Introduction

The Crown of the Continent (the Crown, or COC) straddles the international boundary between the United States and Canada. Waters originating in the Crown travel in three different directions across the North American continent. Some water flows to the Pacific Ocean through the Columbia River system, while other waters drain north and west to Hudson's Bay, providing lifeblood to the Canadian Prairie Provinces. The Crown is also the headwaters for America's great river - the Missouri-Mississippi, which passes through 31 states on its way to the Gulf. In the Crown, the Great Plains meet the Rocky Mountains, and much of this land is mostly in a natural, undeveloped state. Its spectacular landscapes are home to large carnivores and the greatest plant and aquatic biodiversity in the Rocky Mountains. At its core is the world's first International Peace Park - Waterton-Glacier.

The Crown is a region full of boundaries and borders: Tribes and First Nations; two countries; two provinces and one state; federal, provincial, state, and private lands. As a symbol of the "last, best west," the Crown is seeing increasing human activity pressures, such as urban and rural residential expansion, increased recreational use, resources use and extraction, and the physical infrastructure needed to support all of these changes. While growth pressures on the Crown operate at different intensities in different places, they are generally dramatic. On top of this, the Crown is a region highly impacted by climate change, as it is warming at two to three times the rate of the global average.

With so many land managers in the Crown, success in addressing these large scale changes relies on collaboration with neighboring managers. The Crown Managers Partnership (CMP) is convening a Landscape Conservation Design process to facilitate managers who are working together to achieve landscape-scale ecological objectives while working within agency and organizational jurisdictions and mandates.

Landscape Conservation Design (LCD) is a means to achieve a resilient, sustainable socio-ecological landscape by bringing stakeholders together to prioritize and coordinate actions on the ground. The approach empowers stakeholders at all levels of the decision-making process and optimizes operations by aligning actions to achieve outcomes at appropriate scales. Through an iterative, collaborative, and holistic process, the LCD results in maps, analytical tools, and strategies that enable stakeholders to achieve collective landscape goals.

An LCD is participatory from the outset as stakeholders convene and co-develop a shared vision and landscape-scale priorities for the geography while creating and building trust relationships. A Leadership Team adopted a Vision and Goals for the Crown design:

Our Vision

Ensuring a resilient, connected landscape that supports healthy ecosystems and human communities

Goals:

- To rely upon cutting-edge science, Indigenous knowledge, and modeling to collectively increase the resilience of waters, forests, and grasslands
- To sustain healthy ecosystems, communities, and economies through working lands partnerships
- To recognize the leadership, history, culture, and traditional territories of Indigenous peoples as we plan for the future

Crown Landscape Conservation Design
Feature Selection Process

A key early step to achieve these is selection of focal features in the Crown that, collectively, represent the breadth of biodiversity, ecological integrity and cultural and social condition in the Crown of the Continent ecosystem.

Feature Identification

We define **focal landscape features** as representations of the Crown's full complement of biodiversity, ecosystem elements, social and cultural components and economies. We use these representations or focal features because the full complement of features across sectors are far too complicated to analyze and model in any meaningful way. Focal features can be loosely thought of a surrogates, however, we do not use them as true surrogates (that is, as direct representations of other features). Rather, collectively, focal landscape features used for the landscape design possess characteristics and properties that present a robust perspective on the COC socio-ecological landscape. Three types of features will be considered:

Ecological feature: A representation of biodiversity on the landscape
Social/Cultural feature: A representation of cultural diversity on the landscape (not addressed this round)
Economic feature: A representation of economic diversity on the landscape (not addressed this round)

Focal Landscape Features: the sum of features (ecological, social, cultural and economic) we select to represent the Crown socio-ecological system for use in modeling and design of desired future conditions. The set of features selected should, in aggregate, provide:

- Representation of the whole system, which is too complex to model
- Comprehensiveness, to the extent possible
- Extent / Range: be widely distributed across the Project Area
- Impact, Importance – relevant to broad sets of stakeholders
- Context (do we know enough?)
- Contentiousness (low)
- Data Available

The Crown Landscape Conservation Design will identify and use **focal landscape features** to:

- Evaluate and estimate the status of current conditions
- Describe key attributes for each feature that serve to define the feature's health through measurable indicators of those attributes
- Estimate desired future conditions for those feature-attributes
- Build spatial and strategic designs to maintain or achieve desired conditions

The goal is to identify 10-20 focal landscape features that describe, in the most comprehensive way possible, the overall integrity of the Crown LCD Project Area.

Initially we will focus on ecological features. Ultimately we will incorporate social/cultural and economic features as well.

Crown Landscape Conservation Design
Feature Selection Process

To select focal ecological features, the Leadership Team engaged in a four-step process starting with assembly and review of existing natural and cultural resource management plans and documents from across the COC.

1. An Analysis Team (see Appendix) reviewed each plan and summarized priorities expressed in the plans.
2. The Analysis Team summarized spatial information for ecological features identified as priorities by ≥10% of reviewed plans and evaluated inter-feature comparisons.
3. The Leadership Team reviewed the short list and spatial summary evaluation and deliberated the information.
4. The Leadership Team selected a final list of focal ecological features through a vote and final deliberation.

Management Plan Review

To narrow the list of potential landscape features, we reviewed [63] management plans, conservation assessments and other documents published by stakeholder groups in the CCE, including Canadian and US federal agencies, provincial, state and local governments, Tribes, First Nations and various interest groups. We scanned these plans looking for mention or recognition of high priority landscape features, tallying features in spreadsheets.

Table 1: Plans reviewed to focus LCD feature selection.

Lead Organization	Document Title	Year
Alberta Environment and Parks	Livingston-Porcupine Hills Land Footprint Management Plan	2018
Alberta Environment and Parks	Livingston-Porcupine Hills Recreation Management Plan	2017
Alberta Government	South Saskatchewan Regional Plan	2018
Alberta SW Regional Alliance	Economic and Social Profile	2009
Alberta Tourism, Parks and Recreation	Bob Creek/Black Creek	2011
BC Parks	Elk Lakes Provincial Park and Height of the Rockies Provincial Park Management Plan	1999
BC Parks	Management Direction Statement for Akamina-Kishenina Provincial Park	1999
Bureau of Business and Economic Research	2019 Montana Economic Report	2019
Bureau of Land Management	Proposed Resource Management Plan & FEIS Vol. 1 -Missoula	2020
Bureau of Land Management	Proposed Resource Management Plan & FEIS Vol. 2- Missoula	2020
Bureau of Land Management	Middle Rockies Rapid Ecoregional Assessment	2012
Canadian Parks and Wilderness Society – Southern Alberta Chapter	Southern Eastern Slopes Conservation Strategy project	2018
Castle Provincial Park and Castle Wildland Provincial Park	Castle Management Plan	2018
Confederated Salish and Kootenai Tribes	Comprehensive Resources Plan (Vol. I)	2015
Confederated Salish and Kootenai Tribes	Climate Change Strategic Plan	2013
Crown Managers Partnership	Strategic Conservation Framework 2016-2020	2016

Crown Landscape Conservation Design
Feature Selection Process

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Flathead Lakers	Critical Lands Status Report: The North Flathead Valley & The Flathead River Corridor	2002
Glacier National Park	Interagency US2 Connectivity Workshop Report	2018
Glacier National Park	Foundation Document	2016
Glacier National Park	General Management Plan	1999
Headwaters Economics	Crown of the Continent and Climate Change report: Impacts of climate change on downhill skiing and rec fishing	2010
Helena-Lewis and Clark National Forest	Draft 2020 Forest Plan	2020
Intermountain West Joint Venture	Implementation Plan	2013
Ministry of Forests, Lands, Natural Resource Operations	Strategic Policy: Crown Land Allocation Principles	2011
Ministry of Forests, Lands, Natural Resource Operations and Rural Development	Action Plan	2019
Montana Dept of Transportation	Multiple plans	
Montana Fish, Wildlife and Parks	Lost Trail Conservation Project	2019
Montana Fish, Wildlife and Parks	Kootenai Forestlands Conservation Project	2019
Montana Fish, Wildlife and Parks	Montana Action Plan - SO 3362	2019
Montana Fish, Wildlife and Parks	Montana State Wildlife Action Plan	2015
MT Department of Natural Resources and Conservation	State Forest Land Management Plan Implementation Monitoring Report Fiscal Years 2011-2016	2016
National Park Service	Rocky Mountain Network monitoring plan	2007
Northwest Power and Conservation Council	Flathead Subbasin Assessment	2018
Northwest Power and Conservation Council	Kootenai Subbasin Plan	2004
Prairie Pothole Joint Venture	Implementation Plan	2017
Roundtable on the Crown of the Continent	Adapting to Change in the Crown of the Continent	2015
Southern Alberta Land Trust Society	Southern Foothills Study	2007
Southern Foothills Community Stewardship Initiative	Values and Voices	2011
Southwest Alberta Sustainable Community Initiative	Community Values Assessment for the M.D. of Pincher Creek	2012
US Fish and Wildlife Service	Lost Trail Conservation Area Land Protection Plan	2020
US Fish and Wildlife Service	National Bison Range Comprehensive Conservation Plan	2019
US Fish and Wildlife Service	Benton Lake National Wildlife Refuge Complex Fire Management Plan	2017
US Fish and Wildlife Service	Region 6 Long Range Transportation Plan - Public Draft	2017
US Fish and Wildlife Service	Benton Lake National Wildlife Refuge Complex Comprehensive Conservation Plan	2012
US Fish and Wildlife Service	Lee Metcalf National Wildlife Refuge Comprehensive Conservation Plan	2012
US Fish and Wildlife Service	Montana DNRC Habitat Conservation Plan	2012
US Fish and Wildlife Service	Rocky Mountain Front Conservation Area Land Protection Plan	2011
US Fish and Wildlife Service	Blackfoot Valley Conservation Area Land Protection Plan	2011

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US Fish and Wildlife Service	Swan Valley Conservation Area Land Protection Plan	2011
US Fish and Wildlife Service	Lost Trail Comprehensive Conservation Plan	2005
US Fish and Wildlife Service	MOYOCO Ecosystem Plan	2000
US Fish and Wildlife Service	Plum Creek Habitat Conservation Plan	2000
US Forest Service	Flathead National Forest Land Management Plan	2018
US Forest Service	Climate change vulnerability and adaptation in the Northern Rocky Mountains Part 1	2018
US Forest Service	Climate change vulnerability and adaptation in the Northern Rocky Mountains Part 2	2018
US Forest Service	Kootenai National Forest Land Management Plan	2015
US Forest Service	Lewis and Clark National Forest Plan	1986
Waterton Biosphere Reserve Association	Species At Risk Action Plan for Waterton Biosphere Reserve	2015
Waterton Lakes National Park	State of the Park Assessment	2019
Waterton Lakes National Park	Management Plan	2010

We classed priority focal features as either Species (n = 484), Habitat/Ecosystem (n = 102), Ecological Process (n = 40), Ecosystem Service (n = 20), Cultural (n = 64), or Economic (n = 68). In all 778 focal priority features were identified in the 63 documents. For the purposes of this report we focused on Species, Habitat/Ecosystem, Ecological Process, and Ecosystem Services only. Cultural and Economic Features will be addressed at a later time. The frequency with which ecological features were recognized in existing plans is in Appendix X and summarized in Figures 1-4.

Figure 1: Twenty most common species/taxa identified in reviewed plans. All species referenced in plans we reviewed are listed in Appendix A.

Crown Landscape Conservation Design
Feature Selection Process

Species Features identified in plans
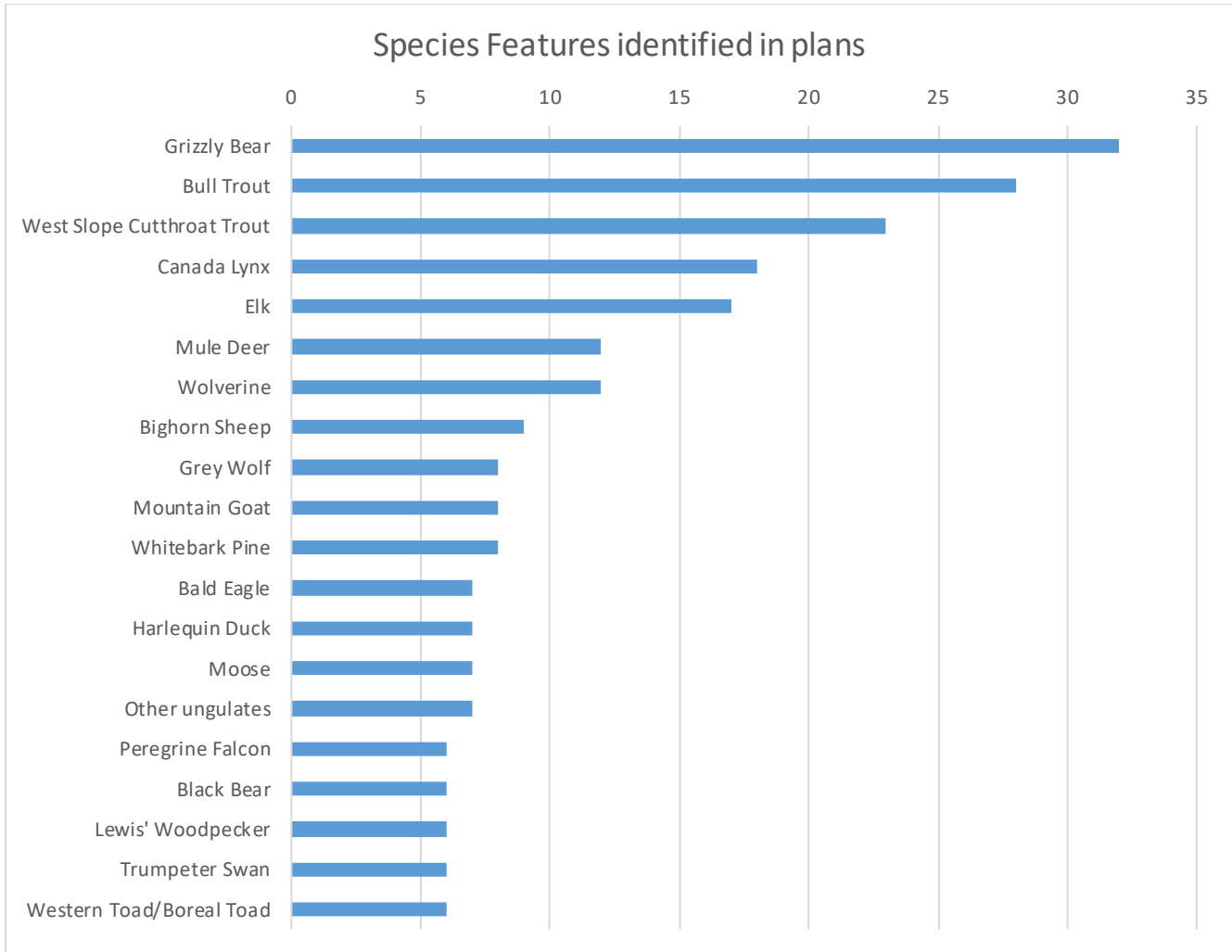
More than 180 species were identified in the 60 plans reviewed. Figure 1 displays only those species identified in 10% or more (i.e., ≥ 6 plans) of reviewed plans. A complete list of all species referenced is in Appendix 1.

Figure 2: Habitat/Ecosystem:

Crown Landscape Conservation Design
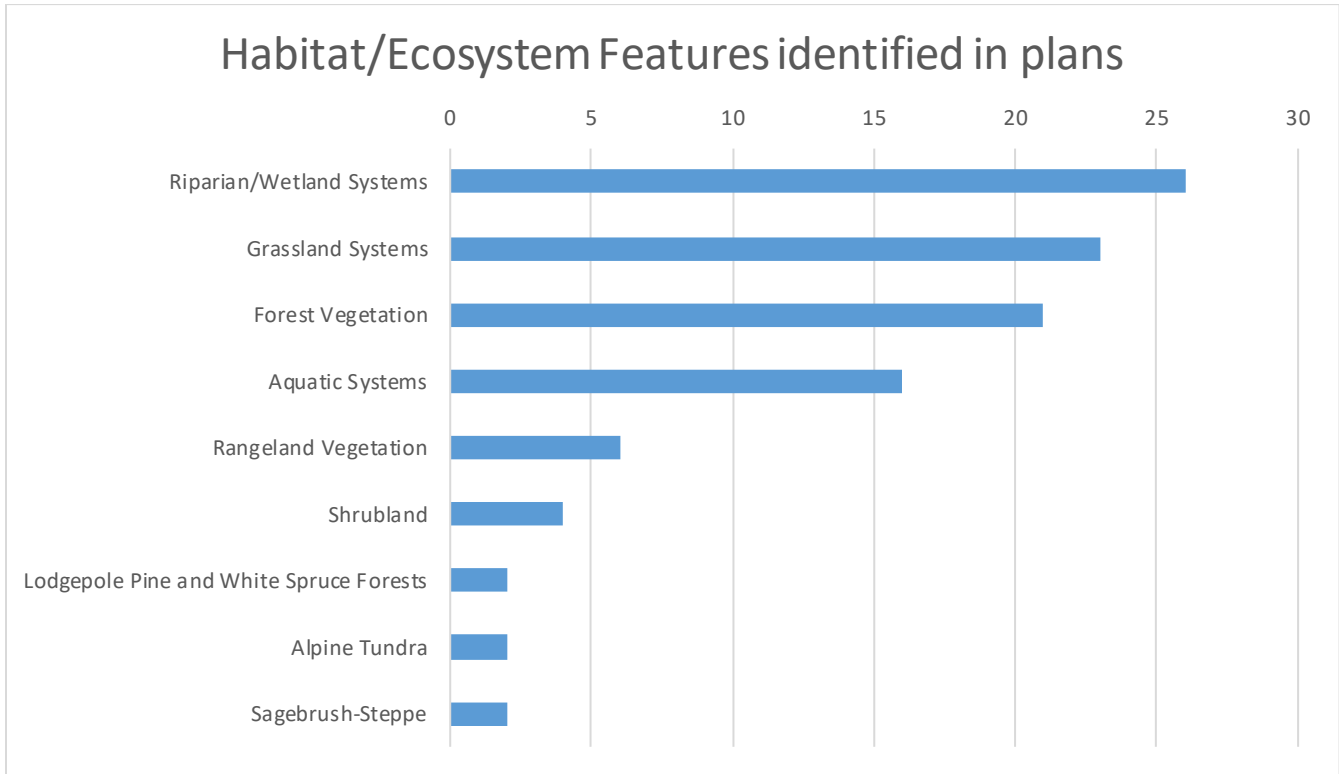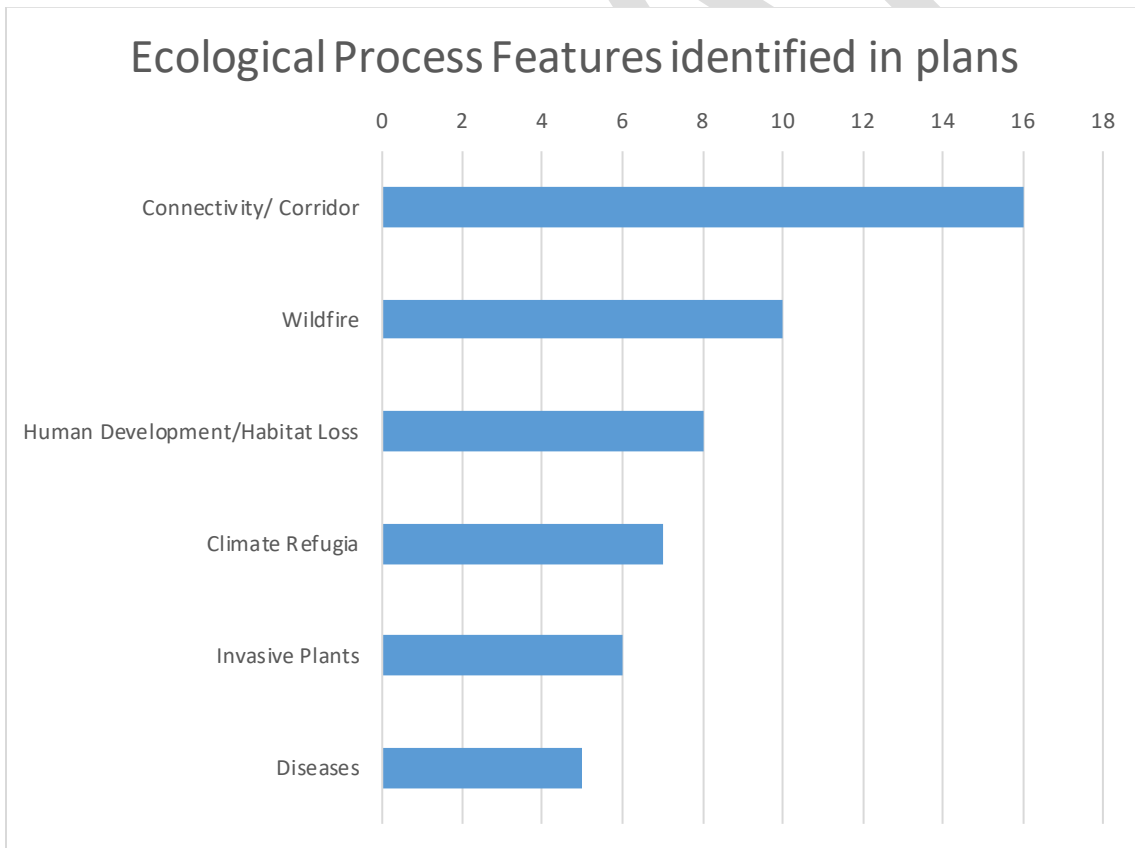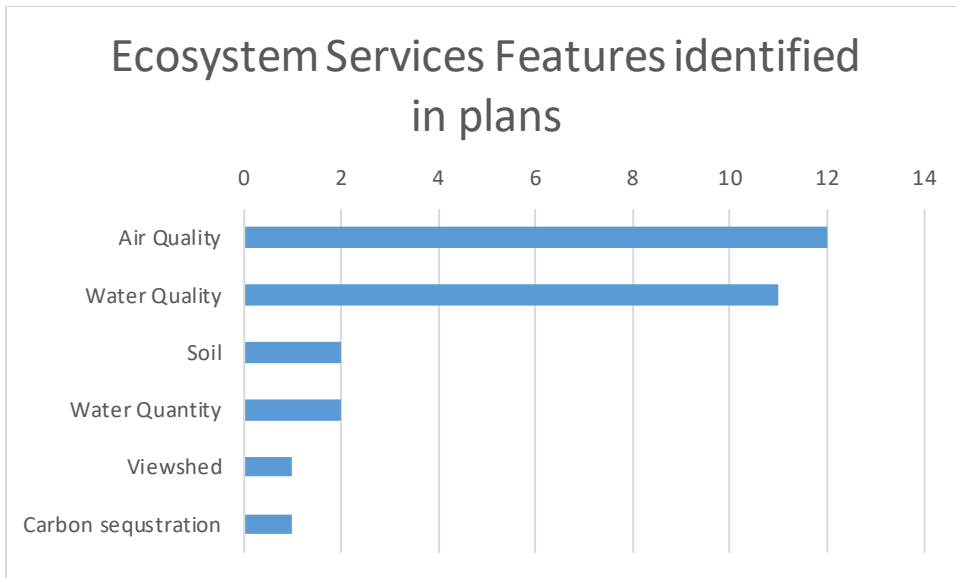**Feature Selection Process**

Habitat/Ecosystem Features identified in plans

Figure 3: Ecological Processes:

Ecological Process Features identified in plans

Figure 4: Ecosystem Services:

Ecosystem Services Features identified in plans

Category	Value (0–14)
Air Quality	12
Water Quality	11
Soil	2
Water Quantity	2
Viewshed	1
Carbon sequstration	1

We identified 36 'candidate' ecological features by considering only the most common (identified in ≥ 10% of plans reviewed) ecological features. Because there is much ecological overlap and potential redundancy among the candidate features, we evaluated options for identifying and selecting coarse features as a way of retaining comprehensive perspective of the set of selected features and efficiently reducing the total number of features.

Two broad types of features are:

Coarse feature: An aggregate or collection of fine features (for example, a habitat type) that serves to both encompass multiple fine features and compensate for our incomplete knowledge of all biodiversity.

Fine feature: A discrete representation of biodiversity (for example, a species) which may not be well represented by a coarse feature and for which we have good knowledge of key attributes related to ecosystem health and function (after Groves and Game 2016).

Feature Evaluation

To facilitate the selection process we compared candidate features when possible using standard metrics describing the relationship of candidate coarse and fine features to each other, their relative importance to stakeholders in the crown, relative vulnerability to change agents acting on the features, published conservation status, data availability, the relative intensity of ongoing monitoring and the potential to initiate new monitoring should that emerge as a viable strategy.

We classified all candidate fine features identified as priority by two or more management plans (Appendix 1) if they could reasonably be assigned to a habitat guild (Table 2) and a life history guild (Table 3). Habitat guilds were defined by candidate Habitat/Ecosystem features; Life history guilds were defined by candidate Ecosystem Process features. The exercise addresses the questions: how many and which species might be reasonably addressed if the LCD included select coarse features? Guild assignments were made using the Analysis Team's general knowledge of species-habitat associations. Generalist species (i.e., species that do not

strongly associate with a specific habitat(s) or process(es) were not assigned to a guild. The results of this qualitative exercise (Tables 2, 3) were summarized in the Coarse and Fine Feature comparison tables (Table 4, 5).

Crown Landscape Conservation Design
Feature Selection Process

Table 2: Coarse/Fine Feature Relationships: Habitat Guilds. Coarse habitat/ecosystem features identified during management plan review and associated fine features (species) with strong ecological associations with identified coarse features. We group these taxa (listed below each coarse feature) as 'Habitat Guilds' indicating that event selection of a coarse feature would, by association, include or address listed taxa in the design.

Riparian/Wetland Systems	Native Grassland Systems	Forest Vegetation	Aquatic Systems (Lentic)	Shrubland/Sagebrush-steppe/Rangeland Vegetation	Lodgepole Pine and White Spruce Forests	Alpine Tundra
Bull Trout	Elk	Canada Lynx	Bald Eagle	Canada Lynx	Canada Lynx	Wolverine
Westslope Cutthroat Trout	Mule Deer	Grey Wolf	Moose	Elk	Gray Wolf	Bighorn Sheep
Harlequin Duck	Sharp-tailed Grouse	Whitebark Pine	Trumpeter Swan	Golden Eagle	Moose	Mountain Goat
Moose	Spalding's catchfly	Black Bear	Common Loon	Mountain Lion	Black Bear	Whitebark Pine
Lewis' Woodpecker	Prairie Falcon	Mountain Lion	Shorebirds	Sharp-tailed Grouse	White-tailed Deer	Golden Eagle
Trumpeter Swan	Chestnut-collared Longspur	Limber Pine	Waterfowl	Prairie Falcon		Clark's Nutcracker
Western Toad / Boreal Toad	Ferruginous Hawk	Bobcat	Burbot	Ferruginous Hawk		
Arctic Grayling	Pronghorn	Northern Goshawk	Rainbow Trout	Pronghorn		
Beaver	Bobolink	Pileated Woodpecker	White Sturgeon	Greater Sage-Grouse		
Columbia River redband trout	Long-billed Curlew	White-tailed Deer		Townshend's Big-eared Bat		
Long-toed Salamander	Rough Fescue	Clark's Nutcracker		Loggerhead Shrike		
Waterfowl	Sprague's Pipit	Olive-sided Flycatcher				
Northern Leopard Frog	Townsend's Big-eared Bat	Ponderosa Pine				
Water Howellia	Black-footed Ferret					
Yellowstone Cutthroat Trout	Loggerhead Shrike					
Columbia spotted frog	Mountain Plover					
Marbled Godwit	White-tailed Prairie Dog					
Rainbow Trout						
River Otter						
Whitefish						
Willow flycatcher						

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Feature Selection Process

Table 3: Coarse/Fine Feature Relationships: Life History Guilds. Coarse ecological process features identified during management plan review (top row) and associated fine features (species) with strong ecological associations with identified coarse features. We group these taxa (listed below each coarse feature) as 'Life History Guilds' indicating that selection of a coarse feature would, by association, include or address listed taxa in the design.

Connectivity / Corridor	Wildfire	Human Development / Habitat Loss	Climate Refugia	Invasive Plants	Diseases	Air Quality	Water Quality	Soil
Grizzly Bear	Canada Lynx	Grizzly Bear	Bull Trout	Limber Pine	Bull Trout		Bull Trout	Whitebark Pine
Bull Trout	Elk	Bull Trout	West Slope Cutthroat Trout	Sharp-tailed Grouse	West Slope Cutthroat Trout		West Slope Cutthroat Trout	Limber Pine
Canada Lynx	Mule Deer	West Slope Cutthroat Trout	Canada Lynx	Spalding's Catchfly	Mule Deer		Harlequin Duck	Spalding's Catchfly
Elk	Whitebark Pine	Canada Lynx	Wolverine	Bolander's Quillwort	Bighorn Sheep		Trumpeter Swan	Bolander's Quillwort
Mule Deer	Limber Pine	Bighorn Sheep	Bighorn Sheep	Northern Leopard Frog	Whitebark Pine		Common Loon	Water Howellia
Wolverine	Sharp-tailed Grouse	Moose	Mountain Goat	Water Howellia	Western Toad / Boreal Toad		Western Toad / Boreal Toad	Black-footed Ferret
Grey Wolf	Spalding's Catchfly	Lewis' Woodpecker	Whitebark Pine	Columbia Spotted Frog	Arctic Grayling		Arctic Grayling	White-tailed Prairie Dog
Moose	Northern Goshawk	Mountain Lion	Moose	Greater Sage-Grouse	Columbia River Redband trout		Columbia River Redband trout	
Black Bear	Pileated Woodpecker	Limber Pine	Long-toed Salamander	Sprague's Pipit	Long-toed Salamander		Long-toed Salamander	
Mountain Lion	Greater Sage-Grouse	Sharp-tailed Grouse	Bolander's Quillwort	Willow Flycatcher	Northern Leopard Frog		Northern Leopard Frog	
Beaver	Rough Fescue	Spalding's Catchfly	Northern Leopard Frog	Mountain Plover	White-tailed Deer		Yellowstone Cutthroat Trout	
Pronghorn	Willow flycatcher	Beaver	Yellowstone Cutthroat Trout		Yellowstone Cutthroat Trout		Burbot	
White-tailed Deer	Ponderosa Pine	Columbia River Redband Trout	Clark's Nutcracker		Rainbow Trout		Columbia Spotted Frog	
Yellowstone Cutthroat Trout		Chestnut-collared Longspur	Columbia Spotted Frog		Townsend's Big-eared Bat		Rainbow Trout	
Clark's Nutcracker		Water Howellia	Rainbow Trout		Black-footed Ferret		White Sturgeon	
Columbia Spotted Frog		Bobolink	White Sturgeon		White-tailed Prairie Dog		Whitefish	
Greater Sage-Grouse		Butterflies	Black-footed Ferret					

Crown Landscape Conservation Design
Feature Selection Process

Rainbow Trout		Flycatchers	White-tailed Prairie Dog
		Greater Sage-Grouse	
		Long-billed Curlew	
		Marbled Godwit	
		Piping Plover	
		Townsend's Big-eared Bat	
		White Sturgeon	
		Willow flycatcher	
		Black-footed Ferret	
		Olive-sided flycatcher	
		White-tailed Prairie Dog	

Crown Landscape Conservation Design
Feature Selection Process

Comparative Evaluation of Candidate Features

To provide a common currency among candidate features we evaluated each candidate in terms of their relative vulnerability, level of protection they are subject to, availability and quality of data useful for modeling, aspects of monitoring (is the feature currently being monitored, what is the potential for efficient monitoring in the future).

Table 4: Comparative evaluation of candidate coarse features identified during management plan review.

Candidate Feature	Relative Concern (Plans)	Relative Protected Status (%)	Estimated Conservation Status	Available Data Evaluation	Ongoing Monitoring	Ease of Monitoring	Obligate Species (#)	Fine Feature useful as Indicator (#)	Source of Information
COARSE FEATURE									
Habitat/ Ecosystem									
Riparian	28	8.5*	More Vulnerable	POOR	LOW	LOW	20	5	MT MSDI (MT only)
Wetland	26	2.5	More Vulnerable	POOR	GOOD	MODERATE	20	2	CEC Landcover – North America (30 m)
Grassland	23	7.1	More Vulnerable	POOR	MODERATE	MODERATE	17	1	
Forest	21	14.3		GOOD	MODERATE	MODERATE	13	2	
Aquatic (lake)	16	7.9		POOR	MODERATE	MODERATE	9	2	
Shrubland/Rangeland/ Sagebrush-steppe	6	12.1		GOOD	MODERATE	MODERATE	11	1	
Alpine Tundra	2	22.8	More Vulnerable	POOR	LOW	MODERATE	6	2	
Ecological Process									
Connectivity/Corridor	15			FAIR	LOW	MODERATE	18	5	
Wildfire	10			GOOD	LOW	MODERATE	13	2	
Climate Refugia	7			POOR	LOW	LOW	18	6	
Invasive Species	6			FAIR	LOW	LOW	11	0	
Diseases	5			POOR	LOW	LOW	16	7	
Human Development / Habitat Loss	5			GOOD	LOW	MODERATE	28	9	
INFORMATION SOURCE	Mgt Plan Review (This document)	World Database on Protected Areas; CEC	Based on quick assessment of IUCN Red List of Ecosystems	Based on LCD data catalog			Crown LCD Feature Analysis	Crown LCD Feature Analysis	

Relative Concern (plans): Sum total of management plans we reviewed (n = 63) that the coarse feature is prioritized in.

Relative Protected Status: Percent of the Habitat/Ecosystem, within the project area, that is on land identified as managed under International Union for Conservation of Nature (IUCN) Protected Status Ia (Strict Nature Reserve), Ib (Wilderness Area) or II (National Park). Data from Commission for Environmental Cooperation and World Database on Protected Areas. See Appendix 3. Comparative data for Ecological Process coarse features not available.

Estimated Conservation Status: Indicates outcome of a rapid assessment of Habitat/Ecosystem coarse features using the IUCN Red List of Ecosystems evaluation process.

Available Data Evaluation: relative volume of data available for the coarse feature; evaluation based on working LCD data catalog.

Ongoing Monitoring / Ease of Monitoring: based on Analysis Team general knowledge of ongoing monitoring and comparative estimate of monitoring potential of partners.

Crown Landscape Conservation Design
Feature Selection Process

Obligate Species: Number of species prioritized in 2 or more of the reviewed management plans that are intrinsically tied to the reference coarse filter. Related to 'Coarse Feature Link' in Table 5.

Table 5: Comparative evaluation of candidate fine features identified during management plan review.

Candidate Feature	Relative Concern (Plans)	Relative Protected Status (%)	Published Conservation Status				Available Data Evaluation	Ongoing Monitoring	Ease of Monitoring	Coarse Feature Link	Source of Information
			NatServ	MT	AB	BC					
FINE FEATURE											
Grizzly Bear	32	13.8	G4	S2S3	S3	S3?	GOOD	GOOD	MODERATE		IUCN range maps
Bull Trout	28	10.2	G5	S2	S2	S3S4B	GOOD	GOOD	MODERATE	Riparian	
West Slope Cutthroat Trout	23	10.3	G5T4	S2	S2	S4B	FAIR	GOOD	MODERATE	Riparian	MT Field Guide
Canada Lynx	18	6.9	G5	S3	S4	S5	POOR	LOW	LOW	LP & WS Forest	IUCN range maps
Rocky Mountain Elk	17	9.7	G5	S5	S5	S5	GOOD	GOOD	MODERATE	Grass/Shrub	
Mule Deer	12	9.0	G5	S5	S5	S5	GOOD	GOOD	MODERATE		
Wolverine	12	11.4	G4	S3	S3	S3	FAIR	MODERATE	LOW	Alpine	COSEWIC
Bighorn Sheep	9	15.6	G4	S4	S4	S3?	FAIR	MODERATE	MODERATE	Alpine	IUCN range maps
Grey Wolf	8	9.8	G5	S4	S4	S5	FAIR	GOOD	LOW	Forest	
Mountain Goat	8	25.5	G5	S4	S4	S3	FAIR	MODERATE	LOW	Alpine	
Whitebark Pine	8	25.3	G3?	S3	S3	S2S3	GOOD	MODERATE	MODERATE		WBP Found.
Bald Eagle	7	9.0	G5	S4	S4B	S5B	GOOD	MODERATE	MODERATE	Riparian/Aquatic	IUCN range maps
Harlequin Duck	7	11.7	G4	S2B	S3B	S4B	POOR	LOW	LOW	Riparian	
Moose	7	11.8	G5	S4	S5	S5	FAIR	MODERATE	MODERATE	Wetlands	
Other Ungulates	7	9.0					GOOD	MODERATE	MODERATE		
Peregrine Falcon	6	9.0	G4	S3	S1B	S3B	POOR	MODERATE	MODERATE		
Black Bear	6	12.4	G5	S5	S5	S5	POOR	LOW	LOW	Forest	
Lewis' Woodpecker	6	11.6	G4	S2B	S3B	S2S3B	POOR	GOOD	MODERATE	Riparian	
Trumpeter Swan	6	0.2	G4	S3	S2S3B	S4B		MODERATE	MODERATE	Aquatic	
Western/Boreal Toad	6	10.6	G4	S2	S3S4	S3S4	POOR	LOW	LOW	Wetlands	
INFORMATION SOURCE	Crown LCD Mgt Plan Review	World Database on Protected Areas; NatureServe	NatureServe (2006)	Montana SWAP	Canadian Endangered Species Conservation Council (2016)					Crown LCD Feature Analysis	

Relative Concern (plans): Sum total of management plans we reviewed (n = 63) that the fine feature is prioritized in.

Relative Protected Status: Percent of the species range, within the project area, that is on land identified as managed under International Union for Conservation of Nature (IUCN) Protected Status Ia (Strict Nature Reserve), Ib (Wilderness Area) or II (National Park). See Appendix 3. Species range data from NatureServe and Commission for Environmental Cooperation except where noted in table.

Published Conservation Status: As reported by NatureServe (global status), MT FWP, and Canadian Endangered Species Conservation Council. G = Global; S = State/Province; 2 = Imperiled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure; ? = inexact ranking. Multiple numbers indicates a range of uncertainty See Appendix 4. More detail on rankings are here.

Available Data Evaluation: relative volume of data available for the coarse feature; evaluation based on working LCD data catalog.

Ongoing Monitoring / Ease of Monitoring: based on Analysis Team general knowledge of ongoing monitoring and comparative estimate of monitoring potential of partners.

Coarse Feature Link: Fine Features (species) intrinsically linked to specific candidate Coarse Features (see "Obligate Species" field in Table 4).

Feature Selection Deliberation

Feature selection is by necessity a subjective process. Few features across a landscape are directly comparable quantitatively; however we attempted to use standardized methods to facilitate comparative evaluations among candidate features identified through an extensive review of existing management plans. This information was presented to the Leadership Team over the course of 9 hours of remote meetings spanning 5 months (Feb-July 2020). Leadership Team comments, questions, requests and deliberations were well-documented. In addition, ancillary discussion and deliberation, especially as related to data availability, quality and consistence, continued among a Technical Team. Evaluations along with supporting literature and citations describing feature selection strategies were presented to the leadership team in a web-based poll soliciting final recommendations from Leadership Team members. The poll asked Leadership Team members to identify from among 13 coarse features (habitats and ecosystem processes) and 19 fine features (species) whether the feature should be 'Must Include', 'Should Include', 'Maybe', 'Should Not', 'Do Not Include' or 'I Don't Know'. Respondents were given 3 weeks to consider and complete the poll.

Twenty-one Leadership Team members voted using the poll. Following final results we scored response choices (Table 6) to broadly differentiate each candidate feature relative to one another.

Table 6. Scoring applied to responses for feature selection poll.

Response	Score
Must Include	+10
Should Include	+6
Maybe	+1
Should Not Include	-5
Do Not Include	-50 (essentially a veto)
I Don't Know	0

Results of the scoring are reported in Figures 5 and 6.

Crown Landscape Conservation Design
Feature Selection Process

Figure 5. Results of Leadership Team (LT) polling and subsequent scoring of candidate coarse features for inclusion in Crown Landscape Conservation Design. Twenty-two LT members voted if each feature was: 'Must Include', 'Should Include', 'Maybe', 'Should Not', 'Do Not Include' or 'I Don't Know'. Vote choices were scored as +10, +6, +1, -5, -50 (a veto) and 0, respectively. Thus, a maximum score possible was 220 and a minimum score -1,100.
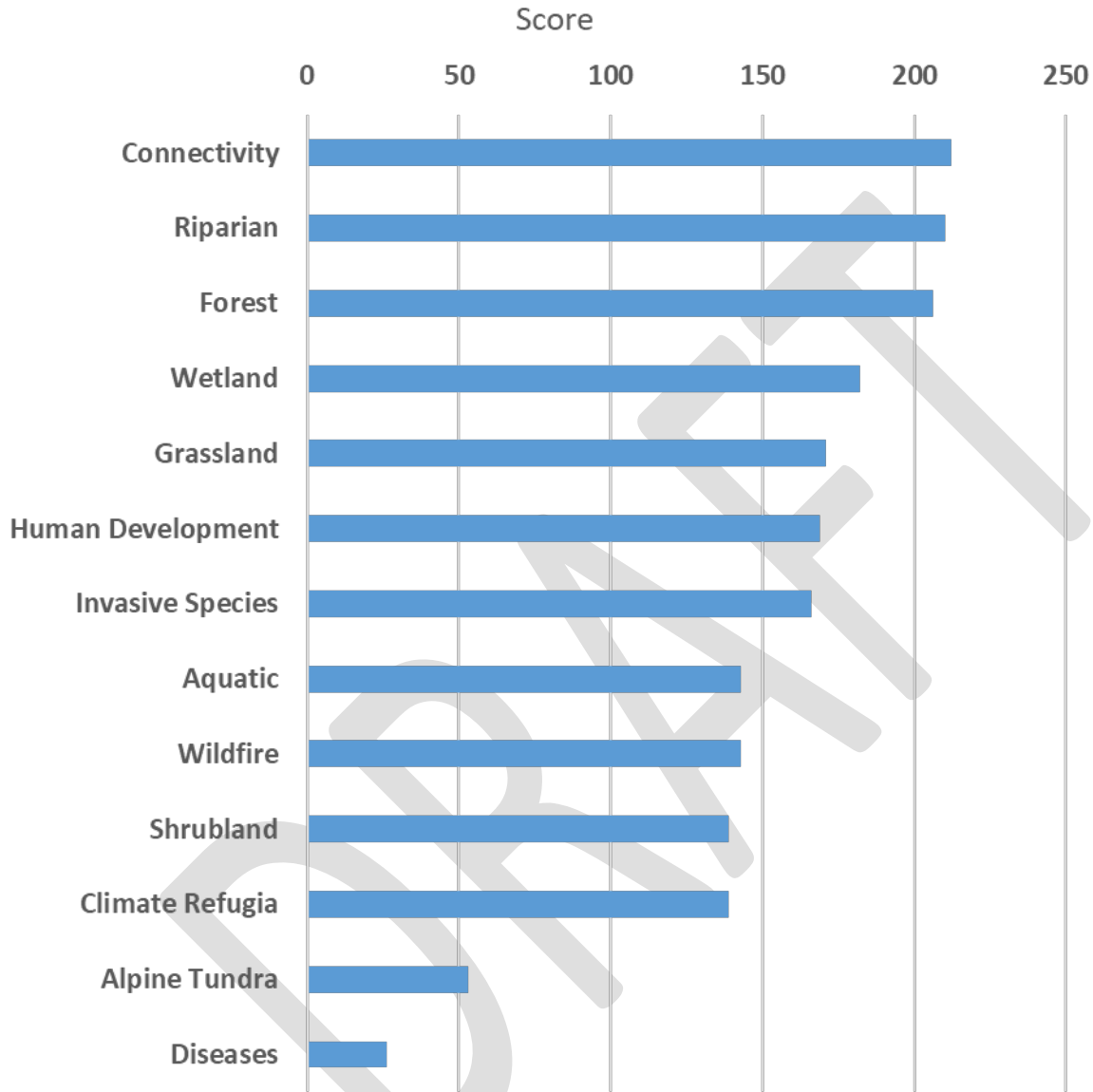
Crown Landscape Conservation Design
Feature Selection Process

Figure 6. Results of Leadership Team (LT) polling and subsequent scoring of candidate fine features for inclusion in Crown Landscape Conservation Design. Twenty-two LT members voted if each feature was: 'Must Include', 'Should Include', 'Maybe', 'Should Not', 'Do Not Include' or 'I Don't Know'. Vote choices were scored as +10, +6, +1, -5, -50 (a veto) and 0, respectively. Thus, a maximum score possible was 220 and a minimum score -1,100.
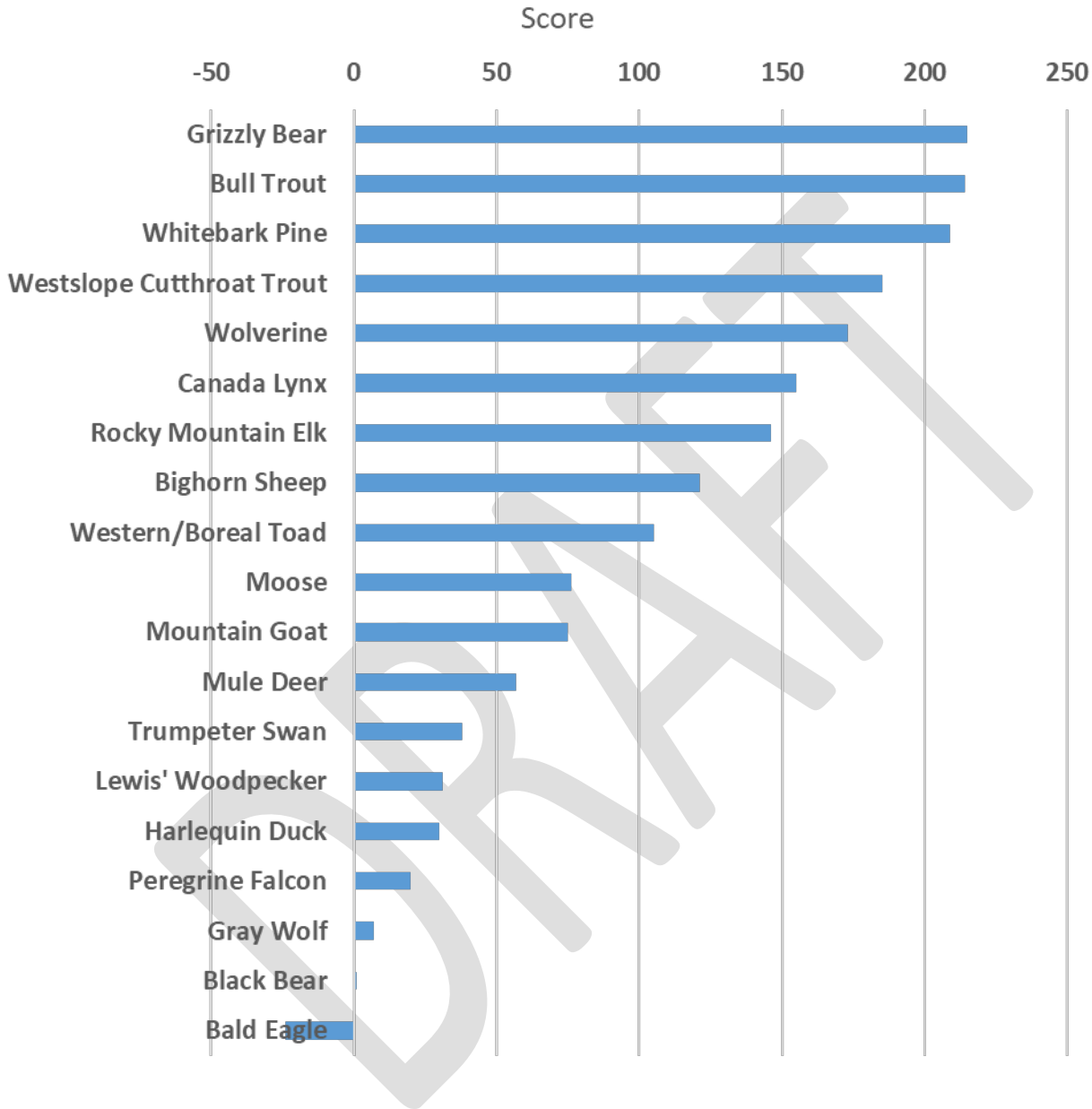
Results were summarized and reviewed as a group during a 1.5 hr phone call (25 August 2020).

Final Selection

Final deliberative debate, occurring over 3 hours of discussions during two remote meetings, resulted in 15 features being selected for inclusion in the Crown Landscape Conservation Design (Table 7).

Table 7. Final Selection of focal ecological features for inclusion in the Crown Landscape Conservation Design.

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Coarse Features	Fine Features
Ecological Connectivity	Grizzly Bear
Riparian	Bull Trout
Forest	Whitebark Pine
Wetland	Westslope Cutthroat Trout
Grassland	Wolverine
Aquatic (lakes and large rivers)	Canada Lynx
Shrubland	Rocky Mountain Elk
	Mule Deer

These results largely followed the outcome of Leadership Team voting and results scoring and high priorities were reasonably consistent throughout the selection process. Notable exceptions include the exclusion of human development, invasive species and wildfire from the coarse feature poll results. The LT decided, with support and recommendation from the Technical Team and Analysis Team, that these features would be better handled at threats or costs during subsequent spatial and strategic modeling. Fir fine features, the LT chose to include mule deer due to their presence across the full extent of the Crown LCD project area, their relative importance to agency management (and in some cases revenue) and their cultural significance. Further, the LT instructed the Analysis Team to consider any of the candidate species as potential key attributes of the coarse features as design analyses proceed. Finally, the LT instructed the Analysis Team to address select fine features as individual species, and sets of guilds (Table 8) and as a cohesive set of complementary fine features during all subsequent analyses.

Table 8: Guilds of select fine features to be considered during all subsequent analyses:

Guild	Species	
Cold Water Salmonids	Bull Trout	Westslope Cutthroat Trout
Mesocarnivores	Wolverine	Canada Lynx
Ungulates	Rocky Mountain Elk	Mule Deer
[No Guild]	Grizzly Bear	
[No Guild]	Whitebark Pine	

The ecological feature selection process concluded in September 2020. This report will be followed by treatment of social, cultural and economic features and by detailed reporting on spatial modeling of the final ecological features.

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- Latimer, W. 2009. Assessment of Biodiversity at the Local Scale for Environmental Impact Assessment and Land-use Planning, Planning Practice & Research, 24:3, 389-408, DOI: 10.1080/02697450903020841 [https://rsa.tandfonline.com/doi/full/10.1080/02697450903020841#.XxcSfudMFPY, accessed 7/21/2020]

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Appendix 1:

All Fine Features (Species) identified in ≥ 1 reviewed management plan. Gray boxes indicate various groups of species as explicitly referenced in a source plan(s).

Species/Taxa	No. of Plans	Species/Taxa	No. of Plans
Grizzly Bear	32	Blue-gray Gnatcatcher	1
Bull Trout	28	Bluebunch Wheatgrass	1
West Slope Cutthroat Trout	23	Boreal Chorus Frog	1
Canada Lynx	18	Breeding Bird Community	1
Elk	17	Brook Trout	1
Mule Deer	12	Burrowing Owl	1
Wolverine	12	Caspian Tern	1
Bighorn Sheep	9	Chinook Salmon	1
Grey Wolf	8	Chipping Sparrow	1
Mountain Goat	8	Chokecherry	1
Whitebark Pine	8	Coeur d'Alene Salamander	1
Bald Eagle	7	Columbian Ground Squirrel	1
Harlequin Duck	7	Common Garter Snake	1
Moose	7	Coyote	1
Other ungulates	7	Creeping Juniper	1
Peregrine Falcon	6	Douglas Fir	1
Black Bear	6	Fisher	1
Lewis' Woodpecker	6	Golden-crowned Kinglet	1
Trumpeter Swan	6	Gray-crowned Rosy-Finch	1
Western Toad/Boreal Toad	6	Great Plains Toad	1
Golden Eagle	5	Greater Short-horned Lizard	1
Mountain Lion	5	Hairy Woodpecker	1
Limber Pine	5	Idaho Giant Salamander	1
Northern Leopard Frog	5	Kinnikinnick	1
Common Loon	4	Kokanee	1
Sharp-tailed Grouse	4	Lake Trout	1
Migratory Birds	4	Lark Bunting	1
Spalding's Catchfly	4	Le Conte's sparrow	1
Arctic Grayling	3	Least Tern	1
American Beaver	3	Little Brown Myotis	1
Bison	3	McCown's longspur	1
Bobcat	3	Milksnake	1
Columbia River Redband Trout	3	Needle and Thread Grass	1
Northern Goshawk	3	Northern Three-toed Woodpecker	1
Long-toed Salamander	3	Northern Bog Lemming	1
Pileated Woodpecker	3	Northern Pintail	1
Prairie Falcon	3	Osprey	1

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Shorebirds	3	Paddlefish	1
Waterfowl	3	Painted Turtle	1
Bolander's Quillwort	3	Pallid Sturgeon	1
Chestnut-collared Longspur	3	Pearl Dace	1
Ferruginous Hawk	3	Plains Garter Snake	1
Landbirds	3	Plains Spadefoot Toad	1
Pronghorn	3	Plankton	1
Water Howellia	3	Raptors	1
White-tailed Deer	3	Rare Plants	1
Yellowstone Cutthroat Trout	3	Red Belly Dace	1
Greater Sage-Grouse	3	Red-necked Grebe	1
Black Tern	2	Red-osier Dogwood	1
Bobolink	2	Rufous Hummingbird	1
Burbot	2	Sandhill Crane	1
Butterflies	2	Saskatoon Serviceberry	1
Clark's Nutcracker	2	Sauger	1
Columbia spotted frog	2	Shortnose Gar	1
Flycatchers	2	Shrew (arctic, northern short-tailed, dwarf)	1
Long-billed Curlew	2	Shrubby cinquefoil	1
Marbled Godwit	2	Sicklefin Chub	1
Piping Plover	2	Smooth Greensnake	1
Rainbow Trout	2	Snow goose	1
River Otter	2	Sockeye salmon	1
Rough Fescue	2	Steelhead	1
Sprague's Pipit	2	Sturgeon Chub	1
Townsend's Big-eared Bat	2	Swift fox	1
White Sturgeon	2	Terrestrial Garter Snake	1
Mountain Whitefish	2	Tiger Salamander	1
Willow flycatcher	2	Trout-perch	1
Black-footed Ferret	2	Western Hog-nosed Snake	1
Common Nighthawk	2	Western Pearlshell	1
Half-moon Hairstreak	2	Western Rattlesnake	1
Loggerhead Shrike	2	Western Wheatgrass	1
Mountain Plover	2	Whooping Crane	1
Olive-sided Flycatcher	2	Willow	1
Ponderosa Pine	2	Wood's Rose	1
White-tailed Prairie Dog	2	Yellow-billed Cuckoo	1
American Pine Marten	2	Wood Duck	1
Aquatic Amphibians	1	Vaux's Swift	1
Aquatic Invertebrates	1	Brown Creeper	1
Aquatic Vertebrates	1	Hoary Bat	1
Quaking Aspen	1	American Wigeon	1
Black Rosy-Finch	1	Redhead	1
Black Swift	1	Long-billed Dowitcher	1

Blue Grama	1	American Bittern	1
Blue Grouse	1	Western Meadowlark	1
Blue Sucker	1	Grasshopper Sparrow	1

Appendix 2:

Analysis Team:

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Appendix 3:

World Database of Protected Areas:

Ia   Strict Nature Reserve

Ib   Wilderness area

II   National Park

III   Natural Monument or feature

IV   Habitat/species management area

V   Protected landscape/seascape

VI   Protected area with sustainable use of natural resources

Appendix 4:

Montana Species Ranking Codes (GRank, SRank)

Montana employs a standardized ranking system to denote **global** (range-wide) and **state** status (NatureServe 2006). Species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure), reflecting the relative degree of risk to the species' viability, based upon available information.

A number of factors are considered in assigning ranks — the number, size and quality of known occurrences or populations, distribution, trends (if known), intrinsic vulnerability, habitat specificity, and definable

threats. The process of assigning state ranks for each taxon relies heavily on the number of occurrences and Species Occurrence (OE) ranks, which is a ranking system of the quality (usually A through D) of each known occurrence based on factors such as size (# of individuals) and habitat quality. The remaining factors noted above are also incorporated into the ranking process when they are known. The "State Rank Reason" field in the Montana Field Guide provides additional information on the reasons for a particular species' rank.

Rank		Definition
G1	S1	At high risk because of **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
G2	S2	At risk because of **very limited** and/or **potentially declining** population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
G3	S3	Potentially at risk because of **limited** and/or **declining** numbers, range and/or habitat, even though it may be abundant in some areas.
G4	S4	Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
G5	S5	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
GX	SX	Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.
GH	SH	Historical, known only from records usually 40 or more years old; may be rediscovered.
GNR	SNR	Not Ranked as of yet.
GU	SU	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
GNA	SNA	A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities as a result of being: 1) not confidently present in the state; 2) non-native or introduced; 3) a long distance migrant with accidental or irregular stopovers; or 4) a hybrid without conservation value.

Combination or Range Ranks

G#G# or S#S#	Indicates a range of uncertainty about the status of the species *(e.g., G1G3 = Global Rank ranges between G1 and G3).*
S#, S#	Indicates that populations in different geographic portions of the species' range in Montana have a different conservation status *(e.g., S1 west of the Continental Divide and S4 east of the Continental Divide).*

Sub-rank

T#	Rank of a subspecies or variety. Appended to the global rank of the full species, *e.g. G4T3* where the G-rank reflects the global status of the entire species and the T-rank reflects the global status of just the subspecies.