

## **International Issues in the Crown of the Continent**

### **Preliminary Summary of Results from a Scientific Workshop**

**July 6, 2005**

On April 6-8, 2005, 37 scientists from Alberta, British Columbia and Montana met at the Flathead Lake Biological Station of The University of Montana to discuss experiences, data, perceptions and issues pertaining to the transboundary area known as the Crown of the Continent. The meeting was co-chaired by Dr. Jack Stanford, Jessie M. Bierman Professor of Ecology and Director of the Biological Station and Dr. David Schindler, Killam Professor of Ecology at the University of Alberta. A detailed report of workshop findings and conclusions currently is being prepared by the co-chairs, based upon review of scientific reports and comments by the participants. The report is particularly focused on key ecosystem processes and gaps in scientific understanding of those processes. The report is planned for public distribution in Summer 2005, but a summary of preliminary conclusions is given below.

The Crown of the Continent Ecosystem (CCE) spans ten million acres of the USA-Canada border area, including southern portions of Alberta and British Columbia and the northern part of Montana on both sides of the Continental Divide. The area is critically important because it encompasses the pristine headwaters of three great continental river systems, the Columbia, the Missouri-Mississippi and the Saskatchewan. The mountain landscape is spectacular, sculptured by geologic processes and scoured by vast glaciers of the ice age, now largely melted away. The CCE holds the highest diversity of plants and animals in North America, including the full array of native carnivores and ungulates.

One-third of the CCE is protected by U.S. and Canadian national parks and wilderness designations. The core of the protected area is the Waterton-Glacier International Peace Park, deemed so valuable and rare that it has international status as a Biosphere Reserve and World Heritage Site. But the remaining two-thirds of the CCE landscape are unprotected timber, range and farmlands, including large unroaded areas that are potential wilderness additions. The growing human demand and appreciation for beautiful natural landscapes has in recent years vastly increased the development rate of infrastructure including roads, power lines, housing construction and commercial activities in the mountain valleys, including the full range of services associated with an area of world-class recreational value. In addition, a large portion of the unprotected area in Canada adjacent to the Peace Park contains coal, gas and mineral resources of extremely high value.

Not surprisingly, conflicts concerning the tradeoffs between conservation and development exist in the CCE and currently are particularly acute owing to national energy development priorities, the rapidly escalating value of fossil fuels and the shifting economics associated with high demand for expensive new homes in the scenic valleys. Moreover, these sensitive issues are complicated by climate change impacts associated with rapid global warming.

Hence, the participants of the workshop were strongly motivated to provide scientific review and synthesis of what is well known and more importantly what is poorly documented about the structure and function of the CCE.

The hydrology of the mountain-valley landscape of the CCE and its profound influence on system biogeochemistry is perhaps the key process. Water that accumulates and flows from snowmelt in all directions above and below ground is the lifeblood of the CCE. It is the “water tower” of the continent. The distribution and abundance of biota, the way people use the landscape and the trajectories of change all are connected in some way to the dramatic moisture gradients of the CCE. Precipitation on the mountaintops is as clean as any on the planet but does contain atmospheric contaminants, although usually in minute concentrations. Runoff takes on characteristics that reflect the biogeography of specific drainage basins as the water flows downhill, often exchanging between groundwater and surface flow paths. Precipitation and water flow patterns are the primary controllers of all life in the CCE. Thus, environmental changes, either natural or man-caused, are reflected in the quality and quantity of water in the CCE. The workshop concluded that water quality is a primary indicator of environmental integrity in the CCE.

Much scientific information about water exists but the workshop documented a number of crucial uncertainties, such as presence of toxic compounds in the atmosphere transported from distant sources and strong negative influences of invading non-native plants and animals. River flood plains and a vast array of associated wetlands in the valley bottoms were identified as vital aquatic-terrestrial interfaces that naturally cleanse water and sustain productivity and diversity of biota. The lakes of the CCE, particularly Flathead, Whitefish, Swan, St. Mary, McDonald and Waterton, are the jewels in the “Crown” with remarkably clear, clean water. Continuous vigilance and advanced scientific enquiry are required to understand the complexities and preserve the integrity of this vital resource.

Another well-documented aspect of the CCE is the influence of its geographic setting on native biota. The CCE is in the middle of the Rocky Mountains and intersects the Pacific and continental climate domains thereby linking the wetter, dense forests on the west side of the Continental Divide and the drier East Front fringe forests and grasslands. This profound environmental juxtaposition accounts for the extraordinary number of species that live in the CCE. Many species of plants and animals that are more common to the south nonetheless are routinely documented in the CCE even though it is the northern extreme of their range. Conversely, many northern species are at the southern extent of their range in the CCE.

Similar overlaps occur between biota from east and west of the continental divide. As one example, the CCE has more species of carnivores, such as mountain lion, grizzly bear, lynx and wolverine, than any other area in North America. The rivers and streams are natural travel corridors that allow the biota to move around in the very rugged topography of the CCE. All of the larger animals are migratory, using the entire landscape of the CCE, moving from east to west and north to south with no regard to the boundaries and jurisdictions established by people. Thus it is essential that all people, managers, conservationists and users, understand and respect the complex processes that maintain the CCE as a global “hotspot of biodiversity.” International

cooperation is essential because the biota and the complex ecosystem processes that influence their distribution and abundance are transboundary.

The hottest summers and driest winters ever recorded in the CCE have occurred in the past decade, as elsewhere on the planet, and are undoubtedly associated with climate change mediated by accumulation of greenhouse gases from human activities worldwide. Lakes and rivers of the CCE have reached unprecedented lows in flows and highs in temperatures. The glaciers are nearly gone, winter snow pack is less, and precipitation has been highly variable and episodic compared to the long-term record. There is some indication that wildfires in the CCE have increased and a warmer climate is expected to build more fuels and burn hotter fires. Overall, less water is predicted to flow from the CCE to the three great rivers of North America in the near future and this likely will be associated with increasing frequency of beetle and other disease epidemics in CCE forests. Influences of these changes on other plants and animals are uncertain and require extensive scientific examination.

The CCE is experiencing rapid human population expansion, among the highest in the intermountain west, particularly in the area around Flathead Lake and in southern Alberta and B.C. The renewable goods and services, especially the recreational and scenic attributes of the ecosystems as opposed to fossil fuel and mineral extraction, appears to be the primary driver of economic growth in the region, although better documentation of this is needed. Of course, with human population growth comes increased demand for water for municipal, industrial and agricultural uses, which often runs counter to the role water plays in sustaining ecosystem functions. Much of the human development is focused in the intermountain valleys and encroachment on flood plains and wetlands is increasing. This is notably problematic because the valley bottoms and flood plains are critical habitat for most of the large animals of the CCE including several species listed as sensitive, threatened or endangered, including bull trout, cutthroat trout, wolves, grizzly bear and lynx.

The workshop identified roads and other linear intrusions as particularly problematic aspects of human-caused environmental change in the CCE. Coal mining, coal-bed methane extraction, and other hydrocarbon exploration and expansion require a vast network of roads and pipelines. Linear disturbances change wildlife behaviour and abundance by providing unnatural movement corridors, altering habitat and habitat connectivity, facilitating non-native weed invasions, increasing hunting and fishing pressure, and disrupting natural patterns of predator-prey interactions. Roads in particular are well known as continuous sources of silt, hydrocarbon and other forms of water pollution. Thus, the workshop focused pointedly on the likely negative impacts of increased motorized access, noise and water quality changes associated with proposed coal and coal bed methane extraction and the additive relations to other forms of human-mediated landscape change in the CCE.

While there is a great deal of information describing the landscape and biota of the CCE, critical uncertainties remain, particularly with respect to ecosystem processes. A major section of the report focuses on the need for better scientific understanding of key processes including: transformation and retention of nitrogen and phosphorus along stream corridors, conversion of high elevation meadows to forest associated with warming conditions, and functional displacement of native biota by invading non-natives. Simply documenting location of

ecologically critical areas, particularly ephemeral wetlands, that have little resilience to human disturbances, is badly needed. Also, effective synthesis and sharing of existing data, coupled with coordinated monitoring of baseline conditions to demonstrate change associated with human use patterns is essential. Specifically, the workshop participants identified water quality trends, wildlife and fisheries distribution patterns and status of flood plains and wet lands as critical baseline monitoring needs that require much greater funding and coordination.

Overall, the workshop concluded that a much more robust understanding of the cumulative effects of human activities is paramount, especially since the very qualities that have attracted people and businesses to the CCE are potentially at risk from the press of human-mediated environmental change. Understanding and controlling adverse change is compounded by lack of coordinated management actions among different jurisdictions at local, regional, national and international levels. Indeed, a very large number of national, provincial, state, and First Nations agencies are responsible for managing different components of the CCE. The bottom line is that the region lacks a coordinated framework for information and data exchange and to guide and integrate work to resolve uncertainties about the cumulative effects of human activities and interactions with climatic change.

The Crown of the Continent Ecosystem is a strategic resource for Canada and the United States. The interplay of science, conservation and economics of the region is demonstrably crucial to the future of B.C., Alberta and Montana. Sustaining the CCE for future generations requires much greater attention than currently is being accorded across the board. Funding of a tactical research plan to reduce uncertainty in ecosystem processes and potential effects of human activities is crucial. An international, multidisciplinary committee or commission is needed to respond to and elaborate the critical scientific uncertainties identified by the workshop. The goal, of course, is to sustain the fantastic natural attributes of the CCE for future generations. Science must inform people in ways that inspire international agreement on how to get this most important job done and done well.