Atelier sur la gestion intégrée des broussailles

Rapport final

les 18 et 19 février 2003
Hôtel Travelodge
Saskatoon, Saskatchewan

Organisé par :

le Comité d'experts des plantes fourragères

Parrainé par :

le Conseil de recherches agro-alimentaires du Canada

et Dow AgroSciences Canada

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Les annexes sont disponibles en anglais seulement.

Résumé

Un atelier sur la gestion intégrée des broussailles a eu lieu les 18 et 19 février 2003, à Saskatoon, en Saskatchewan. Son but était de fournir l'information la plus à jour sur les enjeux et les méthodes servant à la gestion des broussailles et d'établir les priorités de recherche ainsi qu'une stratégie pour s'occuper de l'empiètement par les broussailles. Dix-huit experts provenant des gouvernements, de l'industrie et des universités de l'ensemble de l'Ouest canadien ont été invités à faire des présentations. Les séances de discussion en petits groupes auxquelles ont participé les 90 délégués ont permis d'obtenir un vaste éventail d'information supplémentaire. On y a présenté l'information la plus récente sur une gamme de méthodes de débroussaillage et souligné l'importance d'utiliser plus d'une méthode. Les avantages du maintien d'une certaine végétation ligneuse dans le paysage comprennent l'accroissement de la diversité de la faune et la stabilisation des zones riveraines. On a déterminé des possibilités de gérer les terres pour l'élevage de bestiaux et la foresterie. Sept priorités de recherche ont été identifiées, la collecte et la diffusion de l'information existante sur la gestion des broussailles étant considérée comme la plus importante. Ces priorités pourraient être réalisées : 1) en tenant des réunions régulières des parties intéressées; en établissant des pâturages modèles dans chaque province; et 3) en mettant sur pied un site Web consacré à la gestion des broussailles.

Introduction

La lutte contre la végétation ligneuse, ou le débroussaillage, est devenue l'un des problèmes principaux de l'amélioration des pâturages au Canada. Le peuplier faux-tremble est l'espèce ligneuse la plus répandue dans les pâturages, alors que le saule commun, le saule blanc soyeux et la potentille frutescente sont des envahisseurs sérieux en certains endroits. On estime que le peuplier faux-tremble s'étend annuellement au rythme de 1 à 5 % de la superficie des pâturages dans les provinces des Prairies, selon l'endroit. Cela réduit le chargement des pâturages au moment où l'industrie de l'élevage des bestiaux dans les Prairies est en expansion. Les trois provinces des Prairies, l'Administration du rétablissement agricole des Prairies (ARAP) et le Conseil de recherches agro-alimentaires du Canada (CRAC) ont identifié ce problème comme étant un domaine de grande priorité qui nécessite d'être appuyé par des recherches. Cependant, il n'existe actuellement aucun programme de recherche consacré à la gestion des broussailles.

L'atelier sur la gestion intégrée des broussailles, organisé par le Comité d'experts des plantes fourragères, a eu lieu les 18 et 19 février 2003, à Saskatoon, Saskatchewan, à l'hôtel Travelodge. **Le but de l'atelier était de fournir l'information la plus à jour sur les enjeux et les méthodes servant à la gestion des broussailles et d'établir les priorités de recherche ainsi qu'une stratégie pour s'occuper de l'empiètement par les broussailles.**

Des conférenciers invités ont fait dix-huit présentations le 18 février ainsi que durant la matinée du 19 février. Ces présentations ont été suivies de trois séances de discussion en petits groupes visant à traiter des points suivants :

1. Y a-t-il d'autres projets de recherche ou de démonstration en cours en plus de ceux qui ont été mentionnés par les présentateurs?

2. Existe-t-il d'autres méthodes de débroussaillage qui n'ont pas été mentionnées par les présentateurs?

3. Quelles connaissances nous manque-t-il au sujet de la gestion des broussailles?

4. Quelle serait la recherche la plus prioritaire concernant la gestion des broussailles?

5. Devrait-on mettre sur pied un programme de recherches dans le but de tenir compte de ces priorité? Si oui, comment ce programme devrait-il être organisé? Lieu, organisme dirigeant, partenaires, collaborateurs, financement, etc.?

Les représentants des trois groupes de discussion ont présenté leurs rapports en séance plénière au cours de l'après-midi du 19 février.

Le comité organisateur de l'atelier était formé de : 1) Bruce Coulman, président, Comité d'experts des plantes fourragères; 2) Gil Lahaie, Agriculture et Alimentation Manitoba, Dominion City, Man.; 3) Wilf Pyle, ministère de l'Agriculture, de l'Alimentation et de la Revitalisation rurale de la Saskatchewan, Regina, Sask.; 4) Gerry Ehlert, ministère du Développement des ressources durables de l'Alberta, St. Paul, Alb,; 5) Duane McCartney, AAC, Lacombe, Alb.; 6) Brant Kirychuk, ARAP, Regina, Sask.

Sommaires des présentations des invités : (voir Appendix B – disponible en anglais seulement)

Propagation des broussailles dans les pâturages des Prairies : Au cours du 20^{e} siècle, des espèces d'arbres ont empiété sur les herbages, principalement le peuplier faux-tremble, en raison de l'élimination du brûlage. On estime que 40 % des pâturages de l'ARAP sont maintenant recouverts d'espèces ligneuses (broussailles) et que ce chiffre augmente au rythme de 2 % par année. Nos études ont montré un taux d'expansion annuel des broussailles de 0,05 % à 0,75 %, les valeurs élevées étant observées dans les régions plus humides (zones de peupleraie et zones de transition boréale). La productivité des herbes dans les broussailles n'est que de 10 à 20 % de celle des herbages ouverts.

Surveillance de l'empiètement par les broussailles : On est en train de mettre au point en Alberta un outil d'évaluation de la santé des pâturages afin de surveiller l'empiètement par les broussailles. Plusieurs critères sont enregistrés sur un site et comparés à un pâturage cultivé en santé et productif. Cela indique si la santé d'un pâturage est à la baisse et suggère des mesures à prendre pour l'améliorer.

Gestion des broussailles : On effectue de la recherche sur la gestion des broussailles depuis 1960. Les techniques étudiées et utilisées comprennent la pulvérisation d'herbicides et l'humectage, le brûlage, la coupe, la décortication, l'application d'agents de lutte biologique et le broutage. De nombreuses études ont indiqué que l'application unique d'une seule méthode n'est pas suffisante pour un débroussaillage durable. Quelle que soit la méthode utilisée, elle devrait être suivie dans les deux années suivantes d'un traitement supplémentaire, soit par la même méthode soit par une méthode différente. Parmi les méthodes individuelles de débroussaillage, les herbicides mis au point récemment tels que le Remedy se sont révélés plus efficaces que les herbicides plus anciens. Un nouveau champignon s'est avéré efficace comme herbicide en prévenant la repousse des souches. Le brûlage est beaucoup moins souvent utilisé et presque jamais par les exploitants de ranch, en raison du risque que le feu se répande à d'autres propriétés. Le broutage peut être efficace pour contrôler les drageons après un autre traitement, car de nombreuses essences ligneuses, y compris le peuplier faux-tremble, ont un goût agréable lorsqu'elles sont jeunes.

Agrosylviculture et forestrie : Au Manitoba, une licence d'aménagement forestier a été accordée

pour une zone agricole comprenant des terres publiques et privées. On est en train de réaliser un projet dans le but de démontrer que ces terres peuvent procurer des avantages à la fois pour l'élevage et pour la foresterie. Le Centre de recherches de Brandon, le ministère de l'Agriculture et de l'Alimentation du Manitoba et Louisiana-Pacific (la société forestière) sont en train de réaliser un projet de surveillance d'une durée de dix ans. Des études réalisées en Alberta ont indiqué que l'agrosylviculture offre la possibilité de tirer plus d'une source de revenu des parcours naturels. Le maintien des peupliers faux-trembles à une faible densité sur les pâturages réduit le drageonnement et a des effets positifs sur l'humidité des herbages durant les périodes de sécheresse. Les effets positifs de l'humidité doivent être équilibrés en tenant compte de la réduction de productivité due à l'ombrage.

Considérations liées à la faune et à l'environnement : Les espèces végétales et animales varient beaucoup entre les terrains boisés et les herbages, et la composition des espèces change rapidement lorsque les broussailles sont éliminées. Du point de vue de la diversité, la présence de zones boisées et de zones d'herbage est préférable. Dans les zones riveraines, les espèces ligneuses jouent un rôle important en liant et en maintenant les rives ensemble et en aidant à ralentir l'écoulement de l'eau. Dans les herbages, la présence d'arbres et d'arbustes peut faciliter la capture de la neige et améliorer les conditions d'humidité et l'appétibilité des fourrages. Selon la nouvelle loi sur les espèces menacées d'extinction, la gestion des broussailles peut être problématique dans certains secteurs, car elle peut éliminer l'habitat d'espèces menacées.

Projets de recherche et de démonstration actuels : Au Manitoba, une nouvelle politique gouvernementale exige que les terres publiques fassent l'objet d'un plan de gestion qui prend en considération les questions d'agriculture et de conservation, y compris la surveillance. Les méthodes de débroussaillage mises à l'essai au Manitoba comprennent le brûlage, la pulvérisation de pesticides, la décortication, l'utilisation d'un rouleau lisse, la tonte, le broutage par des chèvres et l'utilisation d'un débroussailleur. En Saskatchewan, la majorité des travaux sur les terres publiques ont été faits dans les années 1960 et 1970, ce qui a entraîné une quantité considérable de déboisement et de mise en culture. Un grand nombre de ces superficies sont vulnérables à une réinvasion majeure par les espèces ligneuses; on y applique donc des méthodes similaires à celles mentionnées ci-dessus pour le Manitoba. En Alberta, on a essayé toutes les méthodes susmentionnées et on utilise maintenant un programme intégré qui fait appel à plus d'une méthode et à un rappel. La province est en train d'évaluer l'aérateur Lawson (qui ressemble à un débroussailleur), et l'herbicide Remedy semble prometteur. L'ARAP utilise en outre un grand nombre des méthodes susmentionnées sur ses pâturages communautaires, la pulvérisation aérienne étant la plus commune. Entre 2 000 et 5 000 acres sont brûlés chaque année. L'intégration de différentes méthodes produit les meilleurs résultats à long terme.

Sommaire de l'information découlant des discussions en petits groupes : (voir Appendix C – disponible en anglais seulement)

A. Autres projets de recherche et de démonstration : Plusieurs autres projets ont été mentionnés et sont énumérés dans l'annexe avec, dans certains cas, des personnes-ressources à contacter.

B. Autres méthodes de débroussaillage : Plusieurs ont été citées, dont un grand nombre mettent l'accent sur le broutage.

C. Information manquante : Bien que les participants aient reconnu qu'il existe un vaste ensemble de connaissances sur le débroussaillage, il manque encore beaucoup d'information, particulièrement

sur les approches intégrées qui tiennent compte de l'élevage, de la foresterie et de la faune.

D. Priorités de recherche : Sept priorités ont été établies au sujet d'une grande partie de l'information manquante en matière de gestion des broussailles.

E. Programmes de recherche : Les participants étaient d'avis que la collecte et la diffusion de l'information existante est plus prioritaire que la mise sur pied de nouveaux programmes de recherche. L'établissement de pâturages modèles dans chaque province serait une bonne méthode qui permettrait de démontrer les techniques nouvelles et intégrées.

Résumé et recommandations :

L'atelier a rassemblé un large gamme de conférenciers qui ont traité de la plupart des méthodes et des problèmes associés au débroussaillage. Au cours des discussions en petits groupes, un public très bien informé a mentionné un certain nombre de projets de recherche et de démonstration et de méthodes de gestion des broussailles.

Voici les **recherches les plus prioritaires** sur la gestion des broussailles :

1. Les programmes de vulgarisation efficaces qui rassemblent et diffusent toute l'information existante.
   -Il ne s'agit pas réellement d'une priorité de recherche, mais plutôt de la reconnaissance de l'existence d'un vaste ensemble de connaissances qui doivent être organisées et mises à la disposition de tous ceux qui travaillent en gestion des broussailles.
2. Séquençage des différents traitements de gestion
   - Tel qu'indiqué, la méthode la plus efficace de gestion des broussailles fait appel à des traitements de rappel. Les recherches qui visent à établir les meilleures combinaisons de traitements et les périodes optimales pour les traitements de rappel seraient utiles.
3. Détermination du paysage optimum qui permettrait de répondre à tous les besoins.
   - Combien faut-il de broussailles dans le paysage pour obtenir une production optimale de fourrages et de bestiaux tout en améliorant la diversité de la faune et en obtenant d'autres effets environnementaux positifs? On a besoin d'études multidisciplinaires pour l'établir.
4. Gestion des broussailles efficaces sur le plan des coûts.
   - Un grand nombre des méthodes de gestion des broussailles sont coûteuses; il faut donc déterminer les méthodes les plus efficientes et efficaces (semblable au point 2 ci-dessus).
5. Gestion des peupliers baumiers
   - Cette espèce a tendance à envahir les pâturages lorsque l'incidence du peuplier faux-tremble est réduite et elle est plus difficile à contrôler que le peuplier faux-tremble.
6. Études physiologiques de base sur les espèces qui produisent des broussailles, y compris la dominance apicale.
   -Le drageonnement des espèces qui produisent des broussailles représente le principal défi suite au contrôle de la croissance existante. Une meilleure compréhension de la physiologie fondamentale de la repousse serait utile pour

concevoir des méthodes de débroussaillage.

7. Effet de la gestion des broussailles sur la séquestration du carbone.
   - Des études fondamentales sur la quantité de carbone séquestré dans les pâturages selon diverses densités des broussailles sont nécessaires pour que les crédits de séquestration du carbone deviennent réalité. Cette priorité ajoute un élément supplémentaire à la détermination du paysage optimal mentionnée au point 3 ci-dessus.

Des universités de l'Ouest canadien, principalement l'University of Alberta, sont en train de réaliser des projets de recherche particuliers. Les universités poursuivront la réalisation de ces projets sous réserve de l'obtention de fonds provenant de diverses sources. Dow AgroSciences a un programme de recherche actif sur l'évaluation des herbicides, et 25 % de ses recherches sur la production sont axées sur les parcours et les pâturages. La plupart des autres activités menées dans les provinces des Prairies sont davantage des projets de démonstration réalisés par des travailleurs des gouvernements provinciaux et de l'ARAP. Certains des projets du Manitoba font appel à une surveillance complète assurée pendant une longue période par le personnel du ministère de l'Agriculture et de l'Alimentation du Manitoba et le Centre de recherches de Brandon d'Agriculture et Agroalimentaire Canada (AAC). En raison de la fermeture du programme de Saskatoon en 1997, la Direction de la recherche d'AAC n'a pas de projet consacré à la gestion des broussailles.

Malgré l'identification des lacunes dans nos connaissances sur le débroussaillage et l'établissement des priorités de recherche, la remise sur pied d'un programme de recherches par AAC ou par un autre organisme n'a pas été considérée comme une nécessité absolue. Ce qui a été considéré comme important est la collecte et la diffusion des connaissances existantes ayant trait à la gestion des broussailles (priorité n^{o} 1 ci-dessus) et l'établissement d'un mécanisme pour évaluer et démontrer les nouvelles technologies à mesure qu'elle sont conçues. Ces objectifs pourraient être atteints de la façon suivante :

1. **Tenir des réunions régulières (au moins tous les deux ans) de toutes les parties intéressées au débroussaillage dans l'ensemble de l'Ouest canadien. Ces réunions seraient semblables au présent atelier.**

2. **Établir des pâturages modèles dans chaque province afin de démontrer ou d'évaluer les nouvelles technologies. Ces pâturages modèles pourraient être semblables aux forêts modèles qui existent actuellement. Ils pourraient être établis dans des pâturages de l'ARAP ou des provinces où la gestion des broussailles est pratiquée.**

3. **Établir un site Web sur la gestion des broussailles afin de fournir et de partager de la documentation sur les technologies les plus récentes. On pourrait procéder de concert avec la mise sur pied du site Web de la Station de recherches de Lacombe (www.foragebeef), par Duane McCartney, mais cela exigerait des mises à jour régulières par les représentants de tous les intéressés.**

Qui pourrait contribuer à ces activités? Toutes les parties intéressées, y compris les agents de vulgarisation provinciaux, l'ARAP, les associations d'éleveurs de bestiaux, les fabricants d'herbicides, les universités et les organismes de recherche appliquée, les organismes de conservation, les ONG environnementales et l'industrie forestière.

Qui assurerait la direction de l'organisation de ces activités? Le personnel chargé de la vulgarisation des trois provinces (spécialement celui qui se charge des terres publiques) et le personnel chargé des pâturages communautaires de l'ARAP. Les personnes provenant de ces organismes qui ont siégé au comité organisateur de l'atelier seraient des personnes idéales pour faire progresser ces activités.

Appendix A. Workshop Program

February 18

7:30 Breakfast (Galaxy Ballroom B)
8:00 Registration

Morning Session (Galaxy Ballroom B) – Chair: *Wilf Pyle, SAFFR, Regina*
8:30 Welcome – Bruce Coulman, AAFC, Saskatoon
8:45 The nature and extent of brush encroachment on the Canadian prairies
- *Brant Kirychuk, PFRA, Regina*
9:15 Ecology of aspen and wildlife interaction
- *Jeff Thorpe, Sask. Research Council, Saskatoon*
9:45 Monitoring brush species in pastures
- *Gerry Ehlert, ASRD, St. Paul, Ab*
10:15 Break
10:45 Brush management research: 1960's to the present
- *Art Bailey, University of Alberta, Edmonton*
11:30 Managing brush: Aspen to alfalfa
- *Garry Bowes, SAFRR, Saskatoon*
12:00 Lunch. (Galaxy Ballroom B)
State of the art and science of the biological control of weeds
- *Susan Boyetchko, AAFC, Saskatoon*

Afternoon session (Galaxy Ballroom B) – Chair: *Gerry Elhert, ASRD, St. Paul*
1:30 Managing brush: Ticlopyr Ester (Remedy herbicide)
- *Scott Middleton, Dow AgroSciences, Calgary*
2:00 Managing brush: Practical considerations of using fire
- *Barry Irving, University of Alberta, Edmonton*
2:30 Brush and wildlife habitat
- *Bill Bristol, PFRA, Regina*
3:00 Break
3:30 Grazing timber harvested areas
- *Bill Gardiner , Mb. Agriculture, Dauphin and Clayton Robins, AAFC, Brandon*
4:00 Agroforestry options in managing aspen
- *George Powell, University of Alberta, Edmonton*
4:30 Brush management considerations on rangeland and in riparian areas
- *Michael Alexander and Lorne Fitch, ASRD, Lethbridge*

6:00 Cocktails (Galaxy Ballroom B)
6:30 Supper.
Saskatchewan's best kept secret.
-*Duane McCartney, AAFC, Lacombe*

Feburary 19

7:30 Breakfast (Galaxy Ballroom B)

Morning Session (Galaxy Ballroom B) – Chair: Gil Lahaie, Mb. Agriculture, Dominion City

8:30 Biological control of deciduous tree regrowth
- Paul de la Bastide, MycoLogic, University of Victoria

9:00 What's going on right now? Research and demo projects
- Manitoba – *Bill Gardiner, MAF, Dominion City, Mb*
- Saskatchewan - *Wilf Pyle and Todd Jorgenson , SAFRR, Regina and North Battleford*
- Alberta - *Gerry Ehlert, ASRD, St. Paul, Ab*
- PFRA – *Ron Moss, PFRA, Dauphin, Mb*

10:15 Break

10:45 Break out groups to discuss research priorities and potential new research programs (Galaxy Ballroom B, Hercules and Lancaster)

12:00 Lunch

Afternoon Session (Galaxy Ballroom B)

1:15 Reports of break out groups. General discussion of priorities and planning, and elaboration of a strategy.

2:30 End of workshop.

Appendix B. Summaries of Invited Presentations

Brush Expansion on the Canadian Prairies

Brant Kirychuk,
Agriculture and Agri-Food Canada,-PFRA, Regina

Rangeland managers and scientists have been concerned with the loss of rangeland productivity and the changes in ecology due to significant expansion of woody plant species onto formerly open grassland. This paper will examine the causes and extent of woody plant species expansion on the Canadian Prairies. The primary species of concern have been trembling aspen and balsam poplar. The area most significantly impacted is pastures in the black soil zone, but there are moist areas in the dark brown soil zone, and also cleared pastures in the grey and grey-wooded zones where control measures are being undertaken.

Cause of Woody Plant Expansion

The prairie grasslands developed as a result of a combination of fire, grazers and climate. The grasses are well adapted to this area because of the predominantly dry climate, which when combined with periods of heat, resulted in occasional periods of drought. The moister areas of the prairies are also suited for the growth of trees with populations expanding during moist periods and dying back during periods of drought. If fire is eliminated from an area, the trees expand and dominate an area. Fire was an extremely common occurrence on the prairies and it's elimination, along with the large herds of bison, had a dramatic effect on the vegetation of the area, resulting in a change toward forest species and less grass cover.

Physiology of Aspen Expansion

Depending on the particular situation aspen will expand at a slow ever increasing pace or there can be production of a tremendous amount of suckers. Existing clones slowly expand their area based on climate and insect populations. Clones tend to slowly expand by sending out new suckers. Drought years and heavy insect infestations will result in die back while good growing conditions will see more rapid expansion. Management practices which increase competition for the suckers or result in browsing will limit this expansion.

Activities which remove or significantly damage the existing top growth will result in a significant flush of suckers. It is not uncommon to see several new suckers establish at the base of a killed aspen. In the year following treatment of an aspen stand with fire, herbicide or clearing there will be a much greater density of stems than there were in the original stand. This is the reason for the requirement for follow up management after any of these treatments.

Aspen trees grow in separate groups of genetically identical clones connected through a root system. They regenerate by seed and by shoots or root suckers. Seedlings need very precise growing conditions and little competition to survive thus do not account for a significant amount of aspen expansion. Suckers on the other hand are supported by the parent clone, and have good rates of survival if not stressed significantly in early years.

Suckering is stopped by auxin translocated to the roots from growing shoots and leaves, a process termed apical dominance. Disturbances that damage, cut or kill stems will reduce the flow of auxin into the roots and result in aspen regeneration.

Rates of Woody Species Expansion

A number of studies have looked at brush expansion rates in Canada. Two of the studies are described in detail below, while the table at the end of this section summarizes woody expansion rates from 4 different studies.
i) Alberta Aspen Parkland

Bailey and Wroe in 1970 examined aspen expansion rates in the Alberta Aspen Parkland. They examined aspen growth in a period between 1907 and 1966 by comparing survey records to their actual field measures. They found that most transects that had brush on them in 1907, also had some brush in 1966. The brush cover increased from 4.8% to 8.0% of the mean area. This was a net 3.2% increase in 59 years or 0.05% per year.

They also found periods of rapid expansion and years of little or no aspen expansion. In the 56 year period, tree ring analysis showed two 5 year periods of significant expansion separated by 10 years of limited

expansion.

ii) PFRA Community Pastures

Garry Bowes conducted a study of the brush expansion rates on 28 PFRA Community Pastures which had reasonable amounts of brush cover. Bowes found that 109,506ha of the total 270,976ha on these pastures were covered in brush. He found that brush was expanding at a rate of 5,881 hectares per year or ___ % of the area per year. This meant that control measures had to be put in place to manage at least 6000 ha per year just to maintain the status quo. He also went on to state that there was opportunity to control the brush on the cleared and cleared and seeded fields which could result in a potential increase in the range of 27,305 to 59,303 AUM's.

Ecology of Aspen and Wildlife Interaction

Jeff Thorpe
Saskatchewan Research Council

In the Prairie Provinces, aspen encroachment on pastures occurs mainly in the Aspen Parkland and Boreal Transition Ecoregions. These ecoregions span a gradient of increasing moisture availability from the southern edge of the Parkland to the northern edge of the Boreal Transition. The natural vegetation changes along this gradient from a mosaic of aspen groves and grasslands to continuous boreal forest. Understory plant communities show corresponding shifts.

There is evidence that groves have expanded in the Aspen Parkland since settlement, probably because of fire suppression. However, this does not imply that the entire zone has moved southward. In fact, historical sources from the mid-19th century describe the Aspen Parkland about where it is now. The amount of tree cover within the Parkland has probably fluctuated with changes in fire frequency over the centuries. Superimposed on these changes has been the clearing of aspen forests for agricultural purposes. The loss in tree cover in the Boreal Transition Ecoregion since 1960 has been around 1% per year.

Anthopogenic global warming is expected to dramatically change the climatic gradient on which these vegetation patterns is based. Climate models indicate that 50 years from now, the climate in the forest fringe could be similar to that presently found in treeless grasslands of the western U.S. This may reduce the vigor of aspen regrowth and encroachment onto grasslands.

Shifts between woodland and grassland cause large changes in other ecosystem components. The composition of shrub and herb species is strongly controlled by the presence or absence of aspen trees. Clearing has often been accompanied by the introduction of exotic plant species, altering the composition of both cleared areas and residual woodlands. Yield of herbaceous forage usually increases after clearing. Animal communities depend on vegetation as habitat, and can be expected to show correspondingly large changes with shifts between woodland and grassland.

Monitoring Brush Species in Tame Pastures

Gerry Ehlert
Public Lands, Alberta Sustainable Resource Development

Brush species such as poplar and willow often regenerate on tame pastures in the Mixedwood and Parkland Regions of Alberta. Brush regrowth species at low cover and densities may act as complementary forage, and add to other values such as snow trap and wildlife. However, at high cover and density, brush regrowth species can significantly reduce the carrying capacity of the tame pasture and increase pasture maintenance costs. Assessing the cover and density of brush regrowth species on tame pastures can provide an early warning bell before the situation becomes more serious and expensive to correct.

Assessment of brush regrowth species on tame pastures should not be carried out in isolation, as other factors may be responsible for forage production declines. Alternatively, an integrated assessment approach should be taken to monitor the health and productivity of a tame pasture. Such integrated monitoring should include the evaluation of a number of related factors such as forage and other species composition, hydrologic function and nutrient cycling, site stability, noxious weeds and woody regrowth. An integrated monitoring approach can further help to identify problems, sustain benefits and reduce pasture maintenance costs.

Alberta range management specialists are developing a tame pasture health assessment tool * to monitor brush species regrowth on tame pastures in Alberta. This tool provides an integrated approach to monitoring the health of a tame pasture based on the following health assessment criteria: plant composition, species shift, weedy and disturbance induced species shift, amount of litter, evidence of site instability, bare soil, noxious weeds, and woody regrowth. The observer answers six questions that measures and estimates the present situation to measurements and values found in a healthy and productive tame pasture. Scores are awarded to each question and tallied up to provide the overall health, function and productivity of the tame pasture. Is the pasture healthy and producing optimum forage production? Does the pasture have problems associated with one or a few of the health assessment criteria? Or, is the pasture unhealthy because of many associated health assessment criteria?

The integrated approach allows the observer to consider a number of integrated and strategic approaches to correcting any health related problems. For example, the observer may find that the tame pasture has a high cover and density of woody regrowth and low volume of litter relative to a healthy situation. Correcting the brush regrowth problem alone may not achieve increased forage production. Alternatively, correcting the brush regrowth and increasing lbs./acre of litter through changes to grazing management practices may increase forage production. This monitoring approach is considered an important awareness and education tool for pasture managers and livestock producers who want to sustain forage production at lowest maintenance costs.

* Range/Pasture Health Assessment for Alberta Rangelands. B.W Adams, G. Ehlert, A. Robertson, M. Willoughby, M. Alexander, D. Downing, C. Stone, D. Lawrence, C. Lane, R. Wells, F. Gazdag, D. Labonte, and C. J. Richardson. 2003. Rangeland Management Branch, Public Lands Division, Alberta Sustainable Resource Development. 31 pages.

Brush Management Research: 1960's to the present

Arthur W. Bailey,
Professor Emeritus,University of Alberta;
Western Rangeland Consultants Inc., Edmonton, Alberta

This is a review of the brush management research program that was conducted from 1966 to the present in the Alberta aspen parkland. My research is included accompanied by selected projects of graduate students and others. The early years of the 1960's were devoted to an exploration of priorities of prairie agriculture, and research options that might lead to advancements in brush management in aspen parkland. Early research included agricultural policy regarding forage resources for the developing beef cattle industry. Brush encroachment into natural grassland was studied as was mechanical clearing of aspen without breaking, effects of herbicide on aspen forest, forage production and grazing use of sprayed aspen forest, and "good brush" as compared to "bad" brush. Aspen parkland ecosystems were studied: rough fescue grassland, shrubland communities, forest communities, and lakeshore communities. Research into the effect of fire was initiated, as was the effect of livestock grazing on parkland ecosystems.

During the 1970's one focus was the fire ecology of the aspen parkland including the long-term effects of annual spring burning. Another focus was the effects of grazing on native *Festuca* grasslands. An exploration began of the role of grazing in modifying burned aspen forest following observations of cattle preferentially selecting browse. This led to further study of cattle effects on establishment of seeded forages following burning. The book by Wright and Bailey entitled "Fire ecology of the United States and southern Canada" will be discussed. In the late 1970's and through the mid-1990's several research projects were carried out on the role of fire and cattle grazing as brush management tools, as an alternative to mechanical clearing and breaking, and as a practical way to provide additional forage resources for livestock. In the 1980's and 1990's the role of prescribed burning in resource management and research was explored in various publications and presentations.

A program of research into the complex effects of cattle grazing in regenerating clear-cuts of commercially viable aspen forests dominated the latter part of the 1990's. It will be demonstrated that cattle can either kill regenerating aspen suckers or enable aspen to regenerate. The results of a shear force study of aspen twigs will be presented.

The presentation will conclude by "looking back in order to project forwards". This will be one researcher's consideration of where have we come from and where are we going to.

Aspen to Alfalfa

Garry Bowes,
Coordinator, Noxious Weed Control Program
SAFRR, Saskatoon, SK

The Aspen Parkland is a mosaic of grasslands, small shrubs and groves of trees dominated by aspen poplar. Since the reduction in prairie fires and buffalo grazing in the 1800's aspen groves have expanded into neighbouring grasslands. The groves coalesce and form an aspen forest. Aspen encroachment on to grasslands reduces available forage. Land managers want to remove the woody growth and graze herbaceous vegetation.

Ranchers have continually expressed a desire to graze alfalfa. At a Grazing Workshop, which was held in Saskatoon in 2001, Wyett Swanson a Rancher from Provost, AB, presented information on the advantages of alfalfa. Forage yields for alfalfa were 2.46 tons/ac compered to 1.01 tons/ac for a grass pasture. In a grazing trail, calf gains were 2.9 lbs/day for alfalfa-grass compared to 1.9 lbs/day for native grass.

Aspen control with 2,4-D, 1 to 2 years after treatment averaged 78%. The highest stem kill was 93% and the lowest stem kill was 57%. Balsam control with 2,4-D was poor.

In a preliminary experiment, Garlon applied at 4 L/ha completely controlled young aspen and balsam poplar suckers. In a series of private company trials, stem kill after a Garlon treatment of 4 and 5 L/ha was 84 and 89%, respectively (Data provided by DowAgrosciences).

The canopy cover of aspen on soil was 0.5% following a treatment of Banvel + 2,4-DE applied at 3.1 + 3.7 L/ha. In the research trials, a small percentage of the sucker cover was balsam poplar. After treatment, the canopy cover for brush was 3.1%.

After an application of Escort at 100 g/ha, the canopy cover of young aspen suckers on the soil was 0.7%. The total cover for aspen and balsam was 1%.

Roundup applied at 4.6 L/ha effectively controlled aspen and balsam suckers for 15 years. After Roundup controlled sucker growth, there was a firm seedbed, which was suitable for sod-seeding forage species. Sod seeding was most successful (1677, 2381 and 3142 kg/ha) when precipitation is at or above normal during early spring and the previous fall. The residual grasses in brome, crested wheatgrass or bluegrass pastures were not completely controlled following the use of Roundup with sod seeding. Tame or native plants can be established by sod seeded.

There was always a need to control poplar suckers. Bark scraping effectively controlled small aspen suckers (suckers <1.5 m tall). The canopy kill was 77 to 79%. Mid June is the best time to control suckers with a bark scraper. Roundup (30% solution) applied with a carpet wiper effectively controlled (2% cover) sucker growth. To keep aspen and balsam from invading pastures, repeat the bark scraping or wiper treatment when sucker growth is 4 or less year old. Small diameter wood disappears quickly from pastures.

Managing Brush with Remedy Herbicide

Scot Middleton,
Dow AgroSciences Canada, Calgary

Remedy* Herbicide (active ingredient triclopyr ester) was registered for aerial and ground application in Western Canada in 2001 to provide brush and tree control in range and pasture land, while being safe to grasses. Remedy is a non-residual herbicide with a relatively short half-life, and a favourable environmental profile. Triclopyr has been registered since 1988 in Canada as Garlon 4 in the industrial vegetation market, and Release* Silvicultural Herbicide for forestry. Remedy is a growth regulator herbicide that translocates effectively down to growing points in the roots. Research has shown that triclopyr provides longer term control of aspen, willow and balsam poplar than 2,4-D or dicamba (which require annual or semi-annual retreatments). Ranchers using Remedy for brush control should not have an economic need to re-treat that area for brush for at least five to seven years. An integrated management plan for subsequent treatments will be required to manage very large, old established root systems in the long term.

Common application rates used in range and pasture are 1.6 or 2 L/ac (4 or 5 L/ha) of Remedy. 1.6 L/ac provides excellent control of species such as aspen, willows, wild rose and birch. The higher rate of 2 L/ac is required for harder to control species such as balsam poplar, Manitoba maple, or shrubby cinquefoil. Consult the label for a full list of species controlled. Ground application water volumes should be a minimum of 20 gallons/acre, and 4 gallons/acre for aerial applications.

The general rule for timing of application should be after full leaf expansion, and at least 7 – 10 days prior to leaf coloration in the late summer. One exception is balsam poplar, which is most susceptible prior to the thickening of the leaf cuticle, allowing an optimum application window in a late May through June time frame. Ideal height for brush application is 4 – 10 feet. Brush < 10 feet in height will easily be managed by the cattle knocking them over without any hazard to livestock. Very small plants < 3 feet generally do not have sufficient leaf surface to effectively translocate enough herbicide into the root system. Brush and trees larger than 10 feet can be controlled, provided that coverage of adequate leaf surface area is achieved. Larger deadfall may become a management issue, creating obstacles to grazing or herd management as larger trees start to fall on their own.

Keys to achieving good efficacy with Remedy:

- Coverage, or footprint. See the Dow AgroSciences fact sheet *Guide to improving Triclopyr ester efficacy* for a better understanding of the relationship between droplet size, droplet number, and the coverage that different spray configurations.
- Higher water volumes generally result in better footprint (aerial application minimum 4 gal/ac)
- Use the appropriate rate for target species. See *Facts on Remedy* fact sheet from Dow AgroSciences.
- Time the application when plants are actively growing, preferably soon after full leaf expansion.
- Do not apply when temperatures are > 25 °C
- Use an aerial applicator that has been trained by Dow AgroSciences

* Remedy, Garlon 4, and Release are registered trademarks of Dow AgroSciences LLC.

Tips for a Successful Rangeland Prescribed Burn

Barry Irving
University of Alberta

Conducting a successful rangeland prescribed burn involves a balancing act between burning when the conditions are dangerous enough that management goals are achieved yet safe enough that control can be maintained. Maintaining control of fire requires a thorough knowledge of fire behaviour (predictable burning intensity determined by fuel, weather, and topography), suppression capabilities (defined by experience and equipment), and conditions in the area immediately outside the planned burn perimeter (which determines escape risk).

The only fire behaviour factor that can be controlled is fuels; management can be applied to accumulate or remove fuels. Successful burning in fuel types such as healthy, vigorous aspen that have limited fine fuel in the under-story will require a deferral of grazing to accumulate enough fuel to carry a ground fire. Conversely, decadent aspen stands have extreme fuel accumulations and can only be safely burned if heavy grazing is applied to remove some of the fine (flash) fuels so that instantaneous fire intensity can be managed. Fire behaviour responds to three key weather variables: relative humidity, wind, and air temperature. Weather can only be controlled through rigorous use of an ignition decision. The ignition decision is a simple yes or no based on a spot weather forecast and pre-determined weather thresholds. Although each burn is unique, some general weather guidelines can be prescribed. Relative humidity below 30% will result in rapid fire ignition and spread, but fuel consumption will be more complete than is achieved at higher humidity. RH above 45% will result in slower fire build-up and easier control conditions, but will likely leave un-burned fuel that could result in a holdover fire and subsequent control problems. Only experienced crews burning inside manageable perimeters should conduct prescribed burns when the RH is below 30%. Although burning in excessive winds (above 20 km/hr) should never be attempted burning in no wind conditions also presents problems. Fire creates wind, and if there is no landscape wind the direction of eventual fire spread can be difficult to predict and manage. Winds in the 10 km/hr range give good fire direction, yet yield manageable fire behaviour. Topography has a similar effect on fire behaviour as wind. Fire burning up-hill (with the wind) will pre-heat the fuel and move at a faster pace than fire burning downhill (against the wind). Complex topography interacting with landscape wind can create extreme wind and fire behaviour events. Fire tornadoes, although spectacular, are not fun in a prescribed fire environment.

Every crew has a control capability that is defined by experience, toughness, and equipment. It is important to realize that every fire in every fuel type can quickly exceed control capabilities. Even experienced crews need to develop and follow prescriptions that set boundaries of expected fire behaviour. Prescribed burning crews will typically be divided into three areas: ignition, suppression, and the fire boss. The fire boss will carefully access the fire danger and the capability of each individual before assigning duty areas. Ranchers, even if they lack formal fire experience, tend to make excellent fire crew members because they have a natural understanding of landscapes and equipment capabilities, the usually approach fire cautiously, and they are mentally and physically tough.

Fire can be controlled from the inside or the outside. Dangerous fuel types that are surrounded by low risk areas can be safely burned by less experienced crews under more extreme weather conditions. It is often safer, faster, and cheaper to expand the size of a prescribed burn until a good perimeter can be maintained, rather than try to contain a smaller burn inside a poor perimeter. Ignition patterns can be used to manage fire intensity inside the burn perimeter. Although backfires (burning against the wind) are the safest ignition pattern, strip head-fires offer a balance between speed and safety.

Finally, every prescribed burn should have a pre-planned back-up that is rehearsed and can be applied in the event of a fire escape. Back-up plans should include secondary containment strategies, provisions for additional people and equipment (i.e. local fire department on notice), and even insurance and incorporation to protect your neighbours and yourself from financial risk. Ultimately, conducting a safe prescribed burn is about planning. Plan a safe burn, but also plan to recover from a loss of control. Fail to plan, plan to fail is never more true than in

prescribed burning.

Grazing Timber Harvested Areas

Bill Gardiner and Clayton Robins
Manitoba Agriculture, Dauphin and AAFC, Brandon

Hardwood timber harvesting and livestock grazing has historically been perceived as conflicting resource use, with cattle producers perceiving timber harvesting as a threat to future grazing (ie: reduced quality and quantity of forage; state/condition and usability of land following harvest) and aspen producers perceiving cattle grazing as a threat to future timber supply (ie: reduced quality and stocking of aspen).

In 1994, Louisiana-Pacific Canada (LPC) was granted a Forest Management License in west central Manitoba, with a significant amount of LPC's overall volume requirements coming from within the agricultural zone (ie: pasture land; Crown and private). In this regard, 20% of the sustainable volume requirements or Annual Allowable Cut comes from leased Crown land and it is estimated that 10-15% of the overall volume comes from the private land source.

In 1997, a multi-partnered project was introduced to assess the interaction of livestock grazing and hardwood timber harvesting. The Garland project is a 10 year Manitoba based research project, designed to collect data to evaluate post harvest grazing in terms of resource impact and compatibility. The objective of this project is "to demonstrate managed grazing systems on hardwood harvested areas which provide livestock benefits as well as allow for optimum regrowth to meet provincial hardwood stocking standards for future timber harvesting". It is hoped that the data collected from the Garland project will assist in resolving potentially conflicting land use for the long term benefit of all resource users (ie: data can be used for planning hardwood timber harvest on Crown land under grazing disposition and/or assist private landowners manage their land resource).

Agroforestry Options for Managing Aspen

George W. Powell and Edward W. Bork
University of Alberta

Agroforestry is the integration of trees into agricultural production. It is a common land management practice in the tropics and is widely used elsewhere in the world, but is relatively unknown in Canada. The typical Canadian perspective is that forestry and agriculture are incompatible and trees have often been viewed in the agricultural sector as little more than weeds. However, long-term trends of increasing demand for wood products, coupled with near full allocation of timber rights on public land, has created strong interest in growing trees on farmland. Agroforestry can meet part of the demand for wood without eliminating agriculture. In this regard, it is a 'win-win' opportunity: expanding the sustainable wood supply and providing landowners with an option for diversification. Independent of agroforestry opportunities there are other reasons for retaining aspen in farming systems, including:
1) to meet regulatory requirements to enable use of public land;
2) to promote conservation and wildlife values;
3) diversification of productive land base (which can mitigate drought and other effects);
4) reducing aspen suckering, eliminating retreatment costs with complete forest removal;
5) using trees as a "sink" for greenhouse gases with the potential for carbon credit payments.
Agroforestry is not a single type of land use, but comprises a group of production schemes ranging from extensive systems with few external inputs, conducted over relatively large areas (e.g. forest grazing) to intensive systems with relatively higher inputs on smaller areas (e.g. production of crops between widely spaced tree rows). In all cases, successful agroforestry requires an understanding of how trees and other crops interact. By virtue of their size, free-growing aspen dominate site conditions. But far from being solely a detriment to understory production, trees modify their surroundings with a mix of effects, both positive and negative for other plant growth. This allows for agroforestry designs that minimize negative interactions and take advantage of natural, production-enhancing processes.
Research in the Parkland and lower Boreal Mixedwood ecotypes of central Alberta was conducted to determine some of the important interactions between aspen and their understory, to help find the right balance between tree and forage production. Some of the key findings are:

- Light reduction by an aspen canopy has stronger effects on the understory than research from lower latitudes have found. A lower tree stocking is necessary, particularly in the boreal, to promote understory production.
- Tree canopies facilitate increased soil moisture under some precipitation patterns, which can be significant to overall production levels during a drought.
- Elevated humidity in the aspen understory can promote growth of some forage types, but this must be balanced against light reductions that also result from the overstory.
- Aspen suckering increases exponentially with aspen canopy removal. Retaining some aspen cover can greatly reduce the amount of regeneration.

The Value and Functions of Woody Plants in Range and Riparian Ecosystems

Lorne Fitch[nn], Barry Adams[nnn] and Mike Alexander[nnnn]

Traditionally, range managers have looked at forest cover or tree and shrub encroachment as a resource issue with significant negative impacts on forage supplies for livestock and grazing wildlife species like elk. Responsible resource management requires that we recognize the value and functions of woody species before we decide that brush management treatments may be necessary. When we "manage" a landscape, for grazing, urban development, industrial uses or recreation, we often focus on an endpoint that meets our immediate needs and wants. It may be that our goals ignore landscape health and ecological functions; the ability of a landscape to produce a broader spectrum of wants and needs. Woody species play an integral role to the health and functioning of both riparian and rangeland ecosystems.

Healthy riparian landscapes sustain us, with their ability to store, filter and buffer water, combined with their agricultural and biodiversity values. What is wanted are riparian landscapes that are resilient, stable and provide us with a long list of ecological services, whether we are livestock producers, farmers, anglers, bird watchers, cottage owners or downstream water drinkers. Trees and shrubs play an especially important role in riparian functions. For many streams and channels, a combination of riparian vegetation with woody root systems, deep-rooted grasses and other vegetation provides a physical barrier to the effects of high water velocities and stream energy. Woody plants act as a form of natural rebar in binding and holding banks together. Root wads and tree trunks provide hydraulic roughness helping to slow the flow of water and dissipate stream energy. An individual tree, depending on species longevity, may influence channel characteristics for decades or centuries. As individual trees and shrubs senesce, die, and are replaced by others in succession, the effects on channel hydraulics and form can be perpetually maintained. This establishes a vegetation influence on the maintenance of dynamic equilibrium in channels, streams and the riparian setting.

The new concept of rangeland health being adopted in North America requires that we look at the normal characteristics of ecological sites, which on even the driest grasslands will include a component of woody plant cover. If the ecological functions and values of ecological sites are to be protected and maintained, we need to ask ourselves how brush management activities may impact natural resource values in the "big picture". For example, brush management activities near a stream or river channel will reduce the normal structural diversity of vegetation, possibly the bank strength. Tree or shrub removal in foothill rangelands in South-western Alberta may reduce winter snow trapping resulting in drier and more exposed growing conditions for herbaceous plant species required for forages. A number of species at risk, like sage grouse, will not survive without extensive health stands of Silver Sagebrush.

Without question, the priority placed on brush management research has declined in the past decade. This conference is an opportunity for researchers and resource managers to consider integrated brush management strategies that consider ecologically sound approaches when dealing with brush management issues.

– Provincial Riparian Specialist, Cows and Fish program, Lethbridge, AB
– Range Management Specialist, Alberta Sustainable Resource Development, Lethbridge, AB
– Range Management Forester, Alberta Sustainable Resource Development, Blairmore, AB

Biological control of deciduous species: the bioherbicide Chondrostereum purpureum

Paul de la Bastide and Will Hintz

MycoLogic Inc., University of Victoria, P.O. Box 3020 STN CSC Victoria, BC V8W 3N5

The management of fast-growing hardwood species in industrial rights-of-way and other areas poses a challenge for vegetation managers. The rapid growth rate and the ability of many of these tree species to propagate by resprouting from cut stumps have prompted the use of a variety of control measures. The application of chemical herbicides to the cut stumps is usually successful in suppressing reprouting and is considered a cost effective control method. However, herbicide use is encountering growing public opposition and there are increasing restrictions on chemical herbicide use in many regions. Where herbicide use is prohibited, the lack of stump treatment leads to extremely high stem densities after several cutting cycles. We have been testing the fungus *Chondrostereum purpureum* as a viable alternative to chemical herbicide application for the control of stump resprouting in industrial vegetation management. Cut stumps of the target species are inoculated with a formulation containing the fungus as the active ingredient. The fungus invades the lower stem and prevents resprouting by killing adventitious shoots or branches. This biocontrol fungus has shown good efficacy against the species of red alder (*Alnus rubra*), Sitka alder (*Alnus sinulata*) and aspen (*Populus tremuloides*) in field trials, comparable to chemical methods of deciduous brush control. This biocontrol agent could be an important component of an integrated vegetation management strategy for vegetation managers working in the utility sector and other industries. A paste formulation of this biocontrol agent is currently being reviewed for registration in Canada and the United States as a pesticide product of MycoLogic Inc. A spray formulation of this biocontrol agent will be subject to further testing in field trials during 2003.

What's Going on Right Now? Research and Demo Projects

Manitoba - Bill Gardiner, Manitoba Agriculture, Dauphin

This presentation will deal with past and present demonstration projects relative to brush control. The methods utilized as per demonstration projects include spraying, mowing, bark scraping, burning, roller chopping, wiping (roundup), drum rolling, drum rolling/wiping/roundup, goats, etc.

The presentation will also deal with a government policy change with respect to treatment of aspen encroachment on Crown land. This policy "Grassland Recovery and Treatment of Aspen Encroachment" establishes a procedure for dealing with aspen encroachment on Crown land whereby proposals are reviewed on a site specific case-by-case basis, resulting in the development of site management plans. One such project/proposal which has come about under this new policy will be highlighted. This proposal incorporates a monitoring/research component.

This presentation will also highlight the Agricultural Policy Framework Agreement and Greencover Initiative and where/how brush control is a natural fit in terms of maintaining biodiversity and/or a balance between grasslands and woodlands.

Saskatchewan - Wilf Pyle and Todd Jorgensen Saskatchewan Agriculture, Food and Rural Revitalization

A short report on the seven techniques used across Saskatchewan is provided with particular emphasis on experiences in the provincial community pasture system. Community pastures have had an active program of brush control over the years but priorities and budgets have shifted over the past fifteen years so that there is less activity today than in the past. There are no longer any major initiatives to develop crown agricultural lands.

Crown agricultural land encompass some eight million acres including the operation of 54 community pastures. About half of the pastures and about two million acres of the crown land experienced tree and brush removal from the period of 1963 until 1978. During those years rangeland improvement notions mainly considered the clearing, burning, repiling, reburning and breaking of land with follow up seeding of tame species as the major land improvement technique. Today, many of the tame species used in those early land development programs are considered invaders that are damaging to the long term health of native grasslands. Driven by the idea that cattle number increases would lead to diversification of prairie farms away from hard grain production and at the same time improve the genetics of the provincial cattle heard these programs on crown lands were aggressively promoted and financially supported.

Although actual numbers are unavailable in terms of acres affected, there is a strong feeling that brush encroachment has reduced grazing in the prairie parkland area. It is well understood that since cattle grazing began in the agricultural area of the province in the 1900's the foraging habits and the lack of prairie fires has favoured the development of woody plants. Also, the extensive clearing and breaking programs undertaken in the 1970's have stopped and these areas are particularly susceptible to reinvasion by woody species given the favourable soil and climatic conditions even in the face of heavy cattle use. Field margins, poplar bluffs, slough edges, waterways and unused road allowances readily repopulate with woody species especially when mid summer moisture conditions are favourable.

Uncontrolled grazing and extended drought promote the growth of all woody species at the expense of grasses. Grass growth is hindered under early spring dry conditions giving woody species an edge in moisture availability as these plants often hold snow that melts slowly in the spring and provides a ready source of moisture.

Two of the most widely distributed native woody undesirable species are western snowberry and trembling aspen. Western snowberry is an increaser on nearly all range sites in this province under most grazing regimes. Trembling aspen in its role as the climax species of the prairie parkland is the major increaser that

encroaches most frequently and aggressively. Other woody species that pose local problems include the various willows, rosebush and silver berry (wolf willow). Importantly, sagebrush and shrubby cinquefoil are not generally considered to be problems.

Brush control techniques used in Saskatchewan include:

* Clearing and breaking
* Aerial herbicide application
* Prescribed burning
* Ground applied herbicide
* Grazing management
* Bark scraping
* Forestry management

The majority of brush control inquiries received by the department are for lands still under crown control. This is no doubt due to the preponderance of trees on crown lands compared to other deeded lands in the province. As well, the Habitat Protection Act has limited clearing and development on some 3.4 million acres of crown land so it relatively easy to suggest that there is encroachment on crown lands. There is a limited number of people with expertise in the whole of area of brush control and the use of chemicals remains expensive in relations to the benefits. Major problem areas remain the forest fringe area of the province and the entire parkland zone. There appears no easy solutions so additional research is recommended

PFRA - Ron Moss, PFRA, Dauphin

PFRA has been involved in brush management for a number of years and current control methods include livestock browsing, fire, herbicides, and mechanical. Natural control from browsing and fire has occurred on the prairies for thousands of years. Livestock browsing is used on PFRA pastures and by manipulating stock density, the degree of browsing can be targeted to problems areas. PFRA has been using fire to manage brush on pastures and there is an extensive burning program on Spiritwood, McCreary, and Alonsa Pastures. From 2000 acres to as much as 5000 acres are targeted for burning annually, depending on conditions.

Aerial application of selective herbicides has been one of the most common methods of brush control used by PFRA. Aerial application is being done on a smaller scale than in the past due to poor control on older re-growth and balsam poplar. Aerial spraying is successful but is dependent on appropriate conditions. PFRA partnered with Dow AgroSciences on a trial at Portage Pasture in 2002, spraying Remedy on oak. The success of this project will not be known until its monitored in 2003.

PFRA has been applying non-selective herbicides with wipers since 1999. The idea of applying roundup with a wiper came from Dr. Garry Bowes and is used extensively in the Dauphin area and the idea is spreading to other areas, including Brandon. Dauphin has four skidders with 30-foot wide wipers attached to the front. There are tractor-mounted models with smaller wipers at Pasquia, Wallace and Langford Pastures. Results have been excellent on both aspen and balsam poplar. PFRA has also applied roundup with a rolling drum, both smooth and with chopping paddles. Initial results are not as good as with the wiper.

A big drum chopper has been used on PFRA Pastures to knock down brush and open areas up. It works best on sandy areas but has limitations in rocky or wetland areas. A couple of smooth drums have been used in 2001 and 2002 in the Dauphin area to flatten the bigger and heavier re-growth particularly in previously burned areas. Trials were conducted in 2001 by applying roundup with a wiper or a sprayer at the back of a smooth drum. The results were not satisfactory and so only the drum was used in 2002. At McCreary Pasture the drum was used to flatten approximately 600 acres of re-growth killed by fire in the fall of 2000 with good results. This area now has a lot of small suckering which can be treated with a wiper.

PFRA includes brush management when a range management plan is developed for its pastures. No one method is going to work at all pastures under all conditions. By integrating methods PFRA hopes to continue to learn which method or combinations of methods will be most effective in managing brush.

Appendix C. Reports from Breakout Groups:

A. Are there any other research/demo projects taking place in addition to those mentioned by the presenters?

1. Tree encroachment in B.C. at Kamloops/Cache Creek, focussing on Douglas Fir and Ponderosa Pine encroachment (Kim Dorn, a U. of Sask. student 306-966-8720).
2. Biocontrol of brush species and leafy spurge in Manitoba using cattle and goats (Bill Gardiner and Jane Thornton 204-622-2044).
3. B.C. brush control projects (contact Reg Neuman, B.C. Forests at Kamloops 250-828-3704).
4. Using sheep for vegetation control in regenerating conifer forests in N.E. Sask. (Elaine Parry 306-622-2024).
5. Cows project at Dawson Creek, B.C. What cattle eat on forest rangeland.
6. Comparison of aspen regrowth - Miller Western (Roger Nesdoly, Meadow Lake, Sk.)
7. Regrassing logged sites - Chuck Richardson, Lac la Biche, Ab.
8. Grassland restoration in Parks (SERM, Government of Canada) - includes work being done in Prince Albert National Park.

B. Are there other brush control methods that were not dealt with by the presenters?

1. Biological control of aspens using tent catterpillars.
2. Complete description of grazing as a brush control tool (including all classes of livestock and ungulates, including bison and elk).
3. Thinning (agroforestry) as a control method. Also involves thinking of brush as a source of income.
4. Windrowing of standing brush
5. Mob grazing to prevent regeneration.
6. Controlling animal movement - training to eat brush.
7. Contract grazing for specific time periods.

C. What information is missing in our knowledge of brush management?

1. Use of alternative livestock for brush grazing - eg. bison.
2. Integration of all management methods with livestock, wildlife and forestry considerations.
3. Cost/benefit analysis of brush management.
4. What is the ideal landscape? How much aspen should be present?
5. Conifer control on tame pastures (Info may be available from B.C.).
6. Plantation agroforestry - intercropping forages and hybrid poplar.
7. Relationship of brush/grassland to Kyoto carbon credits - cost/benefit analysis.
8. Brush effects on riparian areas re ecosystem health and function.
9. Management of Rosa spp. and balsam poplar.
10. Knowledge of apical bud dominance in brush species.
11. Long term studies on integrated control.
12. Strategic direction on land management policy
13. Nutritional value of aspens at various growth stages.
14. Mapping to quantify encroachment.

D. What would be the highest priorities for research on brush management?

1. Basic physiology studies on brush species including apical dominance.
2. Management of balsam poplar.
3. Sequencing of different management treatments.

4. Effective extension programs that capture and disseminate all existing information.
5. Determination of optimum landscape to meet all needs.
6. Cost effective management of brush.
7. Effect on brush management on carbon sequestration.

E. Should a research program be set up to address these priorities? If so, how should this program be set up? Location lead agency, partners, collaborators, funding, etc.?

1. It was felt that 90% of the information required for brush management is there. Gathering and disseminating the information should be the goal.
2. Models for demonstrating techniques and disseminating information
    a. Model brush pastures in each province - like existing model forests.
    b. Applied research associations
    c. Use existing community pastures as models.
3. Partners - provincial extension agents, PFRA, livestock organizations, herbicide companies, universities, applied research organizations, conservation organizations (Ducks Unlimited, Nature Conservancy, etc.), environmental NGOs, the forest industry.
4. Lead agency - Extension divisions of the three provinces or the working group that set up this workshop (reps. from all three prairie provinces). Universities for specific projects.
5. Funding – Always a problem. Some funding may be available in the federal Green Cover program.

Appendix D: Workshop Participants

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