Appendix 6: Compilation of Wildlife Modeling Summaries

Included in this appendix are a series of summaries highlighting ecological characteristics and modeling results of the effects of forest management on species identified by Alberta Sustainable Resource Development (January 2006.)

The following species were all modeled using various model platforms. "ALCES" was utilized for Woodland Caribou, Moose, Goshawk and Barred Owl. Species specific HSI models were prepared for the neo-tropical migratory songbirds and the Canadian Toad.

Identified Species:

Canadian Toad
Goshawk
Woodland Caribou
Moose
Warblers
Brown Creeper
Barred Owl

Species: Canadian Toad

The Canadian toad (*Bufo hemiophrys*) is widely distributed from the Northwest Territories southeast to the Dakotas in the USA. The Canadian toad is provincially listed as a 'May be at Risk' species in Alberta (ASRD 2005[1]), but is listed as 'Not at Risk' across its range in Canada (COSEWIC 2006[2]) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005[3])..

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> *"Once common in boreal and parkland habitats. Dramatic declines in population and distribution, but population monitoring ongoing. Habitat threatened by drought, conversion, agricultural chemicals, and oil and gas activities."*

Habitat Preferences

The Canadian toad is associated with large water bodies in the spring breeding season, but is largely terrestrial the remainder of the year. After the breeding season, habitat selection, behaviour and activity of Canadian toads is poorly known. It is believed that habitat selection between breeding and over-wintering is driven by access to, and availability of prey. However, habitat selection during this period may also be to the result of a requirement for cover, both for thermoregulation and concealment from predators. Graminoid and forb percent cover tended to be higher in areas where toads were found when compared to random locations in the same habitat type; however, this trend was not significant (Golder 2005).

Over wintering habitat is likely the most limiting feature of their annual habitat use patterns; Canadian toad are poor burrowers (Hamilton et al. 1998) and as such coarse-textured, well drained soils are likely the only suitable over-wintering habitat for toads (Garcia et al. 2004). The distance of over-wintering sites from the breeding pond varies from 75 m to over a kilometre away (Garcia et al. 2004, Breckenridge and Tester 1961).

Modeling Approach and Results

A regional Canadian toad Habitat Suitability Index (HSI) model developed for the Cumulative Environmental Management Association (CEMA) for the Regional Municipality of Wood Buffalo (RMWB) was used to assess the effects of forest succession and forest harvesting on Canadian toad habitat supply within ALPAC's FMA area. As the Golder (2006) Canadian toad model had been developed for the CEMA

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[1] *The General Status of Alberta Wild Species 2005* report is available on the website of Alberta Sustainable Resource Development at http://srd.alberta.ca/fishwildlife/wildspecies/

[2] http://www.cosewic.gc.ca/eng/sct1/index_e.cfm

[3] Canadian Endangered Species Conservation Council (CESCC). 2006. Wild Species 2005: The General Status of Species in Canada. http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e

study area, only that portion of the RM of Wood Buffalo that overlaps with the Al-Pac FMA area was used as the study area for this evaluation.

Forest succession and harvest information was provided to Golder from Al-Pac based on timber supply model runs for the following temporal horizons:

- current (0 years)
- 10 years into the future;
- 50 years into the future;
- 100 years into the future; and
- 200 years into the future.

The resultant spatial data from each of these temporal model runs were provided to Golder in AVI format. The Canadian toad model was run separately on each of these temporal databases to determine the effects of forest harvesting and forest succession on Canadian toad habitat supply.

The equation for the regional HSI model values incorporates over-wintering habitat, breeding habitat (hydrology) and vegetation forage/cover value and is derived as follows:

HSI value = [(SI[1]) (0.5)] + [(SI[2]) (0.25] + [(SI[3]) (0.25)]
where SI (1) = over-wintering habitat
SI (2) = breeding habitat
SI (3) = forage/cover habitat

This is a weighted value, where soil is weighted twice as heavy as the breeding and forage/cover habitat as suitable over-wintering habitat is more limiting in the landscape than breeding habitat. For details on the HSI model see Golder Associates Ltd. (2006).

Results and Management Implications

Results showed that Canadian toad habitat supply changed by 0.1% of the ALPAC FMA area, however, the change did not result in any net loss of Canadian toad habitat. These results suggest that forest succession, forest harvesting, and the influences of harvesting on forest succession have a minimal effect on Canadian toad habitat supply. After 200 years of changes in forest succession due to age and harvesting, the modeled area is more favourable for Canadian toads than under current conditions as there is less Moderate-Low quality habitat and more Moderate quality and Moderate-High quality habitat.

For a listing of literature cited and the full report by Golder Associates Ltd. (2006) please contact Al-Pac.

Species: Northern Goshawk

The Northern Goshawk *(Accipiter gentiles)* is widely distributed from. The Goshawk is provincially listed as a 'May be at Risk' species in Alberta (ASRD 2005), but is listed as 'Not at Risk' across its range in Canada (COSEWIC 2006) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> *"Logging, industrial development, and human encroachment on nesting habitat may reduce populations in the boreal forest. Maintenance of mature forest breeding habitat needs to be incorporated into forest planning on both public and private lands. "*

Habitat Preferences

Habitat associations for Goshawk in northeastern Alberta are very limited; as such, habitat preferences stated here are derived from descriptions provided in the literature. Goshawk are forest-dwelling raptors that have the ability to utilize a wide variety of forest ages, structural conditions and successional stages during most of the year (Higgelke et al. 2000). Requirements during the nestings season are more restrictive with important components including deciduous-dominated stands, large trees (with forked structure) and canopy closure of at least 40% but preferably > 80% (Higgelke et al 2000).

Modeling Approach and Results

Evaluating the effects of forestry on goshawk habitat was conducted using the goshawk habitat suitability index (HSI) model in ALCES II (Forem Technologies 2006). ALCES II was calibrated for the Al-Pac FMA with AVI and landuse data updated to 2005 (M. Smith, pers. Comm.). A variety of landscape types in ALCES II were weighted highly for goshawk; those with a value > 0.7 include hardwood forests, mixedwood forests, mesic softwood forests and riparian forests. Seral stage (0.7) and anthropogenic edge (0.3) were the selected habitat element weightings. Forests $\leq$ 40 years were assigned a zero value for seral stage quality; forests 40-60 years were given a seral stage weighting of 0.5; and forests > 60 years were given high seral stage weightings (> 0.8). As the purpose of this modeling exercise was to evaluate the effects of forestry only on habitat suitability the linear buffer switch in ALCES II was turned off. The range of natural variability (RNV) was created by selecting the ALCES control switch for Landscape initialization and Landuse Trajectories to "Presettlement Landscape for RNV No Landuse" and conducting 10 monte carlo simulations (400 years each).

Results and Management Implications

Goshawks utilize a variety of mesic mature to older seral stage forests. From a strict habitat supply perspective, the results of ALCES II modeling for the effects of 'forestry only' showed that goshawk habitat remained within the Natural Range of Variability for the full 200 year modeling horizon. Al-Pac's old forest management strategy will assist in maintaining habitat supply for northern goshawk. Habitat fragmentation associated with cumulative effects of forestry and energy sector activity may compromise goshawk habitat in boreal Alberta. The effects of different types of linear features on goshawk nesting ecology in northeastern Alberta remains to be documented.

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Species: Woodland Caribou

Woodland caribou (*Rangifer tarandus caribou*) are sparsely, but widely distributed from Newfoundland through the boreal forests of central Canada to the mountainous regions of BC, Yukon and Alaska. The woodland caribou is provincially listed as an 'At Risk' species in Alberta (ASRD 2005), and the boreal population is listed as 'Threatened' in Canada (COSEWIC 2006) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> *"Most populations declining, with some at immediate risk of extirpation. Primary threat is increased predation by wolves in response to human activity. Maintenance of old-growth forest habitat is critical. Designated as "Threatened" under the Wildlife Act."*

Habitat Preferences

Alberta's boreal ecotype caribou are typically found in peatland (muskeg) complexes dominated by black spruce and larch (tamarack) (Anderson 1999, Bradshaw et al. 1995, Edmonds and Bloomfield 1984, Fuller and Keith 1981, Hornbeck and Moyles 1995). Caribou movements in northeastern Alberta were shown to be constrained (98.6% of locations) by the boundaries of peatland complexes (Stuart-Smith et al. 1997). This pattern of lowland habitat use, in combination with varying use of lichen-rich stands of jack pine (*Pinus banksiana*) or lodgepole pine (*P. contorta*) are common to caribou in non-mountainous areas. Recent work in north-central Alberta has shown that even in areas where small peatlands are interspersed in an upland matrix, caribou select treed bogs and fens (see review by Dzus 2001). Upland stands of trembling aspen, white spruce, paper birch and balsam fir are seldom used or are avoided. Boreal ecotype caribou inhabiting forests of northern Alberta make extensive movements throughout the year (Hornbeck and Moyles 1995, Stuart-Smith et al. 1997) but most do not make predictable migrations and therefore habitat use does not differ on a seasonal basis.

Research in northeastern Alberta has demonstrated reduced habitat use in areas adjacent to various industrial infrastructure (Dyer et al. 2001, 2002). Such reductions in habitat quality/effectiveness were accounted for in the modeling exercise (see below).

Modeling Approach and Results

Evaluating the effects of forestry on caribou habitat was conducted using the caribou sub-model in ALCES II (Forem Technologies 2006). ALCES II was calibrated for the Al-Pac FMA with AVI and landuse data updated to 2005 (M. Smith, pers. Comm.). Three landscape types in ALCES II were weighted highly for caribou, including hygric softwood, fen/bog, and moss/lichen. Linear buffers were set to 250m. The Boreal Caribou Research Program equation was used with the following constants: a) coefficient for Fire Origin % less than 50% = 0.212 (note: fire switch was turned off for these analyses); b) coefficient for zone of influence = -0.258 and BCRP constant = 1.14. The range of natural variability (RNV) was created by selecting the ALCES control switch for Landscape initialization and Landuse Trajectories to "Presettlement Landscape for RNV No Landuse" and conducting 10 monte carlo simulations (400 years each).

Results and Management Implications

Caribou on the Al-Pac FMA area prefer primarily peatland habitat, while forest management activity occurs on upland locations. From a strict habitat supply perspective, the results of ALCES II modeling for the effects of 'forestry only' showed that caribou habitat remained within the Natural Range of Variability for the full 200 year modeling horizon. While habitat supply relative to forestry activities is not a significant factor influencing caribou populations, there are management considerations worth noting.

While habitat supply does not seem to be altered by forestry activities alone; cumulative industrial effects, and perhaps changes associated with climate change, are creating direct and indirect effects on caribou. Predator-prey dynamics are changing in and near caribou range; white-tailed deer abundance has increased and their distribution has expanded northward into caribou range in the past decade. These probable increases in prey biomass have likely lead to increases in predator density (e.g., wolves, coyotes) and possibly facilitated predation through expanded territories (onto caribou range) and via use of linear features as travel corridors. Concomitant with these changes in predator/prey dynamics are negative population trends for woodland caribou on most ranges in Alberta. In addition to Al-Pac's caribou conservation strategy (available on request); Al-Pac continues to participate with the Alberta Caribou Committee in an effort to advise the government on land use strategies that will evaluate tradeoffs inherent in efforts to integrate caribou conservation and human land use activities.

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Species: Moose

Moose (*Alces alces*) are widely distributed across Canada from coast to coast and also occupy most of Alaska and several northern states south of the 49th parallel (Karns 1997). Moose are listed as a 'Secure' species in Alberta (ASRD 2005) and Canada (CESCC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> "No excerpt available on ASRD 2005"

Habitat Preferences

Moose successfully occupy a large variety of habitats across Alberta (from the prairies to the boreal forest) and North America (see review by Peek 1997). Abundant forage found in post fire or post timber harvest areas make these young seral stage forests preferred habitat for moose for up to several decades after disturbance. Wetland habitat, including forested wetlands, is also an important habitat type for moose. Reduction in structural diversity in mature forests makes this suite of age classes the least attractive to moose; as old mixedwood forests begin to breakup creating more shrub growth than in mature stands moose habitat quality again increases (Stelfox 1995).

Modeling Approach and Results

Evaluating the effects of forestry on moose habitat was conducted using the moose habitat suitability index model in ALCES II (Forem Technologies 2006). The model was calibrated for the Al-Pac FMA with AVI and landuse data updated to 2005 (M. Smith, pers. Comm.). A wide variety of landscape types in ALCES II were weighted highly for moose; those with a value > 0.7 include Low and Tall Shrub, Mixedwood forests, Riparian forests and Hardwood forests. Seral stage (0.4) and shrub density (0.6) were the selected habitat element weightings. Forests < 40 years and > 180 years were given high seral stage weightings. As the purpose of this modeling exercise was to evaluate the effects of forestry only on habitat suitability the linear buffer switch in ALCES II was turned off. The range of natural variability (RNV) was created by selecting the ALCES control switch for Landscape initialization and Landuse Trajectories to "Presettlement Landscape for RNV No Landuse" and conducting 10 monte carlo simulations (400 years each).

Results and Management Implications

Moose prefer young seral stage forests and forestry activity, like fire, creates such habitat. Thus from a strict habitat supply perspective, the results of ALCES II modeling for the effects of 'forestry only' showed that moose habitat remained within the Natural Range of Variability for the full 200 year modeling horizon. While habitat supply relative to forestry activities does not seem to be a significant factor influencing moose populations, there are management considerations worth noting.

Facilitation of access for hunters, and potentially natural predators, is a potentially important management consideration in forest with ongoing forest management activities. Moose are an important source of meat and cultural identity for aboriginal and licensed hunters. Linear corridors created by industrial activity (roads, seismic lines, pipelines, etc.) potentially provide access for hunting of wildlife species such as moose. Rempel et al. (1997) demonstrated the differentiating factor access has on moose populations; areas disturbed by fire or harvest, but without roads showed moose population increases, while areas with open road access showed moose population declines. Thus while habitat quality did not change relative to NRV in the ALCES modeling runs, managers should be cognizant of the fact that access management is an important management lever relative to moose population dynamics. In northeastern Alberta, addressing access associated with the cumulative effects of industrial activity (forestry, energy sector, human development, etc.) needs to be a component of wildlife management.

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Species: Canada Warbler

The Canada Warbler (*Wilsonia canadensis*) is widely distributed from across the boreal forest from Alberta to the Maritimes. The Canada Warbler is provincially listed as a 'Sensitive' species in Alberta (ASRD 2005) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005), but has not yet been assessed by the Committee on the Status of Endangered Wildlife in Canada across its range in Canada (COSEWIC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> *"Population in Alberta estimated at 2 000-10 000 individuals. Species has declined throughout entire Alberta range since 1966. May be vulnerable to habitat loss or deterioration by various forecast land uses. "*

Habitat Preferences

Species level models described by Vernier et al. (2006) were developed using the full set of spatially referenced point count data collected on and near the Al-Pac FMA in 2001 and 2002 as part of the Remote Areas Project (e.g., Schmiegelow and Cumming 2004).

Vernier et al. (2006) report CAWA to be associated with tall deciduous-dominated forests. Interestingly, at the neighborhood level (78 ha annulus), the only significant variable was a negative relationship with the proportion of black spruce.

Modeling Approach

Habitat associations established by Vernier et al. (2006) were subsequently assigned to spatial harvest outputs generated by Al-Pac at 10, 50, 100 and 200 years beyond baseline in the year 2000. Spatial representation of habitat suitability was depicted in the form of predicted probability of occurrence maps (3 ha pixel). These maps were based on logistic regression equations for each bird species as a function of local (3 hectare) and neighborhood (78 hectare) habitat covariates. Maps were restricted to the merchantable mesic forest landbase as Vernier et al. (2006) had insufficient data to accurately model habitat associations on pine, black spruce or wetland sites. The current modeling approach does not compare simulation results to a range of natural variability (RNV); an analysis of RNV was beyond the scope of the existing analysis. See Vernier et al. (2006) for a detailed description of the modeling approach.

Five forest management units (FMU's A14, L1, L2, L11 and S11) were selected to represent North/South and East/West gradients.

Results and Management Implications

For CAWA, Vernier et al. (2006) show a sharp increase in habitat supply in the first decade in four of five FMU's examined; this increase coincides with aging of currently mature forest cohorts in deciduous forests on the FMA area. Habitat supply for CAWA at years 50, 100 and 200 declines relative to year 10 and but remained above baseline levels for the duration of the model runs in 4 of 5 FMU's. A14 was the exception, where supply of suitable habitat remained relatively constant.

Management recommendations from Vernier et al. (2006) target maintenance of a supply of tall, pure deciduous stands, arrayed in large blocks of mesic forest at least 100 ha in size, containing little or no black spruce or non-forested habitat.

For a listing of literature cited and the full report by Vernier et al. (2006), please contact Al-Pac.

Literature Cited

ASRD (Alberta Sustainable Resource Development) 2005. *The General Status of Alberta Wild Species 2005* report is available at http://srd.alberta.ca/fishwildlife/wildspecies/

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Species: Bay-breasted Warbler

The Bay-breasted Warbler (*Dendroica castanea*) is widely distributed across Canada's boreal forest with the bulk of the breeding population east of Ontario. The Bay-breasted Warbler (BBWA) is provincially listed as a 'Sensitive' species in Alberta (ASRD 2005), and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005), but has not yet been assessed by the Committee on the Status of Endangered Wildlife in Canada across its range in Canada (COSEWIC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> "*Dependent on old-growth forest. Forest management plans need to ensure retention of breeding habitat."*

Habitat Preferences

Species level models described by Vernier et al. (2006) were developed using the full set of spatially referenced point count data collected on and near the Al-Pac FMA in 2001 and 2002 as part of the Remote Areas Project (e.g., Schmiegelow and Cumming 2004).

Vernier et al. (2006) report BBWA to be a species preferring taller (i.e., older), mixedwood stands that have conifer (primarily white spruce) as the leading trees. The CMWA also exhibited a strong negative association with recently (<30 year) harvested areas. BBWA appear to become more common from south to north on the Al-Pac FMA area.

Modeling Approach

Habitat associations established by Vernier et al. (2006) were subsequently assigned to spatial harvest outputs generated by Al-Pac at 10, 50, 100 and 200 years beyond baseline in the year 2000. Spatial representation of habitat suitability was depicted in the form of predicted probability of occurrence maps (3 ha pixel). These maps were based on logistic regression equations for each bird species as a function of local (3 hectare) and neighborhood (78 hectare) habitat covariates. Maps were restricted to the merchantable mesic forest landbase as Vernier et al. (2006) had insufficient data to accurately model habitat associations on pine, black spruce or wetland sites. The current modeling approach does not compare simulation results to a range of natural variability (RNV); an analysis of RNV was beyond the scope of the existing analysis. See Vernier et al. (2006) for a detailed description of the modeling approach.

Five forest management units (FMU's A14, L1, L2, L11 and S11) were selected to represent North/South and East/West gradients.

Results and Management Implications

Based on the association of BBWA with older coniferous mixedwood forests and their negative association with recently harvested areas, good habitat for CMWA is forecast to become scarcer and more fragmented over the 200 year planning horizon. As RNV was not calculated in this evaluation, it is unsure if the projected declines in suitable habitat would fall in or out of the RNV. Another important consideration is that there is no spatial control in the selection of harvest polygons beyond year 50; as the amount of recent harvest (< 30 years) in the '78 ha neighborhood' is important spatial configuration of old mesic forest is important for BBWA.

The modeling conducted by Vernier et al supports two important management considerations. (2006):

1. Managing the amount AND distribution of old conifer mixedwood forest will be an important consideration to maintain suitable habitat for species like the CMWA. Integrating mixedwood management strategies with spatial old forest retention strategies are recommended for maintaining these old conifer-leading mixedwood stands.
2. Aggregated harvest strategies, as proposed in the 2006 FMP are a more suitable forest management strategy for following the natural disturbance model than the two-pass harvest strategy employed in the earlier Al-Pac FMP. Vernier et al. (2006) recommend maintaining 'large contiguous patches of post-rotation age white spruce dominated forest at least 100ha in size and buffered so far as possible from any adjacent disturbances'.

There appears to be an unexplained latitudinal gradient on the FMA area, with BBWA and CMWA being detected more frequently as one moves North. The forest companies may wish to consider conifer-leading mixedwood management strategies more closely in the northern FMU's. For a listing of literature cited and the full report by Vernier et al. (2006), please contact Al-Pac.

Literature Cited

ASRD (Alberta Sustainable Resource Development) 2005. *The General Status of Alberta Wild Species 2005* report is available at http://srd.alberta.ca/fishwildlife/wildspecies/

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Species: Cape May Warbler

The Cape May Warbler (*Dendroica tigrina*) is widely distributed across the boreal forest from Alberta to the Maritimes. The Cape May Warbler (CMWA) is provincially listed as a 'sensitive' species in Alberta (ASRD 2005), and as 'Secure' in Canada by the Canadian Endangered Species Conservation Council (CESCC 2005). The CMWA has not yet been assessed by the Committee on the Status of Endangered Wildlife in Canada across its range in Canada (COSEWIC 2006).

Habitat Preferences

Species level models described by Vernier et al. (2006) were developed using the full set of spatially referenced point count data collected on and near the Al-Pac FMA in 2001 and 2002 as part of the Remote Areas Project (e.g., Schmiegelow and Cumming 2004).

Vernier et al. (2006) report CMWA to be a conifer-associated species preferring taller (i.e., older) trees and is negatively associated with deciduous-leading forests. Their results are consistent with other reports that characterize CMWA as a species associated with mature white spruce forests. The CMWA also exhibited a negative association with recently (<30 year) harvested areas.

Modeling Approach

Habitat associations established by Vernier et al. (2006) were subsequently assigned to spatial harvest outputs generated by Al-Pac at 10, 50, 100 and 200 years beyond baseline in the year 2000. Spatial representation of habitat suitability was depicted in the form of predicted probability of occurrence maps (3 ha pixel). These maps were based on logistic regression equations for each bird species as a function of local (3 hectare) and neighborhood (78 hectare) habitat covariates. Maps were restricted to the merchantable mesic forest landbase as Vernier et al. (2006) had insufficient data to accurately model habitat associations on pine, black spruce or wetland sites. The current modeling approach does not compare simulation results to a range of natural variability (RNV); an analysis of RNV was beyond the scope of the existing analysis. See Vernier et al. (2006) for a detailed description of the modeling approach.

Five forest management units (FMU's A14, L1, L2, L11 and S11) were selected to represent North/South and East/West gradients.

Results and Management Implications

Based on the association of CMWA with older coniferous (primarily white spruce) forests and their negative association with recently harvested areas, good habitat for CMWA is forecast to become scarcer and more fragmented over the 200 year planning horizon. As RNV was not calculated in this evaluation, it is unsure if the projected declines in suitable habitat would fall in or out of the RNV. Another important consideration is that there is no spatial control in the selection of harvest polygons

beyond year 50; as the amount of recent harvest (< 30 years) in the '78 ha neighborhood' is important spatial configuration of old mesic forest is important for CMWA.

The modeling conducted by Vernier et al. (2006) supports two important management considerations:

3. Managing the amount AND distribution of old conifer forest will be an important consideration to maintain suitable habitat for species like the CMWA.
4. Aggregated harvest strategies, as proposed in the 2006 FMP are a more suitable forest management strategy for following the natural disturbance model than the two-pass harvest strategy employed in the earlier Al-Pac FMP. Vernier et al. (2006) recommend maintaining 'large contiguous patches of post-rotation age white spruce dominated forest at least 100ha in size and buffered so far as possible from any adjacent disturbances'.

There appears to be an unexplained latitudinal gradient on the FMA area, with Bay-breasted Warbler (BBWA) and CMWA being detected more frequently as one moves North. The forest companies may wish to consider conifer-leading mixedwood management strategies more closely in the northern FMU's.

For a listing of literature cited and the full report by Vernier et al.(2006), please contact Al-Pac.

Literature Cited

ASRD (Alberta Sustainable Resource Development) 2005. *The General Status of Alberta Wild Species 2005* report is available at http://srd.alberta.ca/fishwildlife/wildspecies/

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Species: Black-throated Green Warbler

The Black-throated Green Warbler (*Dendroica virens*) is widely distributed across the boreal forest from Alberta to the Maritimes. The Black-throated Green Warbler (BTGW) is provincially listed as a 'Species of Special Concern*'* in Alberta (ASRD 2005) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005), but has not yet been assessed by the Committee on the Status of Endangered Wildlife in Canada across its range in Canada (COSEWIC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> *"Over 10 000 individuals in the province. Designated a "Species of Special Concern" in Alberta. Habitat loss and fragmentation resulting from industrial development threaten this old-growth dependent species. "*

Habitat Preferences

Species level models described by Vernier et al. (2006) were developed using the full set of spatially referenced point count data collected on and near the Al-Pac FMA in 2001 and 2002 as part of the Remote Areas Project (e.g., Schmiegelow and Cumming 2004).

Vernier et al. (2006) report BGNW to be a deciduous-leading mixedwood species preferring taller (i.e., older) trees. At the locial (patch) level, Vernier et al (2006) report optimum conifer composition to be 45%. Generally their results are consistent with other reports for northeastern Alberta, though the percent conifer was higher than reported by Hannah 2006).

Modeling Approach

Habitat associations established by Vernier et al. (2006) were subsequently assigned to spatial harvest outputs generated by Al-Pac at 10, 50, 100 and 200 years beyond baseline in the year 2000. Spatial representation of habitat suitability was depicted in the form of predicted probability of occurrence maps (3 ha pixel). These maps were based on logistic regression equations for each bird species as a function of local (3 hectare) and neighborhood (78 hectare) habitat covariates. Maps were restricted to the merchantable mesic forest landbase as Vernier et al. (2006) had insufficient data to accurately model habitat associations on pine, black spruce or wetland sites. The current modeling approach does not compare simulation results to a range of natural variability (RNV); an analysis of RNV was beyond the scope of the existing analysis. See Vernier et al. (2006) for a detailed description of the modeling approach.

Five forest management units (FMU's A14, L1, L2, L11 and S11) were selected to represent North/South and East/West gradients.

Results and Management Implications

For BGNW, Vernier et al. (2006) show an increase in habitat supply in the first decade in four of five FMU's examined; this increase coincides with aging of currently mature forest cohorts in deciduous forests on the FMA area. Habitat supply for BGNW at years 50, 100 and 200 declines relative to year 10 and levels to similar levels as year 0 in the two of three FMU's (L1 & L11) for which spatial timber supply results are available. In A14 BGNW habitat supply declines from year 0 to 100 then stabilizes.

The modeling conducted by Vernier et al (2006) supports two important management considerations:

5. Managing the amount AND distribution of old conifer mixedwood forest will be an important consideration to maintain suitable habitat for species like the CMWA. Integrating mixedwood management strategies with spatial old forest retention strategies are recommended for maintaining these old conifer-leading mixedwood stands.
6. The proportion of old mesic forest at the neighborhood level was important for BGNW. As such landscape level management is an important consideration for BGNW habitat supply. Aggregated harvest strategies, as proposed in the 2006 FMP are a more suitable forest management strategy for following the natural disturbance model than the two-pass harvest strategy employed in the earlier Al-Pac FMP. Vernier et al. (2006) recommend maintaining 'large contiguous patches of post-rotation age mesic forest at least 100ha in size.

As BGNW detections decreased with increasing latitude, forest managers may wish to focus efforts for maintaining deciduous-leading mixedwoods in the southern half of the FMA area.

For a listing of literature cited and the full report by Vernier et al. (2006), please contact Al-Pac.

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Species: Brown Creeper

The Brown Creeper (*Certhia americana*) is year round resident in Alberta and is widely across Canada. The Brown Creeper (BRCR) is provincially listed as a 'Sensitive' species in Alberta (ASRD 2005) and as 'Secure' by the Canadian Endangered Species Conservation Council (CESCC 2005), but has not yet been assessed by the Committee on the Status of Endangered Wildlife in Canada across its range in Canada (COSEWIC 2006).

Background excerpt from The General Status of Alberta Wild Species (ASRD 2005)

> "*A mature forest-dependent species that is vulnerable to forest fragmentation, and certain forest management practices.*"

Habitat Preferences

Species level models described by Vernier et al. (2006) were developed using the full set of spatially referenced point count data collected on and near the Al-Pac FMA in 2001 and 2002 as part of the Remote Areas Project (e.g., Schmiegelow and Cumming 2004).

Vernier et al. (2006) report BRCR to be associated at the neighborhood scale (78 ha annulus) with mosaics of old leading conifer mesic forest or black spruce. They were not able to discern habitat selection between old deciduous, old white spruce or black spruce. No local (3 ha) habitat attributes entered the BRCR models.

Modeling Approach

Habitat associations established by Vernier et al. (2006) were subsequently assigned to spatial harvest outputs generated by Al-Pac at 10, 50, 100 and 200 years beyond baseline in the year 2000. Spatial representation of habitat suitability was depicted in the form of predicted probability of occurrence maps (3 ha pixel). These maps were based on logistic regression equations for each bird species as a function of local (3 hectare) and neighborhood (78 hectare) habitat covariates. Maps were restricted to the merchantable mesic forest landbase as Vernier et al. (2006) had insufficient data to accurately model habitat associations on pine, black spruce or wetland sites. The current modeling approach does not compare simulation results to a range of natural variability (RNV); an analysis of RNV was beyond the scope of the existing analysis. See Vernier et al. (2006) for a detailed description of the modeling approach.

Five forest management units (FMU's A14, L1, L2, L11 and S11) were selected to represent North/South and East/West gradients.

Results and Management Implications

For BRCR, model predictions by Vernier et al. (2006) show increased habitat supply in FMU's A14 and L11, with modest declines elsewhere.

However, based on poor model fit and inconsistent results Vernier et al (20006) did not consider it possible to make specific management recommendations for BCRC based on the current model.

For a listing of literature cited and the full report by Vernier et al (2006), please contact Al-Pac.

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ASRD (Alberta Sustainable Resource Development) 2005. *The General Status of Alberta Wild Species 2005* report is available at http://srd.alberta.ca/fishwildlife/wildspecies/

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Species: Barred Owl

In Alberta, the Barred Owl range includes the boreal forest, foothill and Rocky Mountain natural regions. Sightings of this owl in Alberta have been made throughout the forested areas in the north-central regions. The total range extends west of the Rockies through northern Canada and south to the United States. Alberta's Endangered Species Conservation Committee (ESCC) identified the barred owl as a Species of Special Concern—a species that without human intervention may soon become threatened with extinction.

Habitat Preferences and Modeling Approach

The barred owl inhabits swamps and dense forest but hunts in neighbouring open country.

To assess the response of barred owl habitat to forestry in the Al-Pac FMA area, the ALCES land use simulation model was used in combination with a barred owl habitat selection model. The habitat model was based on telemetry locations from 15 radio-collared barred owls tracked on an 800 km^2 area in the FMA area near Calling Lake between 1994 and 1998 (Olsen et al. 2006). Habitat selection was assessed by Olsen et al. (2006) at three spatial scales: nest site (0.16 ha), nesting territory (314 ha area surrounding nest sites), and home range (2000 ha). The habitat model at the home range scale was used in the scenario analysis because it is based on habitat use at the landscape scale rather than only considering nesting requirements. As such, the home range habitat model should better reflect the full range of habitats required by barred owl.

To represent barred owl habitat selection, Olsen et al. (2006) derived a resource selection function (RSF) based on habitat use vs. availability, as assessed from landcover at telemetry locations (i.e., roosting and feeding sites) compared to random points from each home range. Landcover was based on the Alberta Vegetation Inventory. Landcover types used in the analysis were: old (>80 years) deciduous forest, old (>80 years) coniferous forest, young deciduous forest, young coniferous forest, pine forest, treed bog, wetland, open water, anthropogenic, recent (<30 years) cut blocks, and cut blocks of unknown origin (>30 years).

To incorporate the RSF in ALCES, the five forest types (hardwood, mixedwood, mesic softwood (white spruce and jack pine), hygric softwood (black spruce), and riparian) and 20-year age classes tracked by the Al-Pac ALCES model had to be summarized to link with the more general forest types from Olsen et al.'s (2006) RSF. The assumed associations between ALCES forest types and RSF forest types are presented in Table 1. The initial area of cut blocks aged 0-30 years (CUT1) was estimated using information on the historical rate of harvest in the FMA area.

Deciduous cut blocks were assumed to cover 76,057 ha, the area of hardwood forest harvested between 1993 (the first year of hardwood harvest in the region) and 2004 (to be consistent with other species models in the 2006 Forest Management Plan submission[4]).

The 76,057 ha of hardwood harvest was distributed between hardwood and deciduous-leading mixedwood forest based on the relative abundance of the forest types in the FMA area. Softwood harvest area data were not readily available for the FMA, but was approximated to equal 3,000 ha per year over the past 30 years (Dave Cheyne(Al-Pac) pers. comm.) for a total estimate of 90,000 ha within the CUT1 cover type. As with hardwood harvest, the initial softwood CUT1 area was distributed across softwood forest types (mesic softwood, hygric softwood, and coniferous-leading mixedwood) according to the relative abundance of the forest types in the FMA area. New code was added to ALCES to track the age of cut blocks through time for the purpose of tracking the area within the CUT1 cover type.

Results and Management Implications

The 200-year forestry scenario was intended to represent the planned forestry activities for the region as per the 2007 Forest Management Plan (FMP) and Timber Supply Analysis (TSA). All other landuses (energy, settlements, agriculture) were turned off, as was natural disturbance.

Despite limitations of the Resource Suitability Function (RSF) applied in this study, it represents the best barred owl habitat model available for the study area of interest. Perhaps the most important insight provided by the RSF is that barred owls are likely to require a landscape offering both young and older forest to meet foraging, nesting, and breeding requirements (Olsen et al. 2006). Although planned forestry activity in the FMA area will affect the region's forest composition, the simulation suggests that forestry alone should not cause a large sustained regional decline in younger or older forest. As a result, barred owl habitat is also not projected to experience a large regional decline (See attached Figure 1). However, the persistent departure of barred owl habitat from RNV during the simulation suggests that effort is warranted to identify strategies for minimizing the impact of forestry on barred owl habitat in the FMA area. Given the uncertainty associated with the RSF model, an appropriate first step is improving understanding of barred owl habitat relationships in the region.

[4] Al-Pac harvest area data were provided by Dave Cheyne as excel file "FMA Area Harvest – Ha".

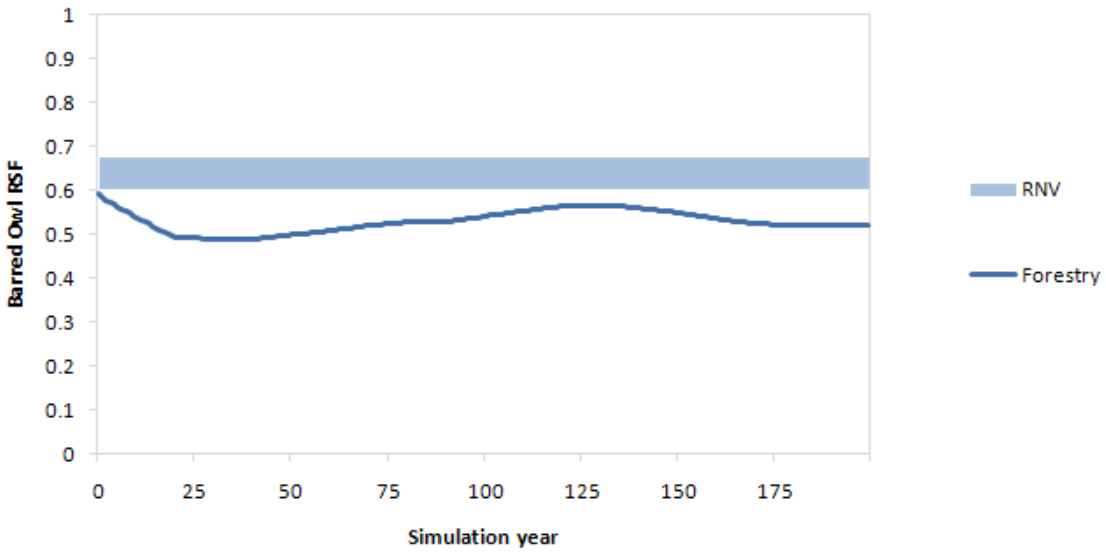

Figure 1. Response of barred owl resource selection function (RSF) to simulated future forestry activity in the Al-Pac FMA area. An estimate of the RSF's range of natural variation (RNV) is included to aid interpretation.

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