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# All terrain vehicles as a cause of fire ignition in Alberta forests

## Abstract

This study was initiated upon the request of Alberta Environmental Protection to investigate the relationship between all terrain vehicle (ATVs) and fire ignition within Alberta's forests. The report summarizes the use of ATVs in Alberta and the specific causes of wildfires associated with these vehicles, describes fire history from 1990 to 2002, reports on other agencies' strategies to lower the probability of ATV-caused fires in forested areas, and makes recommendations for Alberta.

## Keywords

All terrain vehicles, ATV, Wildfire, Fire ignition, Wildfire cause, Alberta.

## Introduction

Both industrial and recreational forest use in Alberta has increased over the last decade. The number of all terrain vehicles (ATVs)<sup>1</sup> has also increased as people require or desire access into areas with no roads or poor road conditions. Unfortunately, the number of wildfires caused by the ATVs has also increased.

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berta and the specific causes of wildfires associated with these vehicles, describes fire history from 1990 to 2002, reports on other agencies' strategies to lower the probability of ATV-caused fires in forested areas, and makes recommendations for Alberta.

## ATV use in Alberta

Determining the number of ATVs in Alberta is a difficult undertaking. Because licensing is not consistent, some machines may not be included in the data available.<sup>2</sup> Table 1 shows the number of ATVs increasing since 1987, with a constant increase over the past three years (Schmiemann 2002). The number of registered ATVs has almost doubled since 1993, with the increase in both industrial and recreational riders.

## Specific causes of fires ignited by ATVs

Three causes of fires ignited by ATVs have been identified:

1. **Solenoids on winches.** Fires have been ignited across Canada when solenoids, associated with winches, have exploded. A recall for the specific model of winch

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## Definition of an ATV:

*"Any motorized off-highway vehicle 50 inches (1270 mm) or less in overall width, with an unladen dry weight of 600 pounds (275 kg) or less, designed to travel on four low pressure tires, having a seat designed to be straddled by the operator and handlebars for steering control, and intended for use by a single operator and no passenger. Width and weight shall be exclusive of accessories and optional equipment."* (Roscommon Equipment Center Program 1990)

<sup>1</sup> ATVs are generally used off-road or on poor-condition roads. The more common ATVs have four wheels although six and eight wheeled ATVs are also on the market. Dirt bikes are not considered to be ATVs.

<sup>2</sup> Vince d'Eon, Alberta United Recreationists Society, personal communication, June 27, 2002.

**Table 1. Registered off-highway recreational vehicles in Alberta <sup>a</sup>**

	1987	1993	1999	2000	As of March 2001
Off-highway bikes	2 042	1 400	1 724	2 007	2 425
ATVs	17 364	17 163	25 148	28 046	32 410
Snowmobiles	17 688	15 829	30 252	29 175	25 965
Total units	37 094	34 392	57 124	59 228	60 800

<sup>a</sup> Data from Schmiemann (2002).

involved has been issued (Transport Canada 2001). These fires occurred both during and just after winch use.

## 2. Hot exhaust systems and machine parts.

In a forest environment, grass and other fine fuels such as muskeg vegetation, regularly come into contact with the exhaust systems. In some cases, this material accumulates on a heat source, either the exhaust system or the brakes (ASRD 2002). Smouldering combustion can occur at temperatures as low as 272° C,<sup>3</sup> and the temperature of the exhaust system of ATVs easily reaches the ignition point for grass. Fine fuels on the machine may ignite and fall to the ground, initiating a surface fire. Hot gas coming from the exhaust may also ignite these fuels.

## 3. Sparks from the exhaust system.

Almost all muffler systems can produce sparks. While these do not ignite as many fires as direct contact, they are an occasional cause. Spark arresters are used on some vehicles, and work effectively.

The specific causes of fires—sparks or material overheating on the exhaust system—usually cannot be distinguished either because the detail was not recorded in the database, or the actual cause of the fire was not determined. Thus, requiring spark arrestors would likely reduce the number of fires, but the impacts cannot be estimated accurately. In Al-

berta current legislation does not require the use of approved spark arrestors on ATVs. The regulations in place state:

11(1) All steam and internal combustion engines used within the forest protection area shall be equipped with spark arresters **or** mufflers in good working condition, each of a type approved by the forest superintendent. (Province of Alberta 2001a)

Fires started by people using ATVs but not directly by the machines, e.g., campfires, are not included in this report. These fires result from the direct actions of people, not due to their equipment.<sup>4</sup>

## Fire history (1990–2002)

Alberta's fire history database (ASRD 2002) was queried and all fires having ATVs listed as responsible for fire cause were extracted. *Hot exhaust* and *burning substance* are the specific causes listed in the database.<sup>5</sup>

<sup>3</sup> Beck, J., formerly of the Wildland Fire Operations Research Centre, field trials in Jasper, Alberta, temperature of burning forest fuels, summer 2001. Unpublished data.

<sup>4</sup> Although not part of the study, fires caused by people using ATVs in forested areas numbered 10 in 2001 alone, resulting from abandoned camp or meal fires.

<sup>5</sup> These causes are listed under attributes Activity and True Cause in the database.

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## Number of fires

Since 1990, 6.5 fires per year have been caused directly by ATVs. However, the number of fires in the last four years averages 12, three times the number caused by ATVs in the mid-1990s (Figure 1). These fires range in size but the majority are less than 5 hectares. ATV-caused fires make up roughly 1.3% of Alberta's fires.

## Timing of ATV-caused fires

Since 1990, 83 fires were caused by ATVs in Alberta's forests, of the total 13 000 fires over this time period. Most (60%) of these ATV fires occur during April and May (Figure 2). At this time of year, grass fuels are cured almost 100%, and spring weather tends to be dry. The dry cured grass, either standing or compacted, is easily ignited.

Fire Weather Indices (FWI) were also examined. The most critical index for fires ignited by ATVs is the Fine Fuel Moisture Content (FFMC). This index represents the moisture condition of the fine fuels—the fuels most likely ignited by ATVs. Table 2 presents the mean index values for fires caused by ATVs for 1990–1995 in Alberta.

**Table 2. Indices at the time of ATV-caused wildfires, 1990–1995**

Indices	Value
Fine Fuel Moisture Code (FFMC)	87
Duff Moisture Code (DMC)	35
Drought Code (DC)	291
Initial Spread Index (ISI)	8.2
Buildup Index (BUI)	49
Fire Weather Index (FWI)	19

These indices may be considered High hazard, but by no means Extreme. For ignition to occur, an FFMC value of at least 75 is required. At the mean value of 87, the probability of an ignition is relatively high. It must be remembered that these are primarily spring indices, and the calculated DMC and DC are generally low.

## Location of ATV-caused fires

These fires are not located in any clear pattern (Figure 3), although the east-central region of the province appears to have the greater concentration. This is consistent with this region's pattern of frequent fires during the spring season. As well, most fires are closely associated with road systems.

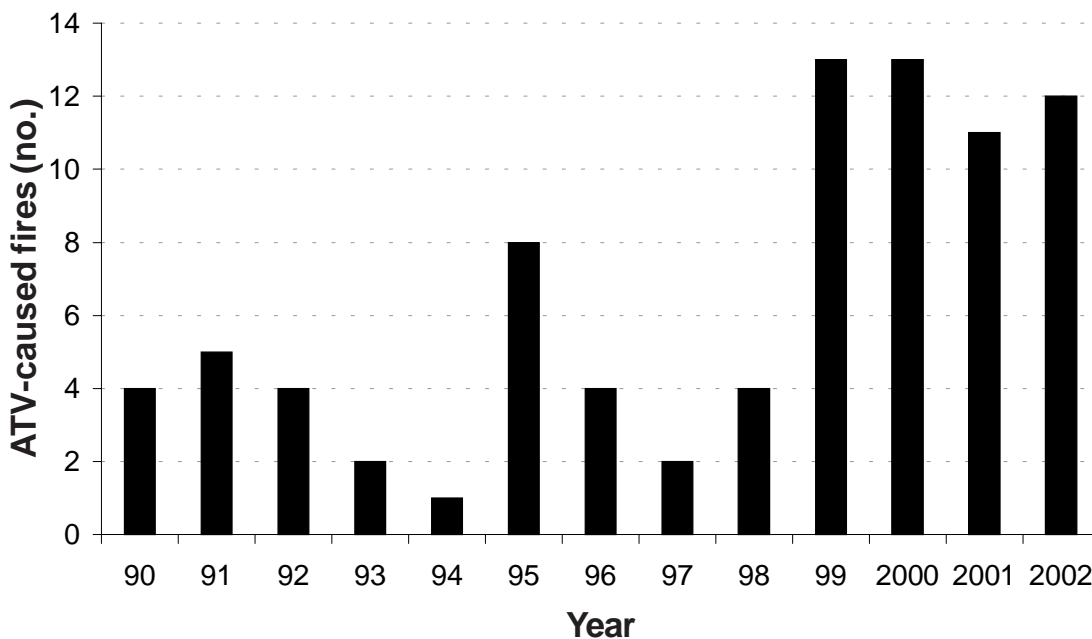


Figure 1. The number fires caused by ATVs since 1990, in Alberta.

Figure 2. The number of fires resulting from ATVs, in Alberta, presented by month for the period 1990–2002.

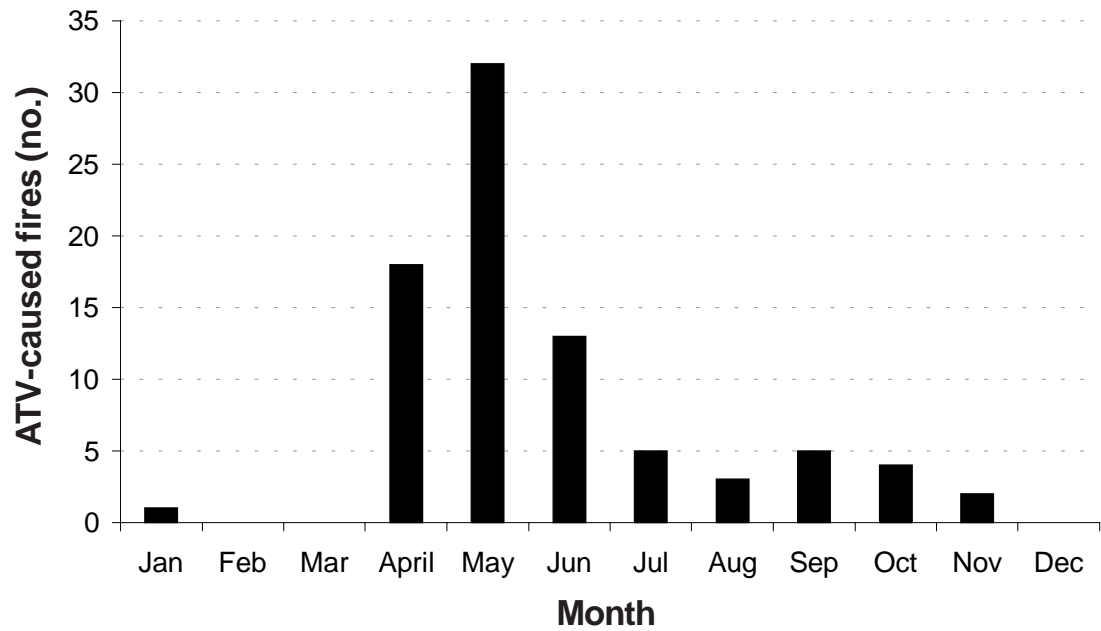
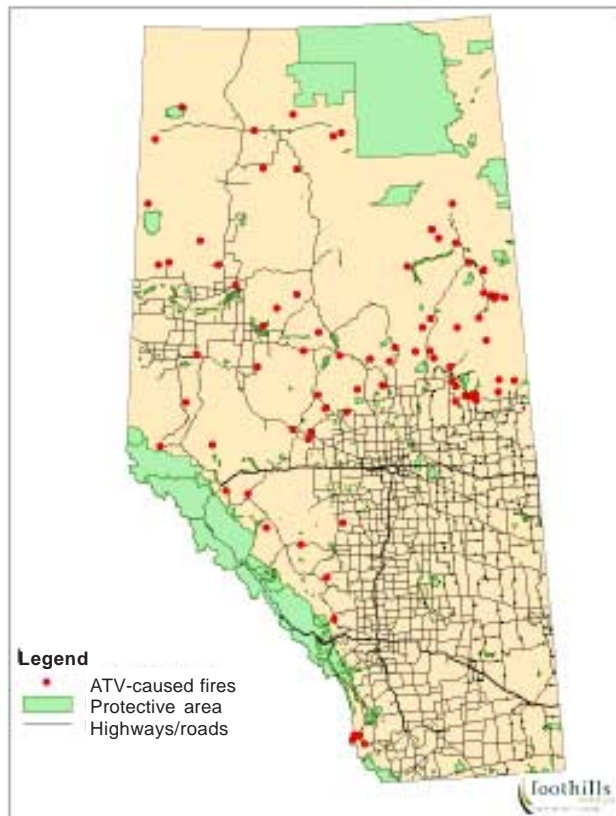


Figure 3. The geographical distribution of ATV-caused fires in Alberta from 1990–2002.



fire dangers (e.g., the forest closure in the Calgary Wildfire Protection Area September of 2001) would likely reduce ATV-caused fire ignition. Spark arrestors and heat dispersion shrouds could be added to ATVs, reducing the probability of ignition by keeping the fine fuels out of contact with the exhaust system. A possible third solution is public education and prevention. The following examples describe jurisdictions that enforce access restrictions and/or require protective equipment on ATVs.

### Alberta

In some circumstances, Alberta implements forest closures in order to reduce the risk of wildfire. However, these closures are not regulated by a set of criteria.

Regulations exist in Alberta in the Off-Highway Vehicle Regulations to enforce fire protection measures, but they are generally not enforced for ATVs. Although spark arrestors are not mentioned specifically, they are inferred. The pertinent regulations are identified below.

### Potential to reduce ATV-caused fires

Three solutions have potential to reduce or eliminate fires caused by ATVs. Restricting or limiting the access of ATVs into forest regions during periods of High to Extreme

## Alberta

### Inadequate muffler

14(1) No person shall operate an off-highway vehicle that is not equipped with an exhaust muffler consisting of a series of pipes or chambers that ensures that the exhaust gases from the engine are cooled and expelled without excessive noise and without the emission of any flame or sparks.

(2) No person shall drive or operate an off-highway vehicle when the muffler with which the vehicle is required to be equipped

- (a) is cut out or disconnected from the engine,
- (b) has had a baffle plate or other part removed,
- (c) has been altered by having the exhaust outlet opened or widened, or
- (d) has been altered by having an attachment or device attached that
  - (i) increases the noise of the expulsion of the gases from the engine, or
  - (ii) allows a flame to be ignited from the exhaust system.

(Alberta Regulation 70/91 s14 (Province of Alberta 2001b))

## British Columbia

British Columbia has legislation and regulations for forest fire prevention and suppression. Various levels of forest closures are based on the fire danger class, time of day, and length of time the fire danger has existed, and limit forest use during extended periods of hot, dry weather. Vehicles are not included in forest closure regulations. As well, ATVs are not specified in the B.C. Legislations and Regulations for forest fire prevention and suppression.

One regulation identifies requirements specific to engine size and the use of tools and equipment. The regulation may be appropriate for application to ATVs (see below).

### United States Department of Agriculture (USDA)

The United States also closes its forests to ATVs during periods of Extreme fire danger (National Wildfire Coordinating Group 2000).

The USDA has invested a great deal of effort to legislate spark arrestors on all ATVs. Problems still arise due to tampering with

## British Columbia

### Large engines (does not include vehicles to transport people) (>7.5 hp or 5.6 kW)

12. (1) A person must not operate a large engine unless it is equipped with a safe and effective device for arresting sparks that is
- (a) an integral part of the exhaust system, and
  - (b) in good repair.
- (2) A person must not operate a large engine that operates in a stationary capacity unless the site has been cleared of combustible material for a distance of at least 3 m in each direction from the large engine.
- (3) A person carrying out an industrial activity must ensure that a large engine meets the requirements under subsection (1) and that combustible material is cleared as required under subsection (2).

### Small engines (does not include vehicles to transport people) (<7.5 hp or 5.6 kW)

13. (1) A person must not operate a small engine unless
- (a) the muffler on the small engine is maintained in good repair, and
  - (b) there is available at all times a fire extinguisher charged with at least 0.225 kg (0.5 lb.) of fire extinguishing chemical.
- (2) A person must not operate a small engine if the ability of the muffler to reduce hot carbon emissions has been lessened by modification of the muffler or by redirection of the emissions.
- (3) A person carrying out an industrial activity must ensure that a small engine is equipped with a muffler that meets the requirements under subsections (1) (a) and (2) and that a fire extinguisher is available as required under subsection (1) (b).

(Province of British Columbia 2001)

the devices by individual users to increase engine performance, although safety checks are made to find altered spark arrestors.

The main source of literature on spark arrestors can be found at:

<http://www.nwccg.gov/pms/pubs/pubs.htm>

## Recommendations

1. Through further research and working with manufacturers, investigate the potential development of heat dispersing protective shrouds around exhaust systems. These would restrict direct contact of fine fuels on the exhaust system of ATVs, by reducing the accumulation of grass and other materials. These materials may be wet when they first come into contact with the ATV, but can then dry to the point of ignition on the muffler. It is believed a greater number of fires are ignited due to the direct contact of materials on the exhaust system than due to sparks—thus, giving these shrouds the greatest priority.
2. All ATVs should have properly operating spark arrestors. Properly maintained spark arrestors will trap over 90% of particles capable of igniting a fire (National Wildfire Coordinating Group 2000).
3. Special areas for ATV riding during Extreme fire danger periods should be developed, centralized, and designated.
4. Forest closures should restrict the use of forests during periods of Extreme fire dangers, especially during spring seasons.
5. Fire protection measures already exist in Alberta in the Off-Highway Vehicle Regulations. These should be interpreted to include spark arrestors, and should be enforced.
6. While riding (especially when fire dangers are High or Extreme), ATV users should regularly remove the fine debris collecting on or near their exhaust systems.

7. During the fire season, a minimum of two powersaw-type fire extinguishers<sup>6</sup> should be carried on each ATV.
8. Fire prevention approaches should be designed to establish attitudes and overall fire awareness in the ATV community, e.g., fishing and hunting regulations could include prevention advertisements with an emphasis on ATVs. Fire prevention should be a component of the training programs.
9. Request the Canadian Interagency Forest Fire Centre's (CIFFC) Fire Equipment Working Group to compile national statistics on ATV-caused wildfires to determine if this problem is national in scope.

## Implementation

1. Fire awareness, prevention and initial action should be embedded in the curriculum of ATV training certification courses.
2. Alberta Sustainable Resource Development employees should be trained to inspect ATV exhaust systems and operator training certification, and to use this information to inform ATV riders.

<sup>6</sup> A powersaw fire extinguisher is typically a plastic squeeze bottle filled with 232 g of ABC fire extinguishing powder.

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