Biosphere Institute of the Bow Valley

Expert Analysis Program

1999-2000

Part 2: Workshop Notes

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Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Vegetation Workshop

April 21, 1999
Canmore, Alberta

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Biosphere Institute of the Bow Valley
Expert Analysis Program
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Vegetation Workshop
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Participants:

Dave Dalman	Banff National Park
Steve Donelon	Natural Resourses Services
Scott Jevons	Geoworks G.I.S.
Dave Knox	Ecosystem Integrity Researcher
Mark Lindbergh	Natural Resources Service - Calgary
Marie-Pierre Rogaine	Wildland Disturbance Consultant
Mark Sherrington	BNP Research Contractor
Rob Walker	Parks Canada, Kootenay, Yoho, & Lake Louise
Cliff Wallis	Cottonwood Consultants
Cliff White	Banff National Park

Chairperson:

Cliff White	Banff National Park

Facilitator:

E. Melanie Watt, Ph.D.	Biosphere Institute of the Bow Valley

Biosphere Institute of the Bow Valley
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ECO-REGION APPROACH

Alpine
Subalpine
Montane
Riparian

ALPINE

Structure

How much is there?
What is the rate of change?
Limited extent
Isolated structurally
Genetic flows
Assumptions on thresholds i.e. climate change

Stressors

Local and Global - Pollution Effects
H*- Human Use - on Ecosystem Level
H*- Which complexes are more significant - e.g. exotics/micro-habitats (within ecosystems)/trampling/rarity (species & communities)
Construction of buildings.
*H**- Heli-touring and trail use – introduction of seeds etc. carried by humans (muddy boots!)
How are these regulated? Guidelines? Sunshine Meadows, Bow Valley landscape approach.
*H**- Mountain biking and horse use (weed introduction) - to use trails or not to use trails?

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*Footnotes

Key of Recommendations for Initiation of Research

*H** = High Priority = start research within 5 years
*M** = Medium Priority = start research in 5 - 15 years
*L** = Low Priority = start research in more than 15 years to start

Research/ Monitoring/ Indicators

Treeline e.g. Photos (Brian Luckman, University of Western Ontario)
Upper limit of semi-continuous vegetation (Brian Luckman, University of Western Ontario)
More sensitive indicators e.g. lichen distribution - Needs to be defined (Brian Luckman, University of Western Ontario)
*M**- Air quality – ozone e.g. Fortress levels (Dave Donald – water quality, Environment Canada)

H IN ALL REGIONS*-Development of long term monitoring plots (transects)
Good marking of plots/transects
G.I.S.
Obtaining records-archival material
Canadian Forestry Service and other government agencies do research (not many in the alpine)
Funding: Ski hills, logging money, heli-skiing, university grants short-term

More information about genetic flows needed i.e. good records exist for butterflies (Jens Roland, University of Alberta; Rob Walker/Rob Longair, University of Calgary)
Permanent photo-plots of (Alpine) larch and pine (white bark pine)
Progress into design of long term monitoring plots
*H**- blister rust is important issue for white bark pine
M* to L* (lots of pictures available) Fire - effects on tree line
Climate change – wind speed and moisture levels
Glacial change - Snow level/treeline, species distribution and snow fall (Brian Luckman, University of Western)
*L**-Exotics – effects of exotics

Expert Analysis of Human Use Needed
G.I.S.
*M**- Has it been micro-mapped? - (Point-data exists)
*M**- Landscape ecology of landscape areas in Alpine regarding climate change (e.g. butterflies - pollinators - flies)
L to H** - Need to know more regarding dynamics of alpine
Martin Price with I.U.C.N.– Researched ecological conditions of Sunshine Alpine Meadows in 1970s, this could be used for comparison
Comparisons with other Rocky Mountain Regions
Species migration (regarding trees- Brian Luckman, University of Western Ontario)
Landscape level goals

SUBALPINE

Structure

Well connected (large contiguous blocks)
Composition fairly well known – vegetation types
Moderately productive, topographically controlled
Fairly homogenous
Avalanche tracks
High commercial value

High recreational value
Wildlife corridors
Highways
Old growth forests (mapped already – stand origin) and climate change, and isolated pockets (see B.C.)
Shifting hypothesis versus stable growth patterns hypothesis
Research needed on dynamics: Size/distance/ "chunks"/fire cycles – OLD or "OLD" growth

Dynamics
Large stand-replacing fire
Forest succession
*L** -Diseases – insects
*L** -Animals – large & small
Blow-down
Avalanches

Stressors
Fire suppression
Transportation/highway/railroads
Development
Rock industry
Logging and thinning
Trail usage – introduced species (Gail Harrison's Research)
Atmospheric pollution
Development – *L** hydrology (Marmot Creek, Nakiska), pollutants, introduced species
Climate change

Indicators
*M** -Stand-age mosaic complexity
*M** -Presence of old growth
*M** -Rare species and association with fires
Connectivity of patches/subalpine (including fauna)
Wildlife habitat- *H* in lower and top Alpine areas* (see Lynx – Clayton Apps)
    Sheep
    Grizzly
    Not Moose

Other components
*L** -Subalpine Wetlands (subzone):
    'Seep' communities – species
    Recreational magnets
    (Possible modeling project – is it covered by GIS?)
*L** -"Parklands":
    clumps of trees interspersed with wetlands/shrubs. Mesic Meadows
*H** -Ski Hills:
    Ecologically define the appropriate mix of forest and open run
    Cut-off points?

Time of year of use in these areas
Monitoring of exotics on runs/re-seeding
Runs extend into Alpine
Use of snow/snow-making/effects on plant communities/water source, hydrology

Research needed
M to H** -Monitoring plots
Historical (include aerial photos) photos/comparisons
Returning to old burns (e.g. Vermillion)
Fire history: Canmore details needed
Wildlife & monitoring <u>including</u> plants!

*H** -Logging – "Big Gap"
What species have regenerated?
Non-native species
Site preparation/disturbance
Historical logging and comparisons

MONTANE
Structure
Limited, increasingly fragmented e.g. 8% in Banff National Park, Provincial very low (0.1%?)
Lots of known, rare communities and species (e.g. Rocky Mountain Juniper)
Quite heterogeneous structure (e.g. forests/wetlands)
Highly linear and therefore elevation/climatic driven
More productive – major riparian areas in Montane
More isolated, "floristically" isolated between subalpine and lower foothills
More complex stand structure – multi-age and species

Processes
Historical human use and changes in use (e.g. fear of fire/housing prices)
Fire – frequency i.e. from frequent/low intensity to controlled
Fire season longer in the past
Complex predator/prey relationships
Animal dispersion/seed dispersion
Localized climatic effects
Historical flood regime - Aquatic workshop
Complex geomorphology e.g. riparian floodplains/alluvial fans active/glacial geology
More active forest disease processes
More active mineral cycling
Possibly more resilient than other elevations

Stressors
Yes-stressors, external influences more important here
Linear Barriers produce fragmentation e.g. fences, railroads, fire pattern
Fire suppression
Dams

Pavement- access – microclimate changes: heat islands/run-off
Human use – traffic, National transportation pressures, potential for disasters, golf, recreation, and trails
Layering/multiplicity of stressors
Pollution including air, water, noise, light effects on vegetation
Resource extraction

Research / Indicators / Monitoring

1) *H** Detailed fire history (Carrot Creek) / map for Canmore area
2) *H** 1:10,000 scale for vegetation mapping
   spatial extent of community types
   patch *size* e.g. meadows and Douglas fir
3) *M** Community composition species/time e.g. Douglas fir– reference sites
   *H** – wildlife exclosures with benchmarks
4) *H** Measure of connectivity
   – widths X lengths of corridors
   – habitat types
   (Danah Duke, University of Alberta-within park)
   (needed –Canmore, Jon Jorgensen, Alberta Environment regarding width)
5) *H** Measure of Restoration
   - riparian
   - valley bottom habitats
   - old mine sites (vs. Golf courses as habitat)
   - "no net loss" concept
6) Ungulate use and effects on native species (Cliff White, Parks Canada)
   - elk density
7) *H* (regarding Canmore Corridors)* Urban perimeters/Edge ratios
8) *H** List of species at risk
   - comparisons with Highwood, Saskatchewan Crossing (ANHIC:CDC)
9) *H** Non-native plant species invasion
10) *H** Classic indicator species
   - level of regeneration (e.g. aspen)
11) Local Guidelines for restoration and landscaping- Palatability
12) *H* in Canmore* Availability of restoration materials
   - native plant propagation regarding Montane
13) *H** Level of Human use – mapping and inventories
14) *H** Biodiversity -index development for Montane (Link to #5)
15) *H** Forestry – management/fire
   -mechanical manipulation
   - biodiversity results – are they acceptable and what benefits are there?
   -compare results of natural vs. mechanical e.g. regeneration rates.
   -treatment sites in Banff, but applicable in Canmore
   *H** Highway Mitigation – fencing and underpasses
   (future changes in elk/moose populations for example)

H* Indicators to be Monitored (For Thresholds & Monitoring)

Aspen

Douglas Fir
Native Grasslands
Occurrence of non-native species (e.g. purple loosestrife)
Prioritized list of invasive species
Risk/analysis, "weed" species
Faunal assemblages

RIPARIAN

Structure

Near water / Valley bottom / Linear / Periodically wet
High Biodiversity
Species adapted to disturbance e.g. flooding

Processes

Ice-dams
Flooding
Beavers and dams
Channel Migration

Stressors

Dams
Channelization
Flood plains
Transportation corridors
Bridges
Point-source pollution-golf course runoff/urban runoff, road chemicals & salt
High human use- e.g. fishermen's trails
Recreation – e.g. rafting
Non-native plants
High herbivory
Up-stream activity and down-stream demand
Water rights and land uses associated with those rights

Indicators

*H** Width of flood plains
Number of barriers (linear)
Disturbance events regarding flooding (historical information)
Alluvial Fans – (Fez Descally – Kamloops)
*M** Tree regeneration, willow etc.
*M** Number/location of beaver dams and moose habitat assessment (Cliff Neitfelt, Parks Canada)
*H** Human use levels
Biodiversity – Bird species diversity (especially Warblers)
Accessibility = human use- e.g. does human use cause modification of riverbanks?
Restoration of native vegetation and water flows e.g. Canmore Creek /Buffer Zones
Monitoring Cascade Creek and Vermilion Lakes restoration projects

Biosphere Institute of the Bow Valley
Expert Analysis Workshop April 21, 1999

VEGETATION

Identified Research Priorities

Identifying priorities: High = start research within 5 years, Medium = start research within 5-15 years, Low = start research in 15+ years

Eco-Region	Research requirements	Priority	Research in progress
ALL REGIONS	Development of long term monitoring plots – transects	High	
ALPINE	Human use on ecosystem level	High	
	Mountain biking and horse use; weed introduction	High	
	Which ecosystem complexes more significant	High	
	Heli-touring and trail use	High	
	Blister Rust	High	
	Dynamics of alpine ecology in landscape areas	Low -High	
	Air Quality - ozone	Medium	Dave Donald (Environment Canada)
	Micro-mapping of human use	Medium	
	Landscape ecology of landscape areas	Medium	
	Fire - effects on tree line	Med -Low	Many pictures available.
	Exotics - effects of exotics	Low	
	Treeline - photographs		Brian Luckman (University of Western Ontario)
	Upper limit of semi-continuous vegetation		Brian Luckman (University of Western Ontario)
	Sensitive indicators e.g. lichen distribution		Brian Luckman (University of Western Ontario)
	Genetic Flows		Good records on butterflies – Jens Roland
	Climate change - wind speed & moisture levels		
	Glacial change		Brian Luckman (University of Western Ontario)
	Comparisons between Rocky Mountain Regions		Martin Price I.U.C.N. Sunshine Meadows
	Species Migration		Trees: B. Luckman (University of Western Ontario)

Eco-Region	Research requirements	Priority	Research in progress
SUBALPINE	Ski Hills	High	
	Logging	High	
	Connectivity of patches/wildlife habitat	High	Lynx - Clayton Apps
	Stand-age mosaic complexity, Presence of old growth, rare species and association with fires	Medium	
	Dynamics of Diseases - insects	Low	
	Dynamics of Animals large & small	Low	
	Stressors - development	Low	Marmot Creek, Nakiska
	Subalpine wetlands	Low	
	Parklands	Low	
	Trail usage - introduced species		Gail Harrison
MONTANE	Detailed fire history map for Canmore	High	
	1:10,000 vegetation mapping	High	
	Wildlife exclosures	High	
	Measure of connectivity	High	in Park: Danah Duke (University of Alberta) on widths: Jon Jorgensen (Alberta Environment
	Measure of restoration	High	
	Urban perimeters/edge ratios	High	
	List of species 'at risk'	High	
	Non-native plant species invasion	High	
	Classic indicator species	High	
	Level of Human use - mapping and inventories	High	
	Forestry management regarding Fire	High	
	Highway mitigation - fencing & underpasses	High	
	Monitoring of indicators (see workshop notes for list)	High	
	Biodiversity index development for Montane	High	
	Availability of restoration materials	High	
	Community composition (species/time)	Medium	
	Ungulate use and effects on native species		Cliff White (Parks Canada)
	Local guidelines for restoration		

Eco-Region	Research requirements	Priority	Research in progress
RIPARIAN	Human use levels	High	
	Width of flood plains	High	
	Tree regeneration, willow	Medium	
	Beaver dams and Moose habitat	Medium	Cliff Nietvelt
	Number of barriers		
	Disturbance events		
	Alluvial fans		Fez Descally - Kamloops
	Biodiversity		
	Restoration of native vegetation		Cascade Creek and Vermillion Lakes
	Monitoring of restoration projects		

Funding Agencies	Research Agencies	Community Agencies
Parks Canada Lands and Forest Service Natural Resource Service Student Grants Alberta Conservation Association Developers Rocky Mountain Elk Foundation Town of Canmore LaFarge Friends of Kananaskis Friends of Banff Y 2 Y - Lists of funding agencies Ducks Unlimited TransAlta	Canadian Forestry Services Parks Canada Universities (i.e. Faculties of Environmental Design) Lands and Forest Service Natural Resource Service Developers Contractors Eastern Slopes Grizzly Project Central Rockies Wolf Project Miistakis Institute	Alberta Native Plant Council Bow Valley Naturalists Trail Groups

Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Mammals Workshop

April 22, 1999
Canmore, Alberta

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Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
Mammals Workshop
April 22, 1999

Participants:

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Tony Clevenger	Parks Canada
Dave Dalman	Banff National Park
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David Knox	Ecosystem Integrity Researcher
Mark Lindberg	Natural Resources Service
Wayne McDonald	University of Alberta
Cedar Mueller	Eastern Slopes Grizzly Bear Protection
Cliff Nietvelt	Contractor for Banff National Park
Melanie Percy	Banff National Park
Dave Poulton	Canadian Parks and Wilderness Society
Bart Robinson	Yellowstone to Yukon Conservation Initiative, Biosphere Institute Board Member
Colleen Cassady St. Clair, Ph.D.	University of Alberta
Jen Theberge	Eastern Slopes Grizzly Bear Protection
E. Melanie Watt, Ph.D.	Biosphere Institute of the Bow Valley
Cliff White	Banff National Park

Chairperson:

Cliff White	Banff National Park

Facilitator:

E. Melanie Watt, Ph.D.	Biosphere Institute of the Bow Valley

Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
Mammals Workshop
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Workshop Notes

SPECIES APPROACH

Large Carnivores
- Grizzly bears
- Cougars
- Wolves
- Black bears
- Wolverine
- Lynx and Bobcat

Small mammal assemblages by habitat type
- Montane
- Aspen
- Wetlands
- Upland – Conifer / Mixed wood

Other species
- Ungulates
- Bats

LARGE CARNIVORES

Grizzly bears, cougars, wolves, black bears, and wolverine

Structure

Wide-ranging, needing lots of linked space
Keystone / umbrella species
Rare, low density
Sensitive to human impact
Public safety issues
Apex predators
Cause ripple / cascading behavioral effects

Stressors

Humans -roads / railway / development
Human use impact levels

Stressors continued

Mortality: roads, hunting, poaching, 'problem animals, trains, disease, ski hills, back country lodges, golf courses, attractants (garbage, etc., pets)

OCA's (outlying commercial areas)

Trails

Sensory disturbances: light, noise, music, smells, etc.

Access to prey limited (human effects on prey distribution)

Fire suppression

Habitat manipulation

Research and Monitoring Needs

These were discussed by species, commencing with:

GRIZZLY BEARS

Between 1994 and 1999 there has been intensive research, (but not guaranteed for future)

*H*Long term* -A need for ongoing population trend monitoring; over the long term, with barbed wire hair snags.

*H*Long term* -Baseline demographic data are needed. Keep adjusting recommendations regarding development, seasonal etc.

The distinction between 'research' (problem oriented) and 'monitoring' relative to the time span of each was illustrated:

----------o----------o----------o----------→ *time*

(Where research is o and monitoring is ----).

*H** -'Semi'-control areas are needed, such as Wind Valley and Cascade.

*H** -Large landscape approach – (Kananaskis country, as an example, as a whole, linked area for population monitoring) rather than isolated area for research.

*M** -Monitoring trends etc. in plant food sources (e.g. berries) needed.

More emphasis on 'bottom-up' processes (e.g. ants and bears) and monitoring over time. Some data already exist and need to be looked at.

'Top-down' or 'bottom-up' studies or both integrated? Is there a bias in research? Do humans operate at the top of Grizzly processes? A need for habitat modeling and population studies.

*H** -human/bear interface in the future. "People management" e.g. garbage, bird feeders enforcement of guidelines.

Human psychology and bears and ecology in general should be considered. Effective education methods are needed such as brochures regarding closures. Personal responsibility factor.

*H*ongoing* -Human access management and monitoring needed.

*H*ongoing* -Secure habitat for female bears identified as most important; more info is needed for the Central Rockies.

Are we focussing on the major threat issues? For example, is development a greater threat than garbage bins; what are the <u>cumulative</u> effects of stressors? ESGB project is studying this.

Continue research e.g. Lake Louise into the future.

Cumulative effects – ongoing studies needed.

COUGARS

Structure

The general group *structure* applies, except that cougars are less wide-ranging / montane / lower elevations possibly less sensitive to human interference than most carnivores. Rocky Mountain cougars are possibly less threatening to humans than are cougars in B.C.

Stressors

Development, golf courses
Displacement from kills
Noise and light, unknown importance
Direct mortality – roads, railway, and control

Research and Monitoring Needs

Demographic monitoring needed (avoiding collaring methods). Some work is ongoing regarding tracks and individuals (Banff National Park).
H* -Scats, tracks and hair. (Worthwhile collecting samples such as scat for analysis at a later date, anticipating advances in DNA technology and lab priorities).
Trends
Corridor monitoring
Dispersal: males/females, dispersal limits, age of individuals, seasonality (tracking in winter)
Detailed assessment of demographic data.

WOLVES

Structure

Populations are typically rare, and of low density. Wolves are the most fecund carnivores on our list. Otherwise, the structure is similar to other carnivores.

Stressors

These include railway kills, and above mentioned stressors. Opinions were mixed regarding attractants as an issue or potential issue for wolves.

Research and Monitoring Needs

Population trend monitoring is ongoing (Central Rockies Wolf Project) and more is needed.
More pellet counts (not snow dependent) – prey densities. Roll together research across valley.
There is a need to contrast low and high-density wolf populations. Mortality and prey population monitoring needs to be ongoing, enhancing wolf population viability.
Assessment is necessary of the effectiveness of mitigation and limiting of human access. Before and after controls, are needed as well as comparative studies. Not able to refer to baseline human data.
Enforcement and compliance monitoring are needed.

BLACK BEARS

Structure
Structure is as other large carnivores as listed, except it is typified by being located in the lower montane, and they are more attracted to humans. Populations tend to be linear and isolated. Used as indicator species. Possible that they have very high mortality rates.

Stressors
Stressors are probably similar to the other carnivores.

Research and Monitoring Needs
Dispersal
Reproduction and demographic issues. Past studies have not provided all the information required.
H* garbage bear studies
Aversive conditioning needs to be investigated.
Human education research
Genetic data bank is needed
Non-habituated bears show different results compared to habituated bears.
Much potential to include data being collected for other species and questions: road kills, wolves/bear comparisons.
'Bottom up' habitat analysis was considered important.

WOLVERINES

Structure
Structure is typically one of low population density, low public safety issues; not an apex predator; and low predation effect.

Stressors
Low tolerance to human use, and no recognized attractant problems.

Research and Monitoring Needs
Future research technology improvements in monitoring may suit this species well. Camera and hair studies may be possible but cost feasibility is a major issue. Data should be collected as available and when studying other species. For example, with current tracking studies: (Clayton Apps, Martin Jalkotzy) and possibly with underpass study.

LYNX AND BOBCAT

It was agreed that Clayton Apps of Aspen Wildlife Research would fill in the lynx section after the workshop. The following is based on his response to that request.

Structures
Populations are patchy and occur at low densities, as both species are near a natural range extent. Resident home ranges of 100 – 300 km^2 can be expected.

Bobcats are associated with low elevation, dry valley ecosystems. In southeast B.C., generally associated with closed canopy, multi-layered Douglas fir stands proximal to moderately steep slopes or rocky outcrops.

In the southern Canadian Rockies, lynx are associated mostly with subalpine landscapes of relatively subdued terrain (broad valleys, saddles of major passes). More likely to occur at the sides of a broad valley.

Potential habitat for both species is relatively limited and disjunct, which may limit dispersal success. Forest structure is very important within stands, influencing prey densities and providing other requisites. Generally, horizontal and vertical diversity is important. Residents appear to also be associated with a high dispersion of suitable stands within landscapes of at least 100 km^2.

Stressors

Habitat loss and fragmentation:

Widespread (regional-level) trend toward "intensive" forest management both within and outside of "protected" areas. At the stand-level, management driven primarily by timber values subjects regenerating stands silvicultural techniques such as pre-commercial thinning, pruning, and herbicides that result in little of the required structure or forage necessary to support small mammals, particularly snowshoe hares. Natural disturbances within old stands that provide ideal structure for natal denning are managed against by eliminating "decadent" stands and through "sanitization" techniques. At the landscape-level, management objectives for the spatial distribution of stand age classes are not at a scale relevant to these and other wide-ranging forest carnivores, and habitat dispersion requirements are not considered. This may effectively result in broad-scale habitat and population fragmentation. Landscapes with inherent capability to support resident of either species are naturally limited and often disjunct in the southern Canadian Rockies, and successful long-distance dispersal may be rare in this region due to the great variation of natural conditions. Hence, additional human-caused fragmentation is a major concern.

Physiography largely defines habitat potential for these species. Habitat is not used homogeneously within home ranges, and inappropriately located developments may decrease landscape value to resident animals. This is of particular concern when the development dictates forest management within the surrounding landscape. Maintaining surrounding stands in a state that minimizes the risk of wildfire to the development will greatly reduce the foraging potential to cats, other forest carnivores, and avian predators.

There is some evidence that population harvest of lynx and bobcat is additive in the southern Canadian Rockies, although demographic data are scarce. There is evidence that these and other fringe populations may not rebound quickly from localized overharvest or extirpation.

Snow compaction in subalpine landscapes is expected to decrease habitat effectiveness for lynx by increasing interference competition with canids. Roads access will increase vulnerability of all cat species to legal and illegal harvest via trapping and hound hunting. Increased recreational access within potential natal denning habitats may also decrease effectiveness, particularly where domestic dogs are allowed.

Research and Monitoring Needs / Indicators
Bobcat ecology and habitat associations in the East Kootenay Trench (1989 – 1996)
Lynx ecology and habitat associations in the Southern Canadian Rockies (1996 - ongoing)

Intensive field research is required to address all aspects of the ecology of these species, including population parameters through time. Due to their elusive nature, patchy distribution, and very low densities, it is virtually impossible to otherwise gauge the population status, associated trends, and probable impacts on these species.

Recommended future studies should include intensive field-based research within areas subject to various types and levels of natural and human conditions. Such research must be conducted at relevant scales of time and space. Although this is beyond the scope of an individual community or organization, they can contribute to regionally important ongoing studies even if outside the local area of interest. Field research is often very labor intensive, and skilled volunteers are can make tremendous contributions.

SMALL MAMMAL ASSEMBLAGES

Small mammal assemblages to be reviewed by habitat type:
Montane, Wetlands and Upland.

MONTANE
Montane grasslands include species such as meadow vole, badger, gopher, ground squirrels, deer mouse, and hare.

Stressors
These include very limited areas.
Aspen areas frequently have roads, overgrazing, fire suppression, development, and control and poisoning programs against some species (rancher management).
Rock industry
Seasonal disturbance (e.g. snow compaction, ski trails, elk, etc.) (Very little known about small mammals.)
Ecological land classification study in Banff National Park and Kananaskis regarding distribution –presence/absence

Research and Monitoring Needs
In general, literature on small mammals is lacking.
Wayne is studying movement along natural and artificial barriers with a focus on movement behavior.
Miller is currently researching demographics and reproduction.
Mike Gibeau, Coyote thesis–inside vs. outside of the fence.
*H** fauna / vegetation study is needed.
Structure and function of grassland types
Montane grassland habitat studies e.g. herbivory on species assemblages and over landscape level.

WETLANDS
Wetlands with species such as meadow voles, deer mice, beaver, muskrat, otter, and mink.

Stressors
Extremely rare habitat (2.6 % of park). Aquatic ecosystems most impacted by humans, by habitat fragmentation and by pollution.
Rail ballast – mitigation via culverts possible in the near term

Research and Monitoring Needs
Beaver – link to CP - Vermillion Lakes; Lac Des Arcs studies could be compared.
Beaver population and vegetation monitoring – long term
Waterfowl and songbird habitat (Peter Duck)
Need to study the relationships between fire – beaver – moose, and effect over 30 years. (Link inferred by literature)
Rail ballast studies
Simple monitoring of beaver lodges to continue
Muskrat, mink and beaver linkage studies (Bow Valley Naturalists)

UPLAND – CONIFER / MIXED WOOD
Species include marten, squirrel, weasels, red-backed voles, heather voles, shrews, golden mantel ground squirrels, hare, bats, bushy-tailed woodrats, red fox, fisher, flying squirrels, porcupines, coyote.

Stressors
Fire, herbivory, habitat fragmentation, urbanization.

Research and Monitoring Needs
Marten and highways and development – effectiveness of marten as an indicator; have been monitored in the three sister development, assumption is that they are dependent on high canopy closure etc., but questions about effectiveness or use of marten as indicators.
Mapping land-use / land use changes and populations of small mammals (Methodology needs to be standardized).
Effects of forest management and fire (Rob Walker-ongoing)
H* - increase species monitoring studies on transect studies to include small mammals.

OTHER SPECIES

BATS

It was agreed that Robert Barclay of the Department of Biological Science, University of Calgary would fill in the bat section after the workshop. The following is based on his response to that request.

Structure

The following six bat species are found in the area (Bow Valley watershed -Bow Lake to Ghost Lake).

Species	Common name	Abundance
Myotis lucifugus	little brown bat	males common females uncommon
Myotis evotis	long-eared Myotis	common
Myotis volans	long-legged Myotis	uncommon
Eptesicus fuscus	big brown bat	uncommon
Lasiurus cinereus	hoary bat	uncommon
Lasionycteris noctivagans	silver-haired bat	uncommon

Habitat Requirements

Foraging - *M. lucifugus* forages primarily over calm water (e.g. ponds, calm areas of streams).
- *M. evotis* forages along forest edges and in openings in the forest.
- *E. fuscus* and *L. cinereus* forage in more open areas, in forest openings, over meadows and above the canopy.

Roosting: - large, early decay-stage trees at low elevation are used as roosts by several species (*M. lucifugus, M. volans, L. noctivagans, E. fuscus*). "Colonies" frequently change roosts so that areas of mature forest with snags are required. *M. evotis* appears to roost primarily in crevices in cliff faces. *L. cinereus* is a foliage roosting species and specific characteristics of roosts seem less important than for the other species.

Hibernation: - all but *L. cinereus* and *L. noctivagans* hibernate in caves and abandoned mines. No hibernacula are known from the area and we do not know where the bats go for the winter.

Typical Population Characteristics

Populations tend to be stable in other areas, but there is very limited information for the Bow Valley. Reproduction rate is low so that response to any decline in population size will be slow. The most significant mortality factor would be over-winter mortality of juveniles. If significant numbers hibernate in as yet undiscovered sites, these could be vulnerable to disturbance.

Typical Behaviours

Females of some species (*M. lucifugus, L. noctivagans, E. fuscus*) form maternity colonies in hollow trees (and buildings – *M. lucifugus* and *E. fuscus*). These may hold several dozen individuals (more in buildings). Males are solitary. In *M. evotis*, typically single females roost in crevices. Limited data suggests that females return to the same roosting area year after year (lifespan may be as high as 30 years), and that first year females return to the area they were born in to reproduce at one-year of age. Individuals forage over relatively large areas. Movement from summer to winter areas can be substantial (100's of kilometers). *L. cinereus* and *L. noctivagans* migrate south for the winter and are only present in the area during the summer.

Predators
Predators at roosts may be a factor but almost nothing is known about predation as a mortality factor. Predation in hibernacula may be important (e.g. by rodents), although hibernacula are not known from the area at this point.

Other general characteristics
M. evotis has both males and females in the area and some females reproduce, but the reproductive rate may be particularly slow because of the generally cool, wet conditions. The other common species is *M. lucifugus* but almost all individuals are males, except perhaps in the Bow Valley itself where maternity colonies have been found in a few buildings. Other species are not common. All bat species have slow reproductive rates with most species having only one young per year. We do not know what proportion of females give birth each year.

Stressors
Loss of large trees with cavities may be the most significant factor for some species. Any pollution or other disturbance to natural insect populations may have a negative impact (e.g. altering water flows on rivers, creeks).

Research and Monitoring Needs
*H** Survey for reproductive females (i.e. are there reproductive populations present in the study area).
H No need for ongoing research as 1-2 years would do it.* Determine roost sites in areas where buildings are not available (i.e. are trees used, what sort, how available are they, what effect would control burns have).
H This would require multi-year surveys (captures).* Assess the proportion of females that are reproductive each year.
Potential volunteer group to assist with bat research = Bat Conservation Society of Canada (based in Calgary)

UNGULATES

Structure
Species include elk, deer (mule and white-tail), moose, sheep, goat, bison, caribou.

Stressors and Processes
Fire, logging, predation, hunting, habitat destruction (degradation and fragmentation), human displacement and habituation
Mortality via roads and railways, legal and illegal hunting
Inter-specific competition, especially for moose from elk (Tom Hurd's study)
Aircraft disturbances

Research and Monitoring Needs
The following were identified as needing ongoing research:
Elk and sheep via irregular aircraft counts (Banff National Park and Natural Resources Service)
Age / sex structure info available for some species (cow/calf counts)

Mortality and road kill counts
Harvest records (hunting)
Pellet counts, tracking, backtracking
Elk attacks
Habitat mapping information (Eastern Slopes Grizzly Bear Project)
Collared elk behavior study (John McKenzie)
Predation rates (Central Rockies Wolf Project)

Other Research Needed
Interspecific competition e.g. moose/elk (Tom Hurd)
Recruitment rates
In the Canmore area, lots of work needed on ungulates
*H ongoing - corridor use –viability (regarding non-habituated elk) (Alberta Environmental Protection)
Existing research needs "boosting" (i.e. Are corridors being used? Are ungulates impacted by golf courses? Is fencing reducing road mortality? What is the impact of helicopters?)
In general, more needs to be known about ungulate responses to a variety of human disturbances.
*H ongoing -Dogs/Trails (Banff project)– human/wildlife issue

Inside and outside the park - There is a need to understand the response differences between habituated vs. 'natural' elk (Banff elk vs. Canmore elk =difference in wildness). Profitable comparisons inside and outside of park; Quantified via flight distance (distance at which elk flee in response to various disturbances); Pellet counts to assess use over time; Tracking paths during the summer; Systematic standardized non-intrusive basis to monitoring needed.

Sheep and goats - habitat degradation and highway mortality; aircraft impacts?
Moose – high highway mortality and habitat changes.

H* - Habitat Enhancement - sheep
Linked to fire protection (via thinning and fire breaks); assessment needed for elk and deer

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Expert Analysis Workshop April 22 1999

MAMMALS

Identified Research Priorities

Identifying priorities : High = start research within 5 years, Moderate = start research in 5 – 15 years, Low = start research in 15 + years

Species	Research requirements	Priority	On-going research needed	Relevant research in progress
Large Carnivores				
Grizzly Bears	Population trend monitoring; long term, using non-invasive monitoring techniques like transponders / bar-code chips and barbed wire hair catchers Baseline demographic data are needed	High	yes	1994-99 ESGP - intensive research (not guaranteed for future)
	'Semi'-control areas needed e.g. Cascade and Wind Valley	High	yes	
	Large landscape perspective needed rather than isolated area research	High	yes	
	Human access management and monitoring needed	High		
	Human interface / bears in future, people management (e.g. garbage, birdfeed), need for enforcement. Effective education methods e.g. brochures, closures	High		
	Secure habitat for female bears needed	High	yes	
	Monitoring trends etc. in plant food sources (e.g. berries) needed	Medium	yes	
	Identification of the major threat issues and putting them in perspective (development vs. bins)		yes	Eastern Slopes Grizzly Bear Project
	Distinction needed between research (problem oriented) and monitoring (long term)		yes	
	More emphasis on 'bottom-up' processes (e.g. ants and bears) and over time			
	Habitat modeling – populations studies			
	Cumulative effects studies needed		yes	
Cougars	Demographics needed: avoiding collaring method except as a last resort, instead use scats, tracks and hair.	High		Some ongoing work on tracks / individuals (BNP)
	Corridor monitoring needed			
	Importance of specific questions and detailed assessment of demographic data			
	Need to identify population and movement trends: dispersal, sex-, age-, and season-specific activity			
	Worthwhile collecting things like scat for analysis later; anticipating advances in DNA technology and lab priorities			

Species	Research requirements	Priority	On-going research needed	Relevant research in progress
Wolves	Enforcement and compliance monitoring are needed	High		
	population trend monitoring, ongoing and more needed; roll together research across valley; pellet counts are useful alternative to snow tracking, particularly in poor-snow winters; need to contrast low and high density populations		yes	Central Rockies Wolf Project
	prey population monitoring		yes	
	Are attractants an issue / potential issue for wolves?			
	Assessment of effectiveness of mitigation and limiting human access; need before and after studies, comparative studies			
	enhancing wolf population viability			
	In summary, we should continue monitoring and, where possible link this to manipulative experiments that are, when possible, replicated in multiple locations			
	mortality monitoring			
Black bears	Garbage/bear studies	High	yes	
	Data collection: non-habituated vs. habituated bears produce different results; much potential to dove tail with data being collected for other species and questions; e.g. tie in with spring bear hunt, and road kill data compared with wolves.		yes	Melanie Percy
	Dispersal poorly understood			
	Reproduction and demographic issues			
	Aversive conditioning			
	Effect of educating humans about garbage and compliance monitoring			
	Genetic data bank needed			
	Bottom up habitat analysis			
Wolverines	Tracking		yes	Clayton Apps, Martin Jalkotzy
	Future technology may help in research e.g. smaller GPS collars, camera and hair studies; cost feasibility issue			
	Collect data as available (e.g. in underpass studies)			
Lynx	Lynx ecology and habitat associations in the Southern Canadian Rockies	High	ongoing	1996–now Clayton Apps
	-intensive field research is required to address all aspects of the ecology of these species, including population parameters through time. Due to their elusive nature, patchy distribution, and very low densities, it is virtually impossible to otherwise gauge the population status, associated trends, and probable impacts on these species.			
	-Future studies should include intensive field-based research within areas subject to various types and levels of natural and human conditions. Such research must be conducted at relevant scales of time and space.			

Species	Research requirements	Priority	On-going research needed	Relevant research in progress
Small Mammal Assemblages				
Montane	Fauna / vegetation study needed to address effects of habitat fragmentation and herbivory over landscape level	High		
	Movement along natural and other barriers		Yes	Wayne
	Demographics and reproduction		yes	Miller
	Structure and function of grassland types			
	Differences in small mammal community to severe grazing (e.g. inside versus outside of the fence). How does this affect the small mammal predators?			Mike Gibeau (Coyote thesis)
Wetlands	Beaver: link to C.P. Vermilion Lakes, Lac des Arcs- comparative studies			
	Linkage studies targeting muskrat and mink plus beaver			Bow Valley Naturalists
	Beaver population and vegetation monitoring – long term		yes	
	Rail ballast – mitigation via culverts possible in near term			
	Simple monitoring should continue by counting beaver lodges, measuring water levels.		yes	
	Relationships between fire – beaver – moose, effects over 30 years			
	Waterfowl and songbird habitat			Peter Duck
Upland - Conifer & Mixed Wood	Increase species monitoring studies on transect studies to include small mammals	High		
	Effects of forest management and fire			Rob Walker
	A need for standardization of methodology			
	Marten and highways; have been monitored in the Three Sisters Development, but questions about effectiveness or use of marten as indicators			
Other Species				
Bats	Survey for reproductive females (i.e. are reproductive populations present in the study area).	High		
	Determine roost sites in areas where buildings are not available (i.e. are trees used, what sort, how available are they, what effect would control burns have).	High	No 1-2 years only	
	Assess the proportion of females that are reproductive each year.	High	multi-year surveys required	

Species	Research requirements	Priority	On-going research needed	Relevant research in progress
Ungulates	In general, more needs to be known about ungulate responses to a variety of human disturbances (Existing research needs "boosting" i.e. are corridors being used? Effects of dogs on corridor use. Are ungulates impacted by golf courses? Is fencing reducing road mortality? What is the impact of helicopters?)	High	yes	Banff studies
	Corridor use –viability (regarding non-habituated elk)	High	yes	Alberta Environment
	Inside and outside of park, need to understand the response differences between habituated vs. 'natural' elk (Banff versus Canmore elk =difference in wildness); profitable comparisons inside and outside of park; quantified via flight distance (distance at which elk flee in response to various disturbances); pellet counts to assess use over time; tracking paths during the summer; systematic standardized non-intrusive basis to monitoring needed	High	yes	
	Habitat Enhancement -- sheep Linked to fire protection (via thinning and fire breaks); assessment needed for elk and deer	High		
	Proper elk and sheep aircraft counts (now via irregular "annual" counts)		yes	Banff National Park and Natural Resources Service
	age / sex structure (info available for some species: cow/calf counts)		yes	
	Mortality and road kill counts		yes	
	harvest records (hunting)		yes	
	pellet counts, tracking, back-tracking		yes	
	elk attacks		yes	
	habitat mapping information		yes	Eastern Slopes Grizzly Bear Project
	collared elk behaviour study		yes	John McKenzie
	predation rates		yes	Central Rockies Wolf Project
	interspecific competition e.g. moose/elk			Tom Hurd
	recruitment rates			
	Sheep and goats – habitat degradation and highway mortality; aircraft impacts?			
	Moose – high highway mortality and habitat changes			

Funding Agencies	Research Agencies
Banff National Park	Banff National Park
Alberta Conservation Association	Central Rockies Wolf Project
W.W.F. (Paul Paquet habitat models,carnivores)	Eastern Slopes Grizzly Bear Project
Friends of Banff	Kananaskis Field Station
Friends of Kananaskis	Alberta Environment
Y2Y (has list of potential funders)	University of British Columbia
Eastern Slopes Grizzly Project	University of Alberta
Rocky Mountain Elk Foundation	University of Calgary
Town of Canmore	
Canadian Pacific Foundation	
Alberta Highways	
Three Sisters	
Silver Tip	
Eagle Terrace	
Banff Housing Corporation	
TransAlta Utilities	
Universities (via NSERC, etc)	

Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Birds Workshop

June 30, 1999
Canmore, Alberta

Prepared by:
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Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
Birds Workshop
June 30, 1999

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Biosphere Institute of the Bow Valley
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Workshop Notes

POTENTIAL CATEGORY SYSTEMS

Alpine
Upper Sub-alpine
Lower Sub-alpine
Montane
Wetlands

Time of Use
Migrants – spring and fall
Residents – summer, winter, permanent

Species Categories
Species of concern
Waterfowl (herons, marshbirds, loons, grebes)
Raptors, nocturnal and diurnal
Exotics
Shorebirds
Neo-tropical migrants
Songbirds
Woodpeckers
Gallaceous birds: Grouse, example ptarmigan during ski season
Cavity nesters

General Stressors
(Not eco-region specific)

Flagged as top priority issues. Known and localized immediate impacts:

- Recreational use (all eco-regions)
- Development (all eco-regions)
  - Roads (all eco-regions)
  - Golf courses (Montane)
  - Housing, infrastructure (Montane)
- Transportation
- Larger-scale concerns
  - Climate change
  - Pollutants

The following are also considered general stressors:

- Fire management (both prescribed and suppressed)
- Mining
- Non-native species
- Water impoundment
- Oil and gas exploration and development
- Agriculture
- Hunting, fishing
- Boating

Impacts

Indirect

- Habitat loss
- Habitat fragmentation
- Habitat degradation

Direct

- Hunting, road and rail mortality

Stressors by Region

Eco-region	Spring	Summer	Fall	Winter
Alpine	Recreational use	Recreational use Ski area maintenance.	Recreational use Hunting (ptarmigan, grouse, waterfowl)	Recreational use: skiing(downhill and cross country), ski-dooing, snowshoeing, ice climbing Helicopters Road mortality Avalanche Control Pollutants from snowpack (e.g. toxaphene)
Sub-alpine			Hunting (grouse)	Sewage ski use Logging
Montane	Mortality from roads and rails	Mortality from roads and rails	Mortality from roads and rails Hunting (grouse)	Mortality from roads and rails Logging (fire break)
Wetlands			Hunting (waterfowl)	

Research and Monitoring Needs

- What are impacts of trail use on bird populations? Summer and Winter.
- Consider variability of number and distribution of individual species over time
  Annual / seasonal / benchmarks / (control areas) / longer time scale
- Migration – where / how do they go from / to here?
  Cross-mountain? Cross boundary issues also in North / South migrations i.e. Golden Eagle.
- Need to know benchmark now and how it changes over time (Fund contribution for future work by developers) etc.
- Need bird research before and after prescribed burns in different habitats
- Breeding bird point counts should be expanded to Subalpine and Alpine Habitat
- Adopting breeding bird techniques to trails
- Human use needs to be monitored and impacts determined
- Sport climbing, impacts on nesting raptors
- Continuation of Vermillion lakes monitoring
- Compare historical lists – heritage (Lillian Gueizt, Wardens etc) to get historical baseline
- Lac Des Arcs monitoring of waterbirds needed – interpretive centre (Vic Mann, EUDSI, Jorgenson started work on interpretive)
- Impacts of reference positive and negative birding tourism on birds and habitat
- Birding eco-tourism
- Effect of herbivory on ground and shrub nesting species
- What are effects of crowding as a result of habitat loss?
- What is the actual ecological footprint loss of losing a specific habitat?
- Effects of highway salting – direct mortality effects on wetland systems
- Effects of water manipulation on quantity and quality of bird populations
- Identifying critical and unique habitats
- Rare and sensitive species – identify habitats and needs for both migrants and residents
- What is the importance of the Bow Valley in a larger context in regards to abundance and diversity and distribution?
- Need to compare to other regions.
- Education and information on lights and windows and their impacts on migratory birds (FLAP)
- Importance of the Bow Valley as a staging /stop over areas for migrants
- Long term productivity and survival of raptors (Osprey / Bald Eagles) and swallows as affected by toxins.
- Woodpeckers and secondary cavity nesters – effects of fire suppression and forest succession.
- Human impacts on bird populations: indirect effects (i.e. habitat loss, degradation, fragmentation), and direct effects (i.e. hunting).

Biosphere Institute of the Bow Valley
Expert Analysis Workshop – June 30, 1999

BIRDS

Identified Research Priorities

Identifying priorities: High = start research within 5 years, Moderate = start research in 5 – 15 years, Low = start research in 15 + years

Category	Research requirements	Priority	Ongoing research needed	Relevant research in progress
General (see previous section for specific research and monitoring needs)	Input of Bow Valley in larger context	High	Yes	Historical data versus now
	Benchmark research, baseline long-term consistent monitoring to decrease observer bias in all habitats, alpine, sub-alpine, montane, and wetlands ELC unit coordination. Research should include diversity and abundance, all seasons, migratory patterns and cross boundary issues as well as control areas across ecoregions. EIA = public, standard. Protocols should be standardized and data made available. Need baseline, long term, immediate management.	High	Yes, budget commitment to ensure continuous research and expanded to include other sites Need quality monitoring and standardized protocols, public access to data (including consulting reports, government documents, developers staff biologists) Lac Des Arc monitoring of water birds needed - important migration site with interpretive potential. Should consider effects of water level manipulation, highway expansion	1. Breeding bird survey routes (CWS designated), at least one empty (M. & D. McIvor) 2. MAPS - monitoring avian productivity and survivorship, BVN volunteers 3. Forest bird monitoring in Montane habitats only, mostly in Banff NP (M. & D. McIvor, Hebblewhite, C. St. Clair) 4. Christmas and May bird counts (volunteers) 5. Harlequin duck, BNP, Kananaskis Park, Alberta Environment, Cyndi Smith) 6. Golden Eagle (other raptors) (Peter Sherrington) 7. Vermilion Lakes Waterfowl breeding and migration, 1992, 1994-96, Peter Duck and Mike McIvor

Category	Research requirements	Priority	Ongoing research needed	Relevant research in progress
Recreation	Impact of recreational use on vulnerable species.	High	Yes As levels of use increase, year-round monitoring needed. Increasing birding tourism : negative versus positive impacts - economic	No
	Impact of recreational use on bird populations generally (trails, skiing, sports climbing, mountain biking, birding, etc)	Medium	Yes – as above Human use levels (social/economic link) generally in all regions and season need monitoring, immediately.	No
Development and transport	Effects of habitat loss and fragmentation on bird populations	High	Yes Before, during and after monitoring needed.	Highway effects as barriers and habitat loss on forest birds (Colleen Cassidy St.Clair) Previous work: Eagle Terrace inventory (Doug Collister), Silvertip (Sherrington), Three Sisters (NRCB), Bird crossing data (Clevenger)
	Highway Mortality Salting, scavenging, predation in roadside ditches (owls, hawks)	High	If impacts are high, need ongoing monitoring; otherwise monitor again with significant increase in traffic.	Highway mortality – Trans Canada vs. 1A Parkway (Clevenger)
	Research, education and information on windows and lights for migrating.	Low	No	No
	Effects of water manipulation quantity and quality on bird density and distribution	High	Yes (aquatics)	No

Category	Research requirements	Priority	Ongoing research needed	Relevant research in progress
Ecological processes: fire and vegetation management	Need population data before and after prescribed burns and thinning (i.e. Woodpeckers and other cavity nesters	High	Yes	Carrot Creek fan; forest bird monitoring (Hebblewhite)
Herbivory	Effects on ground and shrub nesting species	High	Monitor with herbivory changes, (i.e. mammal –Beaver/Elk)	Beaver/Bird (Cliff Nietvelt) Incidental (i.e. aspen point counts)
Habitat affiliations	Identify critical and unique habitats, rare and sensitive species, migrants and residents	High	Yes Need bird surveys stratified by ecological land classification units	Original Banff/Jasper ELC in 1983 Forest bird monitoring (McIvor)
Toxins and pollutants	Productivity and survival of osprey, bald eagles, swallows	High	Yes	Environment Canada

FUNDING AGENCIES	RESEARCH AGENCIES	VOLUNTEER AGENCIES
Parks Canada Alberta Environmental Protection Developers Environment Canada (water quality, etc.) Canadian Wildlife Service Universities Foundations Alberta Conservation Association Alberta Sport, Recreation, Parks & Wildlife Foundation Friends of Banff Friends of Kananaskis Paid Volunteer Vacations Corporations Bow Valley Water Quality Council Bird Studies Canada Wilberforce	Parks Canada Alberta Conservation Association Alberta Environmental Protection Universities Consultants	Bow Valley Naturalists Calgary Field Naturalists Calgary Bird Banding Society Note: Bird research requires highly specialized identification skills. Volunteers play an important role in support of adequately funded professional research. Volunteer participation does not preclude the requirement for research funding.

Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Microfauna Workshop

August 24, 1999
Canmore, Alberta

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Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
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Workshop Notes

CLASSIFICATION APPROACH

By Species

Arthropods - terrestrial
- aquatic

Molluscs - terrestrial
- aquatic

Reptiles & Amphibians
Invertebrates
Fungi and Bacteria
Specialized ecosystems

ARTHROPODS

General Groups

Endemic vs. wide-ranging
Visibility (e.g. Butterflies, Dragonflies) vs. invisibility
Economic vs. uneconomic

Specific Groups

Butterflies
Moths
Dragonflies
Economically Important Species (EIS) / Exotic species
Other species

BUTTERFLIES

It was agreed that Jens Roland of the Department of Biological Sciences, University of Alberta would fill in the butterfly and moth sections after the workshop. The following is based on his response to that request.

Structure

Number of butterfly species: We estimate about 73 in the main valley (not including the alpine) and about 10 more in the alpine. Of the 73 valley species probably about 15 are true montane and grassland (Morley Flats) species, the remainder are really boreal ones that get into the Park.

Habitat requirements (for each life stage): The most important components are larval host plant for the caterpillars, and nectaring flowers for the adults. The need for nectaring flowers coincides with the need for open (early-successional habitats).

Population characteristics: Populations are typically small, isolated, and are subject to stochastic events especially weather.

Typical behaviors: Dispersal is particularly important given the characteristics of small, isolated populations. Ability to disperse differs among species and can be in the order of 10-100m up to several miles. The important thing here is the interaction between habitat structure (especially larval host plant distribution) and dispersal ability.

Important predators for each life stage:

Eggs - ants
Larvae - fly and wasp parasitoids, and some bird predation
Pupae - fly and wasp parasitoids, and some bird predation
Adults - very few.

General Characteristics:

1. Butterflies are often highly host-plant specific, being dependent on a single or a few larval food plants. Hence loss of plants guarantees loss of the butterfly. Therefore, habitat is very easily quantified.
2. Day active, therefore, they are obvious and easy to monitor, relatively easy to estimate their dispersal, and of great interest to the public. Interaction with the public is all-positive (except those that get smushed on your car's grill).
3. Sexually dimorphic - hence easy to monitor
4. Short generation time. This has a generally bad consequence. Negative effects on a single generation (bad weather year) can have drastic effects on the populations.
5. Potentially high reproductive rate. This can offset negative effects (4 above) provided that there are dispersal opportunities for re-colonization of sites that occasionally go extinct.

Stressors

Habitat Degradation:

Most habitats for butterflies is degraded by its loss or fragmentation, either through human effects or to climate change. Herbicide use has also been a cause of loss of butterflies in some areas, and the introduction of generalist parasitoids for control of insect pests (e.g. the parasitic fly *Compsilura concinnata* for control of gypsy moth, and the result that this fly attacks almost all lepidoptera).

Problems with introduced species:

One potential problem is the effect of weeds like knapweed, which out-compete larval host plants for butterflies. I have discussed this potential problem with Dr. Rob Bourchier (weeds biocontrol, Agriculture Canada, Lethbridge) and we feel that the monoculture which some weeds can become will have large impacts on native butterfly host plants. There is little concern for introduced lepidoptera competing for host-plants.

MOTHS

Structure

Number of moth species: This is difficult to estimate, but there are probably 500 to 600 macro-moths in 10 families (based on the number of butterflies and a common pattern of butterflies comprising about 4.5% of the Lepidoptera fauna). Similarly, there are probably about 1000 micro-leps (the small moths) in 25-30 families. These are again for the main valley and montane and would not include sub-alpine or alpine. So you are looking at about 1600 species for the montane.

Habitat requirements (for each life stage): As for butterflies, but less reliance on open meadow habitats since sunlight is not as critical a factor

Population characteristics: as for butterflies, but also the potential for outbreak species.
Typical behaviors: as for butterflies.

Predators for the group (for each life stage): Additional predators on adults include bats, ants, birds,

General Characteristics: Most of the characteristics of butterflies (above) would be relevant for the moths.

Stressors

Same as for Butterflies (above)

Research and Monitoring

There is not a real need for long-term monitoring of diversity, or the creation of species lists within the Park. This does little to address the questions of habitat and populations. What is particularly needed is long-term study of population dynamics of species, which are representative of the most threatened habitats in the Park; In particular, those which are early-successional habitats. It is these habitats which tend to be open, sunny and have an abundance of nectaring plants, and herbaceous larval host-plants. I would recommend that 2 or 3 such early-successional habitats be identified (grassland, aspen, alpine meadow) and within each the selection of 2 species with very different dispersal capabilities.

Because butterflies lend themselves so well to monitoring the integrity of the rarer and fine-grained habitats, they can ‘fill-in” information which may not be adequately identified from the study of animals which operate on a much larger scale (i.e. wolf, elk, grizzly).

These should be started immediately to provide the balance with those studies of larger animals. The short generation-time of this group of animals ensures that usable information would be available within only a few years. As well, the fact that populations are non-overlapping makes the risks to local populations all the more urgent.

On-going research is needed, because it is information on the temporal changes in populations and spatial scale that these occur at, that are the true test of population viability, not a snap-shot of what is there now.

Although there are a number of very good amateur collectors in Alberta, there is currently very little research done in Canada generally on butterfly populations and population dynamics, and none for this region other than the following.

Current references:

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DRAGONFLIES

Structure

30 to 60 species in area
Important predators e.g. on salamander larvae
Associated with water – for breeding
Fly considerable distances
Habitat – lower elevation water bodies
Majority in standing water
River too cold
Some montane species

Stressors

Predation – birds
"Road kills" – unknown
Roads as dispersal routes
Breeding habitats – run-off
Mosquito fish?
Continual fish stocking – impact on dragonflies is of major importance
New Parks policy: no more stocking of non-native species therefore, more pressure outside Park
Channel change/modification affects dragonflies
Run-off, salts, pesticides, roads, golf courses, waterbodies next to railway (grease, etc.)

Natural drying of breeding sites (global warming?)
Some species adapted to temporary water bodies
Permanent change to water bodies may be significant
Loss of terrestrial habitat – e.g. forested
Different species need different types of habitat, therefore need to be specific
e.g. night-time roosting habitat; vegetation specific

Research / Monitoring / Indicators
Kananaskis Field Station - 1960 – 70's check database, check annual reports
Canadian National Collection of Insects
Boom Lake –Rob & Syd Cannings, dragonflies
Montane/Cordilleran – website – E.M.A.N (Ecological Monitoring Area Network)
Several groups
John Acorn working on Popular Guide to damsel and dragonflies, and may know of other work and data
Alberta's "Data Centre" doing tracking
Endangered species?
Argia vivida (damselfly) at Banff Springs, Cave & Basin
Northern species – not common

ECONOMICALLY IMPORTANT SPECIES (EIC) / EXOTIC SPECIES
(Formerly known as pest species)

Structure
Forest: Mountain pine beetle - whether native to region is debatable

Exotic - Asian Gypsy Moth
- Lady beetles - European introduced seven spotted species: dominant, out competing native species; but limited knowledge of native species

Leafy spurge beetle – introduced species, used for bio-control of leafy spurge beetles released in Morley Flats.

A lot of native forest insects

Stressors
Changing vegetation communities
Introduced species
Fire suppression
Other creatures spreading from coasts
Link to other species not very well known
Insect control within Banff National Park
Some urban control
Park policy not clear

What if Mountain Pine beetle population became epidemic? Nothing controls it (except cutting/burning/debarking).
Potential issues: overall impact, logging, helicopters, etc.
Changes associated with climate control? e.g. Mountain Pine Beetle (climate control is tenuous)
What are limiting/controlling factors on the beetle? If we can know that they exist then we don't have to take measures (e.g. last outbreak 20 years ago)
Industry is a stressor; expectations of industry; economic forces & political forces
Tourism would probably want pine beetle controlled (too ugly)
Unpredictable impact of exotics
Chemical tolerance – stresses other systems, not just target

Research and Monitoring
Pest and pest control species, for information, authority is Peter Harris, Lethbridge
Definition of "pest": something is known about them because they are pests and therefore there is an economic interest. e.g. grasshoppers → farmers; mosquitoes (both are well researched)
Forest insect and disease survey (Victoria) 1915, and Canadian Forestry Service – check for "complete" listing
Considered economic importance by a pest control authority
Can be a "pest" at low numbers or high density
Not consistently high population size
40 native (economically important) insects, of which 2 or 3 epidemic occasionally

OTHER SPECIES

Useful exercise would be to estimate number of species 'out there' that we don't know about, and their functions locally; education.

Isopods
Spiders – important predators, very common, but little known
Ticks
Cold insects – ice/rock crawlers, Banff - Sulphur Mountain
Grylloblatta spp. Lots known about this species
Mites

Structure – unstudied

Stressors
Variable, not specific
Habitat destruction – could be very important because of habitat specific species
Cave dwellers
Extent of natural fragmentation compounded by human impact.

MOLLUSCS

Structure

Aquatics better known than terrestrial
- 76 species of gastropods, 39 of these are aquatic, in Province (just snails)
- Approximately 20 aquatic gastropods in Banff National Park.
- Number of terrestrial species not known

More diversity of aquatic gastropods in lower valley
Important biogeographic markers for area (e.g. some dispersed by birds; fish hosts – bivalves)
- Web site: Robert Forsyth
- B.C. key and terrestrial species list that may be applicable to Banff

Second most species known to science, after insects
40% of known animal extinctions have happened in the molluscs since 1600 worldwide
Endemics (as well as some exotics) in Bow Valley as well as wide-ranging species
Bio-indicators; especially bivalves e.g. pollution
Probably important in parasite transmission

Stressors

Biggest one is lack of knowledge
Habitat destruction
Aquatic: runoff, salts etc. (same as for dragonflies)
Terrestrial: Pavement, landscaping
Predation: ducks, garter snakes
Introduction of exotic gastropods; e.g. predatory snails; entire species have been eradicated
Parasite control – possibly

REPTILES AND AMPHIBIANS

Structure

Reptile
- Wandering Garter Snake (only known species in study area); found at Middle Springs, Lake Minnewanka, Cave & Basin, Tunnel Mountain Campground, possible siting in scree on Cascade Mountain in April 1997

Amphibians
- 1 toad – Boreal or Western toad
- 2 ranids – Wood frog, Spotted frog
- 1 hylid – Chorus frog
- 2 salamanders – Tiger salamander, Long-toed salamander

Aquatic component: Temporary and permanent
Exposure – orientation of habitat and elevation – mostly lower
Vegetation distribution
Bio-indicators
Generalists

Edge of ranges -- range marginals
Natural fragmentation of habitat

Stressors
Climate change; U.V.B.; ozone (especially at high elevations)
Drought
Recreational use
Habitat fragmentation and loss
Roads, water quality, pollution, inc. salt
Non-native fish (especially salamanders)
Managed populations of birds (Ducks Unlimited)
Soil fungus (exotics) in tropics; Chytrids – potential threat, introduced here
Pesticides – deformatics
Logging can be species specific in affect
Introductions not much of a problem – e.g. turtles can't breed here
Snakes – den loss is critical – road moralities near dens
Collectors and human attitudes
Climatic instability – interfering with successful over-wintering

OTHER INVERTEBRATES

Earthworms – Kananaskis study
Flatworms
Nematodes, etc.

FUNGI AND BACTERIA

SPECIALIZED ECOSYSTEMS

Glaciers
Caves
Springs
Alpine Lakes
Montane wetlands
Isolated vegetation 'pockets'; e.g. Whitebark pine, Douglas fir

Structure
Entire ecosystems – little known (or nothing) about them
Defined, 'sharp' edges
Vulnerable
Island communities
High numbers of endemics

Stressors
Loss due to development
Overuse by humans – recreational use – bathers
Collectors
Natural Succession
Spills near railway or highway
Island structure – e.g. scale (small areas)
population isolation → extinction
Lack of recognition for specialized species and habitats within concepts of standard conservation biology – e.g. protected areas, umbrella species, and corridors. It is a matter of scale. General to all Microfauna

Biosphere Institute of the Bow Valley
Expert Analysis Workshop April 21 1999

MICROFAUNA

Identified Research Priorities

Identifying priorities; High= start within 5 years, Medium=5 – 15 years, Low = 15+ years

Classification	Research requirements	Priority	Ongoing Research Needed	Relevant Research In Progress
Arthropods				
Moths & Butterflies	Need long-term study of population dynamics of species which are representative of the most threatened habitats in the Park, particularly early successional habitats. Identify 2-3 such habitats and select 2 species with very different dispersal capabilities. Get more fine-grained information than with large mammal indicators (i.e. wolf, elk, grizzly).	High	YES	Jens Roland
Dragonflies	contact Alberta Naturalists Heritage Information Centre for existing and compiled information, and Nature Conservancy Data Service	High	Evaluation, continual monitoring of status	Species Lists – In primary literature
	Need: measure of status, population sizes, and distribution (on fine scale; habitat)	High	Potential indicators of water quality and habitat change	Specific info on *Argia vivida*
	Marketing and interpretive programs; the birdwatcher's insect			
	Road Mortality: Effects of roads (e.g. diversions, run-off) All transportation corridors Include multi-species approach	High	YES	Tony Clevenger - expanded species base needed

Classification	Research requirements	Priority	Ongoing Research Needed	Relevant Research In Progress
Economically Important Species				
Asian Gypsy Moth	Population monitoring			Agriculture Canada: Asian Gypsy Moth Population Monitoring. Control Purposes
Mountain Pine Beetle				-Banff Park forest insect disease plan -Parks and University of Calgary: Mountain Pine Bark Beetle dispersal dynamics – Mary Reid. -Parks and Alberta Forest Service and Forestry Canada : Model-Vulnerability of forests to Pine Beetle
Exotic Species				John Acorn – Province wide species occurrences. 1999→new
7 Spotted Lady Beetle				Canadian Nature Federation: Lady bug survey. 1996-1999
General Exotic Monitoring				None

Classification	Research requirements	Priority	Ongoing Research Needed	Relevant Research In Progress
General Microfauna	General Inventory needed for terrestrial & aquatic species	High		-B.V.N. Amphibian survey -Alberta volunteer monitoring program -Larry Powell: Long-toed Salamander (inventory and historical review) -Mark Thompson: DNA, Long-toed Salamander University of Calgary -University of Calgary terrestrial collection -Kananaskis Field Station, Rob Longair: Terrestrial Arthropods reference (tent traps), cotton malaise traps. Yellow jackets / hover flies / ground beetles -Jack Zloty: mosquitoes / stone & caddis flies / mayflies / dragonflies / water beetles. -Dwayne Lepitzki: Aquatic Gastropods -Wayne Roberts: University of Alberta, Zoology Museum; fish, reptiles, amphibians. -Hugh Clifford: Aquatic insects collection University of Alberta & Alberta Provincial Museum
	Historical review of all literature including gray literature for local Microfauna	High		
	Encourage publication of research			
	Taxonomic expertise			
	Benchmarks would now allow for comparative			
	Reference collection (including specimens) locally available, local species	High		

FUNDING AGENCIES	RESEARCH AGENCIES	COMMUNITY AGENCIES
Endangered Species Recovery Fund, (COSEWIC listed species sponsored by WWF, Canadian Wildlife Service CMPP) Alberta Conservation Association Alberta Sport, Recreation, Parks, and Wildlife Foundation EcoTrust Friends of Banff National Park Friends of Kananaskis Parks Canada Alberta Environment Developers Foundations and Charities Y2Y Xerxes Society (butterfly research) National Geographic Society Canada Trust Environment Fund Biodiversity Challenge Grants-(University of Alberta)	Alberta Research Council: Alberta Forest Biodiversity Monitoring Program, pilot forests: Foothills / Hinton Alberta Conservation Association Status of Alberta Wildlife 2000 Gord Court – AEP (non-game) E.M.A.N. (Ecological Monitoring Area Network) R.A.N.A. (Reporting Amphibian Numbers in Alberta) - Lisa Takats Alberta Amphibian Volunteer Monitoring Program University of Calgary University of Alberta Private Consulting Companies	Bow Valley Naturalists Environment Canada – Green Line *Note*: Volunteers play an important role in support of adequately funded professional research. Volunteer participation does not preclude the requirement for research funding. Most Microfauna research requires highly qualified researchers, and personnel.

Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Aquatics Workshop

December 15, 1999
Canmore, Alberta

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Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
Aquatic Workshop
December 15, 1999

Participants:

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Steve Donelon	Alberta Environment
Bill Hunt	Parks Canada – Aquatics
Dwayne Lepitzki, Ph.D.	Wildlife Systems Research
Mike McIvor	Bow Valley Naturalists
Chantal Ouimet	Contractor for Parks Canada
Charlie Pacas	Parks Canada
Dave Schindler, Ph.D.	University of Alberta, Biological Sciences
Mike Quinn, Ph.D.	University of Calgary

Contributor:

Brian Lajeunesse	Alberta Environment

Chair:

Cliff White	Parks Canada

Biosphere Institute of the Bow Valley
Expert Analysis Program
Ecological Series
Aquatic Workshop
December 15, 1999
Workshop Notes

Valuable to have a complete biological inventory of existing data.
For example: Andrew Nimmo – samples in Bow Valley lists.

Need to open the "boundaries" for discussion between groups.
E.g.: between Parks and Province. Paying for monitoring
– What happens across boundaries: methodologies across boundaries compared to parameters across boundaries.
For example in Hinton – road building, culverts above stream level and affects on riparian habitat. How to solve the silt problem.
Hinton Model Forest is an example. Analogue this.

Information is all wrapped up in reports and therefore hard to access
("Boxes of reports in basements").

Need a reference collection location (see microfauna workshop).
Need to bring existing collections together and to preserve them properly.
Archive collections and then need to know what is there.
Nature Conservancy and ANHIC database.
For example: Dwayne Lepitzki's gastropod listing.

Culverts – questions about them addressed within the Park (Castle to Banff) but what is happening east of the Park? Groups like CP rail etc. could move into data sets and inventories.

Maintenance of good culvert management – removing impediments.

STRUCTURE

A need for a linear approach.

Calgary – pollutants migrating with the movement of fish.

Fragmentation – outside the Park. What is happening there? Do we know?
Perhaps the blockages could be used to implement eradication schemes of non-native species like Brook Trout.

Brown trout introduced at Carrot Creek.

CCRE Atlas – e.g. changes in Cutthroat distribution corridors and damming – can we restore populations?

How do fish species move upstream considering the limitations?

Fishways through dam structures

Bow Valley has 9 dams and over 50 years of movement and flow impediments. These are collection areas for pollutants etc. (see Bob Page) and nutrient movements with respect to dams – e.g. Lake Minnewanka, Cascade – would this be one to evaluate?

Reconstruct picture of what rivers were like before dams – via old reports and their bibliographies.

Goat and Spray changes are being examined by Charlie Pacas.

Dams on the US/Canada border and implications for salmon.

ECOLOGICAL STRUCTURE

Montane, Alpine, Sub-Alpine
Note the temperature tolerance of species

Stocking records could show changes in lakes.

Unstocked lakes – don't have records - NEED

Have huge fluctuations in Alpine ponds – it's a very extreme environment.
No information found (only anecdotal) – a need to investigate these.
Ask Stewart Anderson for his knowledge.

G Powell

Invertebrate work in Kananaskis
Very little fisheries work
Dan? Work on Bow fisheries (Lac Des Arc area)

Brown trout inventories

Licenses – could show angling pressures. Mobility has improved for fishermen – what effects are there?

Disease – there are more diseased fish in the lower Bow – what's causing this?
Brain Lajeunesse knows about this.

What impacts of anglers on both fisheries and riparian habitat – impact by just being there?

Montana – Chris Furzell – indices and modeling

Mapping of corridors important

Lots of information on fragmentation with Alberta Environment. Tying up information with IRS – level of detail decreases as you go into the Park because the scale of maps is different.
Stream and lakes on 1:50 000 maps – BNP not integrated, nor cross-boundaries into Province.
Individual maps don't connect.

Real impediment at the moment – NEED to figure out how to map re native species.

Clearwater in Banff may be a good example of native population
The Old Man River
Athabasca River – sewage
Red Deer River – lots of non-native species introduction.

Urbanization effects on structure

Movement corridors, railway/roads and cutting off Oxbows, Beaver Dams

How many unimpacted ponds are there?
Baseline ponds – most have been bisected by road/railway.
Many unmapped ponds – integration across boundaries

Ephemeral ponds – climate warming and the effects on ponds that come and go.

Co-ordination between researchers (e.g. snails and amphibians) could exchange data. The promised (Banff-Bow Valley Study) Scientific Advisory Group – where is it? Managers do not want to take this on.

Co-ordination
Master database
Voucher specimens – safe depository
Better shared library system
Database to access what other people are doing.

Madison (Wisconsin) Fisheries. Trout Lake area – have a good system at present – this could be adopted.

Ecological land classification processes/characteristics/ aquatic systems <u>within</u> eco-regions (e.g. 2 little ponds side by side might be quite different).
Typology needed.

Ponds e.g. in Bow Valley which are being rehabilitated naturally/ by accident. We should be able to create rehabilitation.

Restoration

Where do you draw the aquatic boundaries?
Between riparian and aquatic: marshy wetland areas. Very little modeling for these.
Detail only provided when area is threatened. Would this be a priority?

Restoration might be considered more important – but there is a need to know what you are trying to recreate (the baseline).

New developments hire short term independent scientists to look at isolated cases. Need for Provincial level work to prepare a database/overview that is then accessed by developers etc. as needed.

Put the real value on a resource e.g. the value of water. Drinkable water needs a functional ecosystem. Education needed. Good ecosystems
Educators need to start including water in their public information. Education of watershed concept (in the same way that education about fires has taken off).

Monitoring of flood regimes.

In 100 years we could never recreate the 'natural' or original state – we would flood Calgary. We have to accept the changed state.

Spring flood – management by dams.

Is the system being "recharged", as it should be?

Eco-summits in Parliament have recently been organized by Dave Schindler and two others. Seventy five MPs attended the last one. This had good publicity in the East.

Structure of ground water – don't have a good idea of how the system works; For example, the spring system in Banff.

Artificial snow: what happens when you draw it, hold for 6 months, then it melts (Sunshine draws water from out of Province)

Ground water – and recharging

Alberta Environment has some knowledge. A lot is known about downstream extraction, but higher up there is a lack of knowledge.

Water rights – not individually maximized – but no one would have handle on exactly what quantities are taken.

Quality – linearity/regimes
Restoration
Biodiversity

(See BC Watershed Atlas)

ANHIC = Alberta Natural Heritage Information Center
CDC = Classification Data Center

Black hole of Morley Reserve area – no inventory information

Which approach do we want?
a) Development occurring then effects on resources
Or
b) Define the resources first before planning development

Do we look at Gaps from the perspective of a) or b)?

Inventory of **STRUCTURE**

Benchmark Project (Charlie Pacas and Chantal Ouimet

Ideas to have a benchmark baseline for waterbodies to follow change, and speed of change, and enable comparisons inside and outside of the Park. Creeks, ponds, lakes, rivers.
Classification hierarchy of benchmark based on disturbance regime.

Disturbance regime
1. Pristine (undisturbed)
2. Disturbed (e.g. stocked, fish died, restored itself) The history is important.
3. Restorable
4. Human disturbance
5. Totally artificial

Looking at: what we know and at what we don't know

Where have the fish gone – information is being gathered currently for a database and then a spreadsheet.

Creeks – lots to find out about creeks.

Next step is to choose another set of criteria such as morphology of water body.

Goal is to have a benchmark network shared between the various Parks,
Evaluate change within Park at local and regional level.

(Including toxicology etc. - Other parameters not just fish)
Definitions need wider critic (from outside the park) so that this can be used elsewhere later on.
Pristine rating is based on what they know now. For example, Trans boundary pollutants – have no information yet, but the classification can be changed, as more is known.

REGIONAL PERSPECTIVE
What is the value of benchmarking outside the Park? Anywhere where trying to follow the rate of change, the benchmark system is useful. Shows how the system functions – can be adjusted to needs – depending on the pressure involved.
Implications for monitoring methodology.
Can use volunteers – and public education and monitoring could be combined. Aiming for a good scheme that will work also without the necessity of big funding. Works for Universities too and sharing of information. Still using professionals to coordinate.
(note: resources are needed for the management of volunteers).

Currently being done within the Park, but would be logical to look at whole ecosystems. Lots of natural areas can use this.

Pristine areas could disappear while we wait to collect the baseline information – so best to go ahead with classifying them.

Enthusiasm is easier to generate when volunteers, etc. can see the bigger picture.

Ecological integrity Report – good thing to apply an overview on Mountain Parks block.

Impediments to all the initiatives and energy are management and money. These prevent projects going ahead/

Don't have the expertise to finesse projects politically.

Aquatics – not glamour animals – can't have a healthy river valley without healthy river – need a public understanding of this.

Need funding for monitoring (students can't do this – not the kind of work needed for degrees).

DS Rossen's work (Dave Schindler) – gaps

What's really happening (change is often very gradual)
Risk or threat analysis needed, but currently working on the 'first cut'.

Don't know life-history strategies – the basic biology (e.g. of Brook trout on a system) – therefore a real need for benchmarks
1. List of waterbodies
2. Benchmarks
3. Impacts so far – monitoring (what to monitor)

Benchmarks - not necessarily a pristine base, so really useful for an historical and big picture view.

Landscape level monitoring is being better received now (Alberta Environment)

Need more public understanding and political will (compare with prescribed burns) need an "Aquatic prescribed burn"

Quebec – Mauricle Park
Classification of Lakes
No benchmark, just classification for resource use. First monitoring is their baseline – no pristine.

Look at future – what's happening and where?

Valley bottom development is the most imminent threat and mitigatable on a local level. But the biggest changes could be affected by high elevation changes (climate change, temperature of glacially fed streams e.g. *gammarus* life cycles reduced from 3 years to 2 years). See Montana stream work (thermal limits for fish) Dave Schindler
Baseline changes really crucial for defining what is happening on a local level.

Paleo-records – show species, nutrients, fire history and these show long-term regimes. (For example, existence of species that don't co-exist with certain fish would indicate what was not there.)

To pick benchmark sites for the Bow Valley – something to compare to?

Could just choose some sites now in the valley and make them off limits. Are there any suitable ones left? As benchmark sites for monitoring.

Lots of variability in water systems by their nature – so comparisons are difficult due to these fluctuations. Boundaries of the system are only known after monitoring over time.

Prey fish: predators ration in lakes open for fishing compared with non-fished sites.
ELA lakes in Ontario (e.g. weeds and logs removed leading to effects). Side by side systems.
Need to benchmark systems under pressure (e.g. from angling) as well as "pristine" systems.

Lake Minnewanka – good trout despite pressures on the system – why?

Regulations of fisheries – the parameters keep going down

Problem with recovered lakes – when are the imposed limits lifted? (Perception of recovery)

WISH LIST (ignoring funding)

Regarding benchmarks – a need to look at mini-systems (i.e. from the water source down) in the Bow River and up. A micro-watershed approach.

How to approach?
Linking past studies – but this is problematic
Benchmarking

Choose one or two benchmark watersheds – may be choose well defined examples
Need to monitor the disturbance systems
We now have more knowledge to control water quality.

Wish list for benchmarks:
Lots of potential benchmarks – need to limit the choice
Could a matrix system be used?
Really important to measure a system over the long-term. There is lots of variability in one system alone (this is why one monitored system is better than none!)

Ecological Integrity Panel
Government agencies and research programs
Decline in public interest influences how/what foundations get involved.- so a need to sell the importance of this work to obtain funding. Water is linked to business – public relations link; what quality of water do we need for political interests? Tax money involved. Water quality IS already important to the general public – shown by the trends in purchasing bottled and purified water.

Importance of Aquatic Biodiversity to the quality of water supply.
People tend to think they can buy a system to purify their water no matter how bad the quality is.
Need to make the connection between aquatic biodiversity and good water.

A key to biodiversity is through fishermen and hunters.

Large proportion of Banff watersheds are dammed – 2/3
A false aura exists that things are good!
Interesting that this group can't think of an unimpacted waterbody in the region.

Compare the Alps and Banff - Education of the problems there

Complexity of aquatic systems at eco-system level makes definition of structure hard. We know so much at the ecosystem level, that it is very complex.

What do we want to know?
What do we know?
What don't we know?

Use the existing structure from BBVS - the Cumulative Effects Study, Mountain District Aquatic Strategy (Mountain Parks) and Blue Lake Watershed Minutes.

STRESSORS BASIS:

- Non-natives
- Chemicals/pollutants
- Obstruction damming

- Benchmarks will lead on to making experimental designs and what to monitor.

- Heritage aspect (Perhaps should preserve a few "screwed-up" lakes!)

- Human use and development

AQUATIC SPECIES

Need to know about non-game, native species and to identify them:
Mountain sucker, Dace, Chubs, and how non-natives operate in the system.

See BBVS list of non-natives: including:
Brown trout, lake trout, rainbow, cutthroat, grayling, dolly varden,

Mysis

See Y2Y Frissell's work using a matrix tool.

NON-NATIVE PLANT SPECIES

E.g. at Hot Springs – watercress, loosestrife, Eurasian water milfoil, tropical aquarium plants (at Cave and Basin), "train-grains"
(Some are good pollution indicator species)

DISEASE

E.g. Whirling disease

Non-native re-introductions and food chain connections e.g. affecting what types of waterfowl occur.

Need:
To monitor abundance and distribution,
Effects of non-natives,
Restoration effects.

ONGOING WORK

Bull trout at Kananaskis
Bull trout at Moraine Lake
Snowflake – in the Red Deer drainage
Big horn Lake

Cutthroat trout at Quirke Creek – a need to public profile something like this – following up with educating about the whole aquatic structure, not just the fish.

Restoration (debatable) as in the cutthroat trout project on Canmore Creek. The brook trout only suppressed, not eradicated.

Bull trout at Cascade Creek 
Goat Creek – restoration
Spray River – restoration

Vermilion Lakes restoration

Middle Spring Creek (145 Kootenay, Banff townsite) and Whiskey Creek

Education and political will and money

- There are projects ready to go but need support

Invertebrates – need to look at them too
Identifying exotics e.g. mysis

Beaver, otters and ducks.

Beavers keeping the Alpine 'alpine' as at Snowflake lake the effects of beaver on willow regeneration have been studied.

Benchmark discussion – representative areas for discussion. A need for ecological information for future step in benchmarks, and for clustering – create an overlay of ecoregions types.

Of **HIGH** importance: cross- boundary standardized methodology.

Stressors continued:

CHEMICALS AND POLLUTANTS

Nutrients (i.e. sewage)
Road salt

Organic contaminants (i.e. airborne)

Nutrients – waste water treatment
Clear point sources, plus golf courses and household cesspits

Composition effects on flora and fauna – mayfly, caddis and stonefly.
Filamentous green-algae (elephant snot)
Working in different norms inside to outside Park
What similarities are there between agencies?
EPCOR reports
Water treatment - For example, in Canmore we [redacted] to monitor the input as well as the output (can't put out better than goes in)

Monitoring OCA
Monitoring back-country streams – fecal coliform
Sediment related to development and roads

IMPACTS

No charges were laid despite impacts.
What limits for degradation?

Need to be more strategic in approach – using people outside of government to inform the public. Catalogue violations – perhaps have a (fun) news conference.

E.g. CNG pipeline and associated sediment problems – who would lay charges?
Private prosecution under the Fisheries Act? Would lead to publicity.

Really good case studies and impacts needed so that effects are made public.

Storm water management plans are needed –outflow inventory (Bow River Water Quality Council)

See Banff-Bow Valley Study for list of pollutants.

Road salt – saline communities. Don't know the impact on riparian habitats. When native vegetation is dying it allows non-natives easy access.

Look at other communities for alternatives to road salt.
Monitoring?

Monitoring? (Banff: water quality monitoring protocol)

Organics

Glacial melting – releasing strata from 1950s and 60s. Glacier contributes 80% of contaminants to the Bow. (Very fine so direct absorption not ingestion.)

Noraphenols are estrogen disrupters, dissolve at room temperature form surfactants in detergents, new herbicides

How important are these? Don't know.

Health consumption advisory for fish

Railroad ties and Trans Alta poles – (creosote and TCPs)

Mountain Peaks are most efficient collectors for air born pollutants, distinguish the sources – need to do this.

Need to have high elevation/altitude monitoring stations. Don't even have temperature, weather and hydrology measurements.
E.g. Osprey nests at high elevations

Dippers and kingfishers need serious consideration as indicator species.

Quantity measurements – not just quality.
Stream flow once the glaciers have gone. Effect on tributaries, etc. - changes everything.

Physical obstruction and damming:

Categorize better so that we can deal with them.
Fish ways on the Spray and on Cascade to Bow River. Need to create these (ladders ineffective?). Refer to Mark Gaberay

Bypassing physical dams for fish.

Ties and poles.

Transport corridors

Inventory of culverts and dams

Inventory upstream for native species – decide which blockages are negative impacts.
Recruitment of native species

Channelization

Transport corridors – isolation of ox-bows

Gravel pits – inventory needed

Reclamation

Water fluctuations – Kananaskis, Spray, and Cascade have been rated and plans are in place. FREWG models etc. out soon. Up to Trans Alta to implement.
Models by Stuart Rude University of Lethbridge – cottonwood regeneration – just need some water, periodically to allow regeneration. (F&W conference in Chicago)

Stream flows and stabilization of riparian habitat/

Understanding needed between the different parties involved in programs e.g. transport

Vermilion Lakes – indicators selected – operating procedures and plans and forecasting – need a code of practice/protocol with them (the same for Banff, Kananaskis and Bow Valley) to plan ahead. Candidates outside Park – working with CP Rail

Cut off oxbows, east of Canmore

Alluvial Fans – most or all are impacted by reservoirs, highway or railway. Restoration – some contingent on other things happening. Know which ones to study. Carrot Creek, Five Mile Creek. Combine projects so that inventory of obstructions tied with major land users.

Timing windows for development – encourage communications between different interests e.g. seismic, gas phone etc. – one hole/several jobs!

Class screenings (TransAlta etc.)

Future Projections/Footprint of human use

6 lanes, 10 years time, at least to Canmore – implications

Morley "blackhole" need to assess the implications of development there – probably won't happen soon, apart from Forestry.

Angling, recreation, rafting etc.
Stream side use and riparian disturbance

Rafting study

Angler attitudes study

Lower Kananaskis BCEAG work

Implications of 30 000 people living near the river in Canmore? Human dilemmas as big as the development dilemma in the Bow Valley.

Human use maps overlaying the inventories.

How many and where can we send people?

Look 50 years down the road.

Need clear expectations in order to impose limits

Dissatisfaction threshold – but tolerance levels can change.

Human access issue

Joint conservation plan really important including other areas on BC side and north AB

Cumulative impacts – workshop on this?

Interaction of stressors – sum can be greater than sum of individual stressors
E.g. transportation plans

Ecological illiteracy

Integrating all the workshops – look what lines up

Biosphere Institute of the Bow Valley Expert Analysis Workshop December 15, 1999	
AQUATICS	
Identified Research Priorities	
Identifying priorities: High = start research within 5 years, Moderate = start research in 5 – 15 years, Low = start research in 15 + years	
Research Requirements	Relevant research in progress
Coordination Required	
Coordination of Methods Of HIGH importance: cross-boundary standardized methodology What happens across boundaries: methodologies across boundaries compared to parameters across boundaries	Hinton Model Forest is an example of this
Coordination between researchers Data exchange (e.g. snails and amphibians). The promised (BBVS) Scientific Advisory Group – where is it? Managers do not want to take this on. Need to open the "boundaries" for discussion between groups, e.g. between Parks and Province, this should include discussions on who pays for monitoring	
Master Database Coordination Valuable to have a complete biological inventory of existing data Better shared library system Need accessible information, now: difficult to access– i.e. boxes of reports in basements Database to access what other people are doing	Samples in Bow Valley lists: Andrew Nimmo
Collection Coordination Voucher specimens – safe depository Need a reference collection location (see microfauna workshop). Need to bring existing collections together and to preserve them properly. Archive collections and then need to know what is there	Nature Conservancy and ANHIC database Dwayne Lepitzki's gastropod listing
Conservation Plan Coordination Joint conservation plan really important including other areas on B.C. side and north Alberta Cumulative impacts – workshop on this? Interaction of stressors – sum can be greater than sum of individual stressors E.g. transportation plans	
Landscape Approach Required	
Need for a linear approach i.e. in Calgary – pollutants migrating with the movement of fish	
Fragmentation – outside the Park. What is happening there? Do we know? Perhaps the blockages could be used to implement eradication schemes of non-native species like Brook Trout.	
Ecological integrity Report – good thing to apply an overview on Mountain Parks block.	
Landscape level monitoring is being better received now (Alberta Environment)	

Research Requirements	Relevant research in progress
Landscape Approach Required continued	
Complexity of aquatic systems at ecosystem level makes definition of structure hard. We know so much at the ecosystem level, that it is very complex. What do we want to know? What do we know? What don't we know? Use the existing structure from BBVS - the Cumulative Effects Study, Mountain District Aquatic Strategy (Mountain Parks) and Blue Lake Watershed Minutes.	
Mapping Required	
Mapping of corridors important Lots of information on fragmentation with Alberta Environment. Tying up information with Integrated Resource Service – level of detail decreases as you go into the Park because the scale of maps is different. Stream and lakes on 1:50 000 maps – Banff National Park not integrated, nor cross-boundaries into Province. Individual maps don't connect. NEED to figure out how to map regarding native species	
Ecological land classification processes/characteristics/ aquatic systems within eco-regions (e.g. 2 little ponds side by side might be quite different). Typology needed.	
Benchmarks Required	
Benchmark Project Idea is to have a benchmark baseline for waterbodies to follow change, and speed of change, and enable comparisons inside and outside of the Park. Creeks, ponds, lakes, rivers. Classification hierarchy of benchmark based on disturbance regime. Disturbance regime 1. Pristine (undisturbed) 2. Disturbed (e.g. stocked, fish died, restored itself) The history is important. 3. Restorable 4. Human disturbance 5. Totally artificial Looking at: what we know and at what we don't know Where have the fish gone – information is being gathered currently for a database and then a spreadsheet. Next step is to choose another set of criteria such as morphology of water body. Goal is to have a benchmark network shared between the various Parks, Evaluate change within Park at local and regional level.	Charlie Pacas and Chantal Ouimet
Can evaluate Paleao records – show species, nutrients, fire history and these show long-term regimes. (For example, existence of species, which don't co-exist with certain fish, would indicate what was not there.)	
Benchmark discussion – representative areas for discussion. A need for ecological information for future step in benchmarks, and for clustering – create an overlay of ecoregions types.	

Research Requirements	Relevant research in progress
Benchmarks Required - continued	
Don't know life-history strategies – the basic biology (e.g. of Brook trout on a system) – therefore a real need for benchmarks 1. List of waterbodies 2. Benchmarks 3. Impacts so far – monitoring (what to monitor) Benchmarks - not necessarily a pristine base, so really useful for an historical and big picture view. Need some benchmark to compare to. Could just choose some sites now in the valley and make them off limits. Are there any suitable ones left? As benchmark sites for monitoring. Need to benchmark systems under pressure (e.g. from angling) as well as "pristine" systems. Lots of variability in water systems by their nature – so comparisons are difficult due to these fluctuations. Boundaries of the system are only known after monitoring over time.	
Benchmarks – a need to look at mini-systems (i.e. from the water source down) in the Bow River and up. A micro-watershed approach. Choose one or two benchmark watersheds – maybe choose well defined examples Need to monitor the disturbance systems We now have more knowledge to control water quality. Wish list for benchmarks: Lots of potential benchmarks – need to limit the choice Could a matrix system be used? Really important to measure a system over the long-term. There is lots of variability in one system alone (this is why one monitored system is better than none!)	
Human Impacts Research Required: General	
Urbanization effects on structure Movement corridors, railway/roads and cutting off Oxbows, Beaver Dams How many unimpacted ponds are there? Baseline ponds – most have been bisected by road/railway. Many unmapped ponds – integration across boundaries Ephemeral ponds – climate warming and the effects on ponds that come and go.	
Stocking records could show changes in lakes, unstocked lakes – don't have records - These are needed	
Licenses – could show angling pressures. Mobility has improved for fishermen – what effects are there?	
What impacts of anglers on both fisheries and riparian habitat – impact by just being there?	
Disease – there are more diseased fish in the lower Bow – what's causing this?	Brian Lajeunesse
Indices and modeling	Montana – Chris Furzell

Research Requirements	Relevant research in progress
Human Impacts Research Required: General - continued	
Valley bottom development is the most imminent threat and mitigating on a local level. But the biggest changes could be affected by high elevation changes (climate change, temperature of glacially fed streams e.g. *gammarus* life cycles reduced from 3 years to 2 years). Baseline changes really crucial for defining what is happening on a local level.	See Montana stream work (thermal limits for fish) Dave Schindler
Large proportion of Banff watersheds are dammed – 2/3 A false aura exists that things are good! Interesting that this group can't think of an unimpacted waterbody in the region.	
Compare the Alps and Banff - Education of the problems there	
Working in different norms inside to outside Park What similarities are there between agencies? EPCOR reports Water treatment - For example, in Canmore we need to monitor input as well as output (can't put out better than goes in) Monitoring outlying commercial areas Monitoring back-country streams – fecal coliform Sediment related to development and roads	
IMPACTS No charges were laid despite impacts. What are limits for degradation? Need to be more strategic in approach – using people outside of government to inform the public. Catalogue violations – perhaps have a (fun) news conference. E.g. CNG pipeline and associated sediment problems – who would lay charges? Private prosecution under the Fisheries Act? Would lead to publicity. Really good case studies and impacts needed so that effects are made public.	
Storm water management plans are needed –outflow inventory (Bow River Water Quality Council)	
See BBVS for list of pollutants. Road salt – saline communities. Don't know the impact on riparian habitats. When native vegetation is dying it allows non-natives easy access. Look at other communities for alternatives to road salt. Monitoring? Monitoring? (Banff: water quality monitoring protocol)	
Timing windows for development – encourage communications between different interests e.g. seismic, gas, phone etc. – one-hole/several jobs!	
Future Projections/Footprint of human use - 6 lanes, 10 years time, at least to Canmore – implications	
Morley "blackhole" need to assess the implications of development there – probably won't happen soon, apart from Forestry.	

Research Requirements	Relevant research in progress
Human Impacts Research Required: General - continued	
Organics Glacial melting – releasing strata from 1950s and 60s. Glacier contributes 80% of contaminants to the Bow. (Very fine so direct absorption not ingestion). Noraphenols are estrogen disrupters, dissolve at room temperature form surfactants in detergents, new herbicides How important are these? Don't know. Health consumption advisory for fish Railroad ties and Trans Alta poles – (creosote and TCPs) Mountain Peaks are most efficient collectors for air born pollutants, distinguish the sources – need to do this. Need to have high elevation/altitude monitoring stations. Don't even have temperature, weather and hydrology measurements. E.g. Osprey nests at high elevations Dippers and kingfishers need serious consideration as indicator species. Quantity measurements – not just quality. Stream flow once the glaciers have gone. Effect on tributaries, etc. - changes everything.	
Angling, recreation, rafting etc. Stream side use and riparian disturbance	Rafting study Angler attitudes study Lower Kananaskis BCEAG work
Implications of 30,000 people living near the river in Canmore? Human dilemmas as big as the development dilemma in the Bow Valley. Human use maps overlaying the inventories. How many and where can we send people? Look 50 years down the road. Need clear expectations in order to impose limits Dissatisfaction threshold – but tolerance levels can change. Human access issue	
Human Impacts Research Required: Physical Obstructions and Dams	
CCRE Atlas – e.g. changes in Cutthroat distribution corridors and damming – can we restore populations?	
How do fish species move upstream considering the limitations? Fishways needed through dam structures	
Reconstruct picture of what rivers were like before dams – via old reports and their bibliographies.	Goat and Spray changes are being examined: Charlie Pacas

Research Requirements	Relevant research in progress
Human Impacts Research Required: Physical Obstructions and Dams - continued	
Bow Valley has 9 dams and over 50 years of movement and flow impediments. These are collection areas for pollutants etc. (see Bob Page) and nutrient movements with respect to dams. e.g. Lake Minnewanka, Cascade – would this be one to evaluate?	
Dams on the US/Canada border and implications for salmon	
Physical obstruction and damming: Categorize better so that we can deal with them Fish ways on the Spray and on Cascade to Bow River. Need to create these (ladders ineffective?) Bypassing physical dams for fish Ties and poles Transport corridors Inventory of culverts and dams Inventory upstream for native species – decide which blockages are negative impacts. Recruitment of native species Channelization Transport corridors – isolation of ox-bows	Mark Gaberay
General Research Required	
Culverts – questions about them addressed within the Park (Castle to Banff) but what is happening east of the Park? Groups like C.P. rail etc. could move into data sets and inventories. Maintenance of good culvert management – removing impediments.	
Have huge fluctuations in Alpine ponds – it's a very extreme environment. No information found (only anecdotal) – a need to investigate these.	Stewart Anderson
Monitoring of flood regimes	
Is the system being "recharged", as it should be?	
Structure of ground water – don't have a good idea of how the system works. For example, the spring system in Banff.	
Artificial snow: what happens when you draw it, hold for 6 months, then it melts (Sunshine draws water from out of Province)	
Ground water – and recharging Alberta Environment has some knowledge. A lot is known about downstream extraction, but higher up there is a lack of knowledge. Water rights – not individually maximized – but no one would have handle on exactly what quantities are taken.	
Morley Reserve area – no inventory information	
Need creek research	
Need funding for monitoring (students can't do this – not the kind of work needed for degrees).	
What's really happening (change is often very gradual) Risk or threat analysis needed, but currently working on the 'first cut'.	
Look at future – what's happening and where?	
AQUATIC SPECIES Need to know about non-game, native species and to identify them: Mountain sucker, Dace, Chubs, and how non-natives operate in the system	

Research Requirements	Relevant research in progress
General Research Required - continued	
NON-NATIVE PLANT SPECIES E.g. at Hot Springs – watercress, loosestrife, Eurasian water milfoil, tropical aquarium plants (at Cave and Basin), "train-grains" (Some are good pollution indicator species)	
DISEASE E.g. Whirling disease Non-native re-introductions and food chain connections e.g. affecting what types of waterfowl occur. Need to monitor Abundance and distribution, Effects of non-natives, Restoration effects.	
Invertebrates – need to look at them too Identifying exotics e.g. mysis	
Beaver, otters and ducks. Beavers keeping the Alpine 'alpine' as at Snowflake lake the effects of beaver on willow regeneration have been studied.	
Composition effects on flora and fauna – mayfly, caddis and stonefly.	
Filamentous green-algae (elephant snot)	
Gravel pits – inventory needed	
Vermilion Lakes – indicators selected – operating procedures and plans and forecasting – need a code of practice/protocol with them (the same for Banff, Kananaskis and Bow Valley) to plan ahead. Candidates outside Park – working with CP Rail	
Cut off oxbows, east of Canmore	
Alluvial Fans – most or all are impacted by reservoirs, highway or railway. Restoration – some contingent on other things happening. Know which ones to study. Carrot Creek, Five Mile Creek. Combine projects so that inventory of obstructions tied with major land users.	
Restoration Required	
Ponds e.g. in Bow Valley which are being rehabilitated naturally/ by accident. We should be able to create rehabilitation	
Restoration Need baseline information for restoration to work New developments hire short term independent scientists to look at isolated cases. Need for Provincial level work to prepare a database/overview that is then accessed by developers etc. as needed.	Bull trout at Cascade Creek Goat Creek – restoration Spray River – restoration Vermilion Lakes restoration Middle Spring Creek (145 Kootenay, Banff townsite) and Whiskey Creek Bull trout at Kananaskis Bull trout at Moraine Lake Snowflake Lake in the Red Deer drainage Big Horn Lake
Reclamation	
Understanding needed between the different parties involved in programs e.g. transport	

Research Requirements	Relevant research in progress
Restoration Required - continued	
Regulations and Restoration Lake Minnewanka – good trout despite pressures on the system – why? Regulations of fisheries – the parameters keep going down Problem with recovered lakes – when are the imposed limits lifted? (Perception of recovery)	
Restoration (debatable) as in the Cutthroat trout project on Canmore Creek. The brook trout only suppressed, not eradicated.	
Water fluctuations – Kananaskis, Spray, and Cascade have been rated and plans are in place. FREWG models etc. out soon. Up to Trans Alta to implement. Models by Stuart Rude University of Lethbridge – cottonwood regeneration – just need some water, periodically to allow regeneration. (F&W conference in Chicago) Stream flows and stabilization of riparian habitat/	
Community Outreach/Education Required	
Put the real value on a resource e.g. the value of water. Drinkable water needs a functional ecosystem. Education needed. Good ecosystems ir public information. Education of watershed concept (in the same way that education about fires has taken off). nd monitoring could be combined. Aiming for a good scheme that will work also without the necessity of big funding. Works for Universities too and sharing of information. Still using professionals to coordinate, and resources are needed for the management of volunteers. a healthy river valley without healthy river – need a public understanding of this. ill (compare with prescribed burns) need an "Aquatic prescribed burn"	Ecosummits in Parliament have recently been organized by Dave Schindler and two others. 75 MPs attended the last one. This had good publicity in the East.
Public interest influences how/what foundations get involved- so a need to sell the importance of this work to obtain funding. Water is linked to business – public relations link; what quality of water do we need for political interests? Tax money involved. Water quality IS already important to the general public – shown by the trends in purchasing bottled and purified water. Importance of Aquatic Biodiversity to the quality of water supplies. People tend to think they can buy a system to purify their water no matter how bad the quality is. Need to make the connection between aquatic biodiversity and good water.	
Cutthroat trout at Quirke Creek – a need to public profile something like this – following up with educating about the whole aquatic structure, not just the fish.	
Funding	
Impediments to all the initiatives and energy are management and money. These prevent projects going ahead. Don't have the expertise to finesse projects politically.	
Education and political will and money - there are projects ready to go but need support	

Biosphere Institute of the Bow Valley

Expert Analysis Program

Ecological Series

Quality of Air, Water and Soil Workshop

April 13, 2000
Canmore, Alberta

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Contributors:

Jay Litke	Alberta Environment
Bob Morrison	Alberta Environment
Al Sosiak	Alberta Environment
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Workshop Notes

WATER

Alberta Environment: Ground Water Study assessing water basin geo-positions, wells – big map, water flow etc. Due out end 2000.

Town: Wellhead Protection Study (needed information on pollutants etc. Was it addressed?) Land uses around wells supplying the drinking water to Town. ("What if?" Scenarios of a train crash or development.) What happened to this steering committee – is it still meeting? (Bill Brown's initiative – he has left Canmore).

Also – half of the Canmore town water supply comes from Rundle Forbay reservoir, and half from a well. EPCOR and Town are looking at different treatment methods. Looking at second source of ground water versus surface source. (Surface water treatment is different to ground water treatment).

Structure

Bow Valley – what is unique?

- Not a very rich system
- High fluctuation range
- 50% of flow is regulated (this is different from the historical picture)
- not as much ice as open water
- Phosphate starved system: algal populations increase with just a small addition of phosphates.
- Nutrients – possibly fertilizers from golf courses and gardens
- Compared with Jasper, which has a low flow regime and therefore really significant changes in algal population after the townsite.
- Banff sources of phosphate – cannot figure out where they are coming from. Banff is a leader in water quality management and Canmore is aiming to do the same.
- Ammonia – major importance – draft out for discussion. Canadian Environmental Protection Act (April 4, 2000). Ammonia is now considered as a toxic substance (cost implications). Risk management processes – also chloromines in distribution system (a stable disinfectant)

Town is working on determining if surface water influences the quality of ground water.

Banff Town:

Has a well system, but not into such a good reservoir; several wells.
Maintains connection with Forty Mile for emergencies.

Bighorn:
4 Hamlets: Harvie Heights, Exshaw, Dead Man's Flats and Canmore

Hotels in Harvie Heights – developers going to MD for licenses to draw water. Concern from residents. Alberta Environment says its OK – supply plentiful. Harvie Heights could be linked to Silver Tip.

Land Use Bylaw has Wellhead protection bylaw details. Very high priority, so funding available. Alberta Environment – very high density of toilets, development (e.g. Fluxworks, future dry cleaners) and ground wells etc.

Western Central Basin:
Palliser is the last area of flat land to create a filtration area. Discussion about raising the area for development which negates it as an infiltration area. Infiltration galleries for sending Storm water into ground water being discussed. These galleries are high maintenance items – big concern, holding up the Palliser development. Other storm water issues have not yet been addressed. Ponds on Silver Tip are wet ponds (i.e. lined) and all water ends up on the one culvert under the Trans Canada Highway. Dry wells with storm-ceptors (pretreatment wells) are being discussed. Water levels.
Upgrading of Bow Valley Trail – it is a major storm water receiver – where does it go? High profile and costly.

Hidden liability issue of private wells – on Canmore Trailer Park (one landowner, 280 homes).

Proximity of municipal system and private wells – bylaws.

Sources of bacterial contamination
Human or wildlife source
Contamination upstream of water sources
Wells and aquifers in Banff are often in protected sites
Could save money in the future by protecting aquifer sites now, in Canmore (e.g. wildlife corridor) e.g. Stone Creek

Canadian Drinking Water guidelines
Alberta has adopted these as regulations. Alberta Environment adds additional parameters for licensing (e.g. giardia). Gives guidelines regarding the frequency of testing)
(E.g. for drinking water: fluorides, continuously, trace metals, monthly and pesticides twice annually).
In Edmonton high-risk areas get extra testing.
Violation if not reported.
Same for output from sewage plants etc.
Different use over year and fluctuations here – need to do extra testing; not a requirement, but a good option.
Alberta Environment tests the Bow River – not the Town.

Lowering consumption? Is this a good way to conserve quality of resource and reduce costs of treatment, etc.? (330 l per day in Edmonton (metered) more per person in Calgary where it's unmetered.)
Should these reduction methods be building guidelines.

Research Topic – low flow toilets and if they actually work. Cost and efficiency of normal toilets much more attractive to builders. Incentives for using less water in toilets – it is biggest single use of water.)

Pembina Agreement (a few years ago) has all kinds of ways to reduce consumption. Green dollars available. Someone in Canmore had to implement the work and therefore it was not followed through.

30 year study for Canmore and implications for long-term future. Cumulative stress point and working backward. Identifying links and tying them up.

Affects of rock industry (Lac Des Arc) "Zero" discharge system and minimal uses of water are the aims of LaFarge.

Increasing size of sediment ponds to address the high Total Suspended Solids (TSS) from mudslides, dust, and storm events. Lac is "backwater" of the Bow. 1994 it was separated from the Bow by culverts opened in summer to let fish through. Try to retain water – used to get lots of sedimentation. Quarry trucks won't be hauling down mountain anymore and therefore the dust will be reduced.

Landfill
One to be closed (Burnco Pit)
"Dry land fills" – partly due to concern over Bill Griffith Creek.

MD landfill has just become regional landfill site – East of Exshaw (5km) on the 1A
Work needed to monitor effect of landfill on groundwater.

Industrial Park
Old landfill under Ball Diamond – is it a time bomb? Several old landfills – most are far back from ground water sources and are high up, so there should be no problem.
Rain causing leaching would be the problem, but generally okay. Class 3 landfills.
Regional landfill pH11-12 (rock waste) is being monitored. Continental Lime waste is really fine pure limestone.

Continental Lime settling ponds treatment methods have had to be changed due to very high pH leaching.

Baymag – not a major source of water release.

Ground water through mines on Three Sisters. H2S levels are very high. Is this a problem? The smell is significant.

Natural cold springs (for example, at Dead Man's Flats) have a definite smell.

Alberta Environment study – for ground water? This covers guidelines for groundwater.

Exshaw
Bow River Water Quality?
Alberta Environment- has a large database of all data, but not consolidated interpretive report.
Federal

Quality of water in = quality of water out. Threshold and Monitoring Committee had trouble gauging this.
Need to study fluctuating ground water levels – Town of Canmore (last reported in 1970's) problem trying to understand develop-ability.

75% of future development will be on Three Sisters' land. Several issues that need more extensive research than originally planned. Soil contamination and Three Sisters Creek containment – effects on water regime.

Storm water
Difficult to treat and is the biggest issue. With increased paving, more of a problem. Affect on ground water.
Infiltration galleries allowed. Dry wells not liked by Alberta Environment (has been the standard in the valley.) Get developers to install "storm-ceptor system". Hydrocarbons float to the top – removed, purer water in the middle goes to ditch, sediment at the bottom. Storm Interceptor system.

Bigger areas mean more money needed for bigger better interceptors.

Need for a cumulative list of places where storm water enters river.

At present, the Federal Government's new Fresh water Policy is in process.

Research indicators needed:
High Priority
Need to study Quantity, Quality and Source of storm water in developed areas of the Valley
This can be tricky- e.g. old diversions, gaps in knowledge of where storm water actually goes.
Is there literature on available technology for other places: Switzerland, U.S. etc. in mountain environments.

High Priority
Need Integrated Water Quality Plan.
What research/data are available by Alberta Environment?

Workshop participants recommended asking Jay Litke of Alberta Environment to help fill in this information. Jay Litke recommended Bob Morrison for information on the Bow Basin Plan. Bob

Morrison recommended Al Sosiak of Natural Resources Service for information on water quality sampling in this area. The following two paragraphs are based on information from them.

There are several programs in progress and documents in preparation that pertain to water issues in and around the Canmore area.

> The *Guide Book to Water Management*: This document lays out policy, laws, projects and programs in effect for the Bow Basin (including Canmore area). It will likely be out in 2000.
> *Bow Basin Plan*: This is mostly a water plan. It started in 1995 and includes the entire Bow from headwaters to just west of Medicine Hat. In 1995-6 public meetings were held to determine the preliminary design for Bow Plan. Terms of reference were developed. Public advisory committee =Bow River Basin Water Quality Council. The Bow Basin Plan will likely be completed in about 4 years.
> *The Year 2000 Review*: Back in 1990 as part of the Water Management Policy for the South Saskatchewan River Basin, they promised that in the year 2000 they would review this policy, it will go beyond irrigation. The Year 2000 Review will likely be completed by 2002.
> *1999 Water Act:* In terms of rules and regulations for water quality in Alberta, the 1999 Water Act has replaced the Water Resources Act that was in effect from ~1931 until 1999.

Water Quality Testing in the region

> There are a total of eight sites in the Bow Basin sampled year round at monthly intervals. These include sites at the Banff Park boundary to check on the effects of Banff, and at Exshaw, upstream of Exshaw Creek to check for effects of Canmore. Environment Canada samples the sites in the Park. The other sites are part of a province-wide program. Sites have been sampled for decades. Data is available from the Data Management Section of the Water Management division of Natural Resources, Alberta Environment. Technical reports on water quality are available from the Alberta Environmental Protection Library. These include a 1996 bacteria report by Karen Saffran, a 1996 Synoptic Survey Report Sosiak, and a 1993 report on the Banff Park site by Environment Canada. Any concerns with water quality that might effect health should be reported to Headwaters Health Authority.

What other information is out there?

Bow River Project – Workshop participants recommended asking Bow River Project Coordinator Jackie McCall about this project. The following is based on her response. The Bow River Project is a non-profit society concerned with riparian stewardship and enhancement with a focus on weed control throughout the Bow Basin. They coordinate weed control in municipalities throughout the Bow Basin. They also offer an education component that includes school programs and tours. By the end of 2000, they will have available a booklet of guidelines for subdivision development for the protection of riparian areas.

'Cows and Fish' project and riparian area preservation. This is a cooperative effort between Alberta Cattle, Alberta Agriculture and Alberta Environment. Educate ranchers and farmers about protecting riparian habitat, stream bank fencing, hard foundation crossings etc. Designed around fish bearing streams.
Work done on the Elbow etc
Bow River Water Quality Council – Provincial, are doing work – what exactly and could they do work for this area as part of a larger watershed – or do we do it?
This area is part of the larger plan. Interpretation needed.
Watershed Management Plan including an integrated WQP – prepared locally. (BCEAG)
Need to find out all the other stuff going on – Federally and nationally, including the New Fresh Water Policy.

Need an understanding of surface water on ground water.
Follow up on the recommendations of the Wellhead Protection Study.
Pervasive influence of man-made / development influences
Biological influences
Soil type effects – connectivity e.g. clay, riverbed etc.
How much treatment is needed?

Need all local players to meet – for an information and planning session:
Alberta Environment, Bow River Water Quality Council etc.
To show who is to do what, and who is already doing what.

Medium priority
Industry feeds – Industry perspective for water treatment standards for the Valley.
Canadian Environmental Protection Act – influence.

AIR

Last report completed by Alberta Environment was 1993/4 Exshaw/Canmore and the just completed Dec 1999 work – mobile unit (Stuart McKinnon)
'93 on Library building roof and Exshaw fall '93.

Alberta Environment – recent works and plans for Air Quality research (check with Jay)

Workshop participants recommended asking Jay Litke of Alberta Environment to help fill in this information. He contributed information for the following three points.

Air monitoring in the valley this year

1) In terms of a stationary passive monitoring network in and around Canmore and Exshaw, 11 sites are being set up in summer of 2000. They will run for at least 6 months and monitor for byproducts of combustion -automobile exhaust, smoke from fires, etc. (sulfur dioxide, nitrogen oxide and ozone).

2) In Exshaw monitoring will be done with TEOM monitors for particulate in small diameters 2.5microns to 10 microns in size. Wind speed and direction also taken into consideration.

3) For the Mobile Monitoring Program, the mobile air monitoring unit will be involved in extensive monitoring during the August 2000 long weekend in the Town of Canmore, Town of Banff and the Exshaw area.

Results of all these three will be taken to BCEAG.

Don Cochen and Stever Gasser - testing
Long-term study for seasonal variations – not done?

CASA – Edmonton (Clean Air Strategic Alliance – Donna Ingly)

Continuous Emission Monitoring on stacks at LaFarge

No real models exist e.g. inversion / skier traffic / bad day at the stack / all events together.
Worst case scenarios.

High Priority – is there a plan? We don't know. What are the baselines? Ability to compare data.

Particulates from the Rock Industry and development being looked at by Alberta Environment and Industry
Alberta Environment doing some tests. Cheap and easy to test.
The berm helped reduce particulates.
LaFarge - monitoring before and after the change in truck use. Landfill site Exshaw – site specific monitoring of vegetation.

Automobile emissions harder to monitor.
Should be considered – Municipal and Regional Transportation Study – link.

Development –related particulates.
Rock industry probably fixed as a source of pollutants. Other sources are growing – development, vehicles.

Growth Management Study recommended a fire place policy – to stop woodburning hearths. (Whitehorse has a weather restriction).
Could include in the census the number of fireplaces. Conversion packages are pretty cheap.

Odour is a big issue for some.

Waste water and biocomposting facilities – weather structure and proximity.
Other sources such as sulphur springs; Hard to measure – subjective; Odour parameters do exist.

At waste treatment plant activities are weather dependent.

Certification for builders – "environmentally friendly" certification. Investigate.

Pollutants inside buildings are a significant consideration. (95% of our air is obtained inside).

Personal air monitoring studies.

SOIL

Undermining issues in Canmore

(Who is now responsible?) Edmonton? - Municipal Affairs. Canmore no longer responsible?

Erosion

Subsidence / slumping - steeper slopes are now being developed.

Infiltration
Fertilization of soils

Importation of soil for development – is there a need for more natural landscaping? Saves water also. Also local composting? (grass clippings).

Lack of naturally occurring soils – where are the soil lenses in the Valley?
Imported sods on lawns.

Past land uses – e.g. dumps, land use, e.g. Georgetown.
Look at Provincial records

USTs – Underground storage tanks – what's the status of these regarding soil contamination and ground water contamination. (Examples in town.)

High Priority
Is there an <u>inventory of data</u> – contaminated sites – sources of date (BIBV) and of landfill sites etc. Railway and mine sites. Old fuel storage sites.

Effect of removal of trees for development on erosion, air quality. No guidelines for re-planting.
Fire management – tree species – system changes e.g. moss and effects on water quality.
Prescribed / controlled burning in Valley – effects on air.

Biosphere Institute of the Bow Valley
Expert Analysis Workshop April 13 2000

QUALITY of AIR, WATER AND SOIL

Identified Research Priorities

Identifying priorities: High = start research within 5 years, Moderate = start research in 5 – 15 years, Low = start research in 15 + years

Category	Research requirements	Priority	Relevant research in progress
WATER	Need all local players to meet – for an information and planning session: Alberta Environment, Bow River Basin Council etc. To show who is to do what, and who is already doing what.	High	
	Need Integrated Water Quality Plan Research/data available from Alberta Environment, Bow River Project, Elbow, 'Cows and Fish' project and riparian area preservation, Bow River Water Quality Council (Provincial), This area is part of the larger plan. Interpretation is needed. Watershed Management Plan including an integrated WQP – prepared locally. (BCEAG) Need to find out all else going on – Federally and nationally, including New Fresh Water Policy.	High	Alberta Environment
	Need to study quantity, quality and source of storm water in developed areas of the Valley and areas of potential development (e.g. upgrading Bow Valley Trail-it is a major storm water receiver). This can be difficult- e.g. old diversions, gaps in knowledge of where storm water actually goes.	High	Check literature on available technology for other mountain environments e.g. Switzerland, U.S.
	Need to understand the influence of surface water on ground water. Follow up on the recommendations of the Wellhead Protection Study. Pervasive influence of man-made / development Biological influences Soil type effects – connectivity e.g. clay, river bed How much treatment is needed?	High	Wellhead Protection Study
	Industry feeds – Industry perspective for water treatment standards for the Valley. Canadian Environmental Protection Act – influence	Medium	
	Phosphates in water: implications of "phosphate starved" system, identify Banff sources of phosphates		
	Effects on water from fertilizers from golf courses and gardens		
	Ammonia: now considered toxic substance – cost implications of monitoring		
	Protection of aquifer sites could save money by protecting them now.		
	Should reduction methods be incorporated into building guidelines (*i.e.* low flow toilets)		

Category	Research requirements	Priority	Relevant research in progress
AIR	Need overall air quality/monitoring plan Now, some monitoring of air quality by various groups (see text), but no real models that look at multiple variables. Need for baseline information and ability to compare data	High	
	Particulate from Rock Industry and development and vehicles should be monitoring (cheap and easy to test).		Alberta Environment, Rock Industry
	Potential for programs that helps with air quality in Valley. For example to improve air quality, Growth Management Study recommended a fire place policy. An "environmentally friendly" builder certification program should be investigated		
	Odour from wastewater and biocomposting facilities. This can be weather dependent. This type of air quality issue hard to measure, but odour parameters do exist	High for parts of Canmore	
SOIL	Need for a central inventory of soil data and of sources of data for this area. Also need information on agencies responsible for different types of soil issues (undermining, erosion, subsidence/slumping, infiltration, fertilization) and information on past land uses (i.e. railway and mine sites, contamination from local underground storage tanks dumps, etc.)	High	
	Information on natural landscaping (also saves water), local composting (grass clippings) and effects of imported soils (imported soil for development, imported sods for lawns)		
	Effects of tree removal for development on erosion, air quality. Need guidelines for replanting.		
	Effects of fire management on air and soil		

Biosphere Institute of the Bow Valley

Expert Analysis Program

Socioeconomic Workshop

September 22, 1999
Canmore, Alberta

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Biosphere Institute of the Bow Valley
Expert Analysis Program
Socioeconomic Workshop
September 22, 1999

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Biosphere Institute of the Bow Valley
Expert Analysis Program
Socioeconomic Workshop
September 22, 1999
Workshop Notes

Workshop Overview

The other workshops in this Expert Analysis Program are included in the Ecological Series, while this workshop deals with the socioeconomic issues that pertain to the Bow Valley Ecosystem. This workshop focused on the relationship between people and the ecosystem. This includes the effects the ecosystem has on people and the effect people have on the ecosystem. The discussion focused on three areas or gaps. The first was the need for consistent methodology throughout this type of research, the second looked at whether there were potential models that could be useful in this area, and the third looked at the effects the ecosystem has on people and vise versa.

1) METHODOLOGY

Duration of Stay and Type of use:

Question the effect of duration of stay and type of use on dollar impact on resources
- Is there a link? (Not necessarily time dependent)

We have information on overnight backcountry use.
Day use is monitored sporadically, but not controlled in any way.
Trail counts are not consistent in methodology
Should we revert to older methods so comparison is possible?

Methodology should be implemented across all Mountain Parks' boundaries.

E.g. Link use of a trail to the characteristics of trail - ask what the characteristics are, what the ecological variables are.

Is there a need to relate type of resident to use of area and activities undertaken?

How to categorize people?
e.g. “long term” define - < 10 years?
(relative to values and decision-making)

- Possibly different categorizations have been used in studies. There needs to be a consistent categorization used within and between studies.

The following categorization of people will be used throughout this report

PEOPLE CATEGORIZATION:

'Residents'
- Long term > 2 years
- Short term ½ - 2 years
- Seasonal < ½ year

'Non-visitor'
- Taxpayer / voter

'Visitor'
- Local
- Non-local

'Shadow'
- Secondary or non-primary homeowners: weekends, seasonal

For example: Proportion of residents of Canmore working in Banff = 21%

- See Norm's Summary of Census, on web site: canmorebusiness.com

- Non-permanent population fluctuates compared with population of permanent residents, which is relatively stable.

- Statistics on summer workers needed as a research project here
This was done in Jasper by looking at numbers of, and wage bills of employers (Peter Boxall explained this to participants - see Appendix ***)

2) POTENTIAL MODELS

Foothills Model Forest Project
Explanation of FMFP (Peter Boxall explained this to participants - see Appendix ***)

Input – Output Models and limitations
- Being linked to environmental approach and ecology.

- Willingness to make trade-off's

E.g. In the U.S. pollution of beach → sue → damages
But instead: compensation of local people or build a park.

E.g. Development permits given in exchange for giving up a Lodge outside Town boundary.

Alternative Models - what is there?

Hinton e.g. everything was viewed under *Tourism,* but now using a separate *visitor* category.

The *Canmore Model* – being quoted as a model to not follow – i.e. the Tourist route → Loss of sense of community, wages affected (downfall in economy)

3A) HOW THE ECOSYSTEM EFFECTS PEOPLE

Sense of Place

In terms of sense of place - What research is needed?

Concept from outsiders would be useful.
Loyalty factors of long term residents.
Sense of place is a key driver in choice of location.

Definition of Sense of Place? Not necessary to be a resident to have one.

'External' compared with 'internal' sense of place.

Human perception

Economic use as a variable in predicting behavior.

Sense of place for trails might be interesting

Models predicting where people go, (for what reasons, followed by ground-truthing) would be useful outside the Parks.

Trail Surveys

Permits – what else should be asked?
Hotel surveys – what else should be added?

3B) HOW PEOPLE EFFECT THE ECOSYSTEM

HUMAN USE breakdown suggestion:

CORE COMMUNITY – impacts e.g. air and quality

+ FOOTPRINT – extension beyond the town boundaries e.g. trail use - (Ecological footprint).

The Footprint really extended by, for example, commuting to Calgary.

Physical set-up of town can affect the footprint and transport/movement within town. It's a Town Planning issue that cuts across the ecological picture.

HUMAN USE IMPACT

On the Town sites in terms of:

- air quality
- water quality
- congestion
- habitat fragmentation
- wildlife corridors
- noise and light pollution
- solid waste
- vistas and viewscapes
- quality of life
- quality of visit

Parks Canada now has "no net negative environmental impact" policy.

On the Region:

Same as for townsite, but the scale and magnitude is different.
Vistas and viewscapes
Designations of use, but specifically of green space

On Flora and Fauna:

E.g. horse-use (animals spreading seeds etc.).

QUESTIONS

- Getting a better handle on the Economic Drivers including the "New Economy" – tourism, footloose entrepreneurs

- Why do people come here?

- Very little understanding of the patterns of behavior of visitors and behavior of residents (E.g. time flexibility of virtual workers)

Biosphere Institute of the Bow Valley		
Expert Analysis Workshop September 22, 1999		
SOCIOECONOMIC		
Identified Research Priorities		
Identifying priorities: High = start research within 5 years, Medium = start research within 5-15 years, Low = start research in 15+ years		
Category	**Priority**	**Relevant Research Needed or in Progress**
Question 1: To know the patterns and effects of human use here. In General: Need improved methodologies that include who / why / what / when… These should include: ❑ Inside the Park ❑ In the town sites ❑ Outside the park ❑ Front country ❑ Back country In terms of the following categories (as defined on page one of this workshop report): ❑ Residents ❑ Non-visitors ❑ Visitors ❑ Shadow	High	In progress:- Parks Satisfaction surveys Back country permits (limited information) Hotel registrations Camping at managed sites Needed: Expand permit questions to include information on behavior/information needed. Consistent across different areas. Done:Tourism group of BBVS surveyed some visitors. Eva Katic +Brent Ritchie in 3 studies, projections. In progress: BCEAG project. Needed: Trail survey
Question 1 Sub-categories: The following sub-categories of Question 1 were identified during this workshop as being of significant impact and influence. They were then considered as follows in more detail. **Question 1A: To know the patterns and effects of human use here, in terms of transportation.** Need to consider □ Commercial □ Recreational □ Parking □ Commuters	High	On-going: just started BCEAG Transportation study on Bow Corridor Towns of Canmore & Banff, Parks Canada, MD of Bighorn, Province of Alberta. All participating at all 3 levels On-going: just started Town of Canmore Transportation Task Force (Mike Heenan) On-going: draft reportLake Louise Transportation study Pilot Study for other areas Done 1997, 1998: Town of Banff studies

Category	Priority	Relevant Research Needed or in Progress
Question 1B: To know the patterns and effects of human use here, in terms of Socio-Demographic Profiles in terms of the following categories (as defined on page one of this workshop report): ❑ Residents ❑ Non-visitors ❑ Visitors ❑ Shadow Forecasts of growth in population Changing composition	Medium	Done: Individual jurisdictional surveys – Need: Interpretation of these Need: Sharing of forecast information Done by: Statistics Canada Town of Canmore Need: Town of Canmore to do an expanded and on-going census Need: Specific information for this area. Identify key information & make it available
Question 1C: To know the patterns and effects of human use here, in terms of: Impact of vehicle access to backcountry, on environment and use of area. e.g. Seismic roads → general access Trends in use of front and backcountry and Air - water quality. Also demographics - Trends in use	 High Medium	Feb 2000 workshop CREILG Central Rockies Ecosystem Inter-Agency Liaison Group CREE Canadian Resource and Environmental Economic Journal of Colorado State University (***Study Group ask Peter Boxall) Biannual Society of Natural Resources Symposium (Bellingham, Seattle) Need: To get general lease line data and has to be on-going, comparable. Consistent methodology.

Category	Priority	Relevant Research Needed or in Progress
Question 2: How do you influence use? Roles of Education / information / communication e.g. trip planning. Management actions e.g. fire management, fish-stocking, fees, quotas	High	General, but not local, information is available. Need: Projects looking at affects of local control actions e.g. fees, closures, quotas Need: Cross jurisdictional coordination Experimentation, trials
Question 3: How best to access and communicate the data, material and studies that currently exist, **How to share the methodology, problems, etc.**	High HIGHEST	1991- 92 last done Exit surveys by Province Needed: Annotated bibliography (some covered in BBVS) 96 & earlier Regional Office Parks Canada Socioeconomic Information on Western Canada Parks Canada Environmental Scan Done: Canadian Forestry Service Wilderness Values Overview Report University of Calgary - Van Horne Institute, Geography (Nigel Waters) Repository for information, data Done: EVRI =Environmental. Valuation Resource Inventory Database of Economic Valuation Studies (Web site) Statistics Canada Visitors surveys: International & Canadian visitors National survey on the importance of Nature to Canadians: ’81 ’87 ’91 ‘96

Funding Agencies	Research Agencies
Donner Foundation	University of Calgary
Trans Alta	University of Alberta
World Wide Fund for Nature	Can. Forest Service – Socio Economic Research Network
Alberta Sports, Recreation and Wildlife Foundation	Trent University
NSERC (National Science & Engineering Research Council)	Simon Fraser Resource & Environment Management
Economic Development Association	Center for Tourism and Resources policy
Environment Canada	Athabasca University
Web site C.O.P.S. for funding agencies	Travel Alberta
Friends of Banff & Kananaskis	Institutes – Van Horne, McLeod Institute, University of Calgary, Pembina
Canadian Council on Human Resources in the Environmental Industry – for hiring students, Calgary	Talk to agencies that will use the data, to find out what are their goals, needs, cross-referencing with others, what format would be most useable. E.g. Tourism Bureau
Social Sciences Human Research Council	Town of Canmore
Banff/Lake Louise Tourism Bureau	Parks Canada
Trans Canada Pipe	Alberta Environment
Parks Canada	Kananaskis,
Mountain Equipment Coop (MEC)	Private Industry/Operators
Alberta Environment	
Wild Rose Foundation	
Canadian Pacific Foundation	**Non - Government Organizations:**
Canadian Association Petroleum Producers	e.g. Canadian Parks And Wilderness Society
Oil Companies	Academic Agencies
Brewster	Other Research Bodies
Laidlaw	Planners/Highways/Transportation
Canadian Forest Service	**Be careful that some needs & drivers will be in conflict*

General Recommendations

- Multi-agency approach required.
- Alliance with a group that could take a leadership role.
- ”Steering Committee” to guide Agencies, to manage funds, to vet proposals & set priorities & need for a “Chief Researcher” to act as a point person within social sciences, (Economics being a social science)
- Learn from others, similar communities.
- Maximize our existing data – knowledge & use of.
- Also maximize usability of the data.
- Emphasis on generating long-term data, for accuracy, usability, i.e. Primary data and credible methodology & secondary data with credible methodology.