	Comments	Score

3. Does the site retain moisture? Is the expected amount of plant litter present?

25 13 0	Comments	Score

4. Is there accelerated soil erosion? Site normally (circle): Stable / Unstable

4.1 Erosion Evidence 5 3 1 0 4.2 Bare Soil 5 3 1 0	Comments Human Caused Bare Soil (%) Moss & Lichen cover (%)	Score

5. Are noxious weeds present?

5.1 Cover 5 3 1 0

5.2 Density Distribution 5 3 1 0

Dominant Species	% Cover	Density Dist.	Infestation Size (ac or ha)

Comments

Score

Grazing Intensity Est. long Term (circle): U U-L L-M M M-H H

Observed Utilization _________________%

Trend (apparent – circle): Upward Downward Stable Unknown

Site Score (total score)

0---50-------------------------------75---------------------------100

<50% (Unhealthy) 50 – 74% (Healthy with problems) 75 – 100% (Healthy)