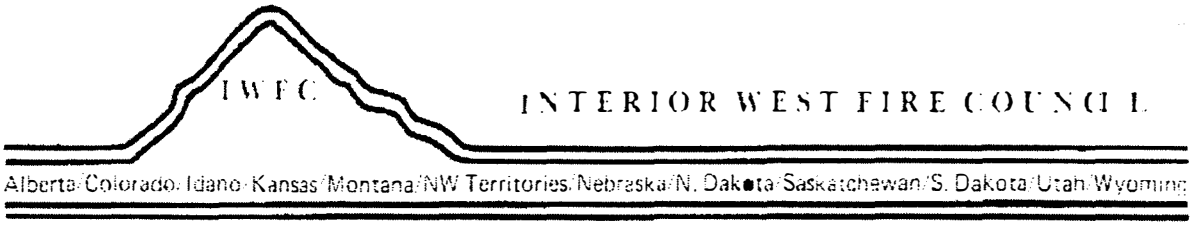

People, Ecosystems and Wildland Fires – Working in Harmony

2000 Interior West Fire Council Annual Meeting and Workshop

Program and Abstracts

Hosted by: Alberta Environment
Canadian Forest Service
Parks Canada

October 3 – 5, 2000
Fantasyland Hotel,
Edmonton, Alberta

Technical Coordinators: M.E. Alexander, Dennis Driscoll, Mark Heathcott, E. George

Table of Contents

Citation

Alexander, M.E.; Driscoll, D.; Heathcott, M., George, E., technical coordinators. 2000. People, ecosystems and wildland fires -- working in harmony. Abstracts and program of the 2000 Interior West Fire Council, annual meeting and workshop held October 3-5 in Edmonton, Alberta. Environment, Land and Forest. Service, Forest Protection Division and Natural Resources Canada, Canadian Forest Service, Northern Forest Centre, Edmonton, Alberta.

Abstract

The 13th annual meeting and workshop of the Interior West Fire Council was held October 3-5, 2000, in Edmonton, Alberta. Over 25 invited presentations related to the theme People Ecosystems and Wildland Fires – Working in Harmony were made, including a keynote address and closing remarks, involving six technical sessions:

(1) introduction and setting the state;
(2) historical perspectives;
(3) ecological, environmental and life safety complexities;
(4) emerging legal, socio-economic and technological issues;
(5) some possible solutions; and finally
(6) innovations and success stories.

The annual meeting and workshop also featured a poster session featuring 15 contributions.

Preface

The year 2000 marks the fourth time that the Interior West Fire Council (IWFC) has held its annual meeting and workshop within the Canadian zone of the Council; two previous workshops of the former Intermountain Fire Council had been held in Alberta in 1978 (Quintilio 1979) and 1983 (Dubé 1985). The very first annual meeting and workshop of IWFC was held at Kananaskis Village, Alberta, October 24-27, 1988, with the theme The Art and Science of Fire Management (Alexander and Bisgrove 1990). The fifth IWFC annual meeting and workshop was held in Yellowknife, Northwest Territories, October 27-29, 1992, with the theme Managing Fire Dependent Ecosystems: Options and Technologies (Duncan et al. 1994). The ninth IWFC annual meeting and workshop was held in Saskatoon, Saskatchewan, October 1-24, 1996, and with the theme Fire in Ecosystem Management Operational Realities.

The theme selected for this annual meeting and workshop of the council, People, Ecosystems and Wildland Fires -- Working in Harmony, reflects the fact that these three entities are often at odds with each. However, if we are to have a lasting peace we have no choice but to find ways for them to co-exist in harmony. Towards this end then, this year's conference program involves some 25 invited presentations in six technical sessions as follows:

- introduction and setting the stage;
- historical perspectives;
- ecological, environmental and life safety complexities;
- emerging legal, socio-economic and technological issues;
- some possible solutions; and
- innovations, success stories and conclusion

The program also features a poster session consisting of 15 contribution presentations.

We wish to extend our sincerest appreciation to the speakers (and their co-authors, as applicable) and the moderators for their obvious contributions to the meeting and workshop. Several speakers were still able to prepare and make their presentation in spite of an extremely heavy workload associated with a major fire season in the western United States during the summer of 2000.

The vendor sponsorship associated with the 2000 IWFC annual meeting and workshop are acknowledged elsewhere in this booklet. The support of Dennis Dubé and Mike Flannigan, Canadian Forest Service, Northern Forestry Centre and of Craig Quintilio and Don Harrison, Alberta Environment, Provincial Forest Fire Centre, Edmonton, Alberta, is gratefully acknowledged as is the support of the Alberta Registered Professional Foresters Association for their sponsorship.

The following contractors and employees with Alberta Environment located at the Provincial Forest Fire Centre are hereby duly thanked for their contribution to the organization of this conference (in random order): Patrick Loewen, Donna Brown, Dian Reddekopp, Mike Dubina, Rosalia Balogh, Cinda Lau, Vernon Remesz, Syd Wood, Debora Perrault, Carol Butler, College Copy, Map Town

We are especially pleased to have been involved in the planning and organizing, this the 13th annual meeting and workshop of the Interior West Fire Council. It constitutes a milestone in the history of wildland fire management in western North America because it reflects the fact that all of the member associations in the council have now hosted the annual meeting and workshop and we have thus come full circle since the origin of the Interior West Fire Council inaugural meeting back in 1988. This speaks well for the health and continued longevity of the council because we have seen other organizations be disbanded in recent times (e.g., the Northwest Forest Fire Council). We should never for granted the fact that the principal reason that the Interior West Fire Council exists is to contribute to the betterment of wildland fire management through participation in a central forum involving its member organizations. This can only help us as we work towards having harmony between people, ecosystems and wildland fires.

Technical Coordinators:

M.E. Alexander
Canadian Forest Service

D. Driscoll & E. George
Alberta Environment

M. Heathcott
Parks Canada

References

Alexander, M.E.; Bisgrove, G.F., technical coordinators. 1990. The art and science of fire management. Proceedings of the first Interior West Fire Council annual meeting and workshop, Kananaskis Village, Alberta, October 24-27, 1988. For. Canadian, Northwest Region, Northern Forestry Centre., Edmonton, Alberta. Inf. Rep. NOR-X-309.

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Duncan, T.A.; Forster, W.A.D.; Lanoville, R.A., compilers. 1994. Managing fire dependent

ecosystems: options and technologies. Proceedings from 1992 Interior West Fire Council annual meeting, October 27-29, 1992, Yellowknife, Northwest Territories. Govt. Northwest Territ., Fort Smith, Northwest Territories.

Quintilio, D., compiler. 1979. Proceedings of the International Fire Management Workshop, October 31-November 1, 1978, Edmonton, Alberta. Environ. Can., Can. For. Serv., North. For. Res. Cent., Edmonton, Alberta. Inf. Rep. NOR-X-215.

Conference Welcome

I am pleased to welcome you to the 13th annual Interior West Fire Council (IWFC) Conference here in Edmonton, Alberta, Canada.

Effective forest and fire management is becoming more crucial as our forested areas are subject to increased uses, and are becoming more socially important to Canadian and American citizens. We can not underestimate the impact effective management has on our economic, social and environmental opportunities and priorities.

The issues that we must address are not bound by borders or jurisdictions; the challenges are ours, collectively. Forums such as the IWFC Conference are integral parts of co-operation and information sharing as we strive to achieve our goals together.

May the presentations and discussions at this year's conference be instrumental in strengthening our forest and fire management programs. They will continue to help the people of our provinces, states and territories enjoy a high quality of life, healthy economies and a healthy environment.

Interior West Fire Council – Who We Are

The Interior West Fire Council (IWFC) is a forum for forest fire managers and interested private sector participants form the area that encompasses Alberta, Colorado, Idaho, Kansas, Montana, Northwest Territories, Nebraska, South Dakota, Saskatchewan, Utah, Wyoming. The purpose of the council is to foster co-operation and information sharing among the area's fire management agencies, technical staff and the private sector. Forest industries, universities and other related groups are also active participants at meetings.

Tracing its origins back to 1955, the IWFC began when the need to incorporate forest fire research information into forest fire operations was identified, State foresters across the US responded to the call and 'fire councils' were developed among management agencies. Over the years, the number of states involved in fire councils increased and Canadian provinces and territories were included. In 1988, two fire councils, 'the Intermountain Fire Council' and 'Rocky Mountain Fire Council' joined together to form the IWFC.

Modern forest fire management has become highly sophisticated and technical, with many rapid and innovative advances occurring in the areas of fire suppression aircraft, equipment, weather prediction/analysis, computerized fire behaviour modeling and operational organization. IWFC meetings encourage the rapid dissemination of new knowledge related to all of these critical areas.

Scholarships

The host zone of the Interior West Fire Council may present scholarships to fulltime students. Recipients must currently be enrolled in the second academic year at a technical school, community college or university. Recipients must also have a passing grade point average and one or more seasons of employment in fire management activities. This year, the Interior West Fire Council has selected recipients from Northern Alberta Institute of Technology (NAIT), and University of Alberta.

General Information

Registration Desk

The conference registration desk will be open at the following times:

Tuesday, October 3: 8:30am – 6:00pm
Wednesday, October 4: 8:00am – 6:00pm
Thursday, October 5: 8:30am – 12:00pm

If you need specific information about the conference, ask at the registration desk. Our staff can be identified by blue denim Alberta Land and Forest Service shirts. Please feel free to contact them with any of your inquiries.

Telephone

Telephone messages will be posted on a board in the registration area. If a contact telephone is required, either 780-427-6807 or the hotel switchboard number 780-444-3000 may be used. The Fantasyland Hotel Fax number is 780-444-3294.

Name Tags

To assist with delegation identification, meeting participants are encouraged to wear nametags at all times during the day sessions and field trips. Again, meeting organization staff can be identified by. blue denim Alberta Land and Forest Service shirts.

Displays and Vendors

Displays will be set up in the Ballroom D adjacent to the conference room on the 3rd floor.

Meal Tickets

Luncheon, barbecue and banquet tickets are included in your registration package. These tickets are enclosed in your nametag holders. Please present these tickets when you attend the banquet, a box will be positioned at the door **(make sure to write your name on each ticket, as these will be used to award prizes throughout the evening).**

In addition to the dining room, there are twenty-three restaurants and forty-four fast food outlets in the Mall.

Parking

Covered parking is available at the hotel free of charge.

Additional Amenities

Luggage storage, fitness centre and 24-hour room service.

Field Trip

There is a field trip offered (pending minimum 48 people) for October 6th and 7th (between the IWFC and IWFSS conferences). Transportation is provided and will leave the Fantasyland Hotel Friday morning at 8:30am. You will overnight (accommodation provided) in Jasper and return to Edmonton Saturday night, October 7. The round trip costs $100/person and includes two lunches and a dinner, as well as a tour of Jasper townsite.

Companion Program

Enter a vacation paradise! West Edmonton Mall is truly a shoppers' paradise. It's the world's largest shopping and entertainment centre. The Mall boasts over 130 ladies' wear stores, over 100 mens' wear stores, over 45 shoe stores, over 20 jewelry stores and over 350 gift and specialty stores.

Take a stroll down Europa Boulevard for a touch of European elegance or down Bourbon Street for the Mall's taste of New Orleans.

We have it all: a world class hotel, the widest variety of one-of-a-kind stores, fantastic attractions, spectacular games, restaurants to suit all tastes and great entertainment.

Edmonton, Canada's Festival City, has a distinct personality and is known as the "Gateway to the Canadian North" and to the picture perfect Canadian Rockies.

The Alberta Advantage:

- No Provincial Sales Tax
- Low Canadian dollar
- GST (Goods & Services Tax) rebate for consumers living outside Canada

Agenda

Interior West Fire Council Annual Meeting and Workshop
October 3 – 5, 2000, Edmonton, Alberta

People, Ecosystems and Wildland Fires - Working in Harmony

TUESDAY, OCTOBER 3

8:30 – 12:45	Check-in and registration
Session 1:	**Introduction and Setting the Stage**
1:00-1:10pm	Opening Remarks: Session Moderator – Dennis Driscoll, Alberta Environment
1:10-1:20pm	Welcome to Alberta: – Cliff Henderson, Alberta Environment
1:20-1:45pm	The Geography of Fire and Fire Management in Alberta - Terry Van Nest, Alberta Environment
1:45-2:25pm	Keynote Address: Forestry, Wildfire and Ecosystem Management: Where are the Concerns? - Stephen Woodley, Parks Canada
2:25–2:30pm	Q/A Period & Closing Comments by Session Moderator
2:30-3:00pm	BREAK
Session 2:	**Historical Perspectives**
3:00-3:10pm	Opening Remarks: Session Moderator – Dennis Dubé, GNWT Forest Management Division
3:10-3:40pm	Reading the Trees: Past Incidence in Western North American Forests – Marie-Pierre Rogeau, Wildland Disturbance Consultant
3:40-4:10pm	Aboriginal Uses of Fire: Why not? – Henry Lewis, University of Alberta
4:10-4:40pm	The Evolution of Forest Fire Management in the Northwest Territories in the Eyes of a Historian – Steve Janzen, University of Alberta
4:40-5:00pm	Q/A Period & Closing Comments by Session Moderator

Council Business Meeting

5:10–6:00pm	Chair – Jack Peters, Montana Department of Natural Resources & Conservation
6:00pm–9:00pm	BBQ hosted by Fire-Trol Canada Company, Conair Group Inc. and PTI Services

WEDNESDAY, OCTOBER 4

Session 3:	**Ecological, Environmental and Life Safety Complexities**
8:30-8:40am	Opening Remarks: Session Moderator – Howard Gray, Alberta Resource Development
8:40-9:10am	Fire, Aspen, and Elk in the Alberta Rocky Mountains- Cliff White, Parks Canada
9:10-9:40am	Consequences of Attempted Fire Exclusion on Forest Health – Fire Management Implications – Brad Hawkes, Canadian Forest Service
9:40-10:10am	BREAK
10:10-10:40am	Projecting Future Canadian Forest Fire Regimes and Impacts Under a Changing Climate - Brian Stocks, Canadian Forest Service
10:40-11:10am	A "Near Miss" Wildland-Urban Interface Case Study: the 1999 Mallard Fire, La Ronge, Saskatchewan – Elvin Reimer, Saskatchewan Department of Environment & Resource Management
11: 10-12:10am	Thoughts on Ensuring the Safety of Wildland Firefighters in the Future – Ted Putnam, USDA Forest Service (retired)
12:10-12:30pm	Q/A Period & Closing Comments by Session Moderator
12:30-2:00pm	LUNCH

Session 4:	**Emerging Legal, Socio-Economic and Technological Issues**
2:00-2:10pm	Opening Remarks: Session Moderator – Lou Foley, Alberta Environment (retired)
2:10-2:40pm	Emerging Legal, Socio-Economic and Technological Issues Litigation Associated with Wildland Fires – Craig Rose, Alberta Environment
2:40-3:10pm	Long-Term Initial Attack Effectiveness: - Al Beaver, Indian & Northern Affairs Canada, Yukon Region

3:10–3:40-pm	BREAK
3:40-4:10pm	Managing Large, Complex Wildfire Incidents – Economics & Social Responsibility - Bill Bereska, Alberta Environment (retired)
4:10-4:40pm	Wood Supply and the Threat of Wildfire: An Industry Perspective – Archie Jacobs, Millar Western Industries
4:40–5:00pm	Q/A Period & Closing Comments by Session Moderator

Poster Session

5:00–6:00	Coordinator – Marty Alexander, Canadian Forest Service

Banquet

7:00 pm	Master of Ceremonies – Jules Leboeuf, Alberta Environment

- Scholarships
- Awards
- Entertainment

THURSDAY, OCTOBER 5

Session 5:	**Some Possible Solutions**
8:30-8:40am	Opening Remarks: Session Moderator – (Craig Quintilio), Alberta Environment
8:40-9:10am	Avoiding Armageddon: Fire Management Applications of Turner's Disaster Model - Risa Lange-Navarro, USDA Forest Service
9:10-9:40am	Landscape-scale Fuels Management Strategy and Fire Suppression Tactics - Dennis Quintilio and Don Harrison, Alberta Environment
9:40-10:10am	BREAK
10:10-10:40am	Can Forest Management Practices Emulate Natural Disturbances? - Brian Harvey, Université du Québec
10:40-11:10am	An Inter-Personal Approach to Community Consultation in Fire Management, Rick Lanoville.– GNWT Department of Renewable Resources, Wildlife and Economic Development.

11: 10-11:40am	Managing Free-burning Fires for Resource Benefits with Wildland Fire Use Teams – Lisa Elenz, US National Park Service
11:40- 12:00pm	Q/A Period & Closing Comments by Session Moderator
12:00-1:30pm	LUNCH

Session 6: Innovations, Success Stories and Conclusion

1:30-1:40pm	Opening Remarks: Session Moderator – Don Harrison, Alberta Environment
1:40-2:10pm	Fire Use by Alberta Ranchers - Barry Irving, University of Alberta
2:10-2:40pm	Partners in Protection: An Example of Interagency Cooperation – Hugh Boyd, Alberta Environment
2:40-3:10pm	BREAK
3:10-3:40pm	Fire Ecology Camp Initiatives in the Northwest Territories – Faye Johnson, GNWT Department of Resources, Wildlife and Economic Development
3:40-4:10pm	Embracing Fire – An Overseas Example: Forest and Moorland Fires in Scotland – Mike Bruce, Scotland Timber Growers Association
4:10-4:30pm	Q/A Period & Closing Comments by Session Moderator
4:30-5:00pm	Closing Remarks - Marty Alexander, Canadian Forest Service

Abstracts and Biographical Sketches of Invited Speakers

(in order from agenda)

Session 1: Introduction and Setting the Stage

Moderator: Dennis Driscoll

Supervisor, Wildfire Operations Section, Alberta Environment, Land & Forest Service, Forest Protection Division, 9920 – 108 Street, Edmonton, Alberta T5K 2M4. Phone: (780) 422- 4438; Fax: (780) 422-7230; E-mail: Dennis.Driscoll@gov.ab.ca

Biographical Sketch: Dennis Driscoll

Dennis Driscoll is a 1976 graduate of Sir Sanford Fleming College in Ontario. Since that time the Alberta Land and Forest Service have employed him in various locations and positions in northwestern Alberta. In 1995, he became the Wildfire Operations Supervisor at the Provincial Forest Fire Centre in Edmonton. He's a Provincial Duty Officer, a Level I Line Boss, and one of the three co-ordinators of this year's conference. Dennis is also a lifelong fan of the Toronto Maple Leafs.

Welcome to Alberta

Cliff Henderson

Cliff Henderson, Assistant Deputy Minister, Alberta Environment, 10th Floor, South Petroleum Plaza, South Tower, 9915 – 108 Street, Edmonton, Alberta T5K 2G8. Phone: 780-427-3542, Fax: 780-422-6068, E-mail: Cliff.Henderson@gov.ab.ca

Biographical Sketch: Cliff Henderson

Cliff Henderson began working on wages for forestry in Alberta in 1960 with summer jobs in Turner Valley and the Grande Prairie area. After graduating from the University of Idaho with an B.Sc. degree in Forestry in 1966, he started a career with the Alberta Forest Service at Fort McMurray in 1966, which has subsequently led to the following:

- Over the past 30+ years has worked in 6 of the 10 regional forests in the province. Key positions included: Superintendent of Footner Lake Forest (1976-1980) and Superintendent of Whitecourt Forest (1980-1989).
- Director of Reforestation Branch (1988-1993)
- Executive Director of Forest Management Division, Land and Forest Service, Department of Environmental Protection from August, 1993 to July, 1995.

Cliff is presently, Assistant Deputy Minister of Land and Forest Service, Alberta Environment, a

position in which he oversees programs related to: protecting forest resources from fire, insect and disease; allocation of public land and forest resources; development of policies, guidelines and standards; and ensuring compliance with policy, guidelines and legislation through monitoring, audit and enforcement. Cliff is a member of the Canadian Institute of Forestry, Alberta Forestry Association and Alberta Registered Professional Foresters Association.

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The Geography of Fire and Fire Management in Alberta

Terry Van Nest

Manager, Training Operations, Alberta Environment, Environmental Training Centre, 1176 Switzer Drive, Hinton, Alberta, Canada T7V 1V3. Phone: (780) 865-8202;
Fax: (780) 865- 8266; E-mail: Terry.VanNest@gov.ab.ca

Alberta encompasses a vast geographic range from the U.S. border at 49°N to the Northwest Territories at 60°N, and from the heights of the Continental Divide in the Rocky Mountains to the rolling prairies and boreal forest in the east. Of its 661,185 square kilometers of total area, 52.9% or 349,726 square kilometers are covered in forests. Alberta's is comprised of six natural regions, each with it's own unique fire environment.

The Grassland Natural Region occupies a broad area of southern Alberta and extends west to the Rocky Mountains and north to the southern edge of the Parkland Natural Region in central Alberta. The region is a flat to gently rolling plain with a few major hill systems. Most of the bedrock is covered with extensive, thick glacial till deposits. The diversity of the uplands is increased by numerous areas of fine-textured materials laid down in proglacial lakes and coarse-textured deposits in dune fields and outwash plains, both of which are associated with proglacial lake basins. Rivers in the Grassland Natural Region are part of either the Saskatchewan River or Missouri River systems. Where valleys are carved deeply into bedrock, badlands have developed. Numerous coulees and ravines are associated with these river valley systems. Seven exposures of igneous rock, all within the Milk River drainage, are the only

igneous exposures in the grasslands of western Canada. With the exception of these isolated igneous outcrops, bedrock exposures are all of sedimentary rocks and commonly occur along stream valleys. The Grassland Natural Region contains four Subregions - Dry Mixedgrass, Mixedgrass, Northern Fescue, and Foothills Fescue. These Subregions are separated primarily on the basis of climatic, soils and vegetational factors. The Dry Mixedgrass Subregion is most extensive, occurring from the U.S. border, north and west to the Mixedgrass and Northern Fescue Subregions. The Mixedgrass Subregion occurs generally west of the Dry Mixedgrass Subregions. The Northern Fescue and Foothills Fescue Subregions occur in narrow belts along the northern and western margins of the Dry Mixedgrass and Mixedgrass Subregions. The primarily grassland fuels are a factor in this region. Agricultural activity (chiefly grazing and cultivation) has modified fuels in many areas. Fires do occur when grass is in the cured stage (including winter when snow-free conditions exist, ignition source is present and Chinook winds occur).

The Parkland Natural Region, with the exception of the Peace River Parkland Subregion, forms a broad transition between the drier grasslands of the plains and the coniferous forests of the Boreal Forest and the Rocky Mountains. Except for small tongues extending a short distance into the northern U.S., this region is confined to the Prairie Provinces of Canada. The Parkland Region occupies 10-15% of the landmass of Alberta, about 60,000 sq. km. It consists of three Subregions - Central, Foothills and Peace River - which are separated on the basis of geographic location and major floristic differences. The Parkland Natural Region is the most densely populated region in Alberta, with the greatest density in the Central Parkland Subregion. Land use has changed much of the native vegetation; the most extensive alteration has been in the Peace River Parkland and the least in the Foothills Parkland. Common fuels are grass and aspen with some mixed spruce and aspen stands. Generally a spring fire situation exists prior to green-up although there is some potential in the fall after fuels have cured.

The Foothills Natural Region is transitional between the Rocky Mountains Natural Region and the Boreal Forest Natural Region. It consists of two subregions, the Lower Foothills and the Upper Foothills. It occurs from about Turner Valley in the south, north along the eastern edge of the Rocky Mountains in a gradually widening belt, and also includes several outlying hill masses such as Swan Hills, Pelican Mountain, and the Naylor Hills. Common fuels are lodgepole pine, spruce and aspen stands, grass meadows with some Douglas fir in the montane areas. Typically in recent times, some ignitions have occurred with very few fires exceeding 200 ha. Late fall and winter fires do occur when snow-free conditions exist, ignition source is present and Chinook winds occur).

The Rocky Mountain Natural Region is part of a major uplift that trends along the western part of Alberta forming the Continental Divide. It is separated from the Foothills Natural Region primarily by structural geology, age and lithology. The Rocky Mountain Natural Region is underlain primarily by upthrust and folded carbonate and quartzitic bedrock whereas the Foothills Natural Region is mostly deformed sandstone and shale. Exceptions include areas of the Montane Subregion in the 'geological' Foothills of the Porcupine and Cypress Hills, and occurrences of the Subalpine and Alpine subregions on folded bedrock of the 'geological' Foothills Belt in the Kakwa area. This Region is the most rugged topographically in Alberta and ranges from about 10 km wide in the Waterton Lakes National Park area to more than 100 km wide in the central portion. Elevations rise from east to west, from major river valleys at 1000 to 1500 m to 3700 m along the Continental Divide. The two major mountain ranges, the easterly

Front Ranges and the westerly Main Ranges, are composed mostly of thrust-faulted sediments. Major valleys trend southeast-northwest through the mountains and are occupied by large rivers. Many of Alberta's largest rivers originate here with drainage into the Saskatchewan and Mackenzie river systems. The highest mountains occur in the central part of the Region with the lower mountains in the far north and far south. Three natural subregions have been recognized within the Rocky Mountain Natural Region -- Montane, Subalpine and Alpine, which mainly reflect changes in environmental conditions due to changes in altitude. Common fuels are lodgepole pine, spruce and aspen stands, grass meadows with some Douglas-fir in the montane areas. Relatively few fires have occurred in recent times

The Boreal Forest Natural Region is the largest in Alberta. It consists of broad lowland plains and discontinuous but locally extensive hill systems. The bedrock is buried deeply beneath glacial deposits and outcrops occur only rarely along major stream valleys. Major surficial features are moraines in the uplands, and glaciofluvial and glaciolacustrine deposits in the lowlands. Fluvial deposits, including the Peace-Athabasca Delta, occur along major rivers. The land generally slopes to the north and east but the most prominent highlands are located in the northern part of the Region. The Region drains primarily into the Mackenzie River system although a substantial portion of the southern subregions is part of the Saskatchewan River system. The presence of extensive wetlands is a major characteristic of the Boreal Forest Natural Region. Large wetlands occupy large areas of the lowlands. Bogs, fens, and swamps are abundant and marshes are locally prevalent. The Boreal Forest Natural Region has been divided into six subregions (Dry Mixedwood, Central Mixedwood, Wetland Mixedwood, Boreal Highlands, Peace River Lowlands, Subarctic) based primarily on vegetational, geological and landform characteristics.

The Canadian Shield Natural Region extends only peripherally into the far northeast corner of Alberta. The Natural Region contains two quite different Subregions. The Kazan Upland Subregion includes most of the exposed Canadian Shield in Alberta north of Lake Athabasca and is characterized by exposed, glaciated bedrock. The Athabasca Plain Subregion includes part of the north shore of Lake Athabasca and the Canadian Shield south of the Lake Athabasca, and is characteristically glacial outwash deposits shallow over Canadian Shield bedrock.

A wide range of fuels exit in the Boreal Forest and Canadian Shield Natural Regions, including lodgepole pine and jack pine, white and black spruce, mixedwood and aspen stands are present. Frequent fires occur with fires exceeding 200 ha more common in situations of extreme burning conditions and/or multi-fire start situations.

Four or more less distinct eras can be distinguish in regards to the fire management history of the province of Alberta. The setting during the "pre-european" times was one of native Indian use of the land. Several anthropologists have made a convincing case that Indians, and Métis in later times used fire in certain places and at chosen times, to create conditions more favorable to maintaining their ways of life.

During the 200-year span referred to as the "Ruperts Land" era between 1670 and 1870, was generally a time of constancy except for increasing European settlement during the last 60 years. Indian use of the land continued essentially the same as prior to 1670. The fur trade by

the Hudson's Bay Company and the North-west Company was a major activity to occur during this period. There is no evidence of organized fire control at that time. Political events culminated in the Rupert's Land purchase, formation of the Northwest Territories, and the beginning of organized governance by a government rather that control by a company.

A period of westward expansion and development referred to as the "Dominion Administration of the Northwest Territories" era between 1870 and 1905, included construction a Trans-Canada railway. With the arrival of more permanently located European settlers, the number of fires increased, and the settlement structures and crops increased the values at risk from fire. Initial policy efforts were focused on prevention, and on prosecution of offenders. Development of control effort gradually emerged, as the limitations of prevention became evident. The persistence of fire problems aggravated by an influx of settlers led to the establishment of the Dominion Forestry Branch in 1899. By 1903 there were four fire rangers in Alberta, two each under the forest rangers in Edmonton and Calgary. In 1905, parliament established the province of Alberta but retained control of natural resources within the federal government. This led to a form of dual administration (Alberta-Dominion Administration) for the next 25 years. Alberta (1905 – 1930). From 1905-1930 the federal govemment administered natural resources including the forests and minerals. The federal thrust was to focus on forest reserves, which represented the major high-value timber areas, and to provide some degree of fire control in the northern forests. The province assumed responsibility for prairie fires in settled areas.

In 1930, the Natural Resources Transfer Act handed ownership of all natural resources over to the provincial government. That same year the Alberta Forest Service was established, effectively ushering in the modem era of forest management and protection. Since then the Service has grown steadily supplementing the rangers with technical specialists, management and administrative personnel. Through this period organizational changes have occurred as a result of advances in communications technology, access and govemment philosophy. The most recent reorganization has occurred in the 90's. Technical advances in suppression equipment, fire management training have also kept pace with the times producing and organization which is continuing to move forward to meet the pressures of fire and resource management issues associated with an increasing population and expanded use of the forest resources.

Today, responsibility for the administration of wildland fire suppression in Alberta is shared by a number of organizations. Within the forested areas of the province the Land and Forest Service and Parks Canada (in national parks) are the primary responder while in the settled areas, structural fire departments are responsible for fire control. Urban interface is continuing to become a greater concern prompting closer working relations between structural and wildland suppression agencies. Also, the forest industry is beginning to play a more active role in providing assistance to fire suppression within the forested areas of the province.

Since 1992, staffing of salaried people in the Land and Forest Service administration has decreased by 35% dropping by 264 people from 751 to 487 permanent positions. In addition, the total staffing level of salaried and non-salaried people decreased by 29%, dropping by 266 people from 921 to 655 people. This staff reduction occurred as a part of a broad restructuring of the Department of Environment and of the Land and Forest Service itself. Some of the reduction related to the elimination of certain programs and activities that the Land and Forest Service traditionally carried out and that are completely unrelated to forest protection. The remaining staff reductions were more general in nature, affecting staffing throughout the

organization. The result was that there were fewer forestry personnel for the fire control program to draw on during periods of heavy fire load and human resource demand. Since then dedicated staffing has increased as a result of changes in organizational structure and resourcing made to address issues arising from the 1998 and 1999 fire seasons.

Efforts to continuously improve performance is an attribute of most successful companies and organizations and the formal presence of a continuous improvement program could be considered a "best practice" characteristic. The Forest Protection branch in the Land and Forest Service currently has in place a continuous improvement program that is aimed at improving the program in a number of areas identified by management and outside stakeholders.

Biographical Sketch: Terry Van Nest

Terry's career in forestry began in 1965 when he accepted a position with the Alberta Forest Service. From 1965 to 1976, he worked in a number of ranger districts in Alberta. From 1976 to 1982, he worked in the Peace River Forest as a forest protection technician. In 1982, Terry became Alberta's first provincial fire behavior officer; a position which he held until 1991. During this period Terry was actively involved in operational fire behavior duties with the province as well as on a national and international scale. Other activities included technology transfer, fuels inventory, prescribed burning, wildfire investigation, fire behavior training, co-operation in fire research projects and the development of operational fire information systems such as Alberta's Preparedness Planning System, and in co-operation with Forestry Canada, the development of the Intelligent Fire Management Information System. In February 1991, Terry transferred to the Forest Technology School (now called the Environmental Training Centre) at Hinton as senior fire control instructor. During the 90's, Terry was involved in the initiation and development of national fire management training and the establishment of the CIFFC National Training Working Group. In March 1999, Terry accepted the position of training operations manager at the Environmental Training Centre. Terry has a forest technician diploma and has attended several fire behavior courses at National Advanced Resource Technology Center at Marana, Arizona.

Keynote Address:

Forestry, Wildfire and Ecosystem Management: Where are the Concerns?

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Abstract. The challenge to this conference is to consider fire, people and ecosystems - working together in harmony. I argue these elements are not now working together in anything like harmony. There is a wide range of obstacles to clear before we can even begin to consider these elements in the same program. The obstacles are conceptual, scientific and practical in nature. Perhaps these elements were never meant to work in harmony. Maybe the model is

more like fire, people and ecosystems - can they survive together?

Biographical Sketch: Stephen Woodley

Stephen Woodley is an ecologist, who has worked in the field of environmental management for 25 years, including working in several national parks, as an environmental consultant, and as Director of the Heritage Resources Centre at the University of Waterloo. His current position is forest ecologist for Parks Canada at the National Office in Ottawa. He works on a number of issues related to ecological integrity, including developing techniques for monitoring and assessment, fire restoration and sustainable forestry. Stephen is Chair of the Greater Fundy Ecosystem Project, which aims to develop a sustainable landscape in an area that includes a core protected area surrounded by lands managed for intensive forestry, agriculture, recreation and tourism. The Greater Fundy Ecosystem Research Group has developed a set of guidelines to conserve biodiversity and recently published an extensive study assessing the state of the Greater Fundy ecosystem. Recent projects include being Team Leader of the North American Test of Indicators of Sustainable Forestry. This project was conducted in cooperation with the U.S, Forest Service and the Indonesian based Centre for International Forest Research. The project tested indicator sets developed by the Montreal Process and various non-government agencies. This past year Stephen was a member of a Ministerial Panel on Ecologica Integrity. This independent panel has been asked to evaluate the success of national parks in meeting their legal mandate to manage for ecologica integrity. Stephen is a member of the World Conservation Union's (IUCN) Commission on Protected Areas and has visited parks and protected areas in over 25 countries throughout the world.

Session 2: Historical Perspectives

Moderator: Dennis E. Dube
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Biographical Sketch: Dennis Dubé

Dennis has a B.Sc.degree from the University of Montana (1966) and M.Sc. degree in plant ecology from the University of Alberta (1976). Dennis began his research career with the Canadian Forest Service (CFS) in Edmonton in 1973 as a fire ecologist. He was primarily involved with fire history and prescribed fire research in National Parks early on his career with the CFS. In 1980 he was appointed Project Leader-Forest Fire Research and served in that capacity until 1984. From 1984 to1986, Dennis was the City Forester for the city of Winnipeg. He then rejoined the CFS in Ottawa where he served as the National Fire Research Coordinator from 1986 to 1991. In this position, Dennis served on several national bodies, including the Canadian Committee on Forest Fire Management and the Canadian Interagency Forest Fire Centre. He was also involved for several years with the Fire Management Study Group of the North American Forestry Commission. Dennis returned to Edmonton in 1991 as Program Director of Forest Resources.

Reading the Trees: Past Incidence of Fire in Western North American Forests

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Abstract. Three topics are covered in this presentation; an overview of the Canadian Mountain fire regime, historical large size fires at a regional level and, the 1889 wildfire year which was felt throughout Northwestern America, from the Yukon to Colorado.

The mountain fire regime of the Canadian Rockies is largely dependent on the source of ignition and its spatial distribution. Lightning strike density patterns and density of human use on the land both affect the frequency and distribution of fire. At a regional scale, zones of higher strike density tend to see more fires. However, this does not hold true at a much broader landscape scale such as that which straddles the Continental Divide. On average 50 strikes are needed to produce one fire in British Columbia, whereas 1400 strikes are required in Alberta. The outcome appears to be from higher daily severity ratings (DSR) during the lightning season in British Columbia as compared to Alberta. Topography also plays an important role in shaping patterns and occurrence of fire in mountain landscapes.

A large scale study done for the East slopes of the Canadian Rockies revealed that 64 to 70% of the fire patterns in the montane and subalpine ecoregions are explained by four topographic elements: valley orientation, elevation, proximity to the Continental Divide and aspect.

Fire size tends to be much smaller in dissected mountain landscapes in comparison to Foothills and Boreal landscapes where the fuel cover is continuous. Most frequently (45% of fires), historic stand replacing fires varied in size from 500 to 2,000 ha, but rare episodes occurred where fires reached up to 20,000 ha. The available fire history studies and historical accounts of fire occurrence revealed that there are years that experienced a larger number of fires of great extent. These extreme fire episodes occurred at a vast regional scale, province or multi province wide. In rare instances, such as the case in 1889, extensive fire events occurred throughout the whole Northwestern American Continent. With the exception of 1889, which was a time of prolonged dry spell, an evaluation of the Daily Severity Rating (DSR), a subsidiary component of the Canadian Forest Fire Weather Index System, from 1894 to 1994 shows that there is no strong correlation between blocks of days under a high fire severity rating and occurrence of large size fires. A separate study also demonstrates that the fire severity seems comparable for the period prior to 1917 and after 1959. However, most of the burning occurred during the early period, while significant burning ceased after 1940. Through an effective fire prevention awareness program, and better fire detection technology coupled with a quick response time, it would appear that Man has shaped today's forest mosaic.

Biographical Sketch: Marie-Pierre Rogeau

After completing her B.Sc. in Physical Geography at the University of Sherbrooke, Quebec, in 1990, Marie-Pierre moved to the Rockies to initiate graduate studies on age-class distributions in Banff National Park and surrounding area. She completed her M.Sc degree in 1996, from the University of Alberta, and now works as a Wildland Disturbance Consultant out of Banff. M-P specializes in the study of fire regimes and reconstruction of past fire events in mountain areas. Her work mainly consists of project management, sampling design, disturbance regime analysis, research technique development and data management. Another facet of her work has been the modeling of disturbance patterns on the landscape and it's application to present day management of forest resources. As part of projects funded by Parks Canada, the Alberta Forest Service or the Foothills Model Forest, she has completed the fire history for the following regions: Mount Assiniboine Provincial Park, Spray Lakes Recreation Area of Kananaskis Country, Whitegoat and Siffleur Wilderness Areas, Fire Management Unit E4 (from the Willmore Wilderness area to the Southesk River), Switzer Provincial Park, montane region of Jasper, and other areas of the Foothills near Hinton. She has also been involved with the preliminary stand origin analysis of Middle Ridges (part of FMU C5) in the Crowsnest Pass Region and the Willmore Wilderness Area. Now that much of the fire history has been done in her neck of the woods, M-P expanded her territory to the Boreal Forest where she completed a fire regime analysis for Blue Ridge Lumber (Whitecourt-Swan Hills Area) and for the Greater Mount Revelstoke National Park Area located in the Columbia Mountains.

She is currently engaged in a multi-year biodiversity-wildland disturbance analysis project of a 60,000-km2 area in the Mackenzie District, north of Prince George, for Donohue Forest Products.

Aboriginal Use of Fire: Why Not?

Henry T. (Hank) Lewis

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Abstract. Earlier studies as well as passing comments about aboriginal uses of habitat fires invariably asked "why" Amerindians, Australian Aborigines, tribal peoples of South and Southeast Asia, and those of Africa set fires within wetlands, brushfields, grasslands, and forests -- and, in many areas outside of North America, continue to do so. Today we know enough about the ecology of fire and the ways that indigenous peoples employed fires and understood many of the consequences of burning (and not burning) to follow a more appropriate line of questioning. This involves inverting the original form of inquiry to asking why hunters, foragers, trappers, pastoralists, and shifting agriculturists would not have set habitat fires? Given that anthropogenic fires can be especially important for influencing the abundance and distribution of the resources on which indigenous people depended -- while reducing the greater levels ofunpredictability and perturbation that otherwise occur -- what conceivable reasons would they have had for not including fire as an important dimension of non-industrial technologies? Comparisons, both those involving indigenous examples from different regions and even different parts of the world, as well as with what fire ecologists have shown in the past fifty years, establish that anthropogenic fire regimes significantly differed from natural fire regimes and were important for maintaining the areas most heavily used for human adaptations. At the same time, the appropriate inquiry is not whether particular regions were shaped by human or natural fires but rather how, in particular areas, the two kinds of fire regimes overlapped and were interrelated given differences in elevation, habitat types, bio-diversity, ignition distributions, natural-cum-cultural resources, demographics, seasonality, timing, frequency, several stages of recovery ("pulse stability"), plus how cultural factors varied and changed in terms of historical developments. Sufficient answers to this require interdisciplinary research that includes biological ecologists, ethnoecologists and, importantly, the participation of those traditional land users who still understand the importance of anthropogenic fires.

Biographical Sketch: Henry T. Lewis

Hank is a retired professor from the Department of Anthropology at the University of Alberta. Most of his work in anthropology has concerned the varied ways that habitat fires are employed by traditional land users, especially hunter-gatherers and pastoralists. His first studies concerned historical-archival work on Native Californians in which he examined indigenous uses of fire, all of which showed a remarkable concurrence between aboriginal practices and what fire ecologists in the 1960's were recommending for the reintroduction of fire into "wilderness areas". His interest in the topic derived from having spent twelve summers as a seasonal employee with the U.S. National Park Service, work that often involved fighting forest fires. A few years after coming to Alberta in 1971, he carried out three summers of research on traditional uses of fire as told him by elder Dene, Cree, and Métis in the northern part of the province, all of which resulted in a number of publications and one film (*Fires of Spring*). During the 1980's he carried

out similar studies in the Northern Territory of Australia which included interviews and field observations comparing the technological strategies and ecological understandings of hunter-gatherers, pastoralists, and employees of government agencies. Since then much of his work has focused on agro-pastoral uses of fire, first in South Australia and, most recently, in northern Arizona and southern Utah. A particular emphasis throughout his work has been on comparing local practices within and between regions, between different parts of the world, as well as comparing local practices with work done in fire ecology. He continues to teach courses at the University of Alberta and elsewhere, and, in terms of traditional uses of fire, is currently doing consulting work at Yellowstone National Park in Wyoming.

The Evolution of Forest Fire Management in the Northwest Territories in the Eyes of a Historian

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Abstract. Fire has played an important role in the boreal forest of the Northwest Territories. For thousands of years it has lent shape to the region's mosaic of flora and fauna. Predating man by at least a few millennia, wildfire was critical in determining the forest habitats that greeted the first immigrants to the Mackenzie region. Until man's arrival, the frequency and pattern of wildfire depended solely on lightning. With the coming of the earliest prehistoric population, a new source of ignition entered the northern forests. Moreover, man's presence in the North's fire environment meant that his activities were, to a large degree, determined by fire. This presentation focuses on the dynamic relationship northern peoples have had with fire since the prehistoric period, but concentrates on the evolution of fire control efforts in the Northwest Territories during this century based on the author's M.A. thesis.

It is clear that applying fire to the landscape, early nomadic man was able to manipulate the surrounding forest habitat. At the turn of the last century, these traditional fire practices gave way to the European ideals expressed by the Canadian government. From 1900 to 1920, the rise of professional forestry and the conservation movement accelerated the government's attempts to limit fire occurrence beyond the settled regions. Ottawa's commitment to fire prevention and protection waned during the interwar years, effectively stalling the delivery of such services to federal lands for another three decades. A large-scale development boom in the North during the postwar period produced a wave of man-caused fires. After 1950, the federal government felt it necessary to take a more authoritative approach to land management in the territories. As a result, a relatively advanced fire program was established in the Mackenzie District. The size, diversity, and population of the Northwest Territories presented the program with a wide range of unique problems. In 1987, the federal government transferred the fire program to the Government of the Northwest Territories, marking a new era in forest fire management.

Biographical Sketch: Steve Janzen

Steve Janzen has worked for the last three summers as an Air Attack Officer in the Government of Northwest Territories' air operations program. During the twelve previous fire seasons (1982-94) he worked in Alberta with the Helitack/Rappattack program and then as a Wildland Fire Specialist with that province's air tanker program. In 1990, he completed a Masters degree in history at the University of Alberta; his thesis was titled "The Burning North: A History of Fire and Fire Protection in the Northwest Territories". During the last six winters he has worked as an associate with the University of Alberta's Western Centre for Economic Research specializing in international trade and resource economics.

Session 3: Ecological, Environmental and Life Safety Complexities

Moderator: Howard Gray

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Biographical Sketch: Howard Gray

Howard has spent 35 years in forestry in Alberta and the NWT. Fifteen of those years were in wildfire specialist roles. Howard has been Chief Protection Officer for the Northwest Territories, Forest Protection Officer for the Slave Lake Forest and Head of Wildfire and Aviation Operations for the Province of Alberta. Most recently he has been Regional Director for the Northwest Boreal Region of Alberta Land and Forest Service based in Peace River and has been responsible for setting up new forest business branches with Alberta Economic Development and Alberta Resource Development. In this role he is responsible for fostering the continued economic contribution of the Forest Industry to Alberta's economic growth and sustainability. Wildfire is a key concern and of significant interest to this portfolio as it has direct impacts on the forest industry and its viability.

Fire, Aspen, and Elk in the Alberta Rocky Mountains

Cliff White

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Abstract. Trembling aspen (*Populus tremuloides*) forests in the Rocky Mountains are an indicator of ecological conditions because they have maintained their presence for thousands of years through vegetative reproduction, and these communities have high biodiversity. Aspen can be tied to ecosystem condition through a 4-level trophic model that links humans, wolves (*Canis lupus*), elk (*Cervus elaphus*), and aspen through the processes of predation, herbivory, burning, and differential wildlife responses to humans. I evaluated aspen conditions in 9 east slope watersheds in Alberta's Rocky Mountains through historical photographs, fire history analysis, and browse transects. Although aspen was historically vigorous in all watersheds, and continues to be vigorous on most provincial lands, stands are currently in decline in busy national parks areas. Trees are intermediate to mature in age (60—120 years old) and elk browse off new suckers before they reach 2 m in height. Fire combined with browsing has hindered regeneration of aspen. An exception to this pattern is northern Jasper National Park where elk densities appear to have been reduced by wolves in the 1970s, and aspen regenerated. I found a gradient of increasing human-caused ecosystem changes in Rocky Mountain watersheds: (1) historic conditions with frequent fires, and low elk density regulated by humans, wolves and other predators (all areas); (2) current conditions of patches of high elk density, where wolves are displaced by human land use, within a matrix of moderate elk density, where wolves and other predators are present (i.e., Banff and

Jasper National Parks); (3) recent conditions inside parks, where wolves are absent, and very high elk density is regulated by competition for food ; and (4) potential future conditions, where increasing human land use around parks displaces carnivores and reduces hunting, and very high elk density occurs throughout landscapes. Aspen stands regenerate well areas of low elk density, and in some areas of moderate elk density; however in areas of high and very high elk density, aspen does not regenerate, and burning accelerates clone deterioration. My recommendation to national park and provincial land managers is to restore carnivores, continue elk hunting seasons wherever possible, use fire in areas of low elk density, and control human uses that displace carnivores.

Biographical Sketch: Cliff White

Cliff White is a conservation biologist for Banff National Park. His interest in fire, vegetation and wildlife interaction was stimulated by over 20 years of work with wildland fire including stints as a fire crew member, a park fire specialist, and as the National Fire Management Coordinator at Parks Canada headquarters in Ottawa, Ontario. During the 1980s, Cliff conducted large-area, high-intensity prescribed burns in the Canadian Rockies. From 1990 to 1996 he managed Banff's team of wildlife and plant ecologists, conducting research and adaptive management in Canada's busiest national park. He is currently completing doctoral research on fire-aspen-wildlife interaction at the University of British Columbia, and serves as a fire boss on Parks Canada's national command team roster.

Consequences of Attempted Fire Exclusion on Forest Health – Fire Management Implications

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Abstract. The western United States fires this year have ignited a culture war. Loggers blame in some ways insufficient logging as a cause while environmentalists accuse loggers of wanting to destroy the forest in order to save it. Changes are occurring on many of our forest and grassland areas. One debate that is occurring is what combination of factors such as climate change, attempted exclusion of fire, grazing, and past logging practices have lead to tree species composition shifts, denser forests, loss of grasslands. Another debate is whether current forest health problems are related to these factors, with special emphasis on fire exclusion.

The current definitions for forest health in Canada and the US are mainly value laden, which makes forest health difficult to measure. A possible definition that would be measurable, independent of value judgement, and applicable to most disturbances has been suggested by

some Canadian Forest Service entomologists: "a measure of the probability of disturbance within a particular forest system." The current concept of natural variability could be useful to determine how natural variability, desired future conditions, and current conditions line up. If they don't then more specific discussions could take place among the forest and fire managers, the public, and the government. Natural variability would also be useful in examining if attempted fire exclusion has affected forest health. One challenge is that we have made good progress documenting and understanding fire history and ecology but have a long way to go with insect and disease disturbances. It seems we are only starting to link the spatial/temporal modeling of fire, insects, and disease.

Stress can be either natural or anthropogenic in origin. Stress acts to influence the probability of disturbance in complex ways ranging from direct impacts to individual tree vigour to modifications of species/trophic interactions. A combination of susceptible host and favourable weather for insect population growth usually results in an outbreak. Prior to logging and fire suppression, the percentage of the landscape in different age classes and species composition varied along with climatic conditions for insect development such that the susceptible host and good weather conditions for insect development did not always coincide. Currently in British Columbia there is a vast area of mountain pine beetle susceptible stands due mainly to attempted fire exclusion and the lack of logging prior to the 1970's. There is a currently a large mountain pine beetle outbreak in B.C. that also happened previously in the 1980's.

Regardless of the actual factors driving changes in the forest, the forest has changed. An example is a study conducted by Steve Taylor (CFS, Pacific Forestry Centre, Victoria) that documented actual changes in southern B.C. dry forests from 1952 to 1992 and then projected future changes using the Forest Vegetation Simulator. The more dense forest stands have a high proportion of the stems composed of smaller diameter Douglas-fir. The fire behavior implications of this change is an increase from 7% to 14% of the normal fire season having crown fires with a forty year projection of 29% of the season. The impact on forest health in these dry forests has not been fully assessed but forest managers are trying to deal with frequent outbreaks of budworm and Tussock moths.

Quantification of fuel changes after insect outbreaks are not common, as well as experimental fire studies to quantify changes in fire behavior. The Canadian Forest Service at Great Lakes did some experimental fires in spruce budworm killed stands and found explosive fire behavior prior to green up of the understory vegetation.

There are changes in our forests happening. Forest, fire, range, and park managers need to work together, along with the public to find some solutions to the current fire and insect problems within the context of the resource management objectives set for different parts of the landscape.

Biographical Sketch: Brad Hawkes

Since 1980, Brad Hawkes has worked as a fire research officer for the Canadian Forest Service at Pacific Forestry Centre, Victoria, B.C. He has worked in the areas of wildland fire ecology and prescribed fire behaviour and ecological effects, along with the development of

methodology, strategic plans, and guidelines for the use of fire in forest management. Brad is currently conducting a number of research studies which cover a range of subjects including fire behavior, fuel moisture, fire occurrence, and fire landscape biodiversity (e.g. interaction of fire and insects). He most recently has started work in the area of fire management systems, specifically looking at the use of wildfire threat analysis in fire planning. He has been working with B.C. Parks since 1994 on the use of fire in beetle management in Tweedsmuir Provincial Park, along with entomologists from Pacific Forestry Centre. Brad holds a B.Sc. degree in Forest Management from the University of British Columbia (1976), a M.Sc. degree in Fire Ecology from the University of Alberta (1979) and a Ph.D. degree in Fire Science from the University of Montana (1993). Brad serves as an Adjunct Professor in Natural Resource Management and Environmental Studies at the University of Northern British Columbia at, Prince George, is an Associate Editor of the International Journal of Wildland Fire, and is Registered Professional Forester in British Columbia.

Projecting Future Canadian Forest Fire Regimes and Impacts Under a Changing Climate

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Abstract. Forest fire is the dominant disturbance regime in Canadian forests, burning an average of ~3 million hectares annually, threatening human life, destroying property, and significantly affecting Canada's economically vital wood supply. Direct fire management costs total ~$500 million annually, with larger indirect costs. Forest fires are also a major influence on the carbon sink/source strength of Canadian forests, with direct effects on atmospheric emissions and the global carbon budget. Climate change projections suggest a strong increase in the frequency and severity of weather conditions conducive to forest fires across Canada, and this translates directly into increased fire activity, shortened fire return intervals, a shift in forest age class distribution, and a decrease in biospheric carbon storage. Projecting the extent and impact of future Canadian fire regimes is essential to developing effective adaptation strategies and policies.

This presentation will describe an integrated investigation, currently supported by the Canadian Climate Change Action Fund, aimed at projecting future fire regimes in Canada using the best scientific information currently available. Provincial/territorial fire records and hourly/daily Environment Canada weather records post-1950 have been compiled and integrated to develop spatially and temporally explicit, gridded, databases. The spatial fire database is used to estimate the percent area burned annually within Canadian ecoregions, and, in combination with Canadian Forest Fire Danger Rating outputs, to determine fuel consumption, carbon loss, and emissions by ecoregions. Analysis is underway to determine predictive relationships between area burned and weather/fire danger conditions in order to quantify the parameters that have driven fire activity over the past half-century. Preliminary results indicate that the frequency and

strength of mid-tropospheric anomalies are a major driver of fire activity in Canada, creating the extreme fire danger conditions over large areas that result in large areas burned. A time-series of fire danger nationally is also being completed for the 1953-1998 period to determine regional-scale trends in fire danger, with an emphasis on the frequency of extreme fire danger conditions, to determine whether fire weather in Canada has changed during this period.

Concurrently, high-resolution, regional-scale projections of future fire climate have been constructed through involvement in the development of a Canadian Regional Climate Model, including validation of current and projected fire danger conditions. This information is integrated with outputs from the fire weather/fire activity analysis to develop plausible future fire regime scenarios that are analyzed in terms of impacts on forest communities, wood supply, and national and global carbon budgets. In turn, these results serve as a benchmark for the development and evaluation of adaptation strategies. Some possible adaptation strategies are discussed.

Biographical Sketch: Brian Stocks

Brian has spent his entire professional career in fire research with the Canadian Forest Service (CFS) based at the Great Lakes Forestry Centre in Sault Ste. Marie, Ontario. During the first twenty years of his career, Brian's research activity covered many aspects of forest fire research, but centered on field investigations into the influence of fuels and weather on forest fire behavior, and the development of the Canadian Forest Fire Behavior Prediction System and the Canadian Forest Fire Danger Rating System. Brian is the author or co-author of more than 130 scientific papers covering many aspects of forest fire and global change research. Over the past decade Brian has become heavily involved in cause and effect relationships between forest fires and global change. This includes research into projecting boreal forest fire regimes under a changing climate, and investigations into the impact of biomass burning on global atmospheric chemistry, studies that require extensive cross-disciplinary international cooperation. Brian is the senior fire research scientist within the CFS. He represents Canada on the United Nations Team of Fire Specialists, serves on biomass burning/atmospheric chemistry steering committees of the International Global Atmospheric Chemistry and Global Change and Terrestrial Ecology Projects of the International Geosphere-Biosphere Program, chairs the Fire Research Section of the International Union of Forest Research Organizations, and chairs the Fire Working Group of the International Boreal Forest Research Association. Brian has received several awards during his career with the CFS (e.g., CFS 1996 Merit Award for Scientiifc Excellence, Natural Resources Canada 1996 and 1997 Department Merit Awards, Canadian Government 1996 Award of Excellence, and Canadian Institute of Forestry 1998 Scientific Achievement Award). Brian holds a B.Sc.F. degree from the University of Toronto (1967) and M.Sc.F. degree from the University of California at Berkeley (1968).

A "Near Miss" Wildland-Urban Interface Case Study: The 1999 Mallard Fire, La Ronge, Saskatchewan

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Abstract. Wildfires annually threaten people and property in various locations across Canada. Property has been destroyed and people evacuated due to wild fire in most provinces at some point in the recent past. Saskatchewan is not immune to this problem, and in 1999 alone evacuated in excess of 200 people from their homes. In May of 1999, the Mallard fire ignited several kilometres from La Ronge and due to explosive burning conditions, within 1 hour was threatening the community. Although a major disaster was averted, a number of homes were destroyed and a significant number of residents had to be evacuated from their homes.

The wildland-urban fire situation in northern Saskatchewan has been complicated recently by several factors. More residences are being built in the wildland-urban environment with no thought to the inherent fire risks, explosive burning conditions are common due to fire exclusion policies, resistance to fuels management around communities and inherent climatic factors all of which collectively challenge fire managers in successfully protecting values.

To address existing concerns, the fire management and forest protection branch has initiated a multi jurisdictional approach to identifying problems, finding solutions and implementing the appropriate measures. Communities, First Nations, forest industry, the Provincial fire management agency and other affected government departments are being asked to co-operate in developing long term solutions for on going wildland-urban interface concerns. Some of the planned initiatives include an aggressive public education program supplemented by joint agency hazard assessments, and improved fire suppression capabilities through mutual aid agreements. Conducting hazard abatement projects utilizing industry and community resources, in addition to modernizing current legislation and agency policy are other important pieces of the over all process.

Due to the multi-jurisdictional nature of this issue, it is clear that a successful wildland-urban interface fire management program is dependent upon a buy in from all levels of society and government. Although many people do not currently understand their role in this issue, success or failure in managing the wildland-urban fire management program will to a large degree depend upon the collective efforts of all stakeholders, and their individual willingness to accept a share of the responsibility. Until this happens, communities and other infrastructure will commonly be threatened by wildfire in the future.

Biographical Sketch: Elvin Reimer

Prior to being employed with the Saskatchewan government Elvin worked for several years in the mining and logging industries. After graduation with a Renewable Resources Diploma in 1978, he worked as a generalist conservation officer achieving a district manager position in 1982. Elvin worked as a district manager, with 4 different postings, until 1990 when he accepted a position as regional fire manager in La Ronge. Throughout his employment as conservation officer he was actively involved in the fire program in various fire preparedness and sustained action roles. After working for 9 years as the regional fire manager out of La Ronge, Elvin moved to the provincial forest fire management center in Prince Albert as the supervisor of wild fire operations. Current duties entail supervision of the provincial wild fire management teams, contract fire crew administration as well as the fire prevention and education programs .

Thoughts on Ensuring the Safety of Wildland Firefighters in the Future

Ted Putnam

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Abstract. Currently the fire organization is not very proactive in making safety a major influence in strategies and tactics. Getting the job done, money and image concerns push firefighters into taking excessive risk. What is needed organizationally is truthful fire investigations, an honest reporting system that tracks physical, mental, cultural and social aspects of firefighting and a willingness to become a learning organization. If safety is ever to become No. 1 in the fire community then the fire community must be willing to spend more time, money and effort towards making it No. 1. The fire community must get beyond its superficial practices like saying over and over again that safety is No. 1 without any true, longer-term, institutionalized commitment. Part of this commitment involves promoting crew resource management (CRM) throughout the organization and following up on the Tri-Data contract recommendations. The central theme discussed is the use of the psychological technique of mindfulness to promote clear thinking under stressful, risky conditions. Clear thinking enhances safety by improving all our actions: self-awareness, situational awareness, risk analysis, and communications, etc. thereby promoting decisive decisions and actions.

Although wildland firefighting is the primary activity discussed, the analysis is characteristic of most risky activities such as structural firefighting, mountain climbing and military operations. This analysis combines western and eastern psychology to promote safety.

The best individual effort you can accomplish is to promote clearer thinking, better overall health, well being and safety by learning and then practicing mindfulness meditation on a daily basis. Meditation is the most cost-effective and potent practice to improve thinking and behavior under stressful, risky conditions. By being mindful of your actions you are mindful of safety. If you would like a copy of a presentation similar to this one, entitled "Mindful of Safety", please send me an e-mail request.

Biographical Sketch: Ted Putnam

Ted Putnam was a fire and safety equipment specialist at the Missoula Technology and Development Center. He started working for the Forest Service in 1963 and spent 3 year's on district fire crews, 8 years as a Region-1 smokejumper, and 3 more years as a supervisory smokejumper. In 1976 he started work at MTDC, retiring at the end of 1998. He was responsible for developing firefighter's protective clothing and fire shelters, including training materials and he is the national expert in those areas. He was a member of two National Fire Protection Association standards-setting committees for protective clothing and equipment and he was the wildland fire expert on those committees. He is the leading expert in the United States for wildland fire entrapments. Ted holds a Ph.D. in experimental psychology from the University of Montana. He majored in learning psychology, which emphasized how rewards and punishments affect behavior. He minored in decision theory, mathematics and statistics. Ted often added psychological elements into his publications such as "Your Fire Shelter". Although he emphasized the need to get more heavily involved in the psychology of firefighting, it was not until the 1994 South Canyon Fire tragedy that this became a major effort. Ted's talk today stresses what firefighters can do from a personal, psychological perspective to reduce poor decisions, accidents and fatalities on fires.

Session 4: Emerging Legal, Socio-Economic and Technological Issues

Moderator: Lou Foley

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Biographical Sketch: Lou Foley

Lou worked for the Alberta Forest Service from 1963 to 1996 in several locations throughout the province at various positions, including; timber cruiser, party chief, forest ranger, land use officer, chief ranger, forest protection officer, and land management forester at the Forest level. He moved into the Provincial Headquarters in 1987 as manager of fire management programs, then moved into manager of wildfire and aviation operations, before finishing as manager of timber management operations. Following his career with the Alberta Government, Lou spent two fire seasons in the Yukon as Head, Forest Protection, with Indian and Northern Affairs Canada in Whitehorse, Yukon. Lou now has his own forestry consulting company and primarily carries out work for one client, Vanderwell Contractors in Slave Lake, Alberta, but depending on the fire season, also helps out Alberta Environment. Lou is a graduate forest technician of the Maritime Forest Ranger School and is a Registered Professional Forester in the province of Alberta through the grandfather clause.

Litigation Associated with Wildland Fires

Craig Rose

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Abstract. Statistics indicate that approximately 36% of all wildland fires that occurred in Alberta during the period from 1990 through 1999 were man-caused. On average, over 7,400 hectares of productive or potentially productive Crown land were burned over each year. Average annual expenditures for suppression of such fires were approximately $4.7 million dollars during the same period. The Forest and Prairie Protection Act, sets out various provincial offences under which persons may be charged. It also entitles the Minister to be reimbursed for costs and expenses incurred as the result of fire suppression operations and for any loss or damage to Crown timber or other forest growth by the person(s) who caused the fire.

There have been 17 prosecutions for offences under the Act for the period 1997 through 1999. Approximately 280 cost recovery files have been opened from 1995 to the present time with more likely to follow.

All of this results in increased costs and requires further effort on the part of the Crown including but not limited to:

- the implementation of additional prevention measures to reduce the risk of wildland fires;
- the investigation of wildland fires to determine cause and provide sufficient proof of cause for prosecutions, civil actions for cost recovery purposes or both;
- the application of existing or the development of new technology in support of wildland fire investigations; and
- litigation costs including the production of documents and the time, effort and scheduling relating to staff participating as witnesses in support of a prosecution under the Act or the Criminal Code or in a civil action to recover costs.

At the end of the day, the objective is to protect persons, property and resources by promoting compliance with the law and to recover costs and damages when and where appropriate. Are you feeling lucky?

Biographical Sketch: Craig Rose

Craig has been employed as a forester and more recently as a forester/legal specialist with Alberta Environment for the past twenty years. Craig received his Bachelor of Arts degree (specializing in Political Science) from York University in 1975 and soon afterwards found himself studying forestry at the University of Toronto where, upon graduation in 1980, received his Bachelor of Science degree in Forestry. After taking some short-term contract work with the Ontario Ministry of Natural Resources Craig moved to Alberta in October 1980 and began his forestry career with the Alberta Forest Service ("AFS") of the Department of Energy and Natural Resources, as they were then known. He was employed as a forester and was responsible for that agency's participation in the department's integrated resource planning program. In 1983, Craig moved to Calgary where as a forester in the Bow/Crow Forest office, as it was then known, was responsible amongst other things for the forest region's integrated resource planning program, and its access management planning and public involvement initiatives until 1994. Craig has been a registered professional forester in this province since the inception of the Alberta Registered Professional Foresters Association in 1986. In 1991, Craig once again found himself studying within the halls of academia after being admitted to law school at the University of Calgary and in 1994 graduated with a law degree. Soon after that, Craig moved to Edmonton and, as a Student-at-Law, completed his Articles of Clerkship with Alberta Justice in 1995, and on July 11, 1995, was admitted as a Barrister and Solicitor to the Law Society of Alberta. Craig has since returned to Land and Forest Service as a forester/legal specialist and in that capacity now provides advice, assistance and services to that agency specifically, the department generally, and Alberta Justice, from time to time.

Long-term Initial Attack Effectiveness

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Abstract. Aggressive initial attack has been promoted and applied as the cost-effective solution to wildland fire. History has shown however that it is not a single, one-size-fits-all solution to what is a dynamic and complex problem. It has also been cited as a causal factor in a number of wildland fire fighter injuries and fatalities. It is a tool of fire management and as such, must be used in consort with the other fire management tools. The optimum mix of prescribed fire prescribed natural fire, mechanical disturbance and suppression is not necessarily transferable between fire regimes or land management objectives. Under the fire environment conditions that over time account for the majority of area burned, initial attack ranges and effectiveness are limited. Under extreme fire danger conditions in high hazard fuels the acceleration period from ignition to beyond control can be only minutes. Time is precious and the distance from attack base to the fire is critical. During the relatively cooler and wetter fire seasons effective initial attack ranges can be far-reaching. These years however, generally contribute little to overall burned area. In the extreme years, when initial attack ranges are limited, all of the initial attack investments from the cooler years, outside of the long-term effective range would be in jeopardy. In the absence of a substitute, flammability-reducing disturbance, as in the manner of wildland fire, an agency's long-term effective initial attack range would be related to the fire environment conditions that contribute most to overall area burned. Fire and land management strategies beyond this range/zone need to be more insightful to the role of fire as an ecological force.

Biographical Sketch: Al Beaver

Prior to graduating with a diploma in Renewable Resources Technology in 1977 from Saskatoon, Saskatchewan Al worked seasonally in the forest industry. This seasonal work experience involved the harvesting, silvicultural and protection aspects of the forestry business. Following graduation, Al moved to Prince Albert where he was employed in the Forest and Fire Management Programs for the Department of Northern Saskatchewan. His wildland fire related work experience involved most facets of the Fire Management business. He moved to Whitehorse in April 1985 to assume a position with the Yukon Forest Management Branch as the Training and Fire Prevention Coordinator. While the main duties of this position were wildland fire training and prevention the nature of the Forest Management Branch provided the opportunity for great diversity within the fire management field. Fire behaviour, fire effects and fire history are areas where Al has focused much of his energies in recent years. In April 1997 he assumed the function of Fire Management Planning in the restructured Forest Management program. Duties of this function include preparedness planning, fire behaviour, fire effects and fire regime analysis. The majority of Al's fire management experience has been in the boreal forest with some exposure to interior British Columbia fuel types through inter-agency assignments. He has participated as a student and instructor in a wide variety of both Canadian and U.S. Advanced Fire Management Training and currently instructs at the National Advanced Fire Behaviour Course and the National Fire Behaviour Specialist Course.

Managing Large, Complex Wildfire Incidents – Economics and Social Responsibility

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Abstract. Wildfire management agencies and the public across North America have concerns over escalating wildfire budgets in the past decade, largely due to increased expenditures for suppressing large fires. Frequent large fire incidents have resulted in enormous losses in life, property, and natural resources. There is continuous debate over the impact of prior fire exclusion policies and the dangerous fuel accumulations in today's forests. Additionally, there is growing recognition that aggressive firefighting is not the solution in a fire origin ecosystem, other mitigating strategies must be considered. Political and social pressures such as those encountered in urban interface areas complicate agency wildfire management options. The economic consequences of alternative management strategies are poorly understood. Cost effectiveness comparisons between prescribed fire and other treatments are difficult to analyze. Expenditures on large fires may bear little relation to values at risk. Current analysis tools for determining the level of protection, justifying budgets and displaying tradeoffs are not widely used by wildfire managers and rarely incorporate consideration of all relevant contributors to fire management costs and net value changes. Numerous reports have recognized the importance of optimizing fire management costs, yet progress toward this end has been slow and uncertain. There is a need for policy makers, natural resource managers, and fire practitioners to exchange ideas and learn from mutual concerns.

Biographical Sketch: Bill Bereksa

Bill Bereska retired from Alberta Land and Forest Service this year following 39 years. His work experience included ten years in timber management, three years as aircraft dispatcher at the provincial forest fire centre in Edmonton, three and half years as forest protection technician. Bill also served as a Chief Ranger for nine years, Forest Protection Officer for five years and Provincial Fire Behavior Officer for five years at the Edmonton Fire Centre and finally four and a half years with the Forest Protection Division in the fire centre as Manager of Wildfire and Aircraft Operations. Since his "retirement" from Provincial government service, Bill has been actively involved as a wildfire consultant specializing in decision support systems, training, fire behavior, prescribed burning and aerial ignition.

Bill is a Forest Technician graduate of the Forest Technology School at Hinton, Alberta. He has since taken numerous additional training courses in personnel management, fire management and in other forest resource management related fields.

Wood Supply and the Threat of Wildfire: An Industry Perspective

Archie Jacobs

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Abstract. A forest company's future and survival is based on its wood supply and security of that supply. Millar Western Forest Product's fibre supply is as follows:

Softwood requirements – 900,000m3 – under tenure 63%

Hardwood requirements – 500,000m3 – under tenure 46%

The remainder is accessed through long term volume supply agreements, log/chip exchanges and general purchases. Over the years of successful fire suppression activities we have helped create a forest health crisis. How we think about forest protection must change; we can no longer center our thoughts on fire suppression, but must consider the growing issue of fuel modification. Some of the ways to achieve this are pre-commercial thinning, commercial thinning, salvage thinning and selection harvest. If we don't start to address fuels, large fires are going to become more common place. Forest companies along with other stakeholders need to develop, understand and agree on values at risk versus the traditional values, which have changed. Based on this, long term management strategies must be developed to deal with planning for fire on the landscape, access, modeling for fire risk and for fire suppression activities. The forest industry must get involved in forest protection. With virtually no unallocated forest left, companies must be considered, and be willing to participate as partners in forest protection. Industry can be an important part of the government's forest protection initiatives. Industry must get involved if for no other reason than to help ensure economic survival. Government must recognize this participation and explore new funding arrangements. When fire does strike what role can industry play? We can provide: initial attack, local knowledge, cat bosses, sector bosses, equipment co-ordination, GIS/GPS services, mapping and first aid. We are not: fire bosses, line bosses, fire behavior specialists, aircraft co-ordinators, public relations or tower personnel. Government and industry have recognized that there is far more to be gained by working jointly than not; this must continue.

Biographical Sketch: Archie Jacobs

Prior to coming to Whitecourt, Archie was raised and received his education in British Columbia. Starting in the forest industry in the southern interior of B.C. in 1970 with then Kootenay Forest Products (Eddy Match Co.) he worked in many different aspects of the industry including engineering and planning, harvesting and silviculture, to eventually becoming Resource Superintendent with Westar Timber in their Kootenay Lake holdings. In 1986 Archie, with his family moved to Whitecourt, Alberta and started work for Millar Western Industries, and took on the position responsible for construction. In 1988 he moved into the Production Department, and in 1990 assumed the position on Production Superintendent (Woodlands). In 1994 he took on the responsibilities of Assistant Woodlands Manager, and in 1996 became Woodlands Manager, the position he holds today.

Session 5: Some Possible Solutions

Moderator: Craig Quintilio
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Biographical Sketch: Craig Quintilio

Craig graduated with a B.Sc. degree in Forestry from the University of Montana in 1972. After graduation he commenced work with the Alberta Forest Service (currently Land and Forest Service, Alberta Environment). He worked in various locations throughout Alberta including a nine-year period in Grande Prairie. Craig has also worked in several functions in the provincial headquarters in Edmonton including Forest Management, Program Support and Land Administration. He is currently the Director of the Forest Protection Division.

Avoiding Armageddon: Fire Management Applications of Turner's Disaster Model

Risa Lange-Navarro
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Abstract. In order to successfully prevent injurious situations in fire management activities such as wildland fire, we must be able to differentiate between the precursors leading to an accident as opposed to a disaster. An accident can be defined as any unwanted event(s) caused by individuals who do not adequately use shared beliefs to account for and cope with the hazardous situations they may face. Examples of shared beliefs include the 10 Standard Fire Fighting Orders, LACES (Lookouts, Awareness, Communications, Escape Routes and Safety Zones), fuel models and fire behavior principles. A disaster can be defined as any event, which threatens precautions or beliefs, previously accepted as adequate. The debilitating consequences of a disaster result from a breakdown of precautions that previously had been culturally accepted as adequate. Thus, serious and damaging results can occur unexpectedly due to the element of surprise. An analysis of Barry Turner's sequential model for the origin of disasters will better prepare us to examine the worthiness of current wildland fire precautions. The sequence of events associated with the development of a wildland fire disaster are Stage I – Pre Disaster Normal Starting Point, Stage II – Incubation Period, Stage III – Precipitating Undesirable Event, Stage IV – Onset, Stage V – Suppression, Rescue, and Salvage, Stage VI – Full Cultural Readjustment.

These stages have been modified as necessary to fit conditions of a wildland fire disaster.

Wildland fire and prescribed fire situations will be used to illustrate the use of Turner's disaster model.

Biographical Sketch: Risa Lange-Navarro

Risa began her fire career as a temporary on the saw crew at Superior Ranger District, Lolo National Forest in 1978, attaining her permanent status on the Ft. Rock Ranger District, Deschutes National Forest in 1984. She has accumulated a wide variety of experience working in the Northern Rockies (Lolo NF, St Joe NF, Crow Indian Reservation-BIA) and Pacific Northwest (Prineville-BLM, Deschutes NF, Umatilla NF, and Wenatchee NF) before moving back home to western Montana in the spring of 1990. She has had way too much fun on district fire and engine crews, Bighorn Interregional Fire Crew, Wyoming Interagency Hotshot Crew, Wind River/Prineville/Frazier Helitack crews, and as a Fuels Tech, Suppression Specialist, Project Forester, Assistant Fire Management Officer, Zone Fuels Specialist and Fire Management Officer on the Darby RD, Bitterroot NF in 1994. From 1995-1999 Risa was the Fire Management Officer for the Ninemile Ranger District, Lolo NF. She moved into her present position in March 1999. She earned a BS degree in Forestry with an emphasis on fire science from the University of Montana in 1981, and in 1989 graduated from Technical Fire Management. She is a qualified Fire Behavior Analyst and Long Term Analyst. Risa has also been a faculty member for S-590 Advanced Fire Behavior Interpretation since 1995. She is married to Tony Navarro, a Redmond, Oregon smokejumper and Frenchtown, Montana High School math teacher. Both Risa and Tony enjoy hiking, mountain biking, backcountry skiing, rock climbing and generally being outside.

Landscape-scale Fuels Management Strategy and Fire Suppression Tactics

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Abstract: Historically in Alberta, forest management issues have been addressed at the stand level and landscape solutions were not contemplated. As fuel management programs evolve in Alberta in the next decade, landscape strategies could provide the proper context for fire management interventions at the stand and forest level. As well as setting out broad landscape metrics to recognize biodiversity and other related values, these strategies should link to both indirect and direct suppression tactics. Fuel management programs designed to be supported

by current and future fire "day of reckoning arrives". This presentation will discuss the current level of fuel and fire behavior knowledge in relation to initial attack and sustained action capabilities. An understanding of the limitations of suppression resources and fuel management initiatives in an important element in rationalizing landscape strategies.

Biographical Sketch: Dennis Quintilio

Dennis Quintilio has worked as a fire behavior specialist in Alberta for 24 years prior to assuming management positions. From 1967-1974 he was stationed at the Northern Forestry Centre as study leader and worked on early design and implementation of the Canadian Forest Fire Danger Rating System. He was appointed project leader in 1975 and continued to refine fire behavior prediction elements of the system through study of large-scale experimental burns. From 1980 to 1990 he taught at the Environmental Training Centre, which offers a two-year diploma program in Forestry, and coordinated all in-service fire management training. In addition to his teaching responsibilities, Dennis was also a practicing Fire Behavior Officer and served on the Alberta Forest Service fire investigation team. Dennis moved into his role as Director of the Environmental Training Centre in the fall of 1990. In 1995 he assumed the position of Executive Director, Forest Management Division, and in 1999 was appointed Executive Director of the Integrated Resource Management Division responsible for implementation of IRM in Alberta. Dennis has a B.Sc.F and an M.Sc. degree from the University of Montana and is a member of the Alberta Registered Professional Foresters Association.

Biographical Sketch: Don Harrison

Don Harrison began his career with Alberta Environment, Land and Forest Service upon graduating in 1975 from the Northern Alberta Institute of Technology. In these 25 years Donald has worked in various positions, both in numerous field and office locations throughout the Province of Alberta. Position duties include responsibilities in the Forest and Land Management and Forest Protection disciplines of the department. He was the Forest Area Manager, Foothills Forest Area, Northern East Slopes for 4 1/2 years prior to assuming his present position as manager of Wildfire and Air Operations in the Provincial Forest Fire Centre this year.

Can Forest Management Practices Emulate Natural Disturbances?

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Sylvie Gauthie

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Abstract. Over the past decade there has been an increasing interest in the development of forest management strategies that are based on our understanding of natural disturbance regimes (Attiwill 1994, Bergeron and Harvey 1997, Angelstam 1998). The approach is based on the following premise: That a management regime that favours stand and landscape compositions and structures similar to those that characterize natural ecosystems should be favourable to the maintenance of biological diversity and essential ecological functions. In this presentation we will explore several avenues that provide greater linkages between natural disturbances, silvicultural practices and forest management strategies. Although we use the eastern boreal forest of Quebec for our examples, it is possible to apply the approach to those portions of the boreal forest whose dynamics are driven by fire. The following are some of the major points.

Respecting historic variability of forest conditions. In the boreal forest, the risk of a fire occurring is such that one site may burn several times over the period of 100 years whereas another may be spared for several hundred years. Similarly, the area burned by a fire can vary from less than one hectare to 100s or even 1,000s of km^2. Moreover, while certain surface fires may only affect ground vegetation, an intense crown fire will kill virtually all trees in its path and may consume the forest humus layer down to the mineral soil. The combinations of these characteristics - fire frequency, fire size and fire severity – make up the disturbance regime that is proper to an ecosystem or a forest region. In the boreal forest considerable variation generally occurs in each of these traits. Nonetheless, other than the variability imposed by permanent sites features, it is the disturbance regime that is responsible for the forest conditions observed in a region. As an

analogy, the time interval between harvesting, the size of cutovers and the type of harvest constitute the parameters of a management regime whose variability is very often much narrower than that of the natural disturbance regime. Although conceptually the objective of ecosystem management is to respect the inherent variability of natural disturbance regimes, its application is aimed at defining a socially and economically acceptable compromise within the limits of historic variability that will reduce the risk of negatively affecting biodiversity. This management target is generally situated somewhere between the heterogeneity of natural forest mosaics and the homogeneity generated by a management regime aimed primarily at sustained fibre yield.

Fire frequency and its implications for management strategies and silvicultural practices. In the boreal region where even-aged management is practised with the objective of creating a fully-regulated forest age structure, theoretically all stands older than the rotation age are eventually eliminated from the landscape. In contrast, in a region under the influence of a natural fire regime where the probability of burning is independent of stand age (as is generally reported in the literature – e.g., Johnson 1992), the forest age structure will, again theoretically, resemble a negative exponential curve, with about 37% of forests older than the fire cycle. This in an important point because these older forests constitute an integral part of the forest landscape and are considered essential to biodiversity maintenance. Far from being a negligible fraction of forest area, in the boreal region of northwestern Quebec, our fire history studies show that almost 50 % of the forest is categorised as over-aged or old growth. In order to safeguard these forests while minimising losses in allowable cut that would result from integral protection or lengthening of forest rotations, we have proposed the development of adapted silvicultural practices designed to maintain or to facilitate a relatively rapid recovery of the structural and compositional characteristics of older stands (Bergeron et al. 1999). Examples are provided for the boreal mixedwood forest in which both structural and compositional changes occur through stand development, and for the black spruce forests in which stand changes are principally of a structural nature. We will also present a method that can be used to fix forest-level age structure objectives based on fire cycle and maximum harvest age.

Fire size and its implications for size and spatial distribution of cutovers. It may appear socially unacceptable - if not totally irrational! – to want to use fire size as a basis for developing management directives for cutover size and distribution. While individual cut blocks are clearly much smaller than the mean size of natural burns, they are normally created in a continuous progression or spread and tend to be clustered in a given area. The proximity of numerous blocks over time usually results in the creation of vast areas in regeneration within which remain only fragments of mature forest, essentially in the form of cutblock separators, buffer strips and unproductive or inaccessible forest. While individual cutblock size cannot exceed 150 ha in the boreal forest of Quebec, forest regulations allow up to 70% of landscape reference units (max. 300 km^2 in the balsam fir zone and 500 km^2 in the black spruce zone) to be occupied by forest stands under 7 m. Consequently, regeneration areas (cumulative cutblocks) and unproductive areas could theoretically occupy 210 km^2 and 350 km^2 of these units, in each of these zones. Analysis of fire records of the past 60 years for northwestern Quebec has revealed that most fires burn less than 1000 ha but that these smaller fires account for less than 10% of the total area burned. At the other extreme, 65% of area burned in the balsam fir mixedwood forest region is a result of fires varying in size from 850 to 15,000 ha, whereas in the black spruce zone 950 to 40,000 ha would be considered characteristic. For areas under management where considerable mature and over-mature forest exists, these size intervals could provide possible

guidelines for cumulative regeneration areas. With respect to spatial distribution of regeneration areas, there is currently little evidence that fires tend to be clustered within a given region. It would be prudent to maximise dispersion of regeneration areas in order to limit the cumulative impacts that could result from a more proximate distribution.

Fire severity and its implication for cutting patterns. Fires in the boreal forest are typically severe and most trees affected in large fires are generally killed. However, in the eastern boreal forest, fires that extend over large areas and burn for more than a day tend to vary in severity such that patches of green trees are usually left in their paths. Far from being insignificant, zones of low fire severity can constitute up to 50 % of burns depending of forest type and, especially, weather conditions preceding and during the fire. The occurrence of lightly burned zones partially explains how mortality patterns generated by fire are often very different from those resulting from forest harvesting. As a measure to reduce these differences between the two disturbance types, various volume retention strategies have been proposed in different regions of North America. Moreover, the existence of extensive areas of uneven-aged or irregular, over-mature forests composed of species or individual stems that established well after a catastrophic fire strongly suggests that that there is a place for uneven-aged silviculture involving partial or selection cutting in the boreal forest. In effect, diversification of silvicultural practices can increase structural diversity in forest stands as well as stand diversity over the landscape. By setting regional objectives for forest composition and age structure based on natural dynamics, disturbance cycle and regional site classification, stand-level scenarios involving both even-aged and uneven-aged silviculture are being developed in northwestern Quebec to create desired outcomes at both stand and landscape scales (Harvey et al., accepted).

Maintaining flexibility in the approach. The fact that, historically, disturbance regimes have varied considerably due to changes in climate and influences on vegetation, underlines the importance of maintaining flexibility in any approach to managing natural systems (Landres et al. 1999). For example, contrary to what might appear intuitive, climate warming since the end of the "Little Ice Age" (*ca.* 150 BP) has corresponded with an increase in the fire cycle in northwestern Quebec, probably due to an accompanying increase in annual precipitation. However, these changes in disturbance regime are occurring too rapidly (and concurrently with forest industry-induced disturbance) for regional vegetation to reach any sort of equilibrium condition with regional climate and disturbance regime. Thus, rather than fix rigid forest-level objectives and silvicultural regulations, establishing acceptable ranges for forest composition and age structure, situated within the range of historic variability, and diversifying stand-level interventions are probably two key elements to maintaining biodiversity in any sustainable forest management regime.

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Biographical Sketch: Brian Harvey

Brian Harvey is Coordinator of Forest Research and Development Unit at the University of Quebec in Abitibi-Témiscmingue and Director of the Lake Duparquet Research and Teaching Forest situated in the boreal region of northwestern Quebec. He has a forestry degree from the University of New Brunswick, a M.Sc. from the University of Quebec in Montreal and he's hoping to soon complete his Ph.D. at Laval University. He has published numerous articles on forest ecosystem classification, post-harvest vegetation dynamics and forest management strategies based on natural disturbance. The Lake Duparquet Forest provides a working example of how disturbance and natural dynamics can be integrated into forest- and stand-level management planning and implementation.

An Inter-Personal Approach to Community Consultation in Fire Management

Rick Lanoville

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Abstract. In the author's opinion, the key to successful community consultation concerning fire management issues involves around respect for the land, respect for the people who live on the land, and respect towards oneself. From this starting point, a shared vision of what we wish to accomplish can be formulated. To be successful, the participants need to consider four main attributes: commitment to a shared vision, a chance to participate, a sense of ownership, and above all, patience and perseverance. Several examples from the Northwest Territories are presented to illustrate these principles.

Biographical Sketch: Rick Lanoville

Rick Lanoville has 33 years of fire management experience and has spent the past 24 years in the Northwest Territories holding the positions of District Protection Officer and Fire Behavior Officer. He is currently the Manager of the Forest Science Services section of the Forest Management Division in the Government of Northwest Territories' (GNWT) Department of Resources, Wildlife and Economic Development. Rick and his group provide forest fire

meteorology, fire behavior, and strategic planning services to fire managers across the NWT. Rick has been personally active with the International Crown Fire Modeling Experiment since its inception in 1994 looking after the logistical needs of the scientists, acting as liaison with the community of Fort Providence and coordinating the fire suppression operation following the experimental burns.

Managing Free-Burning Fires for Resource Benefits with Wildland Fire Use Teams

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Abstract. Knowledge concerning the role of fire as a natural process over the last 30-40 years has stimulated an advocacy to increase the use of fire on the landscape. While fire was being managed in some areas, competition between fire management activities had frequently been a source of diminished fire use accomplishment. The 1995 Federal Wildland Fire Management Policy and Program Review advocated an increase in fire use accomplishments and created a foundation for implementing both fire use and suppression concurrently. Interagency Fire Use Management Teams were developed to meet these needs. The teams are comprised of overhead resources available to provide support to Agency Administrators for all phases of planning, implementation, management, and evaluation of complex long term fires and prescribed fires. Since their advent in 1995 the teams have increasingly been managing both prescribed and wildland fires. During the 2000 fire season they were used to fill a critical role in managing suppression fires as well as long term planning.

Biographical Sketch: Lisa Elenz

Upon graduating with a General Chemistry degree in 1988 from Northern Arizona University Lisa began her career with the National Park Service. She worked seasonally at Grand Canyon National Park collecting fees, working on resource projects, and fighting fires. From here she went to work in Yosemite National Park, California again collecting fees for a short time then working in fire management where she worked until 1996. This experience involved prescribed fire, fire suppression, fire use, structure fire, fuels management, and emergency operations. In 1996 Lisa was accepted in to a Fire Management Officer Intake program and moved to Grand Teton National Park, Wyoming. During this two year training opportunity she gained considerable knowledge in fire management administration, fire behavior technologies, and attended various operational training. Currently Lisa is the Assistant Fire Management Officer at Grand Teton National Park managing suppression and fire use operations for the Park. She has also recently taken on responsibilities for some Bridger-Teton National Forest suppression operations.

Session 6: Innovations, Success Stories and Conclusion

Moderator: Don Harrison
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Biographical Sketch: Don Harrison

Don Harrison began his career with Alberta Environment, Land and Forest Service upon graduating in 1975 from the Northern Alberta Institute of Technology. In these 25 years Donald has worked in various positions, both in numerous field and office locations throughout the Province of Alberta. Position duties include responsibilities in the Forest and Land Management and Forest Protection disciplines of the department. He was the Forest Area Manager, Foothills Forest Area, Northern East Slopes for 4 1/2 years prior to assuming his present position as manager of Wildfire and Air Operations in the Provincial Forest Fire Centre this year.

Fire Use by Alberta Ranchers

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Abstract. Prairie settlement in western Canada altered the historical fire and grazing regimes. Fire and grazing operate as important controls along a forest-grassland tension zone in the Aspen Parklands of the Prairie Provinces and along the foothills of southern Alberta. Forest encroachment onto grasslands has occurred in the parklands and is continuing today. At the University of Alberta Kinsella Ranch forest cover on undisturbed native range has increased from 5% in 1908 to about 70% today. Forest invasion of grassland is accompanied by a decrease in available forage of up to 90%. The interest of Alberta ranchers in prescribed burning is mostly for the purpose of converting forest back to grassland and re-establishing forage production. Prescribed fire in the ranching community is not a common practice. Prescribed burning is limited because of financial risk and the overall lack of experienced people to extend burning methodology to ranchers. Ranchers who do use prescribed fire are typically young, have limited financial resources, and are willing to balance financial risk against financial gain. Ranchers who use fire commonly incorporate some type of pre-burn fuels management program; altering grazing intensity the year before a burn is the most economical but methods such as mechanical clearing of forest and plowing fireguards are also common. Most prescribed fires are followed by several years of intensive management to minimize suckering and push the site to grassland. Thus, prescribed fire for ranchers is not a quick fix solution but is an integral part of a long-term management program.

Biographical Sketch: Barry Irving

Barry was raised on a mixed farm in the foothills west of Sundre, Alberta. Following stints as a labourer in the oil and forest industries, Barry attended the University of Alberta and earned a B.Sc. Forestry specializing in wildlife and rangeland management and a M.Sc. in Range Science. Barry has been employed at the University of Alberta since graduation in 1983 and was appointed manager of the Kinsella Research Ranch in 1996. Barry managed the rangeland research program at the Kinsella Ranch and learned the scientific application of fire in ranching systems from Dr. A.W. Bailey. Prescribed fire is an important component in the management of the Kinsella Ranch and is being extended into the local community via field days and demonstrations. Barry also operates a small private consulting business and does contract prescribed burning within the aspen parkland zone. Barry instructs plant taxonomy and practical applications of rangeland management at the University of Alberta. He is the coach of the U of A Range Team who have had success in international rangeland management competitions. Barry has a wide variety of duties, but the favorite time of the year is always spring; the optimum time for rangeland prescribed burning in the aspen parklands.

Partners in Protection: An Example of Interagency Cooperation

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Abstract. Partners in Protection is an Alberta based multidisciplinary non-profit association, made up of members representing national, provincial and municipal associations, and government departments responsible for emergency services, forests and parks management and land use planning. The groups mission is to have the partnership committed to *raising awareness, provide information*, and *developing forums* to address common problems that will encourage community based initiatives to reduce the risk of fire losses and enhance safety in the wildland -urban interface(WUI). Specifically the association has a mandate to increase the level of interagency co-operation and to promote public awareness and education aimed at reducing the risk of loss of life and property from fire. All of this is a noble cause and creates an atmosphere of high expectations and potential for associated internal pressure to produce quantity and quality end products. Partners in Protection have succeeded in meeting the challenge of its mandate. From the associations beginnings in 1990, an official association in 1993, two international symposiums, the creation of the FireSmart WUI planner and CD, web site development, and associated community interface projects, the association continues to meet the needs and wants for interface scenarios. Throughout the history of the association different "partners" have come and gone and even returned. The associations members and products evolve through time reflecting the change and dynamics of the organization and needs for the interface. Gathering and keeping diverse members of the association together as well as producing accomplishments is goal of any organization. Partners in Protection takes pride in its foundation of collective vision and active participation.

The key to this success is not complex or intricate; it is simply due to the commitment of the individuals directly involved in the partnership. These individuals in turn take back to their respective agency the same level of commitment and desire, where the philosophy turns to actuality.

Biographical Sketch: Hugh Boyd

Hugh has accumulated over 21 years of experience with the Land and Forest Service. He worked the majority of that time at field offices in northern and central Alberta. Intermixed with the years in Alberta, were just over three years working in New Zealand for the New Zealand Forest Service and a private forest consulting company. He has had an opportunity to be involved in fire suppression operations in Alberta on Provincial Fire Management Teams as well as operations in the Northwest Territories, New Zealand, and the United States. His involvement as a director with Partners in Protection has been most rewarding with the recent publication of the FireSmart wildland urban interface manual and CD production. Hugh has worked in his current position as Manager of Wildland Fire Prevention, Land and Forest Service since January 1999.

Fire Ecology Camp Initiatives in the Northwest Territories

Faye Johnson

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Abstract. Since 1995, a "Fire Ecology Camp" initiative has been applied in the Northwest Territories' Department of Resources, Wildlife and Economic Development (RWED) fire management program. The South Slave Region started this initiative in an area called Wildbread Bay near the community of Lutsel K'e and then held another camp at Powder Lake. For the next four years, the South Slave was the only region that carried out this program until the summer of 1999 when the North Slave Region held a camp at Tibbitt Lake. During the summer of 2000, two more camps were held in the Deh Cho and Inuvik regions as well as in the South Slave and North Slave regions. Unfortunately a camp was not held in the Sahtu Region due to an increase in wildfire activity throughout the area this past summer. However, the summer of 2000 proved to be successful since four out of the five regions participated in the program and a total of five camps were held.

Fire ecology camp sites are established by the RWED region near recently burned areas. About nine to 12 students between the 15-18 years of age, two elders, a fire crew or camp attendants, and cooks stay for the duration of the camp. The camps last between 5 and 10 days on average. Some of the activities which the students and elders participate in in addition to fire weather, fire behavior, fire history and fire effects are as follows: (1) introduction to timber cruising; (2) water quality monitoring; (3) small mammals survey; (4) introduction to botany/medicinal and traditional plant use; (5) orienteering; (6) safety awareness program; (7)

smoke patrol reconnaissance; (8) traditional knowledge; and (9) wilderness survival skills. RWED staff and the elders teach the students through this educational approach and the students learn how fire plays an integral part in the ecology of the boreal forest through applied science and observation.

Biographial Sketch: Faye Johnson

After graduating in 1995 with a diploma in the Renewable Resources Technology in Fort Smith, Northwest Territories, Faye worked has intermittently for the Department of Resources, Wildlife and Economic Development (RWED). During 1997 and 1998, Faye worked as a Fire/Wildlife Technician in the Wildlife Division of RWED. In 1999, Faye earned an Applied Degree in Forest Management from the Natural Resource Technology Program in Fort Smith. One of the course requirements included that for each semester school completed, one 15-week work placement in a managerial role was necessary as well. Therefore, two work placements were arranged through consultation with the RWED Forest Management Division Director at the time. During the work placements, Faye began working as a Traditional Knowledge Coordinator and became involved with traditional knowledge pursuits as a result. Faye was assigned the management of the International Crown Fire Modelling Experiment Post-burn and Restoration Project. Faye is also involved with RWED's Fire Ecology Camp initiatives and will be in consultation with RWED's Managers of Forests and camp coordinators to discuss ideas and recommendations for next year's camps. [technical coordinators' note: Faye is the daughter of NWT fire management legend Paul Johnson.]

Embracing Fire -- An Overseas Example: Forest and Moorland Fires in Scotland

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Abstract. Scotland has a maritime climate with moderate temperatures and regular rainfall. The forest in the northern half of Scotland is the maritime fringe of the European boreal zone, further south it becomes the temperate and deciduous forest zone. With a moderate climate and low forest cover forest fires are not common. However wildfires including grass, heath, scrub and peat fires are quite common. There are also regional differences in climate (Raper et al. 1997) between the north and west, which are generally wet and the east and south of the country that can be quite dry. In some areas to the east of the mountain ranges there is also a rain shadow effect.

Prescribed burning is used extensively for habitat management for red grouse, an upland game bird that lives in heather *(Calluna vulgaris)*. Fire is also used to regenerate grazing land for cattle, sheep and deer. In forests, fire is used to clear branches or heather from sites as a ground preparation tool prior to forest establishment by planting or natural regeneration. Firebreaks are also sometimes created alongside forests by burning. Fire is used occasionally on farmland to burn straw. Prescribed burning is used more frequently on private land than on publicly owned land. Some 88% of land is privately owned with 67% of land held in units larger than 2,000 hectares (Whiteman 1986).

Heather and associated vegetation covers some 27% of Scotland's land area (Tudor and Mackey 1995). Estimates of the actual area vary but in Scotland it was estimated in 1970 as 12,600 km^2 with 18,300 km^2 of bog (peat) with grass and heather, totalling some 30,900 km^2 (Malcolm 1994). Only 11% of the landscape is covered by forest (Forest Industry Council 1998).

Heather is ideally burnt in prescribed (controlled) burns on an 8 –15 year cycle (Hudson 1992). After heather is burnt it goes through four successional stages over time: pioneering, building, mature and degenerate. These phases also represent broad guidelines for the quantity of fuel that one can expect to find in an area, which in the mature stage can be as high as 25 tonnes per hectare of above ground bio-mass (Gimingham 1972). The quantity of biomass is also related to normal bio-geographic factors such as climate, soils, altitude and exposure as well as the reduction of fuels by the grazing of herbivores such as cattle, sheep and deer. The potential available fuel is high it also has tremendous continuity in both the vertical and horizontal planes. When dry enough to burn this creates high fire intensities (Hobbs and Gimingham 1984; Mayhead 1990).

The aim of burning on moorland is to create a network of habitats of different ages of heather at a small scale. This is the habitat the game bird the "red grouse" prefers. The ideal width of each fire is 15 – 50m. Fires are generally lit to burn with the wind. The width and the intensity of the

fire are managed by controlling the fire at the "shoulders" of the head of the fire. This is hot hard work with escapes a constant danger.

The fire hazard is increasing in some areas where there is insufficient prescribed burning. Also new native pinewoods are being created to fulfil bio-diversity objectives and heather is growing along with the regenerating trees. Fuel loads may increase in the future due to a reduction in grazing pressures caused by the rationalisation of upland farms and pressure from conservation interests to reduce wild deer populations. There has also been a reduction in staff available for heather burning operations due to economic pressures.

Fire risks are increasing with higher levels of public access to forests and moorland. Climate change scenarios also suggest increasing risks in the east and south of the country but stable or reduced risks elsewhere (Raper et al. 1997). Heather and grasses will continue to have a significant fire risk, especially in the spring. Heather and grasses have small particle sizes, which can be considered as "fines" or as 1-hour timelage fuels (Teie 1997) -- i.e. they have a very short drying time. Escapes from prescribed heather burning operations do occur. The interface between heather moorland management and young forests, especially new native pinewood areas, is of particular concern. Arson also occurs in areas of social tension.

The vast majority of fires are human caused but there are historical records of lightning started fires of small and landscape scale (Allison 1952-1954; Weatherall 1952-1954). Lightning fires were recorded with fire fronts 8 – 11 kilometres long, which also burnt 2 metres into the peat (Aberdeen Journal 1826). It has been estimated that some forests of the eastern highlands of Scotland have had fires at frequent return intervals (Miller and Ross 1990; Snodgrass 1996). Fire and the pine forests of Scotland have had a continuing relationship that has been much discussed in the literature (Steven and Carlisle 1959; Malcolm 1994). Although it is only recently that researchers and managers have started to look beyond fire as an event, usually considered catastrophic, to the gradation of effects generated by the different intensity and severity effects caused by variations in fire behaviour during a fire.

One difference found in Scottish forests from some of the drier parts of the boreal zone is the presence of a vigorous shrub layer in the forest, largely consisting of heather and blaeberry. There is also often a deep organic soil layer. In dry conditions a large amount of fuel, both surface fuel and peat can become available. The presence of a continuous high water table also stimulates root development close to the soil surface. So when there is a drought and a forest fire occurs, the fires tend to be stand replacement fires. The extensive tree mortality likely to be caused by damage to the crowns from the high intensity surface fire coupled with root damage from charring of the organic soil layer.

Forest and moorland fires were traditionally put out by large numbers of people using fire beaters. From the 1980's this has been augmented with helicopters using underslung dipper buckets (Aldhous and Scott 1993). However there are increasing problems of resources in terms of manpower and helicopter use, due to financial pressures. The mechanisation of many rural jobs has reduced the manpower available for fire fighting and helicopters are expensive.

The traditional tools used for extinguishing heather fires are long handled fire beaters or scrubbers with wire mesh or metal heads. More recently "pump and roll" techniques using very high-pressure fire fogging units have been tested (Murgatroid 1999) and are increasingly popular. Generally helicopters are only used when either a fire is completely out of control or is threatening a forest.

For some years a Scottish pump manufacturer has been developing a range of "fire fogging" units. The concept of the units is to maximise the efficiency of water use by creating a fog of small droplets of water. This removes some oxygen from the fire environment and creates the maximum cooling effect for a given volume of water. Outputs range from 6, 15 and 24 litres per minute of the fog of water, which is pumped out at 210 bar -- i.e. at very high pressure. This system has proved very effective with heather, shrub and peat fires. The units are used extensively on private estates for heather burning and by fire brigades. The units have also been used successfully on Australian bush fires as well. . The new fire fogging equipment has made motor manual systems increasingly cost effective.

Co-operative mechanisms called rural fire groups or forest fire protection groups are being created to cope with the developing fire situation. These groups are public/private sector partnerships. The groups include private estates, Fire Brigades, Forestry Commission, and heritage agencies. The group approach is being adopted on a wide scale

A key operational change to achieve improved management of incidents has been the development of forest fire protection groups as public/private sector partnerships. A key aim of the groups is to create a fire fighting resource that can cope with larger wildfires, both forest and moorland.

The aim of the groups is to:

- Improve labour and equipment availability at short notice,
- Improve the effectiveness, efficiency and communication on the fire ground,
- Improve safety, training, cost sharing and general mutual assistance.

A key aspect leading to the success of the groups is that they are local. Competency based training to improve the standard of staff carrying out prescribed burning and attending wildfires is being developed for both land managers and the fire brigades. When achieved the competency will be recognised by vocational qualifications.

Fire suppression strategies, tools and techniques have been developed according to local needs in the UK. These needs have been identified by first establishing likely fire behaviour, especially of heather. Then by looking at historical fire events to create an understanding of the local fire regime (Stevenson 1996). With this information we have tried to identify appropriate fire suppression tools, effective fire suppression techniques and appropriate organisational structures.

An understanding of the economic values threatened by fire along with fire fighting costs helps define appropriate financial support for pre-planning and fire fighting. The frequency and type of

fires will determine whether a full fire fighting service is required or more use can be made of private sector and other local resources. Partnership approaches can create conditions for "best value" where the skills of land managers, largely gained from prescribed burning operations, can be linked to the resource base of publicly funded urban oriented fire brigades.

It is difficult to relate our experience to the interior west area of Canada and the USA directly. However the value of partnership working, good equipment testing, systems development and training, will transcend any boundary or border.

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Biographical Sketch: Michael Bruce

Michael Bruce is the Chairman for the Scotland Timber Growers Association and owner/manager of Glen Tanar Estate that extends to 10,000 hectares (25,000 acres) of which 4,000 hectares (10,000 acres) is forest. Half of the forest is designated as a European Special Area of Conservation and is managed as a nature reserve in agreement with the government. Half of the estate is covered by the fire tolerant scrub species called heather (*Calluna vulgaris*), which is managed by the use of prescribed burning. Michael graduated from UMIST (Manchester) with an honours degree in Management Sciences, where his thesis was on the Production and Management Control Systems of Scottish Softwood Sawmills. Following this Michael spent three years in the army. He joined his regiment "The Black Watch" in Germany and also served in Norway, Canada, Scotland and Northern Ireland. Michael then returned home and took over running the family business, Glen Tanar Estate in Aberdeenshire, Scotland in 1986. In addition to his responsibilities at Glen Tanar, Michael is a forest fire instructor and independent consultant on specialist issues such as birch management, salmon fishing improvement schemes, training standards development and bio-diversity species action plans. In the last three years Michael has helped develop a network of fire protection groups, which are private/public sector partnerships between land managers, fire brigades and other agencies, with fire brigades in Scotland. There are now nine such groups. He has also been involved in creating appropriate SOP's for private sector and fire brigade to tackle wildfires together. He was also contracted by the Forestry Commission to conduct various fire tests looking at the productivity of different fire suppression tools and systems. He has also written and delivered basic fire training courses and represented the United Kingdom at the recent Baltex Fire 2000 conference in Finland. Michael is a panel member of the Prince's Trust, training representative for Scottish Landowners' Federation and Chairman of the Game Conservation Industry Sector within the national standards setting body, LANTRA. Other associations he is involved in include the South Grampian Forest Fire Protection Group, Dee Salmon Fishing Improvement Association and the East Grampian Deer Management Group.

Closing Remarks

Martin E. Alexander

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Abstract. This presentation will attempt to summarize the moderators' comments, the invited speakers presentations, the question and answer periods and the various "informal discussions" that have taken place outside the formal program. The emphasis will be on highlighting the major points pertaining to the conference theme.

Timing obviously doesn't allow for the closing remarks to be printed in advance; these will be made available on the conference web site (http://www.iwfc2000convention.com/) in the very near future. However, I'd like to provide you with one very simple observation that can be made in advance.

In 1987, I wrote this definition for the Canadian Committee on Forest Fire Management glossary:

Fire management is the activities concerned with the protection of people, property, and forest areas from wildfire and the use of prescribed burning for the attainment of forest management and other land use objectives, all conducted in a manner that considers environmental, social and economic criteria. Fire management represents both a land management philosophy and a land management activity. It involves the strategic integration of such factors as a knowledge of fire regimes, probable fire effects, values-at-risk, level of forest protection required, cost of fire-related activities, and prescribed fire technology into multiple-use planning, decision making, and day-to-day activities to accomplish stated resource management objectives. Successful fire management depends on effective fire prevention, detection, and presuppression, having an adequate fire suppression capability, and consideration of fire ecology relationships.

Now 13 years I find that this definition is still quite valid but perhaps what needs to be added is a definitive acknowledgment of the fact that the human dimension or element to fire management is extraordinarily complex and requires far more consideration than its previously been given if people are to truly coexistent in harmony with ecosystems and wildland fires now and in the future.

Biographical Sketch: Marty Alexander

Marty Alexander is a Senior Fire Behavior Research Officer with the Canadian Forest Service located at the Northern Forestry Centre in Edmonton, Alberta. Marty has in his 24-year career with the CFS specialized in studying the physical aspects and impacts of wildland fires, including the practical application of such knowledge to fire management issues. He was one of the architects of the Canadian Forest Fire Behavior Prediction System and has been heavily involved in fire behavior training on a national basis. He was also one of the co-coordinators of the International Crown Fire Modeling Experiment which took place in the Northwest Territories in 1997-2000. From 1989-93 Marty was on professional development/educational leave from the CFS in Australia and New Zealand. Prior to joining the CFS in 1976, Marty worked for the Colorado State Forest Service and the USDA Forest Service in fire management (Greybull hotshot crew; Selway-Bitterroot Wilderness fuel inventory) and fire research (National Fire Danger Rating Project) from 1972-74. He received his B.Sc (Forest Management Science, 1974) and M.Sc. (Forest Fire Science, 1979) degrees from Colorado State University and his Ph.D. degree in Forestry from the Australian National University in 1998. Marty, his wife Heather and their four children (3 boys & 1 girl) live on a wooded acreage southeast of Edmonton near the southern extent of the boreal forest in western Canada where he serves as one of the fire guardians for the New Sarepta Rural Fire Response Area. Marty was a co-organizer along with Gord Bisgrove (Alberta Forest Service) of the Interior West Fire Council's first annual meeting and workshop which was held at Kananaskis, Alberta, back in October 1988.

Poster Session: Abstracts

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The Mann Gulch Fire and the Canadian Forest Fire Danger Rating System

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Abstract. The year 1999 marked the 50th anniversary of the Mann Gulch Fire that occurred in western Montana on August 5, 1949. There has been considerable interest amongst the Canadian wildland fire community in the 1949 Mann Gulch Fire. In order to supplement the usefulness of the Mann Gulch Fire as case study material in wildland fire training in Canada, the burning conditions and potential fire behavior have been examined in light of the two major subsystems of the Canadian Forest Fire Danger Rating System, namely the six standard components of the Canadian Forest Fire Weather Index System and the various quantitative outputs of the Canadian Forest Fire Behavior Prediction System. Presumably this CFFDRS hindsight analysis adds to the existing body of knowledge concerning the state of the fire environment associated with the Mann Gulch Fire during the afternoon of August 5, 1949.

A copy of the complete paper of the same title included in the preprint volume of the Third Symposium on Fire and Forest Meteorology (January 9-14, 2000, Long Beach, California) published by the American Meteorological Society of Boston, Massachusetts, is available upon request from the senior author.

Ecosystem Management in the Montane of Jasper National Park: Impacts and Interactions of Fire and Elk Browsing

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Alan Westhaver and Peter Achuff, Parks Canada,
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Abstract. In the past, fire played an important ecological role in the montane region of Jasper National Park, Alberta. However, fire has largely been excluded from the ecosystem over the last century. In addition, large populations of elk now thrive in this area and severe browsing affects the vegetation. Prescribed fire is being used to help restore ecosystem processes with

the goal of maintaining an open-canopy lodgepole pine forest with grassland. As part of this management activity, we are studying the impact of prescribed burning, elk browsing, and elk-fire interactions on the montane vegetation. Permanent vegetation plots were established in 1998, some of which involved fenced exclosures to exclude elk browsing. Plots were placed in non-burned control areas, in an area burned in the spring of 1999, and in a planned-burn area for the autumn of 2000. Plots represent both closed-forest canopy and open-forest/grassland sites. The prescribed fires are lit as lines using hand torches, and the fire behaviour measured in the plots. This includes flame height and rate-of-spread, as well as measurements of soil depth-of-burn. Pre- and post-burn vegetation sampling was done, which included measurements of: tree height, condition and d.b.h; shrub height and crown diameter; and ground vegetation percent cover by species. The 1999 spring burn caused 50% tree mortality where about 65% of the tree crown was scorched. Almost all of the shrubs were burned, but *Shepherdia canadensis* is now regenerating. Regenerating aspen is evident within the exclosures, but these are mostly eaten by elk in non-fenced areas. There is little impact on ground vegetation cover and phytodiversity one year after the fire, although dead grass has been reduced. Vegetation recovery is being monitored annually, and it is expected that a few more years will be needed to see the full impact of fire and elk interactions.

Fire Growth Modeling at Multiple Scales

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Abstract. This poster shows a fire growth modeling system designed to run consecutively over three time scales, imposed by meteorological forecasting ability. The short-range model is a deterministic, eight-point fire growth model that uses hourly weather. The medium-range model uses the same deterministic fire growth but uses more general, daily weather information. This model becomes probabilistic through the introduction of the probability of precipitation. The long-range fire growth model is probabilistic and is based upon climatology. The models are designed so that they may be run in sequence, with the results of one model initializing the subsequent model run. The poster includes a case study illustrating the linkages between the models.

New Insights into the Effectiveness of Fuel Reduction Treatments at the Stand Level

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Abstract. Research in being carried out by the B.C. Ministry of Forests Protection Branch, Canadian Forest Service (CFS) and the Government of Northwest Territories (GNWT) Forest Management Division on the effectiveness of current thinning and pruning standards recommended for fire safe landscaping. Creating a 10-m zone around your house free of trees, shrubs, woodpiles and any other combustible material, as well as spacing trees ~3 m apart and pruning to ~ 2 m for the next 20 m, has been advocated for protecting your home from wildfire. In theory, fuel treatments are designed to reduce fire intensity and rate of spread thereby lessening the chances of a conflagration developing. Nonetheless, thinning and pruning treatments open up a stand, and result in increased within stand wind speeds and faster fuel drying rates. These changes in the fire environment may, in fact, counteract some of the positive effects fuel reduction treatments have on potential fire behavior.

Test fires have been carried out in treated and untreated conifer stands in the Northwest Territories as part of the International Crown Fire Modeling Experiment (ICFME) coordinated by the CFS and GNWT Department of Resources, Wildlife and Economic Development (see: http://www.nofc.cfs.nrcan.gc.ca/fire/fmn/nwt/). On the basis of this initial testing, the authors suggest that some caution needs to be exercised in judging the effectiveness of fuel treatments. Extreme fire behavior can be experience in both treated and untreated stands depending on the burning conditions and level of fuel reduction. Preliminary results suggest that fuel treatments will be more effective if surface fuels such as leaves, grass, twigs and old pine needles are raked up and removed within a 30 m radius of a home in order to decrease the potential surface fire intensity.

Drier and winder burning conditions presumably increases the probability of crown fire initiation in spite of the fact that the effective crown base height has been increased. To evaluate the tradeoffs between fuel reduction, increased winds and drying rates, and warmer and drier fuels, the fuel characteristics and the moisture regimes within treated and untreated stands are being studied in detail at a site near Kelowna, British Columbia. Further experimental fires in paired treated/untreated plots are planned in the NWT as one has "gotta burn to learn".

Response of Jack Pine Seed to High Temperature Exposure

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Abstract. Jack pine (*Pinus banksiana* Lamb.) is a pioneer species well adapted to wildfire disturbance. Evidence of this is provided by many characteristics of the tree's ecology, and in

particular the presence of its serotinous cones. Typically, the majority of jack pine area burnt is consumed by high intensity crown fire, where frontal fire temperatures can be in excess of 1000 degrees Celsius. While the general fire ecology of jack pine has been well noted, the effect of high temperatures and the duration of exposure to these temperatures on the viability of jack pine seed are not well known. This experiment was conducted in order to better understand and predict the density, quality and success of post-burn jack pine regeneration. Twenty jack pine trees were felled and 10 cones from each collected from a site approximately 50 km north of Fort Providence, Northwest Territories. Two cones from each tree were randomly placed in one of five exposure-duration treatments; 0 (control), 10, 20, 40 and 60 seconds. The cones were then subjected to open flame for the respective treatment duration, and flame temperatures were recorded. Seed from each cone was collected following the treatments and germination tests were carried out. Cones from half of the trees were germinated in a pure water solution and the other half in an ash solution. The ash solution was prepared by removing loose surface material from a recently burned jack pine stand. The material was then sieved, weighed and added to germination dishes in the same proportion (based on area) as it was removed from the natural surface. Temperatures measured during treatments were as high as 1124°C, and considered similar to that of a crown fire. A reduction in percent germination occurred in the 60-second treatments compared to the shorter exposure times. Germination in the pure water solution was similar to germination in the ash solution for short exposures. Temperature duration measured during large field experiments show exposures of typically less then 40 seconds, suggesting jack pine seed is well adapted to the exposure produced by a wildfire.

Predicting the Initiation and Spread of Crown Fires

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Abstract. Crown fires are spectacular natural phenomena for which fire research has not yet been able to fully describe and understand. The unknowns in fire phenomenology lead to an empirically based fire modeling approach for predicting crown fire spread. Based on an extensive field experimental crown fire behavior database models aiming at predicting the initiation and spread rate of crown fires were developed. The premise behind this study was that the amount of crown fire behavior data available from many years of fire research in North America had covered an adequate spectrum of fuel complexes fire behavior characteristics that would allow the development of empirically based models describing some aspects of crown fire behavior. Crown fire initiation was modeled through a logistic approach using 10-m open wind speed, fuel strata gap or height to live crown base, a surface fuel consumption class and an index of fine dead fuel moisture content as independent variables. The crown fire spread modeling approach considered crown fires as spreading in two distinct phases, active and passive. Crown fires were modeled through multi non-linear regression analysis following physical reasoning. Independent variables used in the models are wind speed, crown bulk density and fine dead fuel moisture content. Model coefficients agree quite well with models with similar form for shrublands and grasslands. The crown fire initiation model correctly predicted 85

% of the cases in the dataset used for its construction. The model for active crown fire spread yield an R^2 for 0.61. Passive crown fire spread was modeled through the output of the active crown fire model with a correction based on the criteria for active crowning. The active crown fire spread model was evaluated through a sensitivity analysis procedure and against an independent dataset, with satisfactory results. The models build in this study are believed to have application in support decision-making in various fire management problems.

Crown Fire Intensity Indicated by Post-fire Twig Tip Diameters

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Abstract. Intensity of fire in woody vegetation crowns is one of the parameters needed to assess many fire effects. However, crown fire intensity is very difficult to measure. Seven plots burned during the International Crown Fire Modeling Experiment near Fort Providence, Northwest Territories, were sampled by taking 30 postfire twig tip diameters (TTD) from each of 12 randomly located trees. The mean TTD of each of plot was compared with several fire parameters. Highly significant linear regression was found between TTD and rate of spread (ROS) that explained 63 percent of the variation. Energy released multiplied by ROS yields fire intensity. Assuming that forest fuels have very similar heat of combustion, the fuels consumed would be directly proportional to energy released. Regressing TTD against the product of ROS and fuels consumed (live fuels <0.5 cm + dead fuels <1cm) explained 77 percent of the variation between all plots. Five trees from one of the plots were analyzed by measuring TTD from 30 twigs in each vertical third (top, middle, bottom) of the crown. ANOVA showed significant differences in TTDs between thirds in three of the five trees with the middle third having the largest TTDs. The other two trees came from the fringe of the unburned area in the upper right corner of the plot. This finding agrees with the higher heat production found in the middle of the crown layer. From these data it appears that TTD integrates the various factors that go into fire intensity and provides a usable indicator. This should be verified by measurements in other fuel types where ROS and fuel consumption can be measured.

Spatial Fire Management System

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Abstract. The Spatial Fire Management System (sFMS) is a fire information management and display system that integrates fire science models and decision support planning tools into a geographic information system. It is designed to be incorporated into the daily planning operations of fire management agencies. The system includes a full implementation of the Canadian Forest Fire Danger Rating System, providing assessments of fire ignition and growth potential and predicted fire behavior. It also includes tools for resource allocation planning, wildfire threat rating, and spatial data management.

The system is used operationally by several Canadian provinces and the State of Florida, as well as nationally for the Canadian Wildland Fire Information System. Planned enhancements include regional reporting capabilities and fire occurrence prediction.

Probability of Containment by Medium Initial Attack Crews in the Boreal Spruce Fuel Type

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Abstract. An expert judgement study was conducted to evaluate the effectiveness of "medium" (5- to 7-person) initial attack crews. Structured interviews were conducted with over 30-experienced crew leaders from four Canadian forest fire management agencies. Each expert they provided assessments of the probability of containment (POC) for 35 initial attack scenarios that varied in terms of fire size and head fire intensity. A statistical analysis of the data indicated that fire size, fire intensity and the interaction of these two variables were significantly correlated to the POC assessments. This poster presents a brief overview of the study's methodology, assumption, and limitations, as well as POC charts for initial attack with and without support from bucketing helicopter. Note: Copies of this poster can be obtained free of charge by writing to: Publications, Canadian Forest Service, Northern Forestry Centre, 5320 – 122 Street, Edmonton, Alberta T6H 3S5.

Effectiveness of Landscape Level Fuels Management at Reducing Area Burned

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Abstract. Wildfires are a major disturbance in Canada's boreal forest ecosystems and have important socio-economc and ecological effects. Given that a considerable portion of the productive forest land base will be disturbed through logging over the next 50 years there is an excellent opportunity to reduce the likelihood of extremely large wildfires by incorporating fuels management (e.g., fuel conversion and fuel reduction) into forest management activities. In this study we assess the impact of strategically located landscape level fuels treatments on wildfire size in a 200,000 ha area in central Alberta. A set of 146 wildfires were independently simulated on both the existing land base and a "fire-smart" land base that was developed in consultation with forest managers. Ignitions points were determined using a systematic grid and fire spread

was modelled using a cellular propagation, hourly time-step fire growth model. Inputs consisted of a 100 m by 100 m fuels grid and a constant set of extreme fire weather conditions derived from an analysis of historic fire occurrence and fire weather data. The results showed that the average fire size was about 25% lower on the treated land base in comparison to the present land base. This suggests that in certain parts of the boreal forest the application of landscape level fuels management could reduce area burn by escaped wildfires. This, in turn, will decrease the possibility of timber supply shortages, lower potential future carbon emissions, and allow greater opportunity for the use of prescribed burning to meet the ecological goals of sustainable forest management.

Spatial and Temporal Variations in Fire Hazard Associated with Forest Management Practices

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Abstract. Although the ecological importance of forest fire is recognized, reducing area burned by wildfires is necessary to maintain an adequate wood supply in Canada's industrial forest. In this context, we need to develop procedures and techniques for integrating fire and forest management. This study was conducted to determine the effect of 4 different forest management practices on forest-level wildfire potential. Vegetation characteristics of each scenario were converted to Canadian Forest Fire Behavior Prediction (FBP) System fuel types in order to produce fuel type maps at 50-year intervals over a 200-year rotation period. Qualitative assessment of fuel type continuity and spatial arrangement indicate that none of the analyzed forestry practices reduce the flammability of the area since they continue to have a large component of fuels that are very prone to crown fire and a general reduction in other less flammable fuels. In fact, some scenarios make the area more susceptible to very large fires during the 200-year rotation. New strategies that advocate compartmentalization of a forest area through the use of strategically located treatments (fuel conversion, reduction, and isolation) are being developed to reduce the potential for large fires while attempting to maintain timber production goals.

How Does Fire Behave Itself in the North?

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Abstract. The subarctic region of Canada ranges from tree line in the north to closed boreal forest in the south. A first-time visitor is often surprised to see on a fire history map the size that some wildfires reach in this northern environment considering the rocky, open, shrubby, and

swampy areas that are interspersed with the lakes, rivers, and closed forests of this region. This poster presents some characteristics of the fire environment that lead to a fire behavior sometimes more active than first expected in the north. This is done through the presentation of two large wildfires that occurred in the Northwest Territories at different latitudes, with emphasis on the effect of long summer days and low rates of decomposition on fire behavior in the north. The Tibbitt Lake Fire [ZF-029] (62° 39' 00" N, 113° 00' 00" W) was ignited by lightning approximately 70 km north-east of Yellowknife in the summer of 1998. It burnt over 155 000 ha of land. The Sunny Tower Fire [EV-006] (67° 35' 48" N, 132° 45' 06" W), also of lightning origin, was ignited in the summer of 1999 approximately 45 km north-east of the community of Tsiigehtchic. It reached a size of 172 000 ha. Fuels, weather, and topography are discussed for these two fires in relation to the large size that they reached.

Canada's Wildland-Urban Interface

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Abstract. Canada's wildland-urban interface fire problem is growing and becoming increasingly complex. To provide guidance to individuals and communities about what, where and how to reduce the risk from wildfire, the Partners in Protection Association has developed a manual entitled FireSmart: Protecting Your Community from Wildfire. The material contained in FireSmart is based on science and experience but is written in a non-technical style aimed at a wide range of potential users including the general public. The book has eight chapters under three themes (Assess the Situation, Resolve Existing Problems and Avoid Future Problems), a set of currently available resources and sample communication documents. More specifically, contents include discussion of assessment issues, gauging wildfire hazards, problem-solving, emergency measures, firefighter training, communication, public education and land-use planning.

A New Computer-Based Wildland Firefighter Safety Training Course

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Abstract. Interactive multimedia technology has been utilized in the development of a CD-ROM based wildland fire safety training course, Wildland Fire – Safety on the Fireline which was completed in July 2000 by Alberta's Environmental Training Centre and the Canadian Interagency Forest Fire Centre (CIFFC) National Training Working Group in concert with Christie Communications and Vicom Multimedia. Wildland Fire -- Safety on the Fireline contains 72 video clips, over 250 audio clips, some 500 graphics/photos, on-line help, a glossary and a SI-to-unit conversion calculator Interactive multimedia technology allows delivery of training to a large number of students on a consistent basis. In addition, cost savings can be achieved through reduced learning time, reduced travel, minimal use of instructors, and most of all, thorough retention of knowledge as a result of using multimedia. The course Wildland Fire – Safety on the Fireline was developed and reviewed by a national team of specialists in wildland fire behavior and wildland fire safety with the intent of reducing and/or eliminating injuries and fatalities associated with the suppression of wildland fires. Wildland Fire – Safety on the Fireline focuses on due diligence, situational awareness, entrapment survival, health, equipment, and hazards encountered when working on the fireline. Each of the four sections comprising the course (Introduction, Entrapment, On-the-Job and On the Line) is followed by a board game test in preparation for a final test that is tracked by the computer. This poster presentation will feature a live demonstration of the computer software. Wildland Fire – Safety on the Fireline can be run on a stand alone computer or over a network. The following is required: Pentium 166 or better (with Windows 95, 98 or NT), minimum 32 MB of total RAM memory and 100 MB of free hard drive space (4 MB actually required for software), color SVGA monitor set (for 800 x 600, 16 bit color and 4 MB video memory), 16 bit sound card, 16X or better CD-ROM and its driver(s) (on every workstation). To order the CD-ROM Wildland Fire -- Safety on the Fireline contact (cost: $CAN 98.95 + shipping charges): Raincoast Distributors, 8680 Cambie Street, Vancouver, British Columbia, Canada V6P 6M9; Tel: 1-800-663-5714; Fax: 1-800-565-3770; Email: custserv@raincoast.com

Plants Collected at the International Crown Fire Modelling Experiment Site

Margaret Vandell, Fort Providence, Northwest Territories

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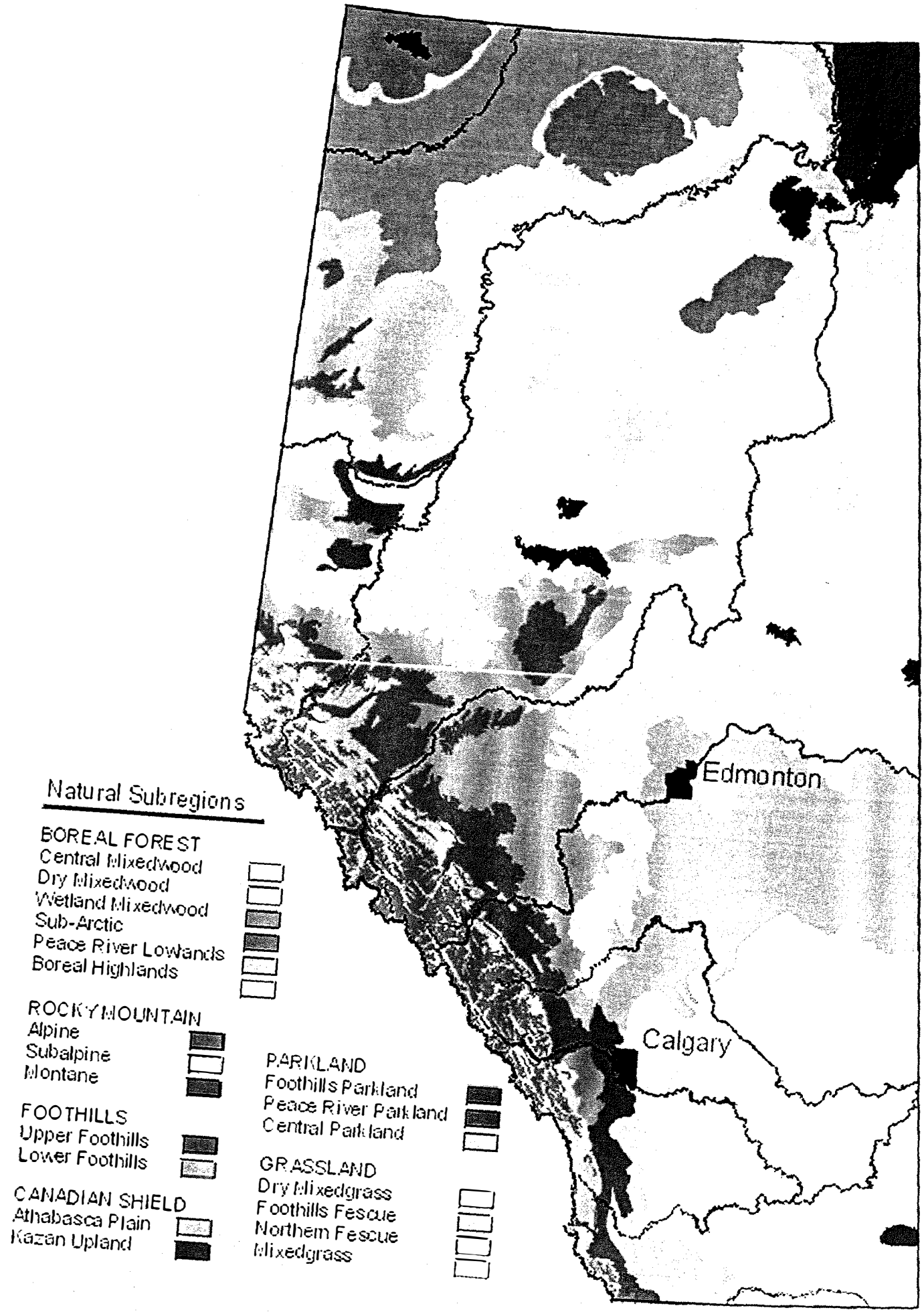
Abstract. Margaret Vandell is a respected Dene elder who lives in Fort Providence, Northwest Territories. Margaret works at the Deh Gah Elementary and Secondary School in Fort Providence where she teaches students about the traditional values in the Dene culture. Margaret is also a member of the fire research team working on the International Crown Fire Modeling Experiment (ICFME) site. She and her students are gathering post-burn information including photo documentation and vegetation responses. The project is expected to last several years and provide the community with first hand information about plant responses

following fire while at the same time fostering greater student interest in both traditional knowledge and natural resource science. Margaret will be showcasing plant samples from the ICFME site that she collected and laminated. A list of the plants that have been collected will be shown as well. In addition, Margaret will be displaying relatively fresh samples of some medicinal and traditionally important plants such as sweet grass (*Hierochloe odorata*). Faye Johnson, who is responsible for managing the ICFME Postburn and Restoration Project, will be displaying some poster materials portraying the Fort Providence students' involvement with the project . Photo albums will also be available for viewing purposes.


Natural Subregions
BOREAL FOREST
Central Mixedwood
Dry Mixedwood
Wetland Mixedwood
Sub-Arctic
Peace River Lowlands
Boreal Highlands
ROCKY MOUNTAIN
Alpine
Subalpine
Montane
FOOTHILLS
Upper Foothills
Lower Foothills
CANADIAN SHIELD
Athabasca Plain
Kazan Upland
PARKLAND
Foothills Parkland
Peace River Parkland
Central Parkland
GRASSLAND
Dry Mixedgrass
Foothills Fescue
Northern Fescue
Mixedgrass
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