BAP REPORT #2:
THE SPECIES SELECTION PROCEDURE

Prepared for Millar Western Forest Products'
Biodiversity Assessment Project

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2.1 INTRODUCTION

BAP is comprised of both coarse-filter and fine-filter biodiversity assessment models (see BAP Report #1: The Biodiversity Assessment Project, Duinker *et al*. 2000). The coarse-filter analyses assess bioindicators intended to predict the quality of the FMA area as habitat for a wide range of wildlife species. Coarse-filter bioindicators evaluate changes in ecosystem diversity and landscape configuration over time and with disturbance. Conversely, the fine-filter analyses make use of species-based habitat supply models (HSMs) that estimate the value of the FMA area as habitat for a group of selected species. When used together, the coarse- and fine-filter models can assist forest managers in determining the potential long-term effects of alternative management strategies on forest biodiversity and help to set priorities for research and monitoring to reduce the uncertainty associated with biodiversity conservation.

2.2 THE SPECIES SELECTION PROCESS

Development of the Selection Process

In developing and testing models for species-based habitat supply analysis, it was understood that the species selected would comprise an imperfect representation of the large array of species that occupy the forests under consideration. The selection process was based on the following premises:

- It is not possible to create models for each and every wildlife species that occupies the FMA area.
- The coarse-filter approach can account for habitat requisites needed to maintain viable population sizes of most forest-dwelling species.
- Models created for a carefully selected list of species will adequately represent the habitat needs of many other wildlife species.

In support of these premises, we chose to select only terrestrial vertebrates for modelling purposes. This decision was made for several reasons:

- Terrestrial vertebrates use a large range of forest features and are therefore good indicators of change in forest structure and landscape configuration.
- In general, the public is concerned about the welfare of vertebrate species in managed forests. Some vertebrate species also have economic importance.
- Approaches for analysing forests in terms of vertebrate habitat potential are relatively well developed.

To begin the HSM development process, it was necessary for the BAP team to devise a system by which species could be selected for fine-filter analysis. The following steps were taken to lead us toward species selection:

- List the terrestrial vertebrate species using the forests of the FMA area as habitat;
- Choose and weight a set of selection criteria;
- Rank the species according to the selection criteria;
- Select the species using a hierarchical approach;
- Propose the draft list and seek comments from reviewers;
- Revise the list according to the comments; and
- Produce the final list of species.

Terrestrial Vertebrates Using the Forests of the FMA Area

First, we compiled a preliminary list of terrestrial vertebrate species present within the FMA area that are expected to be adversely affected by forest management practices: Moose, White-tailed Deer, Mule Deer, Marten, Pileated Woodpecker, Barred Owl, Ovenbird, and American Redstart. Arlen Todd, wildlife biologist with the Alberta Fish and Wildlife Service, proposed that the Northern Flying Squirrel, Southern Red-Backed Vole, Mink, Saw-whet Owl, Boreal Owl, Ruffed Grouse, Three-toed Woodpecker, Northern Flicker and/or Mountain Bluebird, Common Yellowthroat, Least Flycatcher, and Clay-coloured Sparrow be added to this preliminary list. In addition, the BAP team consulted several Alberta wildlife atlases and the lists of vertebrate species provided by Daishowa-Marubeni and Weldwood to identify other species of west-central Alberta that should be entered into the selection process. From this, another 56 species were added to the list and the species selection process began with a total of 76 species (Table 2.1).

Criteria for Species Selection

Each of the 76 species listed in Table 2.1 was given a ranking that indicated its potential as a bioindicator of habitat supply within Millar Western's FMA area using a set of nine criteria covering a range of biological and socio-economic values. A weight was assigned to each criterion based on its perceived importance to forest management in Alberta. A description of the criteria and weighting scheme used in the selection process is shown in Table 2.2 and described in more detail below.

Description of the Criteria Used for Species Selection

Sensitivity to disturbance

As stated by Wakelin (1996) and in the latest draft of the Woodlands Long Term Forest Management Strategy, Millar Western is interested in implementing an enhanced timber harvesting system (referred to in BAP Report #1: The Biodiversity Assessment Project, Duinker *et al.* 2000). By this new system, the Company may elect to use a number of silvicultural practices that differ from their traditional methods:

- Salvage thinning of mature stands;
- Spacing and pre-commercial thinning of young stands;
- Final felling at a younger age;
- Harvesting by cut-to-length instead of tree length method;
- Commercial thinning;
- Increasing the density of seedlings in plantations;
- Tending and controlling competition to future crop trees; and
- Selective harvesting in riparian zones.

Table 2.1. List of species entered into the species selection process.

Species	
American Crow	Mule Deer
American Redstart	Northern Flicker
Bald Eagle	Northern Flying Squirrel
Barred Owl	Northern Goshawk
Bay-breasted Warbler	Northern Waterthrush
Beaver	Ovenbird
Black Bear	Palm Warbler
Blackburnian Warbler	Philadelphia Vireo
Blackpoll Warbler	Pileated Woodpecker
Black-throated Green Warbler	Pine Siskin
Blue Jay	Red Squirrel
Boreal Owl	Red-breasted Nuthatch
Brown Creeper	River Otter
Brown-headed Cowbird	Rose-breasted Grosbeak
Canada Lynx	Ruffed Grouse
Canada Warbler	Savannah Sparrow
Chestnut-sided Warbler	Saw-whet Owl
Chipping Sparrow	Sharp-shinned Hawk
Clay-coloured Sparrow	Short-eared Owl
Common Yellowthroat	Snowshoe Hare
Coyote	Solitary Vireo
Deer Mouse	Southern Red-backed Vole
Downy Woodpecker	Spruce Grouse
Elk	Swainson's Thrush
Fisher	Tennessee Warbler
Golden-crowned Kinglet	Three-toed Woodpecker
Great Gray Owl	Tree Swallow
Grey Wolf	Varied Thrush
Grizzly Bear	Warbling Vireo
Hairy Woodpecker	Western Tanager
Hermit Thrush	White-tailed Deer
Least Flycatcher	White-throated Sparrow
Little Brown Bat	White-winged Crossbill
Marten	Winter Wren
Masked Shrew	Wood Frog
Mink	Woodland Caribou
Moose	Yellow-bellied Sapsucker
Mountain Bluebird	Yellow-rumped Warbler

Table 2.2. Description of criteria and weighting scheme used in the species selection process.

Criterion	Description	Weight (1-4)
Sensitivity to disturbance	Expected to be sensitive to intensive forestry practices	4
Species status	Have been given rare, vulnerable, threatened, or endangered status	3
Monitoring	Easily monitored (*i.e.*, relatively common with entire home range contained within the FMA area)	3
Habitat specificity	Have specific requirements for particular habitat types	2
Special habitat elements	Use special habitat elements such as snags, downed woody debris, and arboreal lichens	2
Functionally essential species	Have a substantial influence on the ecosystem (e.g. top predators or large browsers)	2
Landscape configuration	Expected to be sensitive to landscape composition and structure (e.g. area- or edge-sensitive species)	2
Socio-economic value	Hunted, trapped, viewed, or photographed by local people	2
Available information	Have been studied extensively	1

These practices have the potential to significantly alter both the composition and structure of the forest. Terrestrial vertebrate species were rated according to their perceived sensitivity to disturbance by these intensive forest management practices. Since BAP's main goal is to compare silvicultural practices at the landscape level, this criterion has been weighted highest of the nine criteria at 4.

Species status

Species that are listed as rare, vulnerable, threatened, or endangered at either federal or provincial levels have special status. The more critical the species' status, the higher the score. However, a highly endangered species whose geographical range only marginally overlaps with the FMA area received a reduced score. In addition, migrant species received a lower score since they are not continuously dependent on the habitat conditions of the FMA area.

From the Status of Alberta Wildlife report (Anonymous 1996), we see that there are currently Blue, Yellow A, and Yellow B species using the province's forests. Current knowledge suggests that Blue listed species may be at risk of extirpation within Alberta but more detailed studies are required to accurately determine their status. Yellow listed species are sensitive but are not believed to currently be at risk. The Yellow list has been divided into two categories: A and B. Yellow A listed species are those that are thought to be experiencing long-term population declines. The Yellow B group includes species that are naturally rare but not in decline, naturally rare with clumped breeding distributions, and associated with habitats or habitat elements that may be deteriorating. From the 76 species on the selection list, 19 were identified as Blue, Yellow A, or Yellow B listed species (Table 2.3).

Table 2.3. Blue, Yellow A, and Yellow B listed species that are part of the species selection process.

Status	Species
Blue	
	Bay-breasted Warbler
	Black-throated Green Warbler
	Grizzly Bear
	Short-eared Owl
	Woodland Caribou
Yellow A	
	Clay-coloured Sparrow
Yellow B	
	Bald Eagle
	Barred Owl
	Boreal Owl
	Brown Creeper
	Canada Lynx
	Canada Warbler
	Chestnut-sided Warbler
	Fisher
	Great Grey Owl
	Northern Flying Squirrel
	Northern Goshawk
	Pileated Woodpecker
	Western Tanager

In general, Blue listed species received high scores under the species status criterion. However, since the Bay-breasted Warbler and Black-throated Green Warbler are migratory, their scores were slightly reduced. Similarly, though the Western Tanager and the Short-eared Owl are Yellow B listed, their geographic ranges only marginally border the FMA area. Therefore, they received reduced scores.

Monitoring

Adaptive management is the gradual improvement of forest management practices through knowledge acquired from experience. We must be able to monitor a species' abundance and habitat use over time during forest management activities for adaptive management of biological resources to succeed (CSA 1996). Therefore, ease of monitoring is an important criterion in the species selection process. Rare species are relatively difficult to monitor. Species received high scores if techniques and resources for their monitoring are known, available, and inexpensive. Moreover, species that require a territory larger than the FMA area to maintain a viable population received reduced scores.

Habitat specificity

As shown in BAP Report #3: Habitat Classification (Doyon 2000), habitat types that can be meaningfully correlated to stand types present within the FMA area have been defined for use in BAP. Though the habitat classification process was not complete at the time of species selection, it was sufficiently detailed for our purposes here. In general, the more intimately connected a species is to its specific niche, the higher the score it obtained.

Special habitat elements

Special habitat elements (SHEs) are habitat features that are not specifically related to a particular habitat type but that are essential for the survival of some species. These include, for example, density of snags, percentage of the forest floor covered with downed woody debris, arboreal lichen cover, and canopy closure. The full list of SHE variables can be found in BAP Report #5: Special Habitat Element Model Development (Doyon and MacLeod 2000). A species received a high score if it required one or more of these SHEs for survival. However, if it was expected that the modelling of a certain SHE variable would prove overly difficult or inaccurate, the score was reduced. Scores are higher for less common SHEs.

Functionally essential species

Keystone species are those that have a substantial influence on the functioning of the ecosystem in which they live (Hunter 1990). These species generally hold critical roles in the ecosystem such as top predators or large

browsers. The elimination of these species from the ecosystem could have significant cascading repercussions on the integrity of the ecosystem as a whole. Functionally essential species were identified with the use of this criterion.

Landscape configuration

Forest management will modify the composition and structure of the forest at a landscape level. Using the traditional two-pass clearcut system with an average cutblock size of 20 ha, the activities of the forest industry have resulted in fragmentation of the forest. The proposed adaptive forest management strategy (Wakelin 1996) makes an important move towards mimicking natural disturbance patterns. To accomplish this, the Company plans to use a wider distribution of cutblock sizes.

Many species require a large, continuous tract of forested land as habitat (area-sensitive species). Others are edge-sensitive, being influenced, either positively or negatively, by the different habitat features present at the edge between forested and non-forested land (Hunter 1990). Some species require several different habitat types in proximity to each other to fulfil their life requisites. Therefore, the adjacency of habitat types is an important consideration. For this reason, sensitivity to landscape configuration was included as a criterion in the species selection process. The more sensitive a species to the relative positioning of habitat types, the higher its score.

Socio-economic value

Species of highest socio-economic value are those that are hunted, trapped, or fished. Other species that contribute to recreational activities such as birding and photography can also receive points for this criterion. The more important a species is to the local people, the higher its ranking.

Available information

To develop a model that will predict the way habitat supply will change with management, knowledge of the species' habitat and landscape requisites and population characteristics is required. The more information known to be accessible, the higher the score for this criterion.

2.3 SPECIES SELECTION

Each of the 76 terrestrial vertebrate species listed in Table 2.1 was given a score of 1 to 10 based on each of the nine criteria (Table 2.2). The scores for each criterion were then multiplied by the weight of that criterion. The results were summed to produce an overall ranking for each species. The score that each species received for each of the nine criteria and the weighted and summed scores can be found in Table 2.4. Since small differences in overall ranking can result from rather arbitrary decisions of scores for each criterion, a difference in score of less than 15 is not considered important. Also important to note is that though the ranking is not absolute, it is indicative. Other aspects were considered in species selection and the selection matrix served as one step in the process.

While the species ranking on the selection matrix serves as an important tool for selection, the BAP team did not intend to simply choose the highest ranked group of species, indiscriminately. Instead, we wanted to ensure that species with a range of taxonomic classes, territory and/or body sizes, and habitat requirements would be represented in the HSMs. In particular, we were interested in including at least one representative from each of the following taxonomic classes:

- Large terrestrial carnivores;
- Large ungulates;
- Raptors;
- Medium-sized herbivorous/omnivorous mammals;
- Medium-sized carnivorous mammals;
- Gallinaceae;
- Passerines; and
- Small mammals.

Usually, home range size and body size are correlated. Therefore, we attempted to select species such that animals with small (< 10 ha), medium (10 to 100 ha), large (100 to 1000 ha), and very large (> 1000 ha) home ranges are included. Finally, it was hoped that, when considered together, the species would use virtually all of the habitat types encountered within the FMA area.

Selected Species

From this selection process, it was decided that HSMs would be developed for 22 species, representing a range of taxonomic classes and body sizes (Table 2.5).

Revisions to the List of Selected Species

After the BAP team had begun to develop the HSMs, it was suggested by Jonathan Russell, Planning Forester for Millar Western, that the Gray Wolf should be included in the list of species to be modelled. Work began on development of its HSM but was later terminated (refer to Table 2.6 for explanation). In addition, model development for the Beaver, Little Brown Bat, Mountain Bluebird, and Wood Frog ceased (Table 2.6). As White-tailed Deer are considered generalists, they were not a high priority species in terms habitat modelling. Because of this factor and considering time constraints, a HSM was not developed for White-tailed Deer.

Table 2.4. Ranking scores received by each species by the selection process.

Criterion	Sensitivity to disturbance	Species status	Monitoring	Habitat specificity	Special habitat elements	Functionally essential species	Landscape configuration	Socio-economic value	Available information	All criteria	All w/o socio-economic value
Weight	**4**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**		
Species Name											
Woodland Caribou	7	9	5	7	8	6	6	8	6	**146**	**130**
Marten	8	3	3	8	7	5	6	8	9	**127**	**111**
Barred Owl	7	6	3	8	6	5	8	1	6	**117**	**115**
Grizzly Bear	6	10	1	2	1	8	7	8	7	**116**	**100**
Sharp-shinned Hawk	6	3	6	4	5	7	7	1	3	**102**	**100**
Brown Creeper	7	5	6	9	7	1	7	1	6	**117**	**115**
Varied Thrush	8	1	6	7	1	3	8	1	4	**97**	**95**
Northern Goshawk	6	6	3	7	5	7	5	2	6	**109**	**105**
Wood Frog	7	3	7	5	7	3	5	1	3	**103**	**101**
Canada Lynx	7	6	1	5	4	6	7	6	6	**111**	**99**
Three-toed Woodpecker	8	5	3	3	10	3	5	1	4	**104**	**102**
White-tailed Deer	4	2	5	4	1	7	7	10	9	**104**	**84**
Beaver	4	2	7	7	3	8	3	7	7	**106**	**92**
Spruce Grouse	6	3	2	7	4	4	6	6	7	**100**	**88**
Mountain Bluebird	6	1	5	7	8	2	5	1	7	**95**	**93**
Southern Red-backed Vole	5	2	8	6	3	8	2	1	8	**98**	**96**
Bald Eagle	4	6	3	4	8	7	5	3	4	**101**	**95**
Pileated Woodpecker	6	6	4	7	7	6	2	1	8	**108**	**106**
Winter Wren	5	2	7	8	6	1	5	1	5	**94**	**92**
Tree Swallow	6	2	5	6	9	2	6	1	6	**99**	**97**
Moose	6	2	3	6	1	5	5	10	9	**102**	**82**
Elk	3	3	5	4	3	6	8	7	8	**100**	**86**
Northern Waterthrush	6	3	7	5	6	3	5	1	3	**97**	**95**
Snowshoe Hare	3	1	7	5	1	8	7	7	7	**99**	**85**
Northern Flying Squirrel	6	5	2	7	6	3	5	3	7	**100**	**94**
Red Squirrel	5	1	6	8	4	4	5	3	5	**94**	**88**
Black Bear	4	3	1	3	6	7	6	7	7	**93**	**79**
Grey Wolf	6	3	2	3	1	8	6	7	4	**93**	**79**
Ruffed Grouse	3	1	3	5	5	6	6	7	9	**91**	**77**
Great Grey Owl	4	5	2	4	6	7	6	1	5	**90**	**88**
Boreal Owl	5	5	3	6	6	4	5	1	5	**93**	**91**
Saw-whet Owl	5	3	5	4	6	4	4	1	7	**89**	**87**
Masked Shrew	7	1	7	4	4	6	2	1	3	**89**	**87**
River Otter	4	3	3	3	5	4	8	5	4	**88**	**78**
Least Flycatcher	5	1	7	8	1	1	5	1	6	**82**	**80**
Little Brown Bat	6	3	3	5	6	4	5	1	3	**87**	**85**
Ovenbird	5	1	8	6	1	1	7	1	8	**87**	**85**
Chestnut-sided Warbler	6	3	8	7	1	1	4	1	8	**93**	**91**
Mule Deer	2	2	1	5	1	5	6	10	6	**77**	**57**
Brown-headed Cowbird	8	1	2	8	1	1	7	1	9	**86**	**84**
Mink	6	3	4	5	1	3	2	7	5	**86**	**72**
Red-breasted Nuthatch	6	2	5	7	6	1	3	1	5	**86**	**84**
Swainson's Thrush	6	2	7	5	1	1	7	1	5	**86**	**84**
Black-throated Green Warbler	5	6	2	8	1	1	8	1	3	**85**	**83**
Palm Warbler	3	1	5	10	1	1	6	1	5	**73**	**71**
Deer Mouse	4	1	7	2	6	8	2	1	7	**85**	**83**
Fisher	3	5	1	4	4	4	5	6	5	**81**	**69**
Short-eared Owl	2	6	3	6	2	4	2	1	5	**70**	**68**
American Redstart	5	1	7	5	1	1	5	1	9	**79**	**77**
Coyote	3	2	3	1	1	7	6	7	7	**78**	**64**
Blackpoll Warbler	5	1	6	7	1	1	3	1	2	**69**	**67**
Bay-breasted Warbler	6	6	2	8	1	1	4	1	2	**80**	**78**
White-winged Crossbill	6	3	3	8	1	1	3	1	4	**74**	**72**
Blackburnian Warbler	4	3	2	7	1	1	5	1	3	**64**	**62**
Yellow-bellied Sapsucker	4	1	6	4	7	2	2	1	4	**73**	**71**
White-throated Sparrow	2	1	7	6	3	1	6	1	6	**72**	**70**
Golden-crowned Kinglet	5	1	4	7	1	1	6	1	4	**71**	**69**
Solitary Vireo	4	3	5	6	1	1	3	1	5	**69**	**67**
Hermit Thrush	2	2	5	8	1	1	6	1	5	**68**	**66**
Tennessee Warbler	4	3	5	3	1	1	4	1	4	**64**	**62**
Canada Warbler	2	5	5	5	1	1	4	1	2	**64**	**62**
Hairy Woodpecker	1	2	6	5	5	1	3	1	6	**64**	**62**
Northern Flicker	2	1	7	3	3	1	3	1	6	**60**	**58**
American Crow	4	1	2	2	2	3	6	3	6	**63**	**57**
Rose-breasted Grosbeak	2	2	4	5	5	1	6	1	3	**65**	**63**
Downy Woodpecker	1	1	6	5	5	1	3	1	6	**61**	**59**
Western Tanager	4	3	3	6	6	1	4	1	3	**73**	**71**
Blue Jay	4	1	3	3	3	3	6	1	4	**64**	**62**
Pine Siskin	4	2	3	5	5	1	3	1	5	**66**	**64**

Table 2.5. List of species originally selected for HSM development.

Common Name	Scientific Name
Barred Owl	*Strix varia*
Beaver	*Castor canadensis*
Brown Creeper	*Certhia americana*
Canada Lynx	*Lynx canadensis*
Elk	*Cervus elaphus*
Least Flycatcher	*Empidonax minimus*
Little Brown Bat	*Myotis lucifugus*
Marten	*Martes americana*
Moose	*Alces alces*
Mountain Bluebird	*Sialia currucoides*
Northern Flying Squirrel	*Glaucomys sabrinus*
Northern Goshawk	*Accipiter gentilis atricapillus*
Pileated Woodpecker	*Dryocopus pileatus*
Ruffed Grouse	*Bonasa umbellus*
Snowshoe Hare	*Lepus americanus*
Southern Red-backed Vole	*Clethrionomys gapperi*
Spruce Grouse	*Dendragapus canadensis franklinii*
Three-toed Woodpecker	*Picoides tridactylus*
Varied Thrush	*Ixoreus naevius*
White-tailed Deer	*Odocoileus virginianus*
Wood Frog	*Rana sylvatica*
Woodland Caribou	*Rangifer tarandus caribou*

Table 2.6. Species removed from the list of species to be modelled.

Species	Reason for inclusion in HSM process	Reason for removal from list of species to be modelled
Beaver		
	The Beaver originally received high ratings for socio-economic importance, habitat specificity, quality of available information, and ability to be monitored.	The most important aspect of Beaver habitat is condition of the water resource. Conversely, HSMs assess the quality of forested habitat, placing emphasis on terrestrial instead of aquatic habitats.
Gray Wolf		
	The Gray Wolf has an important influence on the ungulates using the FMA area.	Wolves are not particularly selective about their choice of habitat type but tend to centre their activity around prey habitat use. It may be appropriate to produce a wolf model based on population models of ungulate species. These are not yet available. Therefore, it will not be possible to create an accurate model of wolf habitat use at this time.
Little Brown Bat		
	The Little Brown Bat was selected for its specific tree-level (*i.e.*, bark crevices) and stand level (*i.e.*, high dbh, tall trees) requirements.	The literature regarding canopy closure and proximity to edge requirements of the Little Brown Bat is contradictory. While some sources indicate that the bats prefer closed canopy forest distant from edge, others state that they will roost in the centre of open agricultural fields if bat houses are present. An effective HSM can not be created without further study into bat cover habitat preferences in west-central Alberta.
Mountain Bluebird		
	The Mountain Bluebird was selected for its specificity to sparsely treed, shrubby stands and its use of tree cavities.	The bird is at the edge of its natural range in west-central Alberta. It would not be expected to inhabit the forests of Millar Western's FMA area without the implementation of a nest box program.
Wood Frog		
	The Wood Frog originally received high ratings for habitat specificity, sensitivity to disturbance, and ability to be monitored.	Like all amphibians, the Wood Frog depends on water quality features such as nutrient loading, pH, dissolved oxygen, presence of fish as predators, and hydroperiod. Information specific to the FMA area on aquatic biology and chemistry is lacking. In addition, there would be great uncertainty associated with modelling change in these variables over time and with disturbance.

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