

Biosphere Institute of the Bow Valley

Expert Analysis Program

1999-2000

Part 1: Introduction and Summary

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Introduction

The Bow Valley: A Changing Ecosystem

The Canadian Rocky Mountains create diversity. Their rugged topography shapes weather patterns and presents a wide variety of landforms and soil-building materials. Unique conditions, conducive to supporting a rich variety of life, change over short distances. In the Bow Valley, lying west of the Alberta city of Calgary, such conditions have converged to create a “hotspot” of both scenic and biotic diversity. Cutting east-west through the north-south trending mountains, the valley is a life-sustaining artery that runs from the Alberta plains to the heart of the Rockies. As a low-elevation corridor featuring a major river/riparian system and a mixture of montane and subalpine habitats, the valley has high value as both a year-round wildlife refuge and a desirable setting for human habitation and recreation.

People have long-understood and benefited from the mountain ecosystem. First Nations have lived in the Bow Valley since the great Ice Age glaciers retreated. The bones of bison and bighorn sheep are buried in campsites used for ten millennia. Beginning in the 1700s, the ancient trails linking these camping grounds were followed by fur traders, then railway surveyors, and today by highway engineers. Valley-bottom camping grounds that once provided for a few families are now coveted real estate for planners building subdivisions for thousands. New four-lane and six-lane highways are traveled by millions seeking clean mountain air, deep green valleys, glaciated peaks, and the chance of seeing North America’s wildlife icons.

The ecological changes that have accompanied the last 200 years of changing land use in the Bow Valley are pervasive. Before the Europeans arrived, for example, forest and meadows were routinely burned by scattered groups of First Nations hunters who used fire to renew habitat. That practice ended with the European settlement of the valley, and fire suppression has been the order of the day for over 100 years. That single change in practice has dramatically altered the amount and type of habitat available for wildlife. As well, the explosion of the valley’s human population, infrastructure, and activity is challenging the viability of local and regional wildlife populations, including the wide-ranging carnivores. The valley’s current landscape – bisected by busy highways and railroads, dominated by subdivisions, commercial developments and golf course fairways, and subject throughout to the escalating din of human activity – is raising threshold questions regarding the compatibility of human and natural communities and the ecological integrity of the valley itself.

The socio-economic changes for humans associated with the rapid development are also profound. Coal miners and other old-timers have been displaced by tourist support industry workers, telecommuters and weekenders, and even the latest of the new arrivals quickly become concerned that their newly acquired “mountain amenity” life style will be undermined by even newer arrivals.

From coffee-shop conversations to newspaper headlines and public hearings, residents of the Bow Valley are expressing widespread concern regarding the interrelated issues of ecological, economic, and social change in the Bow Valley. Their concern is amplified by the speed and magnitude of change itself, which has nearly overwhelmed our ability to understand both the nature of the change and its implications. Fortunately, we have in the valley a relatively strong

knowledge base – ranging from the hard-gained experiences of old-timers to the detailed studies of the current crop of university students – which provides us valuable data and information for measuring change, making sense of it, and moving effectively to plan, manage, mitigate and govern its effects. In 1998, working on the premise that good information opens the door to good planning, the Biosphere Institute of the Bow Valley compiled a comprehensive ecosystem database of ecological, economic and social knowledge in the valley. In the spring and fall of 1999, and winter of 2000, the Institute continued that work by convening a series of “expert analysis workshops” to identify gaps in the database and to make recommendations regarding further research in the social, economic and ecological domains. This report provides a summary of these findings.

History and Background of the Biosphere Institute of the Bow Valley

The rapid growth in human use and settlement in the Bow Valley and the associated pressures on the surrounding ecosystem are of concern to a wide range of stakeholders. Decisions are being made on a daily basis that will permanently affect the people, the wildlife and the environment of the Bow Valley. A wide range of studies has been undertaken on the ecological, economic and social issues pertinent to these decisions, but no central source was available to act as a clearing house for this ecosystem information. In 1997, the Biosphere Institute of the Bow Valley was created as a result of recommendations from the Town of Canmore’s Growth Management Strategy. The Biosphere Institute was formed as an objective, non-political, non-profit society that makes such ecosystem information available to decision makers as well as local citizens. The Biosphere Institute also facilitates, encourages, supports and coordinates ecological, economic and social research pertinent to the region's ecosystem.

The Biosphere Institute of the Bow Valley is dedicated to enhancing understanding of ecological integrity as it pertains to the Bow River watershed. Ecological integrity is defined as the condition in which all ecosystem structures and functions remain resilient to human-caused and natural stressors, and in which all currently existing native species persist in viable populations. The needs and aspirations of the human population are included as a component of the watershed’s ecology.

This Expert Analysis Workshop Program grew out of the Biosphere Institute of the Bow Valley’s initial desktop study program. The desktop study involved collecting information on over 3000 references relevant to the Bow Valley ecosystem. This information on previous research is now compiled on a computer database that is available for public use in the Biosphere Resource Centre. The next step was to identify where knowledge gaps exist and define and prioritize future research through this Expert Analysis workshop series.

The Workshop Process

The objective of the Expert Analysis Workshops was to identify knowledge gaps in information available on issues as they pertain to the ecological integrity of the Bow Valley ecosystem (ecological, social, and economic). The workshops focused on the Bow Valley watershed from Bow Lake to Ghost Lake and included the Kananaskis, Ghost, Spray and Cascade Valleys.

Each workshop followed a similar format. First, the participants described the general structure of their ecosystem topic – what does it look like on the land or in the community? What are the critical habitat areas and keystone species, and who are the key human community players. Second, what are the processes that interconnect the structure? In ecology, these are often climate, fire, or links between species like predators and prey. In the socioeconomic sphere, key processes are often economic growth, or education and wage shifts. Third, participants looked at stressors that could cause unplanned or unwanted changes in structure and process. Fourth, the workshops focused on how best to research and monitor the effects of these stressors. This included identifying current knowledge on their states and trends.

When key knowledge gaps were identified, participants prioritized how soon we should attempt to fill them (1 to 5 years, 5 to 10 years, or greater than 10 years). Potential sources of expertise in the community, universities, or government agencies were listed. Finally, suggestions were made for potential sources of funding for such research.

A total of seven Expert Analysis Workshops were held. One workshop was held on socioeconomic issues as they pertain to the Bow Valley ecosystem and six others were held on ecological issues. The ecological series included workshops on: Vegetation; Mammals; Birds; Microfauna (insects, amphibians etc.); Aquatics; and Quality of Air, Water and Soil. Workshop participants included representatives from the federal, provincial, and municipal governments; universities, private consulting firms; non-profit organizations; and industry.

How To Use This Document

The Expert Analysis Workshop Report is presented in two parts. The Introduction and Summary section includes the introduction and background information that is pertinent to all the workshops. It also includes the general conclusions of the workshops, followed by summaries for each workshop. The summaries focus on the research priorities that were identified in each workshop. This section will be most useful for those interested in a summary of the workshop process and research priorities identified.

The Workshop Notes section is designed for those in the research field or others that are looking for more detailed information on structures, stressors, and research and monitoring recommended and ongoing in a particular field of expertise. The Workshop Notes section includes a listing of the participants and contributors for each workshop, and their affiliations. It also includes the verbatim flipchart notes from each workshop. During each workshop, flipcharts were used to record the discussion. The flipchart notes were displayed, and changes were made to them by the group throughout the workshop. The Workshop Notes section of this document is the final version of those notes.

The Workshop Notes section will also be particularly useful to researchers because it identifies funding, research, and community agencies that are either presently involved or that could be potentially involved with local research in each workshop category.

General Workshop Conclusions

Each workshop in this Expert Analysis Series focused on a very different topic: Vegetation; Mammals; Birds; Microfauna (insects, amphibians etc.); Aquatics; Quality of Air, Water and Soil; or Socioeconomics. The individual participants and the organizations represented also varied greatly between workshops. In spite of these differences, the top priorities for each workshop were surprisingly similar.

Overall Research Priorities

General research needs:

- Standardized data gathering methods should be developed and used valley-wide, to improve research quality and to help facilitate comparisons between research projects;
- A landscape approach to research should be employed, rather than isolated area research; and
- The need for a coordinating body (or coordinating bodies) was also seen as a top priority due to the multi-jurisdictional nature of the resources and the varied research agencies and individuals involved.

Such standardization and coordination would improve the quality of the research and increase research efficiencies.

Research topics:

- Baseline data must be collected in order to determine local trends;
- The establishment of long-term monitoring programs is essential;
- Studies of the direct and indirect effects of human use are an immediate priority; and
- It is essential to establish control regions where human use is minimal.

Along with these general conclusions, specific recommendations were made for each workshop category. The following workshop summaries identify these workshop-specific recommendations.

Vegetation

Overview

Widespread changes in the vegetation of the Bow Valley have been brought about by both direct and indirect human use. The unique mountain valley bottom vegetation is very limited and is experiencing a range of direct human impacts through urbanization and indirect impacts through fire suppression (which affects wildlife habitats) and recreation. The workshop participants identified knowledge gaps within the following four eco-regions:

- Alpine
- Subalpine
- Montane
- Riparian

Immediate & Future Research Priorities

All Eco-Regions

Immediate research needs:

- Development of long-term monitoring plots.
- Studies on the effects of human use on vegetation.

Alpine Region

Immediate research needs:

- Research on the effects of mountain biking, horse use, weed introduction, heli-touring, and trail use.
- Research on the effects of blister rust on white bark pine.

Future research needs:

- Research on the dynamics of alpine ecology in landscape areas.
- Monitoring of air quality.
- Micro-mapping of human use.
- Research at the landscape ecology level.
- Monitoring of the effects of fire on the treeline.
- Research into the effects of exotic species on natural vegetation.
- Photographs to use for treeline research.
- Monitoring of changes in the upper limit of semi-continuous vegetation.
- Sensitive vegetation indicators identified.
- More information about genetic flows.
- Research into the effects of climate change.
- Research into the effects of glacial changes.
- Studies on species migrations.
- Comparison studies among Rocky Mountain regions.

Subalpine Region

Immediate research needs:

- Research on the impacts of ski hills and logging.
- Research on the influences of connectivity of vegetation patches for wildlife habitat.

Future research needs:

- ❑ Stand-age mosaic complexity monitoring.
- ❑ Old growth distribution monitoring.
- ❑ Research into rare species and their association with fires.
- ❑ Studies of the dynamics of diseases and animals and their effects on vegetation.
- ❑ Effects of human development on subalpine vegetation.
- ❑ Studies on subalpine wetlands and parklands.
- ❑ Research into the effects of trail usage, particularly in terms of introduced species.

Montane Region

Immediate research needs:

- Standardized 1:10,000 vegetation mapping.
- A detailed fire history map for the Canmore and Exshaw corridor.
- To establish wildlife exclosures to serve as control areas for herbivory effects.
- Determination of measures of connectivity, including corridor width/length and habitat type.
- Determination of measures of restoration.
- Determination of urban perimeters/edge ratios regarding Canmore corridors.
- A list of 'at risk' species, including comparisons with other regions.
- Research on non-native plant species invasions.
- Research into classic indicator vegetation species and levels of regeneration.
- Determination of levels of human use through mapping and inventories.
- Studies on the effects on vegetation from various forms of forest fire management.
- Research on highway mitigation including fencing and underpasses.
- A biodiversity index developed for the montane region.
- To ensure the availability of vegetation materials for restoration projects.
- Monitoring of aspen, Douglas fir, native grasslands, non-native species, and faunal assemblages (as part of a thresholds and monitoring program).
- A prioritized list of invasive species.
- A risk analysis of "weed" species.

Future research needs:

- ❑ Monitoring of changes in community species composition over time.
- ❑ Research into ungulate use and their effects on native vegetation.
- ❑ To develop local guidelines for restoration projects.

Riparian Region

Immediate research needs:

- Monitoring of human use of riparian areas and its effects.
- Monitoring of the width of the flood plain.

Future research needs:

- ❑ Studies on tree regeneration (particularly willows).
- ❑ Restoration of native vegetation and water flows.
- ❑ Monitoring of linear barriers.
- ❑ Monitoring of disturbance events regarding flooding, including historical information.
- ❑ Monitoring of Cascade Creek and Vermilion Lakes restoration projects.
- ❑ Monitoring of bird species diversity, especially warblers.
- ❑ Monitoring of the number and location of beaver dams.
- ❑ Moose habitat assessments.

Mammals

Overview

Mammals in this region have been greatly influenced by human activities. Although more is known about mammals in the Bow Valley than most other categories, the effects of both direct and indirect human activities on populations of both large and small mammals are not well understood. Control areas with low human impact are seen as important in establishing a baseline for research.

Specifically, the workshop participants identified knowledge gaps by species or by species assemblages. The following groups were identified:

- ✓ Large carnivores
 - Grizzly bears
 - Cougars
 - Wolves
 - Black bears
 - Wolverines
 - Lynx

- ✓ Small mammal assemblages
 - Montane
 - Wetlands
 - Upland - conifer/mixed wood

- ✓ Bats

- ✓ Ungulates

Immediate & Future Research Priorities

All Groups

- Bow Valley mammal research could be greatly enhanced through the integration of resources and expertise to facilitate coordination and the interdisciplinary nature of research, including the following.
 - Standardized data collection procedures to allow for valley-wide comparisons of data.
 - Organized data collection of non-target species with each project (i.e. include small mammal and wolverine data collection in underpass studies). This would result in additional useful data collection at little cost.

Large Carnivores

Grizzly Bears

Workshop participants noted that a large landscape approach to research would be much preferable to the current isolated area approach. They also recommended that the distinction be drawn between problem-oriented research and long-term monitoring, and that more emphasis be placed on research into bottom-up and long-term processes.

Immediate research needs:

- Continued population trend monitoring using non-invasive techniques.
- Establishment of semi-control areas where human impact is low.
- Management and monitoring of human access in grizzly bear areas.
- Identification of secure habitat areas for female bears.

Future research needs:

- ❑ Monitoring of trends in plant food sources.
- ❑ Identification of major threats placed in perspective.
- ❑ Habitat modeling population studies.
- ❑ Cumulative effects studies.

Cougars

Immediate research needs:

- Collection of demographic data using non-invasive methods.

Future research needs:

- ❑ Detailed assessment of the demographic data.
- ❑ Identification of population and movement trends.
- ❑ Monitoring of corridors.
- ❑ Data (i.e. scat) collection in anticipation of advances in DNA technologies and lab priorities.

Wolves

Immediate research needs:

- Monitoring of people for compliance to human access limitations.

Future research needs:

- ❑ Increased monitoring of wolf population trends.
- ❑ Combining and integrating prey research done throughout the valley (using standardized methods).
- ❑ Ongoing monitoring of prey populations and mortality.
- ❑ Assessments of the effectiveness of mitigation, including before and after controls and comparative studies.
- ❑ Assessments of the effectiveness of limiting human access, including before and after controls and comparative studies.

Black Bears

Immediate research needs:

- Studies on garbage/bear issues.

Future research needs:

- ❑ Studies of human/black bear interactions: habituated bears, aversive conditioning, the effects of educating humans about garbage and then monitoring for compliance.
- ❑ Research on dispersal patterns, reproduction and other demographic issues.
- ❑ The establishment of a genetic data bank.
- ❑ Collection of black bear data as a side project with ongoing research on other species.

Wolverines

Future research needs:

- ❑ To make use of opportunities for collecting wolverine data while conducting other research.
- ❑ To track the development of future technologies that may reduce costs and make wolverine research more feasible.

Lynx

Immediate research needs:

- Studies on lynx ecology and habitat associations in the Canadian Rockies.

Future research needs:

- ❑ Intensive field research into all aspects of lynx ecology, including various levels of natural and human impacts.

Small Mammal Assemblages

Montane Regions

Immediate research needs:

- Fauna/vegetation research addressing the effects of habitat fragmentation and herbivory on the landscape level.

Future research needs:

- ❑ Studies of demographics and reproduction.
- ❑ Research on movement patterns along natural and man-made barriers.
- ❑ Research into the structure and function of grassland communities.
- ❑ Studies on the effects of severe grazing on small mammals and their predators.

Wetlands Regions

Future research needs:

- ❑ Studies of beavers and their links to vegetation, waterfowl and songbird habitat, muskrat and mink.
- ❑ Research into the fire/beaver/moose relationships.
- ❑ Comparison of these studies to other areas.

- ❑ Continued monitoring of beaver lodges and water levels.
- ❑ Investigation of mitigation methods.

Upland - Conifer/Mixed Wood Regions

Immediate research needs:

- Expansion of transects studies to include monitoring for small mammals.

Future research needs:

- ❑ Studies of the effects of forest management and fire.
- ❑ Valley-wide standardization of small mammal research methods.

Bats

Immediate research needs:

- Surveys for reproductive females.
- Determination of roost sites in areas where buildings are not available.
- Assessment of the proportion of females that are reproductive each year.

Ungulates

Immediate research needs:

- Development of systematic, standardized, non-intrusive methods of monitoring.
- Determination of ungulate responses to a variety of human disturbances.
- Comparisons between the behaviours of habituated and nonhabituated animals.
- Research into the viability of wildlife corridors for ungulates.

Future research needs:

- ❑ Habitat mapping.
- ❑ Determination of predation rates.
- ❑ Studies on interspecific competition.
- ❑ Mortality (including hunting) and road kill counts.
- ❑ General life history information, including the differences between habituated and non-habituated individuals.
- ❑ Studies on habitat degradation and highway mortality for sheep and goats.
- ❑ Research into highway mortality and habitat change for moose.
- ❑ Research into the relationship between fire suppression effects and potential habitat enhancement for sheep.

Birds

Overview

Bow Valley bird populations are being affected by both direct and indirect human use in the alpine, sub-alpine, montane, and wetlands. The type and extent of the effects vary seasonally. The workshop participants identified research priorities within the following research categories:

- General research
- Recreational use
- Development and transportation
- Fire and vegetation management
- Herbivory
- Habitat affiliations
- Toxins and pollutants

The participants noted that the lack of financial commitment to bird research is a major hurdle for nearly all researchers. Bird research requires highly specialized skills, and although volunteers play an important role in support of adequately funded professional research, their participation does not preclude the requirement for professional research and funding.

Immediate & Future Research Priorities

General Research

Immediate research needs:

- Baseline data and long-term monitoring in relation to habitat, season and stressors in Bow Valley bird research.
- Quality monitoring, standardized protocols and public access to data, without which it is impossible to determine trends with respect to populations and habitat quality.
- To look at the Bow Valley in a larger temporal and spatial context, comparing historical data to current data to see the changes over time.

Recreational Use

Immediate research needs:

- Ongoing research into the impact of recreational use of the landscape on vulnerable species.

Future research needs:

- Research into the impact of recreational use of the landscape on bird populations generally.

Development and Transportation

Immediate research needs:

- Monitoring the effects of habitat loss and fragmentation on bird populations before, during and after habitat loss and fragmentation occurs.
- Research into the more immediate effects of highways, including highway mortality, effects of salting, scavenging, and predation in roadside ditches. If impacts are found to be high, then ongoing monitoring would be needed, otherwise monitoring should be repeated with any significant increase in traffic.
- Determination of the effects of manipulation of water quantity and quality on bird density and distribution.

Future research needs:

- Development of research, education and information on the problems of windows and lights during migrations.

Fire and Vegetation Management

Immediate research needs:

- Bird population data both before and after prescribed burns and thinning, especially for woodpeckers and other cavity nesters.

Herbivory Effects

Immediate research needs:

- Studies of the herbivory effects on ground and shrub nesting bird species.

Habitat Affiliations

Immediate research needs:

- Determination of habitat affiliations of local bird populations, including identifying critical and unique habitats, rare and sensitive species, and migrants and residents. This would require bird surveys stratified by ecological land classification units.

Toxins and Pollutants

Immediate research needs:

- Studies of toxins and pollutants and their effects on the productivity and survival of species such as osprey, bald eagles, and swallows.

Microfauna

Overview

The Microfauna category was, by definition, varied. The participants focused on recommendations for Arthropods first and followed these with recommendations for other groups including molluscs, reptiles and amphibians, worms, and specialized ecosystems such as glaciers, springs, and montane wetlands. For microfauna in general, the participants noted that the lack of recognition for specialized species and habitats within concepts of standard conservation biology (e.g. protected areas, umbrella species, and corridors) presents significant challenges for researchers. There is a need for recognition of non-glamorous species in environmental assessment studies.

Immediate & Future Research Priorities

All Groups

Immediate research needs:

- A general inventory for terrestrial and aquatic microfauna species.
- A historical review of all literature, including unpublished sources, for local microfauna.
- Researchers to be encouraged to publish their findings so that they are more easily accessible.
- Benchmarks established to allow for comparative studies.
- Taxonomic expertise sought and developed, as it is now lacking.
- To establish locally available reference collections, which include local specimens.

Arthropods

Moths and Butterflies

Immediate research needs:

- Ongoing, long-term studies of population dynamics of species that are representative of the most threatened habitats in the Park, particularly early successional habitats. It is recommended that two or three such habitats be identified and two species with very different dispersal capabilities be selected. This project will allow researchers to get more fine-grained information than with large mammal indicators.

Dragonflies

Immediate research needs:

- Measurements of status, population sizes and distribution (on a fine scale) of dragonflies. This is considered valuable as dragonflies are potential indicators of water quality and habitat change.
- Compilation of existing literature and data.
- Studies on the effects of roads and other transportation corridors (mortality, diversions, and run-off). A multispecies approach that includes dragonflies should be considered as part of other transportation corridor research.

Future research needs:

- ❑ Establishment of marketing and interpretive programs involving dragonflies. Dragonflies are considered “the birdwatcher's insect” in terms of their marketability.

Economically Important Species / Exotic Species

Future research needs:

- ❑ Continued population monitoring of the Asian gypsy moth.
- ❑ Continued research on the mountain pine beetle.
- ❑ General exotic species monitoring.

Aquatics

Overview

The Bow Valley aquatic systems comprise very limited habitat, and the habitat is often linear and fragmented. It is the target of human manipulation and concentrated human use. The Bow Valley has nine dams and over 50 years of movement and flow impediments. These are collection areas for pollutants and they affect nutrient movements. The group of participants could not think of an unimpacted waterbody in the region, and noted that the general impression that the Valley's aquatic systems are healthy and functioning well should be challenged.

Aquatic benchmarks need to be established since we know very little about long-term conditions or about impacts. The centralization of information is required and should include data, specimen collections, and library materials. Research coordination is needed and cross-boundary standardized methodologies are required.

There is a need to study the whole length of water courses including effects of damming and other fragmentation, and of pollutants. There is also a need to research native aquatic species, especially non-game species, and the effects of non-native species on systems. Aquatic restoration is necessary, but a volatile issue with the general public. There is a need to look ahead at human population growth and human use and its impacts in this area. Public education is important and should be tied to water quality.

The workshop participants identified requirements for aquatics research in the region. The recommendations fell into the following categories:

- coordination
- landscape approach
- mapping
- benchmarks
- human impacts research: general
- human impacts research: contaminants
- human impacts research: physical obstructions
- general research
- restoration
- community outreach and education
- funding

Immediate & Future Research Priorities

Coordination Required

- Coordination of methods: cross-boundary standardized methodology is of high importance.
- Coordination between researchers including data exchange; investigation into what happened to the promised (BBVS) Scientific Advisory Group; and opening "boundaries" for discussion between groups, e.g. Parks and Province, which should include discussions on who pays for monitoring.
- Master database coordination including a complete biological inventory of existing data; better shared library systems and more accessible information; and a database to access what other people are doing.
- Existing voucher specimen collections brought together and preserved properly.

- Conservation plan coordination: A joint conservation plan is very important and should include adjacent areas in B.C. and northern Alberta.

Landscape Approach Required

- Research that incorporates the linear flow of aquatic systems, i.e. pollutants migrating with the movement of fish.
- Research into the effects of fragmentation outside the Park.
- Research to determine if blockages could be used to implement eradication schemes of non-native species like brook trout.
- Consideration of Parks Canada Ecological Integrity Report to be used as a useful tool to apply an overview on Mountain Parks block.
- To use the existing structure from BBVS - the Cumulative Effects Study, Mountain District Aquatic Strategy (Mountain Parks) and Blue Lake Watershed Minutes.

Mapping Required

- To improve mapping so that it is integrated and standardized and includes cross-boundary areas and corridors.
- To determine how to map regarding native species.
- Ecological land classification processes/characteristics/aquatic systems within ecoregions (e.g. two little ponds side by side might be quite different).

Benchmarks Required

- Long-term benchmark baselines for waterbodies to follow change, speed of change, and enable comparisons inside and outside of the Park, in creeks, ponds, lakes, and rivers.
- Classification hierarchy of benchmarks based on disturbance regime (see workshop notes).
- To benchmark systems under pressure as well as “pristine” systems.

Human Impacts Research Required: General

- Monitoring of baseline changes.
- Studies of the urbanization effects on structure.
- Studies on movement corridors, railway/roads and cutting off oxbows, beaver dams.
- Pond studies, including baseline ponds (most bisected by road/railway), ephemeral ponds (climate warming and the effects on ponds that come and go), and unmapped ponds (including the need to integrate across boundaries).
- Records showing changes in stocked and unstocked lakes.
- Investigations into why more diseased fish are in the lower Bow River than the upper.

- High elevation/altitude monitoring stations. The biggest aquatic changes could be affected by high elevation changes (climate change, temperature of glacially fed streams).
- Comparisons between the Alps and Banff to learn from the problems in Europe.
- Storm water management plans – outflow inventory.
- To consider dippers and kingfishers as indicator species.
- Quantity (not just quality) measurements on stream flow once the glaciers have gone.
- To establish unified timing windows for development by encouraging communication between different interests.
- Assessment of the implications of development in Morley.
- Research into the effects of angling, recreation, rafting, etc.
- Studies of the effects of stream side use and riparian disturbance.
- Research on cumulative impacts (a workshop may be beneficial).
- Human access management: human-use maps developed to overlay the inventories.
- Consideration of implications of future projections (i.e. human use footprint, including a six-lane highway to Canmore and 30,000 residents).
- To look 50 years down the road with clear expectations in order to impose limits.

Human Impacts Research Required: Contaminants

- To distinguish sources of air born pollutants.
- Research on glacial melting effects.
- Monitoring of inputs as well as outputs of water treatment systems in Canmore.
- Monitoring of outlying commercial areas; of back-country streams (fecal coliform); and of sediment related to development and roads.
- Studies on the effects of road salt on riparian habitats.
- Research into the effect of Noraphenols (estrogen disrupters that form surfactants in detergents, new herbicides).
- Health consumption advisories for fish.
- Studies on effects of railroad ties and TransAlta poles treated with creosote and TCPs.
- Improvements to methods of handling violations, including public involvement.

Human Impacts Research Required: Physical Obstructions and Dams

- Studies on changes in cutthroat distribution corridors and damming to determine if populations can be restored.
- Effective fishways constructed through dam structures.
- To reconstruct a picture of what rivers were like before dams – via historical reports.
- Studies of the dams on the US/Canada border and their implications for salmon.
- Physical obstructions and dams categorized better so that we can deal with them.
- Inventories of culverts and dams.
- Inventories upstream for native species – decide which blockages are negative impacts.
- Recruitment of native species.
- Studies of transport corridors including isolation of oxbows.

General Research Required

- To address the management of culverts within and outside park boundaries.
- Investigations into fluctuations in alpine ponds.
- Research and monitoring of hydrologic cycles: flood regimes, ground water, recharge, artificial snow, role of tributaries.
- Research on non-game, native species.
- Inventories and assessments of non-native plant species.
- Research into disease issues: monitoring abundance and distribution, effects of non-native species, restoration effects.
- Inventories of invertebrate communities, including the identification of exotics.
- Continued bull trout research (Kananaskis Lake, Moraine Lake).
- Inventories of gravel pits.
- Studies of alluvial pond obstructions, with obstructions coupled to major land use.
- Research on the effects of beaver, otters and ducks.
- Research on the ecology of filamentous green algae.
- Inventories of the Morley Reserve area.

Restoration Required

- Studies of Bow Valley ponds etc. that are being rehabilitated naturally/by accident.
- Baseline information in order for restoration to work.
- Provincial level work to prepare a database/overview to be accessed by developers etc. as needed. (Currently, new developments hire short term scientists for isolated cases.)
- Research to determine why Lake Minnewanka has good trout despite system pressures.
- Standards to determine recovery: When should imposed limits be lifted? When is restoration complete?
- Research and management of water fluctuations.
- Research into stream flows and stabilization of riparian habitat.
- Understanding between different parties involved in restoration programs.

Community Outreach/Education Required

- Education to place the real value on a resource, e.g. the value of water. The public needs to understand that a functional ecosystem is a requirement for potable water, and that a healthy river is a requirement for a healthy river valley.
- Emphasis on the importance of aquatic biodiversity to the quality of water supply.
- Educators to start including water in their public information. Education about the watershed concept is needed (in the same way that education about fires/prescribed burns has taken off).
- To use volunteers to combine public education and monitoring, while using professionals to coordinate and manage.
- To publicly profile something like the cutthroat trout at Quirk Creek – following up with educating about the whole aquatic structure, not just the fish.

- To sell the importance of this work to obtain funding. Public interest influences how/what foundations get involved.

Funding

- Funding and management for research. The impediments to all the initiatives are management and money. Expertise is needed to finesse projects politically.
- Support for projects that are ready to go. Education and political will and money are all required.

Quality of Air, Water and Soil

Overview

The quality of air, water and soil in this region has been effected both directly and indirectly through human use. Due to the multi-jurisdictional nature of these resources, communication between the stakeholders needs to be improved.

Immediate & Future Research Priorities

All Categories

Immediate research needs:

- Overall quality/monitoring plans or central inventories.

Water

Immediate research needs:

- All local stakeholders to meet together for an information and planning session. This session was considered an immediate priority, as it would clarify what is already being done and what needs to be done, as well as identify the organizations responsible for the work.
- An integrated water quality plan. Research and data is available from several sources, but interpretation is needed. This would include issues at the local level as well as on a bigger scale, which would incorporate provincial and national policies and issues. An initiative now underway to address some of these issues is the Bow Basin Plan, a water management strategy plan by Alberta Environment.
- Studies of quantity, quality and source of storm water in developed areas of the Valley. This can be difficult, as there are old diversions, and general gaps in knowledge of where storm water actually goes.
- To understand the influence of surface water on ground water in this area. This includes the pervasive influence of people and their developments, as well as biological influences. As part of this surface water issue, there should be follow up on the recommendations of the Canmore Wellhead Protection Study.
- To consider aquifer site protection, as this could save money in the long term.

Future research needs:

- ❑ Information on the implications of phosphate additions (through sewage etc.) to aquatic ecosystems where this nutrient is limiting (e.g. the Bow River).
- ❑ To consider new cost implications for monitoring ammonia, which is now considered a toxic substance.
- ❑ To consider the potential for lowering water consumption through building guidelines (i.e. low flow toilets).

Air

Immediate research needs:

- An overall air quality/monitoring plan. Although there is monitoring of air quality by various organizations, there seem to be no real models that look at multiple variables.
- Baseline information and methodologies that allow for data comparisons.
- Determination of the extent of odor from wastewater and biocomposting facilities. This is seen as an immediate priority for some parts of Canmore. This type of air quality issue can be weather dependent and is hard to measure, but odor parameters do exist.

Future research needs:

- ❑ Monitoring of particulates arising from the rock industry, development, and vehicles. Alberta Environment and the rock industry are already doing some of this type of monitoring.
- ❑ Investigation of the potential for programs that help with air quality in the area. Suggestions include following up on the fireplace policy recommendation of the Growth Management Study and the development of an “environmentally friendly” builder certification program.

Soil

Future research needs:

- ❑ A central inventory of soil data and of sources of data for this area.
- ❑ Information on the agencies responsible for different types of soil issues (undermining, erosion, subsidence/slumping, infiltration, fertilization, etc.).
- ❑ Information on past land uses (railway and mine sites, contamination from local underground storage tanks, dumps, etc.).
- ❑ Information on natural landscaping, local composting (grass clippings) and effects of imported soils (imported soil for development, imported sods for lawns).
- ❑ Research on the effects of tree removal (for development) on erosion. Guidelines for replanting should be also developed and employed.
- ❑ Research on the effects of fire management on air and soil, and integration of this research into resource management plans.

Socioeconomics

Overview

Workshop participants agreed that a multi-agency approach is required to assess and address the range of socioeconomic issues that pertain to the Bow Valley ecosystem, and recommended that an alliance be developed with a group that could take a leadership role. A steering committee should be formed to guide agencies, to manage funds, to vet proposals and set priorities. Also identified is the need for a “chief researcher” to act as a point person within the social sciences, including economics.

Participants further noted it is important to learn from others facing similar issues in similar communities. And they identified a need to maximize the knowledge and use of our existing local data and to maximize the utility of the data. Emphasis should be placed on generating long-term data, for accuracy and utility (i.e. both primary and secondary data need credible methodologies).

Immediate & Future Research Priorities

All Categories

Immediate research needs:

- Develop a system to allow researchers to share the methodologies, problems, etc. This is considered the highest priority.
- To determine how best to access and communicate the data, material and studies that currently exist.

To Determine the Patterns and Effects of Human Use: General

Immediate research needs:

- Improved methodologies that include who, why, what, and when. These studies should include inside the Park; in the town sites; outside the Park; front country; and back country.
- Studies to consider the following categories (as defined on page one of the workshop notes): residents; non-visitors; visitors; and the shadow population.

To Determine the Patterns and Effects of Human Use: Transportation

Immediate research needs:

- Research into transportation issues. This research should include commercial use, recreational use, parking and commuters.

To Determine the Patterns and Effects of Human Use: Socio-demographic profiles

Future research needs:

- Research on human use issues that focuses on socio-demographic profiles in terms of the following categories (as defined on page one of the workshop notes): residents; non-visitors; visitors; shadow. This research should include forecasts of growth in the population as well as its changing composition.

To Determine the Patterns and Effects of Human Use: Impact of Vehicle Access

Immediate research needs:

- Research into the impacts of vehicle access to backcountry areas, on the environment and the use of area (e.g. seismic roads providing general access).

Future research needs:

- Studies to determine trends in use of front and backcountry and how they affect air and water quality. These studies should also include the effects demographics will have on those trends.

To Determine How to Influence Use

Immediate research needs:

- Investigations of the roles of education and information and communication (e.g. trip planning) to influence use.
- Research into the roles of management actions that influence use (e.g. fire management, fish stocking fees, quotas).