



Seeing What Is Hidden in Plain Sight

Triumphing Over Diminishment and Loss

HOW LOCALS AND VISITORS ALIKE experience the Rockies has changed dramatically over the past fifty years. Along the entire spine of the Rockies, from Canada to the United States, communities are losing their unique character and becoming more and more alike and more urban in character. As a large proportion of the present local population has been in the region for only a short time, what they discover in themselves through the experience of the new and exotic landscape they now call home is very different than the relationship to place experienced by First Nations people or by earlier generations of non-Native residents. Because the landscapes of the Mountain Parks never fail to astound, inter-generational pride in place makes it possible to redress some of the injuries and losses related to place that have accrued through time, or to at least compensate for them. But more and more, locals are confronted with evidence that we face in this region potential losses that are almost beyond imagination.

There are three sets of statistics that put into relief the direction and flow that history has and continues to take, with respect to human influence on the ecological history of the mountain West as it pertains to the Mountain Parks. The first statistic is the change in the size of the

population of the resort town of Banff. In 1900, the population of Banff was 271 people. Fifty years later, it was 2,357. Fifty years after that, in 2000, it was about 7,000. As we will see in the next chapter, caps on the population size of the town of Banff may have very positive ecological effects on the park. The next statistic is equally interesting. In 1900, there were about 5,000 visitors a year to the park. Fifty years later that number had multiplied nearly ten times to 413,000. In the fifty years since, the number of visitors has multiplied another ten times.¹ Now we have nearly 4.5 million visitors a year. The third statistic that deserves very careful analysis is the growth of the regional population.

In 1885, in all 100,000 square miles (258,999 square km) of the territory that is now Alberta, there were only 15 non-Native people. In the fall of 1885, when the Canadian Pacific Railway was completed, there may have been 3,000 people living in the entire Bow Valley. Now more than 1,500,000 people live in the river basin alone.

We are only now taking time to properly examine how these changes have impacted where and how we live, and how they will affect our future. Since World War II, tourism has been moving toward greater mass, toward increased visitation, toward globalization, toward improving standards of amenities and higher financial yields. It has worked. Tourism has become the economic engine of the mountain West and many livelihoods depend on it. But there is concern that this success may not be sustainable if we are unable to prevent large-scale ecological change.

It was not until a blue-ribbon scientific assessment called the Banff Bow Valley Study was completed in the fall of 1996 that we came into possession of a thorough assessment of the cumulative effects of human interaction with the landscape on the broader ecological history of the mountain West. The report acknowledged that ecosystems within the Bow Valley had co-evolved with a variety of natural disturbances that helped maintain a diversity of vegetation types and wildlife habitat. The report noted that natural fires, as well as fires set by Aboriginal people, were important to the evolving health of the montane and subalpine areas of the valley. Floods were also an important part of the natural succession of life in the valley. Flooding along the Bow River and its tributaries was essential for maintaining healthy riparian communities. Avalanches cleared areas of trees and shrubs, opening them up for new growth that was essential for the perpetuation of many wildlife species. It was also observed that insect infestations and disease also played a natural role in the long-term renewal of valley ecosystems.

The report then noted that, since the arrival of European settlers in the valley, the nature of the disturbances has changed. The park was becoming “islandized” by urban development and other forms of human use. Towns, lodges, highways, railways, trails and other facilities have eliminated or altered many natural valley communities. Increasing numbers of residents and park visitors contributed to air pollution, sewage discharges, solid waste, and demands on potable water. It was also noted that sensitive wildlife avoided areas of high human activity, further compounding the problem of diminishing natural habitat. Transportation corridors through the park were understood to fragment the landscape and block natural movement of wildlife through the region. It was also noted that transportation corridors were avenues by which exotic plants were being introduced into the park and into the rest of the World Heritage Site. Nearly eighty years of fire suppression had led to the gradual aging of forests and a loss of important wildlife habitat. The report recognized that, though the hunting pressure that had so diminished wildlife early in the twentieth century had subsided, wildlife mortality pressures continued along the highway and the railway.

Consistent with what Ian Syme witnessed, the Bow Valley Study also noted that predator-prey relationships had been altered in Banff National Park over the past century. Most species of large carnivores were exterminated from the park and surrounding areas twice, between 1910 and 1950, as part of a provincial initiative to control rabies. Elk numbers were controlled through culls and translocations as late as 1960. Though not well documented, it appears that ungulates, upland game birds and some large carnivores were hunted as sources of food by wardens and other park users until the 1950s.

These were not the only ecological impacts that human presence had on the valley. Aquatic resources have been compromised by a range of impacts from water level control and impoundment, loss and degradation of aquatic habitat through development of transportation corridors, the increased urbanization of Banff and Lake Louise townsites resulting in releases of nutrients and other chemicals, pollution deriving from garbage landfills, and past mining activity. Aquatic ecosystems have been further impacted by gravel extraction and atmospheric pollution. The aquatic ecosystems themselves have also been severely affected by over-fishing and by the introduction of non-native fish and other species.

The direction and flow of ecological history indicate that since European contact, mountain ecosystems in many parts of Canada are

moving in the direction of greater disturbance and disruption of natural processes, resulting in diminishing native biodiversity. The diminishment and loss that have been a central ecological theme in North America since the beginning of the Pleistocene continues unabated.

Through initiatives like the Bow Valley Study, we have come to possess a far greater understanding of the natural systems that surround and support human societies. Much of that research has been focused on thresholds, interdependence, and interactivity of complex systems of environmental resources such as climate, oceans, forests, mountains and agricultural lands. As Thomas Homer-Dixon has indicated, over the last decades the public has generally held the view that the earth's environmental systems are resilient and stable in the face of human impacts.² Over the past two decades, however, the perception of science has shifted: these systems may respond slowly and incrementally over time before suddenly changing their character. In other words, natural systems exhibit "threshold effects."

In 2007, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) assessed the then-current scientific knowledge of the natural and human drivers of climate change, observed changes in climate, estimates of projected future climate change, and the ability of science to attribute changes to different causes. Its key findings include the fact that global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values. The report pointed out that global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while increases in concentrations of methane and nitrous oxide are primarily due to agriculture.

The IPCC has concluded that the global mean surface temperature will continue to rise and that we might expect projected increases of somewhere between 1.1 °C and 6.4 °C by the year 2100. As of 2007 at least, IPCC models predicted that if something is done to mitigate greenhouse gas emissions, mean global surface temperature could still rise by somewhere between 1.1 °C and 2.9 °C. Or it may rise as much as 2.4 °C and 6.4 °C within this century if we carry on as we are now. The huge range in these predictions reflects uncertainty related to how humanity will respond to the need to reduce greenhouse gas production. Put bluntly, our planet's mean surface temperature could rise by 1.1 °C if we do something about human population growth, energy



KOOTENAY RIVER VISTA

Kootenay National Park is more than just a highway. It protects the headwaters of the Kootenay River. The 780-kilometre-long Kootenay is a major tributary of the Columbia which is confusing to some in that it flows out of Kootenay National Park and flows within a kilometre of Columbia Lake, which is the headwaters of the Columbia River. The Kootenay then flows out of Canada into Montana and Idaho before flowing back into Canada and joining the Columbia near Castlegar, British Columbia.
Photograph by R.W. Sandford.

consumption and energy conservation; or it could rise two and half times that if we don't.³

The consequences of climate change would be manifold. We can expect weather disturbances, heat waves, droughts, forest fires, violent storms and floods. Polar icecaps will shrink and weaken. We have already seen evidence of this. In 2000, an icebreaker made its way through the thin and melting ice to a two-kilometre-wide pool of open ocean at the North Pole. By 2007, the entire Northwest Passage was free of ice in summer. Sea levels will rise just a few centimetres or nearly a metre. If the latter, coastlines worldwide will shrink and lowlands will disappear. Huge numbers of people will have to be resettled.

As thermoclines of global climate advance poleward, plant communities and animal species have to struggle to keep up. Plant communities, in particular, are slow to respond to changing climate. At the close of the last ice age, two species of cold-adapted spruce advanced northward with the retreating ice. They now form the great northern forests of Canada and Alaska. They advanced northward at only three to fifteen kilometres a century. The velocity of the northern movement of climatic zones in the next century, however, may be much more rapid

than what happened at the end of the last ice age. The future of slower-paced native floras and faunas is uncertain. Many native animal species and plant communities are trapped in isolated reserves, islandized by agriculture and urban sprawl. Plants and animals in these situations have no place to go.⁴ Many parks and reserves will no longer remain within the biogeographical regions they were created to represent.

As E.O. Wilson has suggested, it may well be possible to transplant some threatened plant and animal species northward or inland. But it is impossible to physically move entire ecosystems. Among the most vulnerable ecosystems are the alpine and arctic tundra. In the event of even a modest amount of global warming, they will be pushed upward and pole-ward into oblivion. Thousands of mountain species from lichens to mosses, some of our most cherished wildflowers, and mammals such as pikas, marmots and bears, all the way to polar species such as penguins and polar bears, could disappear.

There are other ramifications that could present themselves through such climate change. The problem with rapid upward change in the surface temperature of the earth is that it makes our weather more unpredictable, altering patterns of rainfall and hence impacting agriculture and food supply. It would melt glaciers and icecaps, and reduce snowpack and snow cover, altering the flow and reliability of our rivers and the levels of our oceans.

Projections have been made on how climate change might affect national parks that have been created in the mountainous regions of Canada.⁵ Climate change projections for the southern mountain national parks indicate that winter and spring precipitation is expected to increase, while summer precipitation is expected to decrease. Warmer spring and fall temperatures will extend the melting seasons of glaciers by at least one month, in the southern Rocky Mountains. Lower-elevation glaciers are projected to retreat rapidly as a result of projected climate warming. Accelerated glacial retreat would increase summer runoff until the glaciers have been largely depleted. However, once these glaciers have melted, input to streams could decrease substantially within only a few years.⁶ Scientists have observed high concentrations of persistent organochlorine compounds in glacial ice and snow in the mountain ranges of western Canada. These pollutants have accumulated over decades via long-range air transport. A rapid glacial melt may release these trapped pollutants in sufficient quantities to be of concern for downstream aquatic ecosystems.

There will also be changes in the make-up of mountain ecosystems. Banff National Park, for example, contains montane, subalpine and alpine vegetation zones. Forty-one species in the park are at the limits of their ranges, and are therefore particularly sensitive to climate change. Both latitudinal and elevational boundary shifts should be expected. A temperature increase of between 1°C and 6°C will cause vegetation zones to shift upwards by approximately 500 to 600 metres or a range of about 1,600 to approximately 2,000 feet, the equivalent of one vegetative zone in mountainous regions. This may result in the loss of some alpine species that will be unable to compete with subalpine or montane species that expand upward. One scientific study modeled the loss of mammals in montane habitats from climate change and predicted that an increase of 3°C would result in species losses of 9 to 62 percent from mountaintops.⁷

The migration of animals and birds through the region will also be significantly affected by climate change. The current wintering zone for the park's ungulate herds is in the montane regions of the lower river valleys in most of the parks that compose the World Heritage Site. The montane zone provides a shallower snow pack, allowing these animals to move with relative ease. Though winters are expected to be shorter and spring run-off earlier, a projected increase in winter precipitation may impair the movement of these species. In response to these changes, ungulates may migrate down valley to find food throughout the winter.

The fire regime in the mountain national and provincial park region will be affected by climate change. Forest fires are projected to become more frequent. The intensity of fires may also increase as a result of drier summer conditions. Higher summer temperatures and less severe winter cold spells are expected to increase forest disease and insect attack, such as those by species of bark beetle on lodgepole pine communities and high elevation spruce and fir forests. Fires are likely to become more intense when they occur in forest stands affected by these insect species. Higher temperature fires will have impacts on water storage in vegetation and soils and influence run-off patterns in ways that we cannot presently fully predict.

The impact of climate change on popular recreational activities like downhill skiing in western Canada has not been adequately studied. An increase in winter snowfall may result in better ski conditions, however warmer temperatures in late fall and early spring may result



AVALANCHE HAZARD

Avalanches are a serious and much under-estimated winter hazard in the mountain West. In a big avalanche, millions of tonnes of snow can move several kilometres in just a few seconds. Despite enormous efforts committed to public education, the number of avalanche deaths remains unnecessarily high.

Photograph by Frances Klatzel.

increase the length of the summer season for activities such as hiking, camping, golfing and rafting. Deeper snow pack may continue to restrict the accessibility of some high-elevation trails. However, trails in lower areas would experience an increase in season length. Higher stream water levels may impede backcountry trail users and, at times, pose an extra risk to visitors. Rafting may benefit from high late-summer water levels resulting from increased glacial melting, as long as there is a large enough volume of ice to still be melted. Higher spring peak flows, however, may threaten park infrastructure like bridges, culverts and trails. Decreased summer precipitation and higher evapotranspiration rates may increase irrigation requirements for golf courses.

Recent studies have indicated that the climate in the Canadian West is warming at a rate that exceeds the global average. In Alberta, for example, mean annual temperature has increased in the range of 1 to 2.5 degrees Celsius over the last century. We are already experiencing higher winter and nighttime temperatures. Snow and ice are declining as warmer, shorter winters convert snow to rain. Mean annual stream flows on the Canadian prairies have been decreasing since 1947. Over time, changes in precipitation are expected to have substantial impacts on total water supply.

While the southern Great Plains move in the direction of desertification, the climate in the western mountains has also begun to change. For the last century, the strategy for protecting global biodiversity has been to protect representative parcels of each important eco-region. The foundation of this entire global program, of which our mountain national and provincial parks are an important part, is

in a shortened season. In addition, increased temperatures may push quality ski conditions to higher elevations, potentially increasing the pressure to expand ski facilities upward. The potential increase in avalanche activity due to increases in snow pack and higher winter temperatures may increase the disruption of ski operations and highway and railway corridors in the park.

On the positive side, warmer temperatures are expected to



**PRACTICING
PROBING FOR BURIED
AVALANCHE VICTIMS**

Because there are more inexperienced people skiing in the backcountry and because skiers at established resorts do not always take out-of-bounds warnings seriously, the avalanche hazard remains the prominent winter public safety threat in the Canadian Rocky Mountain Parks World Heritage Site. Although ski patrols at established ski areas are well-trained in search and rescue techniques, avalanche victims seldom survive long if they are buried. *Photograph by R.W. Sandford.*

that these representative areas will remain biogeographically stable. But the Alberta climate change vulnerability assessment argues that global climate change impacts are already invalidating this assumption. The maintenance of global biodiversity will require us to aim to protect what will effectively become “a moving target of ecological representativeness.”⁸

Protecting existing landscapes will require that disturbances be managed, new stresses will need to be controlled and habitat modifications will likely be necessary in order to reconfigure protected areas so that they can survive emerging climate conditions. Whole ecological systems are already advancing northward. Current ecological communities are disassembling and re-integrating into new assemblages. These changes could bring about a huge dislocation of human settlement. That relocation will likely be inland and uphill toward cooler temperatures and reliable water supplies. The Canadian West will be a different place by 2050.

The implications of these changes could dramatically change our culture. As climate change impacts accelerate, as they almost certainly will do, governments will have to do a great deal more to ensure the



**A MOST UNDESIRABLE
END**

For all their glory, the Rocky Mountains parks can be a very dangerous place. The actor in this photograph has been positioned in exactly the posture in which many avalanche victims have been found after being buried in the near cement-like conditions of a big slide. Such accidents generally can be avoided by knowing the avalanche conditions and by never skiing out-of-bounds at an established ski area.

Photograph by R.W. Sandford.

reliable and predictable availability of the basic environmental resources and of goods and services that make our large cities and prosperous urban way of life possible. A whole new global economy will emerge to provide the environmental needs that nature at one time provided free on our behalf. The sheer scale and urgency of the project will require this to be so. More and more of our resources will have

to be spent on managing natural, agricultural, forest and urban ecosystems so as to ensure the vitality of the basic processes that form the foundation of the environmental stability upon which our continued prosperity depends.

Though we are presently looking at a complicated future, we have to see that there is a huge window of opportunity in this. Never before have we had a greater reason to create a vision of the West we want and to act on it. Never before has there been a greater urgency to get past the frontier free-for-all that once again defines our age, to create a vision of what we want our West to be like at its future and ultimate best. By protecting the core of the central Rocky Mountain ecosystem, we have laid down the foundation for the next iteration of scientifically informed public policy in the mountain West. So what might we do next?

It took about fifty-five years to lay down the foundation for the protected area system that presently defines the ecological and cultural milieu of the mountain West. Due to the urgency created by population growth, landscape change and accelerating climate impacts it is not likely we will have that much time to affect change. We might have ten to twenty years at most – and the next five are the most critical. There are at least seven things we might consider doing. To transform the West around our founding landscape values, we won't have time to do one step before we advance to the next. We will have to move simultaneously on all fronts. Fortunately, some of these steps are already being undertaken. What we seem to lack, however, is urgency, and that is something we can either have now, while we still have choices, or later when we don't.

The first thing we should do is acknowledge the true nature of our accomplishment in the mountain West. We have to think in larger terms about what we have, appreciate what we have done, acknowledge what we have learned by doing it, and be unabashed in creating a vision for the future based on the foundation of past success. Though we may not have consciously intended to do it – or even known we were doing it – the creation of the Mountain Parks and surrounding buffers is one of this country’s greatest cultural achievements. It is a triumph of persistent, forward-thinking public policy. This accomplishment, in my estimation at least, should trump the history of development and fragmentation we presently celebrate as being so central to our identity in the West. We need to keep in mind that the real history, the one that will matter most to the future, is not what we built, but what we saved.

Breakthroughs in understanding the dynamics inherent to self-willed, self-generating ecosystem function will be as important to the future as the discovery of electricity was in the past. Those discoveries can only be made where such systems still exist. Our greatest future wealth may reside in the fact that we still have such places.

It is not enough, however, to tell people what we have. Due to the galloping impacts of population growth, landscape change and climate warming, what we have now could well be history before we can explain its loss. What we need is a desirable vision of this world transposed over the next. No one is going to create this vision for us. Governments might ultimately bless and perhaps even fund what we do regionally, but they are not going to do the work. The vision has to come from somewhere. Whatever the future holds for this region, it is going to be created on the ground by selfless people working together toward a common vision and linked to one another through the Internet. Ideally, whatever we do next should be informed by science and should be founded on ecosystem values. This isn’t going to be easy. We are going to have to get out of our intellectual, institutional and jurisdictional silos to achieve and create a larger vision, but once again the Central Rockies Ecosystem provides a means to do so. The compelling natural character of the Rockies drove the first iteration of the mountain West. It can drive the next.

The second thing we might consider is that we have to stop making things unnecessarily worse. Instead of trying to avert climate change, we are dismantling natural systems that serve as protection against climate extremes. At the same time we are going full speed ahead in

making landscape changes that will not diminish but amplify climate impacts. Sooner or later, we are going to have to stop inappropriate development in the mountain West if only because, in terms of energy and climate impacts, it is not sustainable.

Third, there is an urgent need to link scientific research outputs to public policy inputs. We have to build a bridge between science and public understanding so that we can establish a common vision of the value of what we have in the context of global and climate change. Presently, we don't act fast enough on what science tells us. It has been estimated that it would cost \$30 trillion a year to provide the planetary ecological services that nature presently provides to us free. It might only cost one one-hundredth of that to protect and expand much of the world's existing ecological function. Viewed this way, E.O. Wilson argues, conserving biodiversity can be seen to be the best deal that nature has offered humanity since agriculture. We need to realize and then act on this fact.

Fourth, we need to build a strong local culture around ecosystem productivity. The most effective way to incorporate ecosystem-based sensibilities into the fabric of our culture is through land-use policy. Only by tying all human activity directly to a landscape ethic can all the energies of our unique Western mountain culture be harnessed in support of sustainability. Only then will we be able to use art, literature and popular culture, grounded in solid science, to inspire in the public imagination a new sense of pride in what we possess, in terms of ecological wealth in the mountain West and why it is important to our future. We need to articulate a simple but sensible ecosystem ethic and communicate it outward, in a way that will constantly reinforce local understanding of the value of what we possess in the mountain West that is unique to where and how we live.

We need high-profile public champions for the expanded bioregion. Every time we turn on a television or radio, we need to hear the message. We have to get past worn-out environmental clichés about the importance of ecosystems, which put people into nostalgic sleep. We need some edge. We need to teach Westerners the value of what ecosystems do and provide – for us and for the world. And we need to do it now.

To survive economically – which is to say ecologically – we need to create a culture commensurate with the remarkable nature of the landscape we occupy. We can't do that without the sincere support of the tourism industry. The tourism industry, however, has made this

commitment without expecting every gesture in support of ecosystem understanding to be rewarded with further development approvals.

If we want to keep what we have, we will have to find ways to participate in the creation of an economic foundation compatible with an ecologically sound future. If we don't, then the future could take away from us all that we have worked to protect. This suggests that, whether we like it or not, we have to do a far better job of articulating the economic value of the ecological wealth we possess, so that our whole society can redefine itself in the context of what that wealth might ultimately mean to them.

Finally, we need to embody our society's need to be positive and persistent while being flexible and adaptive. Those locals and visitors who have come to know and love the western mountain landscape all have community and family lives. Our knowledge of mountain geography and ecosystems allows us to be highly influential witnesses to climate impacts in our time and to extend that influence beyond the mountain community to everyone around us.

We have to dispel the myth that we can't do anything about what is happening, that we have to essentially sit back and watch as our world and everything that matters in it declines, that we have to accept the diminishment and loss that began in the Pleistocene to persist into our epoch to become the central theme of our historical era.

Now is not a time to be timid. We can't retreat because there is no place to retreat to. We should go up not down. We should expand our ecosystem ideal and see if, in making our ecological wealth apparent to ourselves and to others, we can't shape a different kind of future than the one obviously before us. We've done it before. We can do it again. We can create the West we want.

