



AI-Pac

5. Cumulative Impacts

Integrated Resource Management in Alberta

With the exception of the northeast, where petroleum deposits are absent and forest productivity is low, most of Alberta's boreal forest is subject to the overlapping activities of multiple industrial operators (Fig. 5.1). For example, a given area might have an FMA holder, several forestry quota holders, and many petroleum companies, all operating concurrently and independently.

Although attempts at integrated resource management have been made in Alberta since the 1970s, the reality is that different industrial sectors continue to be managed by different government agencies utilizing different policy instruments (Kennett, 2002). If there is any unifying feature among these agencies it is a common mandate for economic growth (e.g., ARD, 2001: 43). In spite of provincial commitments to maintain forest integrity (e.g., AEP, 1998a), environmental protection continues to be handled through piecemeal regulations focussed on mitigating the local short-term effects of individual industrial activities. Strategies for achieving long-term ecological objectives at the regional scale, including limits on cumulative industrial impacts, have yet to be implemented.

In the absence of an integrated planning framework, the activities of resource companies operating on the same land base are largely additive. In addition, fire continues

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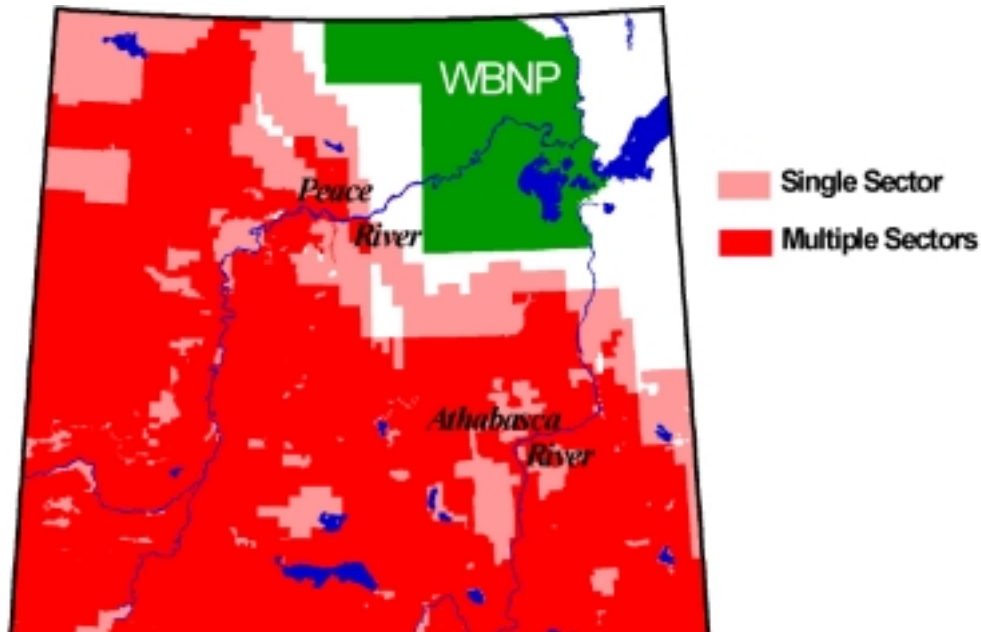


Fig. 5.1. Area of northern Alberta subject to overlapping industrial activities. Sectors include agriculture (White Zone), forestry (FMA boundaries), and petroleum (extent of deposits). (Map: Forest Watch Alberta)

to be a significant source of disturbance, in spite of the efforts of the Forest Protection Branch (see Chapter 6).

Although the forest has a natural tendency to regenerate after being disturbed, the rate of regeneration varies widely, depending on the type of disturbance. For example, regeneration after fire and clearcutting is usually well advanced within 10 years. Other disturbances such as cutblock landings (where trees are stored prior to hauling) and seismic lines may take decades to regenerate (Osko and MacFarlane, 2001). Roads, well sites, and pipelines represent long-term deletions from the forest.

The lag in regeneration following many types of industrial disturbance has already resulted in observable changes to the structure of the forest,

relative to its natural state (AEP, 1998b). The amount of additional change that will occur in the future will depend on the interplay between the rate of new disturbance and the rate of regeneration. Given the current high rates of disturbance over most of the north, and observed lags in regeneration, it appears certain that profound changes in forest structure will continue to occur unless changes are made to the way the forest is managed.

A new integrated resource management initiative began in 1999 (AE, 2000) that could address many of the issues outlined here. The process is still in its formative stage, so it is too early to determine the eventual outcome. But one thing is clear — to succeed, the new process must be fundamentally different from the various proc-

esses that preceded it. Earlier integrated resource management initiatives had the following deficiencies (Kennett, 2002):

- vague short-term objectives emphasizing multiple use instead of a long-term vision for the entire forest that includes clear ecological objectives;
- failure to accept that the forest has finite limits that are now being reached, and that thresholds on cumulative industrial impacts need to be instituted;
- reliance on the existing organizational and policy framework instead of undertaking structural reform designed to provide the basis for truly integrated forest management;
- failure to entrench the integrated management process in law and provide it with sufficient power to overcome sectoral resistance;
- failure to establish direct links between planning and decision-making (e.g., for dispositions, project review, and regulatory decisions);
- rigid policy of honouring existing commitments instead of seeking innovative solutions for progress;
- failure to incorporate meaningful public input and public values into the planning process; and
- insufficient application of political commitment and will to ensure success.

The Future Forest

To illustrate the future state of the forest under current management policies I present here a case study involving the FMA of Alberta-Pacific Forest Industries (Al-Pac). The data are from a recent

cumulative impacts study conducted by Schneider et al. (2002) using a computer model called *ALCES*[®] (Alberta Landscape Cumulative Effects Simulator). *ALCES* was developed over a period of seven years by Dr. Brad Stelfox for the purpose of tracking cumulative changes in forest structure arising from human and natural disturbances under alternative management scenarios.

Study Area

The study area was the Al-Pac FMA, encompassing 59,054 km² in northeast Alberta (Fig. 5.2). The area has minimal topographic relief, with the exception of a few scattered hill systems. Most of the area is within the Central Mixedwood Natural Subregion, with some representation of the Boreal Highlands Natural Subregion (AEP, 1994a).

The study area contains 23,842 km² of potentially merchantable forest and is underlain by extensive oil and gas deposits. The oil deposits

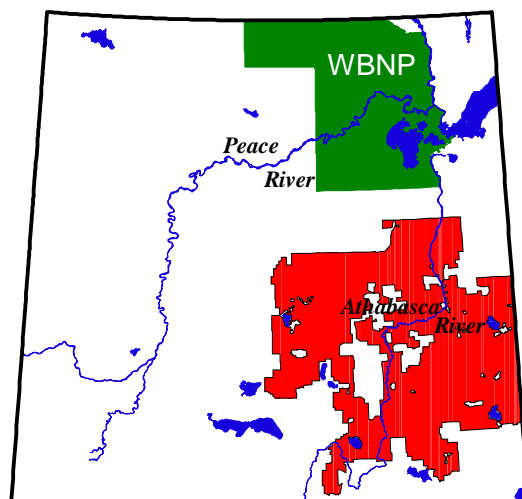


Fig. 5.2. Location of the Al-Pac FMA (in red).

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include conventional liquid oil, heavy oil (low viscosity), and oil sands (a mixture of sand and semi-solid oil). In an area of approximately 37 townships the oil sands are sufficiently close to the surface to be extracted using surface mines. The remaining deeper oil sands deposits must be extracted through special well systems that utilize steam to heat the oil and mobilize it.

Industrial activity within the study area was minimal in the first half of the 20th century (Weatherell and Kmet, 2000), but expanded rapidly thereafter. Small-scale forestry operations producing dimensional lumber and conventional oil and gas operations were active first. In 1967 the first full-scale commercial oil sands mine went into operation, ushering in a period of rapid growth of the petroleum sector. In 1990 the Al-Pac Forest Management Agreement was signed, and the company's \$1.3 billion pulp mill went into operation in 1993. The forestry sector currently clears a total of 16,000 ha/year on the study area, compared with 11,000 ha/year for the petroleum sector (Pope, 2001).

GIS map overlays provided by Al-Pac were used to quantify the industrial footprint existing in the study area in 2002 (Table 5.1). Included in the industrial footprint were all areas of the forest land base currently in a non-forest state as a result of industrial activity. Forestry cutblocks were not included in the tally because they are immediately regenerated to forest; however, in-block haul roads and landings (which experience delayed regeneration) were included. These data were used to define the initial state of the forest for the *ALCES* model runs.

The ALCES Model

ALCES was developed for the purpose of tracking industrial footprints and ecological processes

under alternative management scenarios. To facilitate scenario analysis the model provides results within minutes, even for very large landscapes (such as our 59,000 km² study area). As input, the user must specify the initial state of the landscape and provide quantitative assumptions concerning future industrial activities, natural disturbances, and rate of regeneration for each disturbance type. Given this information the model tracks and updates the state of the landscape in one-year time steps for as long as requested.

When only forest harvesting and regeneration are activated, the model is functionally equivalent to the non-spatial timber supply models used by forestry companies for long-term harvest planning (Forestry Corporation, 2002). The major

Table 5.1. Area of the Al-Pac FMA in a non-forest state in 2002 resulting from industrial disturbance.

Type of disturbance	Area (ha)
Seismic lines	41,082
Pipelines	22,258
Roads (minor)	20,000
Pasture grass	19,992
Well sites	15,516
Roads (major)	11,606
Roads (well site)	7,346
Oilsand surface mine	5,829
Recreation areas	3,100
In-block losses	2,800
Towns	2,460
Misc. agriculture	1,809
Coal	1,947
Transmission lines	1,000
Peat mine	234
Miscellaneous	130
Total disturbed area	155,162

advance of *ALCES* is that the user can include a variety of additional natural and human-origin disturbances in model runs. The suite of available ecological output measures is also far greater than what is typically included in timber supply models.

In operation, the model continuously tracks the quantity of various landscape features (e.g., roads, wells). However, because the model is designed to operate rapidly, it does not track the spatial location of these features. For example, the model knows how many seismic lines there are within the study area, but it does not know where they are. To address this spatial limitation, *ALCES* permits users to stratify the landscape into subunits that are tracked independently. For example, the forest land base can be stratified by stand type, and different harvest and regeneration strategies can be applied to each stratum.

For some types of industrial activity new disturbances may overlap existing features. For example, new seismic programs are sometimes conducted along existing seismic lines that have not yet regenerated. Such an activity does not increase the total industrial footprint (though it does affect the state of regeneration). Because *ALCES* is not fully spatial it cannot directly account for the overlap of individual features. Instead, the user must specify the average proportion of new disturbances that overlap existing features. Changing the proportion of overlap of features between model runs may be an important component of a scenario comparison.

Modelling Assumptions

The analysis presented here is intended to illustrate the future state of the forest under current management policies and conventional operating practices. The disturbance types were limited to

forest harvesting, petroleum exploration and development, road construction, and fire. The model was run for 100 years into the future.

Forest harvesting protocols were matched to conventional practices in use in Alberta, as described in Chapter 3. The basic approach was a two-pass clearcut system with a target harvest age of 70 years for hardwoods and 100 years for softwoods. Stands older than the target harvest age were cut first, while they remained on the landscape. Regeneration systems and stand growth and yield curves were also matched to current industry norms. In-block haul roads and landings (which experience delayed regeneration) were assumed to occupy 5% of each cutblock.

The future trajectory of petroleum industry activities was based on the assumption that drilling would continue at the current rate (Fig. 5.3)

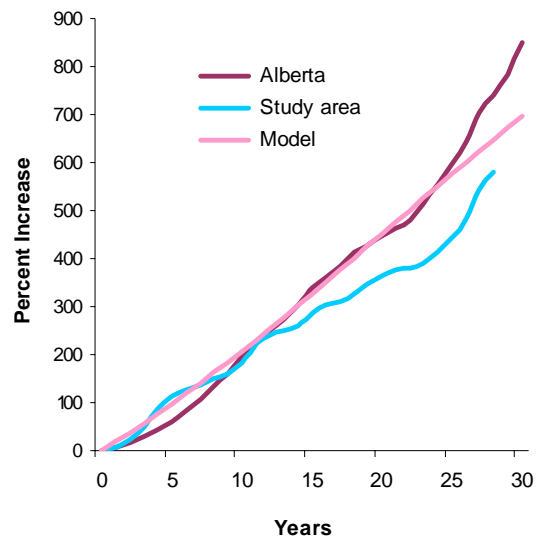


Fig. 5.3. Cumulative number of wells in the study area and Alberta, 1970-1999. Superimposed are the cumulative number of wells in the first 30 years of the model run. Data are expressed as the annual percent increase relative to year 0, to facilitate direct comparison.

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until reserves are depleted (Fig. 5.4). Only 1% of the 315 billion barrels of potentially recoverable oil sands reserves have been recovered to date; therefore, oil sands reserves will last well into the next century (AEUB, 2001:2). Separate trajectories for conventional oil, gas, and oil sands were used in the model (Fig. 5.5).

Historical trend data on the rate of seismic line development were incomplete for the study area. However, from Al-Pac's GIS dataset we determined that an average of 3 km of seismic lines are generated for each well drilled and this relationship was used in the model runs. Similarly, we used a ratio of 0.1 km pipeline for each well drilled. Other petroleum sector variables are listed in Table 5.2.

Based on Al-Pac's road development plan, together with anticipated road construction associated with energy sector development, we estimated that 75 km/year of major roads would be

built over the next 50 years. At that point the major road network in the study area would be relatively complete. The construction of in-block haul roads and well site access roads was linked to the rate of harvesting and drilling, respectively.

Over the past two decades fire has burned an average of 0.65% of northern Alberta per year (excluding water bodies), and the rate appears to be trending upwards (see Chapter 6). Estimates of long-term rates of burn, based on mathematical analysis of forest age structure and fire history data, range from 0.4% per year (Cumming, 1997) to 2.2% per year (Murphy, 1985). Balancing these various sources of information we selected a burn rate of 1% per year for the model runs. Instead of varying the area burned from year to year we utilized a constant burn rate, so as to simplify comparison between alternative management scenarios. Fire salvage logging was not included in the model.

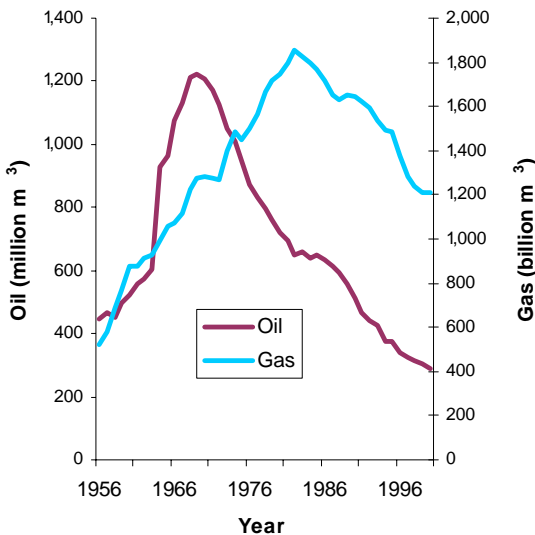


Fig. 5.4. Conventional oil and gas reserves in Alberta, 1956-2000. Source: AEUB, 2001 and earlier AEUB reports.

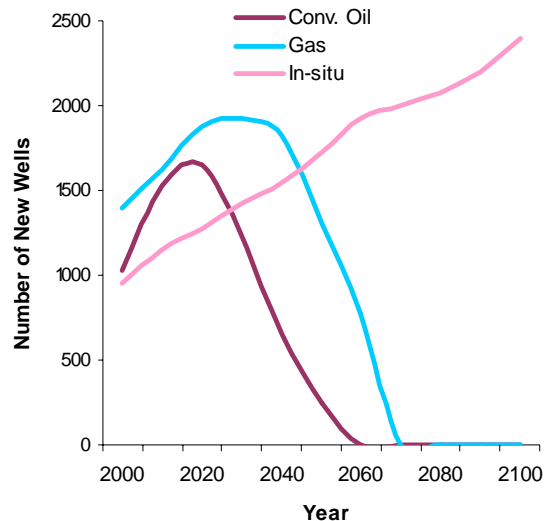


Fig. 5.5. Annual number of new wells used in the simulation, by product type.

Table 5.2. Description of current practices simulated in the model.

Variable	Simulated Practice
Harvest of hardwoods	Oldest first; minimum harvest age = 70 years.
Harvest of softwoods	Oldest first; minimum harvest age = 100 years.
Cutblock size	All cutblocks = 21-40 ha in size
In-block losses	5%
Road harmonization between the petroleum sector and forestry sector	10% sharing of new roads
Width of seismic lines	5 m
Reforestation of seismic lines	25 year lag (seeded to grass)
Spatial overlap of new seismic lines with existing linear disturbances	10%
Spatial overlap of new pipelines with existing linear disturbances	10%
Number of wells per drill pad	1
Reforestation of well sites after decommissioning	25 year lag (seeded to grass)

Model Results

Until about 1950, our study area could be characterized as boreal wilderness (Wetherell and Kmet, 2000). By 2000 it had undergone a profound transformation, as a consequence of accelerating industrial development (AEP, 1998b). However, this transformation pales in comparison to the changes we predict are yet to occur in coming decades unless changes are made to the current regulatory framework and operating practices.

According to our model there will be a progressive reduction in the forest land base, the remaining forest will become progressively younger and more fragmented, and there will be a marked increase in human access. The cumulative industrial footprint, in terms of landscape fragmentation by linear features and total area disturbed, will quadruple over the next 20-30 years, and then moderate (Fig. 5.6). The total length of

roads (after accounting for the reclamation of in-block haul roads) will rise from 17,764 km today to 162,000 km over the next 50 years (Fig. 5.6).

Because these predictions are for the most part based on a simple projection of current trends, they are relatively robust. Indeed, localized examples of development at the high intensities predicted by the model already exist in Alberta in areas where industry is mature (Fig. 5.7). Moreover, more than \$50 billion dollars in new petroleum developments in northern Alberta have already been announced (ARD, 2001: 15). In cases where accurate estimates of model parameters were unavailable, conservative estimates were used so that the results would not be construed as a worst-case scenario.

The increase in fragmentation is primarily attributable to industrial features that persist on the

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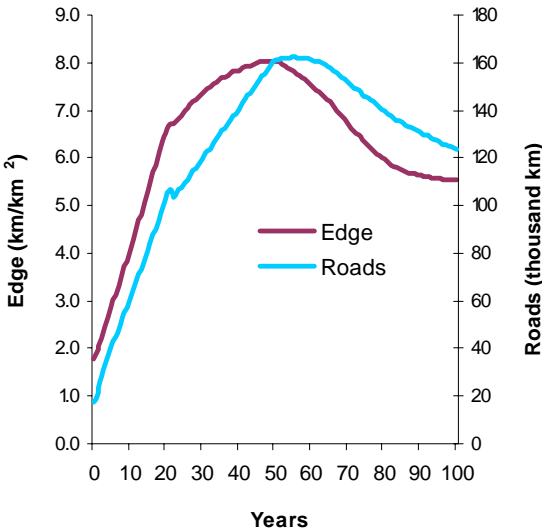


Fig. 5.6. Projected density of disturbance edge and length of roads in the AI-Pac FMA over the next 100 years.

landscape, leading to cumulative impacts far in excess of the annual rate of disturbance. Most prominent among these features are seismic lines, because they are generated at a high rate and require decades to regenerate under current practices (Revel, 1984; Osko and MacFarlane, 2001). Roads, well sites, pipelines, and in-block losses associated with harvesting are also important contributors to landscape fragmentation.

Given that conventional oil and gas reserves are already in a state of decline in Alberta (AEUB, 2001), the predicted rapid expansion in the industrial footprint over the next two decades is somewhat counterintuitive. However, the annual rate of production in the near term is primarily limited by economic factors and industry capacity, not the size of reserves. Provincial government policy is focussed on maximizing short-term eco-

1949

1964

Fig. 5.7a. Aerial photo time series illustrating cumulative industrial impacts in the Swan Hills (Twp. 63, Rge. 11, W5th). The dimensions of the figure are approximately 7 km by 7 km. The first photograph, taken in 1949, shows the area while still pristine. By 1964, oil wells (white squares) and access roads (white lines) had permeated the area. (Photos: Air Photo Services, Alberta Sustainable Resource Development)



1991

Fig. 5.7b. Aerial photograph of the same area as Fig. 5.7a (yellow square), and the surrounding landscape in 1991. By 1991 additional road development and petroleum activity had occurred, and the first pass of logging (large grey polygons) had taken place. The once thriving grizzly bear population in the Swan Hills had by this time been reduced to a few remnant animals. The scale is similar to the previous photographs, (Photo: Air Photo Services)

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conomic returns from the remaining reserves, and the royalty system has been structured to ensure this occurs (Macnab et al., 1999). Petroleum companies share the desire to develop rapidly because there exists a risk that alternative forms of energy may reduce demand for petroleum in the future, and because oil that is extracted provides cash for investment, whereas oil in the ground does not. In consequence, the conventional oil and gas sector is poised to undergo a pronounced “boom and bust” cycle over the next 20-30 years, ending when reserves are depleted. The exception to this pattern is the development of oil sands deposits, which are sufficiently large to last well into the next century (AEUB, 2001).

Another structural change to the forest predicted by our model is the elimination of old-growth from the study area. Old-growth stands of softwoods (> 140 years) were lost within 20 years, and old-growth stands of hardwoods (> 100

years) within 65 years (Fig. 5.8). This result is the direct manifestation of current forestry practices in which oldest stands are logged first (AEP, 1994b: sec 2.2.1). Although forest clearing by the petroleum industry and fire do not target older stands specifically, they do remove some old growth by chance and hence increase the rate at which old-growth is lost.

Through our model runs, it also became evident that not even the timber supply was sustainable under the current system of management. A shortfall in timber will begin to be experienced by softwood operators in approximately 60 years (Fig. 5.9). In areas of the province where the forest industry is more mature this shortfall will occur even sooner and may also affect deciduous operators. Because mills have substantial fixed costs, running below full capacity translates into reduced economic return, and in some cases may result in mill closure. A further consequence is

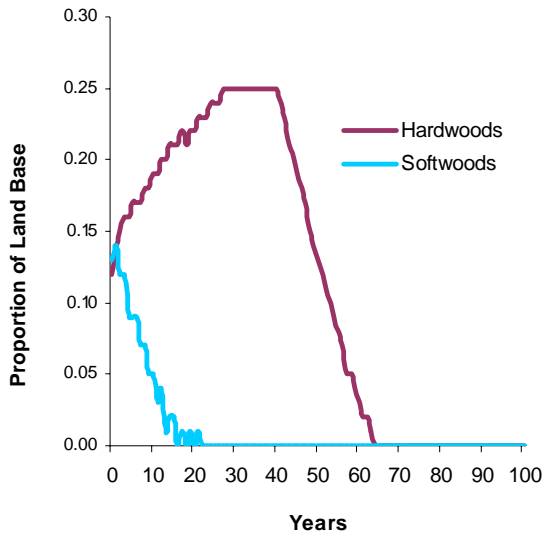


Fig. 5.8. Proportion of the study area in old-growth, projected over the next 100 years.

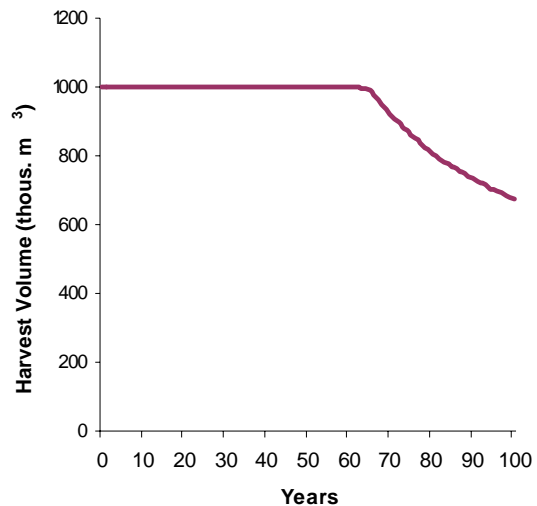


Fig. 5.9. Projected softwood harvest volume in the study area over the next 100 years.

that companies may abandon ecological management in favour of intensive forest management.

The timber shortfall occurs because annual harvest rates are currently set by the maximum rate of tree growth without accounting for losses from fire and the activities of the petroleum sector (AEP, 1996). Salvage logging cannot fully compensate for these external losses because more than half of the area of merchantable forest lost to fire and the petroleum sector is too young, too damaged, or too inaccessible to be used (Al-Pac, unpub. data). Moreover, as time passes and the forest becomes progressively younger, less and less wood lost to external causes is suitable for salvage and all sources of disturbance effectively become additive.

Field Studies

According to the *ALCES* model, the basic structure of the forest will undergo a dramatic transformation in coming decades. But how will this affect forest wildlife? To answer this question a variety of field studies have been undertaken in Alberta over the past few years.

The most compelling data, with respect to cumulative industrial impacts in an Alberta context, have been generated by the Adaptive Management Experiment Team, based at the University of Alberta (www.ameteam.ca). In 2001 this research group initiated a two-year study to examine the relationship between the abundance of selected wildlife species and total industrial footprint, at the township scale. In this study a series of townships that differed in the level of industrial use was selected within and around the Al-Pac FMA. Townships with little forest cover (e.g., containing large peat complexes) were excluded from the study. Within the selected townships field crews conducted systematic surveys of bird

populations (by listening for songs during the spring breeding season) and selected mammal populations (by conducting track counts during the winter). In total, 43 townships were sampled in the bird surveys and 70 townships were sampled in the mammal surveys.

Although the collection of data is still ongoing, and statistical analysis has not yet been completed, preliminary results from the initial year of study already demonstrate some clear trends. In the mammal survey, increasing industrial footprint was associated with a decline in the abundance of fishers (Boutin and Moses, unpub. data) (Fig. 5.10). Similar trends were evident in several of the resident and migratory bird species surveyed (Schmiegelow and Cumming, unpub. data) (Fig. 5.11). It is likely that even more marked declines in abundance would have been observed in the highly impacted sites had there not been a

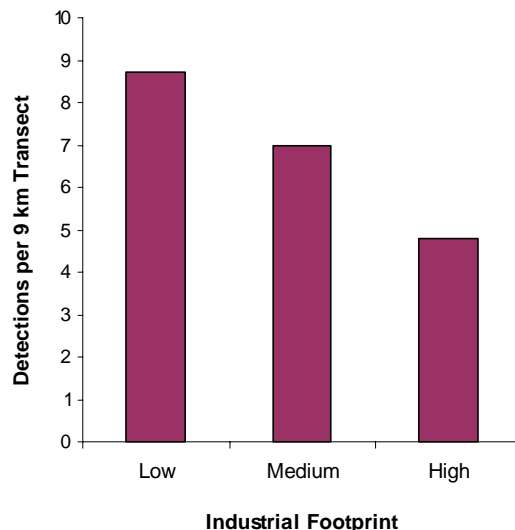
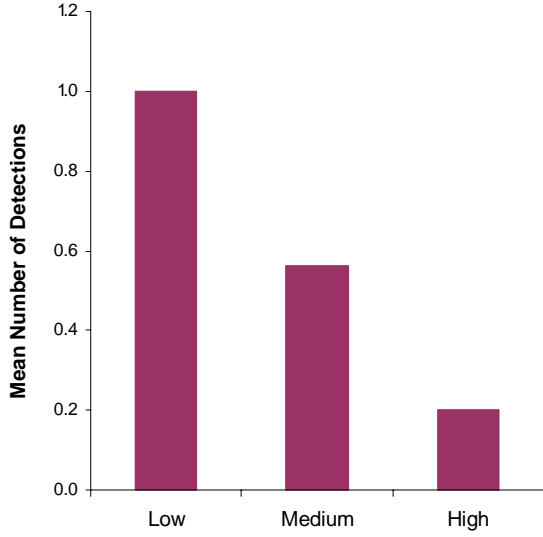
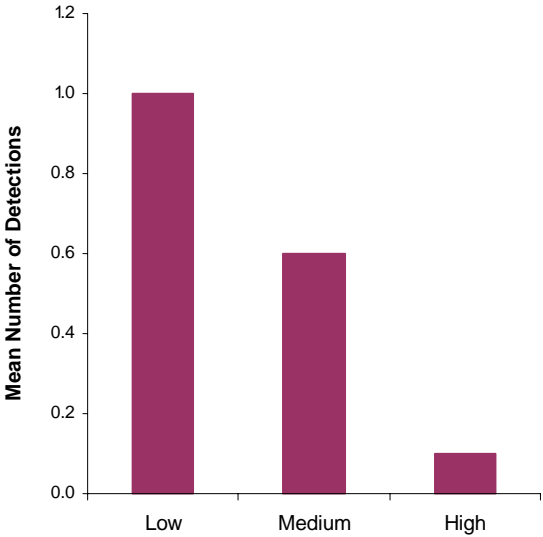


Fig. 5.10. Abundance of fishers in the Al-Pac FMA relative to the intensity of industrial footprint. Source: Boutin and Moses, unpub. data.

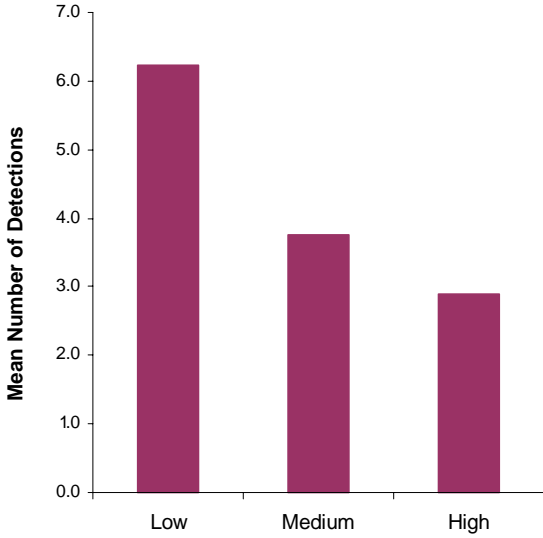
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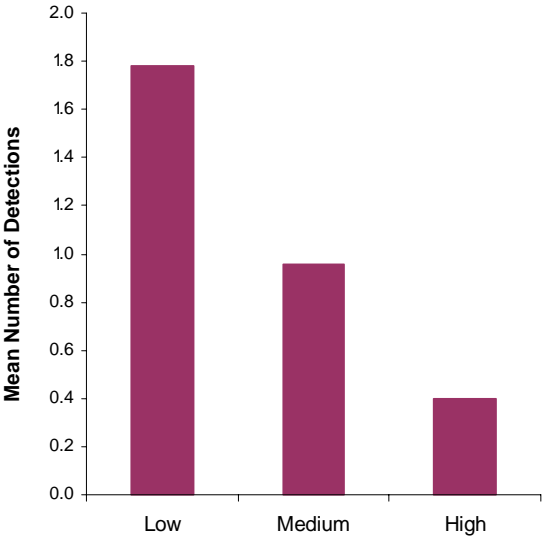
Brown creeper



Rose-breasted grosbeak



Red-breasted nuthatch



Yellow-bellied sapsucker

Fig. 5.11. Abundance of four species of birds in the AI-Pac FMA relative to the intensity of industrial footprint (low, medium, and high). Source: Schmiegelow and Cumming, unpub. data.

surrounding matrix of intact forest, providing a source of dispersing individuals (Donovan et al., 1995).

Seminal research on the ecological effects of industrial activity in Alberta's boreal forest has also been conducted by the Boreal Caribou Research Program (www.deer.rr.ualberta.ca/caribou/bcrp.htm). More than ten years of data from radio-collared caribou from across northern Alberta have now been collected through this program. These data were recently summarized in a provincial status report on woodland caribou (Dzus, 2001: 14, 30), which concluded:

The current distribution, intensity, amount, and type of human activity on and near caribou range is compromising the integrity of caribou habitat. Analyses for six study areas in northern Alberta suggest that caribou populations in most boreal ranges are declining.

There appear to be several causes for the observed decline in caribou populations. Forest harvesting in or near caribou range results in abundant growth of new vegetation that tends to stimulate moose populations. Increased abundance of moose can in turn increase the presence of wolves, leading to higher mortality of caribou (James, 1999). Increased mortality of caribou may also occur through poaching and native hunting, as a consequence of increased access via roads and seismic lines (Dzus, 2001: 23). Finally, studies of radio-collared caribou have shown that caribou avoid industrial features, implying an effective loss of habitat that is much greater than the local area of disturbance (Dyer et al., 2001). The distance of avoidance ranges from 250 m for seismic lines to 1000 m for well sites. Additional studies have determined that the density of lin-

ear features in northern Alberta is already so high that 48% of the core caribou ranges are (on average) within the avoidance zone (Dzus, 2001: 25). Simulations using the *ALCES* model predict that habitat availability will continue to decline in the future (Fig. 5.12). Consequently, unless fundamental changes are made to the way industrial activities are managed, the extinction of woodland caribou from Alberta appears inevitable.

As a final note, the fact that extinctions have not yet been observed in Alberta's boreal forest is no cause for complacency. Extensive industrialization of northern Alberta is too recent a phenomenon for extinctions to have occurred. But one need only look to Europe, where industrial forestry has been practiced for an extended period, to gain insight into the long-term consequences of conventional industrial forestry. In Europe, declines and extinctions of bird and in-

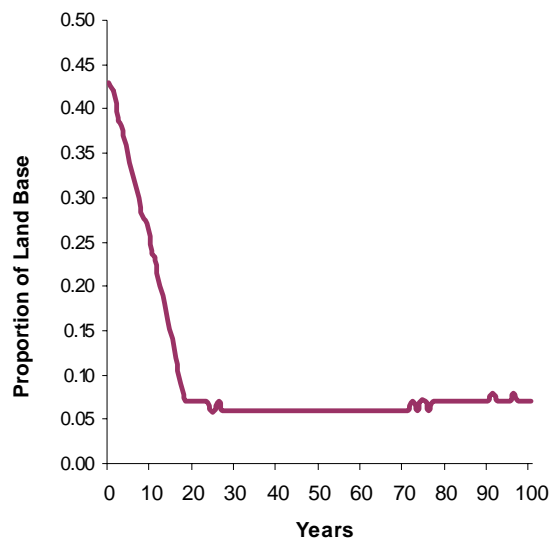


Fig. 5.12. Availability of caribou habitat on the AI-Pac FMA over the next 100 years, predicted by *ALCES* simulations.

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sect species have both been documented and correlated to the intensity of industrialization (Siitonen and Martikainen, 1994; Angelstam et al., 1997; Mikusinski and Angelstam, 1998; Niemela, 1999). It has also been demonstrated that because of the progressive loss of old-growth forest, birds that require old-growth habitat are being concentrated in protected areas (Virkkala et al., 1994).

Summary of Part I

The Alberta Forest Conservation Strategy (AFCS) serves as an unassailable guide to the vision and goals held by Albertans regarding public forests. In spite of the fact that the government, forest industry, and petroleum industry were all signatories to the AFCS, the evidence I have presented here and in previous chapters suggests that the current system of forest management in Alberta is fundamentally inconsistent with the *Strategy*. The specific deficiencies of the current system are summarized below, using the Principles of the AFCS (AFCSSC, 1997: 4) as a framework.

Principle 1. Ecological Sustainability: *The forests of Alberta will be appreciated as ecosystems and our activities managed in ways that conserve ecological integrity, biological diversity, long-term forest productivity and the forest landbase.*

Deficiencies:

1. The rate of harvest by the forestry sector is too high. Annual allowable cut levels continue to be based on maximizing the flow of timber, not the capacity of the forest to absorb disturbance. Furthermore, the growth curves used in the calculations appear to be overly optimistic, and the additive effects of fire and clearing by the petroleum industry are not accounted for.
2. Harvest planning by the forestry sector does not incorporate meaningful ecological objectives (though two or three companies have made a start). Consequently, the basic structure of the forest is being transformed. Most significantly, old-growth stands are being eliminated from the landscape, as are mixedwood stands. The size of forest stands is declining and becoming more uniform, and natural patterns in the spatial distribution of patches are being altered.
3. Harvest practices by the forestry sector are still largely based on a simple multi-pass clearcut system (though a few companies are beginning to implement modifications). Clearcuts leave little structural legacy in the regenerating forest, which is detrimental to species adapted to natural disturbances that do provide such a legacy.
4. Regeneration of softwood stands continues to be based on plantation techniques, including invasive soil preparation, planting of genetically selected stock, and the use of herbicides to control competing vegetation. This form of regeneration presents another form of structural simplification of the forest, with negative implications for the conservation of biodiversity.
5. Effective controls on the landscape-level impacts of the petroleum sector are lacking. In contrast to the forestry sector, there are no annual limits on the rate of forest clearing by the petroleum sector, no cap on the cumulative intensity of activity in any given area, and no requirement for reforestation. The result has been and continues to be a

- cumulative loss of forest and a dramatic increase in fragmentation and human access — all of which threaten the integrity of the forest and the associated biota.
6. The operating practices of the petroleum sector also have detrimental effects at the local level. Oil sands developments, including both mines and in-situ projects, have the greatest impact. In addition to the direct loss of forest, the most notable concerns include pollution of the soil, water, and air, erosion of soil, damage to aquatic systems, direct disturbance of wildlife, and reduction in supplies of fresh water.
 7. Road construction continues at a rapid pace throughout the north, and there is no limit on the maximum road density in any given area. Roads are associated with a wide variety of negative ecological effects, including direct and indirect loss of habitat, fragmentation of habitat, disruption of water and fish movements, erosion of soil, changes in animal movement patterns, and increased access by humans (resulting in increased hunting, poaching, and road-kills).
 8. A workable framework for integrated resource management is still lacking in the province. Under the current system, tenure rights are provided to multiple operators on the same land base and the management of these operators involves multiple governmental agencies with differing policy mandates. Because of the lack of an integrated planning framework, resource companies generally conduct their planning and operations independently. This situation makes it all but impossible to achieve landscape-level objectives and instead results in ecological impacts that are largely additive.
 9. There has been no acceptance on the part of the government or industry that the forest has finite ability to meet the demands being placed on it. Forestry allocations and petroleum developments continue to be approved in the absence of defined limits on cumulative industrial impacts.
 10. Minimal resources are being directed toward maintaining the viability of rare and endangered species. The few recovery plans in existence are largely comprised of measures that mitigate the most egregious industrial practices but do not go far enough to ensure the long-term viability of affected populations.
 11. The evidence suggests that the political will to implement the AFCS is lacking, despite various policy statements affirming the government's commitment to sustainable forestry. The government's failure to define and champion meaningful and measurable ecological objectives means that management decisions at all levels continue to promote resource extraction over ecological concerns.
- Principle 2. Economic Sustainability:** *Human activities on forested lands in Alberta will be managed in ways that will provide sustained and enhanced, economic and other benefits for Albertans well into the future.*
- Deficiencies:
1. Current rates of harvest are not sustainable. Because losses to fire and the petroleum sector are not accounted for, and because

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growth assumptions are overly optimistic, there will be a decline in the timber supply in coming decades. This implies a loss of employment in the forestry sector (in addition to on-going losses from technological advancement).

2. As old-growth stands are liquidated the size of trees on the landscape will become progressively smaller. This will negatively affect mills that require large trees to produce dimensional lumber.
3. Current forestry practices are incompatible with the requirements of new forest certifications schemes (e.g., FSC, 2002). This means that forestry companies in Alberta may face restricted access to markets in the future if the current practices are maintained.
4. Petroleum royalties per barrel of oil equivalent are low in Alberta relative to other jurisdictions. This implies that Albertans are not receiving their full share of economic benefits from this resource. Furthermore, the unprecedented rate of development brought on by the low royalties is causing a great deal of environmental damage.
5. In addition to the ecological costs associated with the activities of the petroleum sector, there are also substantial unnecessary financial costs. These costs include timber damage fees paid to forestry companies, excessive road construction costs due to lack of coordinated planning, and foregone carbon credits.

Principle 3. Precautionary Principle: *Caution will be exercised when the consequences of actions in the forest are uncertain. Where there is a threat*

of serious or irreversible damage to any forest ecosystem, lack of full scientific certainty will not be used as a reason for failing to implement appropriate ecological measures to avert the threatened damage.

Deficiencies:

1. The precautionary principle has yet to be incorporated into the decision-making process. First, no systematic effort been made to identify threats and uncertainties or to develop appropriate responses to such threats. Second, despite the deficiencies listed under Principle 1 there has been no substantive change in the basic approach to forest management in Alberta and no reduction in the rate of industrial development.
2. The system of protected areas in Alberta, vital to the management of risk from industrial development, remains incomplete. The existing system lacks adequate representation of all ecoregions (and representation of merchantable forest in general), individual sites are generally too small to maintain ecological processes and integrity, the total area of protection is insufficient, and buffers and connectivity corridors are lacking.

Principle 4. Adaptive Management: *Forest managers will employ the adaptive management approach in managing the forests of Alberta. This approach will be based on the best-available scientific information, ongoing research, and routine monitoring of all activities carried out in the forest to continuously improve our management techniques as we learn from experience and adapt to evolving conditions and demands.*

Deficiencies:

1. Although the term adaptive management is now commonly used, it would be difficult to find examples of the formal implementation of this approach in Alberta.
2. Key obstacles to the implementation of adaptive management are the absence of a comprehensive system for monitoring forest structure and biodiversity (though a provincial biomonitoring system is now being developed) and the lack of capacity for threat assessment and prediction.
3. The availability of ecological benchmark areas, providing a “control” or reference for industrial “experiments”, is inadequate because the system of protected areas is incomplete.

Principle 5. Accountability: *Individuals, companies and governments, as forest users and as consumers of forest products, have a duty to minimize the adverse effects of their actions upon the forest. They will be accountable and responsible for all of their actions and decisions which affect the forest.*

Deficiencies:

1. The *Forests Act* is devoid of direct reference to forest management, except for a simple directive regarding sustained-yield. As a consequence, forest management in Alberta is governed almost exclusively through policy, not law. This means that major forest management decisions are neither subject to legislative scrutiny nor open to legal recourse. Moreover, the government cannot be held legally accountable for its failure to implement its own policies pertaining to forest sustainability.

2. Collectively, resource companies are profoundly transforming the structure of the forest and threatening its integrity, yet there exists no effective mechanism for holding companies accountable for their cumulative impacts on the forest.

Principle 6. Decision-making: *All Albertans will have the opportunity to contribute in meaningful ways to decisions that are important to them. Decisions affecting the forest will consider the entire spectrum of interests in a fair and open manner.*

Deficiencies:

1. Through consultative processes such as the AFCS, it has been firmly established that the public demands a balance between resource extraction and forest conservation. However, operational decision-making by the government continues to be focussed on maximizing short-term economic gains through resource extraction. This indicates that meaningful public input has yet to become a reality in Alberta.
2. Consultative processes are becoming increasingly regionalized. This effectively increases the voice of local economic interests while reducing or excluding the voice of urban Albertans (that generally place a priority on forest conservation). Furthermore, there are no independent organizations with the mandate and resources to provide scientific and technical support to these consultative processes.
3. Forest allocations continue to be made through closed-door negotiations involving government and industry (e.g., the recent Grande Alberta Paper negotiations). Not

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only is the public excluded from these negotiations, but information on the negotiations can only be obtained through appeals to the Freedom of Information Process.

4. In contrast to many other jurisdictions, Alberta continues to be a very difficult place for the public to obtain baseline data on the forest and information on industrial activities.

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Part II

New Ideas