Towards a Yukon Conservation Strategy

Workshop Report

Scientific Basis of a Conservation Strategy for the Yukon

Feb 11 and 12, 2005, Whitehorse, Yukon, Canada

Hosted by:
Yukon Chapter of the Canadian Parks and Wilderness Society with financial support from the Wildlife Conservation Society

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CANADIAN PARKS AND WILDERNESS SOCIETY
YUKON CHAPTER

Acknowledgements

The Yukon Chapter of the Canadian Parks and Wilderness Society hosted the conservation science workshop with the generous support of the Wildlife Conservation Society of New York.

We thank Dr. Alan Rabinowitz of the Wildlife Conservation Society, and Dr. Brian Miller of the Denver Zoological Society for their continuing interest in Yukon conservation. We appreciate their leadership in supporting this workshop; and, their encouragement and conviction that the Yukon has a remarkable opportunity to protect boreal and sub-arctic ecosystems of global importance.

We thank the visiting and Yukon scientists for participating in this timely workshop, and for offering your collective knowledge and wisdom to help CPAWS and the Yukon scientific community achieve our conservation goals through applied conservation science.

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Executive Summary

On February 11 and 12, 2005, a small group of scientists, activists and agency personnel gathered in Whitehorse to further refine an approach to developing a conservation strategy for the Yukon Territory. This workshop was designed to further the thinking and outcomes from a similar workshop held a year previously. The bulk of the 2005 workshop consisted of presentations and discussions aimed at exploring whether the classic elements of conservation planning—e.g., ecological feature representation, focal species assessment, and special element identification—were the appropriate building blocks for a "reverse matrix" conservation strategy, particularly in the context of a rapidly changing climate.

The workshop format was to introduce each topic via a presentation on current understandings and issues, followed by a general discussion. Jim Pojar, Executive Director of the CPAWS-Yukon Chapter, chaired the workshop and in many cases posed questions for the group to answer. Wendy Francis captured the key themes and main points of the presentations and discussions, and produced the first draft of this report. Jim Pojar revised the report to its present state. Although the workshop did not arrive at consensus on all issues or specific questions, where there was clear agreement among participants on a particular point, those conclusions are highlighted in bold type. In the interests of promoting open dialogue, the names of individuals making specific remarks are not recorded, except in the case of those making presentations to the group.

The significant conclusions reached by the group were:

1. Climate change will be the single most significant impact on ecological patterns in this century; conservationists must attempt to predict and plan for potential climate change scenarios. Detecting change and linking it to ecological processes is an area of needed research. Uncertainty and variability need to be accommodated in any future conservation planning. Participants suggested that research that focuses on the adaptability of species and the likely response of invasive species would be helpful to reduce the uncertainty of some of the models. Research on phylogenetic distances or models of how plants had migrated during the Beringian period would be useful for predicting how plants could adapt to climate change.

2. The conventional reserve design model embeds networks of conservation lands in a hostile matrix of human-altered landscapes. It asks the question, how much protection is enough to conserve ecological values? A reverse matrix approach would embed nodes of development in an intact supportive matrix and ask how much could be taken away from the matrix without degrading ecological integrity. The Yukon is a good place to try and implement a reverse matrix approach.

3. Participants identified six roles for focal species in conservation planning:
    i. as surrogates for a suite of species or landscape types;
    ii. in delineating the size and configuration of protected/conservation areas;
    iii. in monitoring or managing ecological health of the matrix;
    iv. in communication and marketing of conservation goals ("flagship" species);
    v. as indicators of climate change; and
    vi. as surrogates for processes representative of ecosystem function.

   It was agreed that it might make sense to identify a suite of species that would fulfill all six roles. A matrix could be created that rates the six roles against various species to develop the best mix of focal species.

4. Special elements play multiple roles in conservation plans:
    a. They help fill gaps in coarse-filter reserve designs based on representative landforms or ecoregions
    b. They help focus attention and resources on species of special conservation priority
    c. Keystone and flagship species provide hooks on which to hang conservation plans
    d. They can be surrogates for ecological integrity.

   However, many (although not all) Yukon special elements are not imminently threatened or are not necessarily biologically productive (as in the case of geological elements). There was general agreement that special elements should be addressed in a conservation strategy after a coarse-filter approach had first been applied.

5. At a global scale what is unique and special in the Yukon are the large scale intact landscapes, systems and species assemblages.

6. Aquatic and terrestrial systems have much in common and react to ecological stressors in similar ways. Hydrologic connectivity is a key consideration. Intact watersheds are natural and logical units of conservation. Much more communication is needed between terrestrial and aquatic ecologists.

7. Knowledge is insufficient to set the thresholds beyond which various species or special elements cannot be sustained. Such information is critical for making the reverse matrix approach work. It might be more effective to seek to maintain the processes that sustain ecosystems and enable adaptability to change.

8. Protecting landscapes large enough to support large-scale, evolutionarily viable dynamics and processes (predator-prey interactions, fire regimes, flows of energy and nutrients, etc.) could provide the blueprint for building

a conservation plan, with the six categories of focal species being used to refine or augment the primary areas.

9. Within a reverse matrix context that simultaneously evaluates conservation and development areas, it is important to plan for and designate benchmark areas using criteria that go beyond enduring features.

10. The background work for the Yukon Protected Areas Strategy is valuable for assessing ecological representation. It could be useful as a baseline, to which could be added community values, climate change variability, and other indicators discussed in the text below. But remember that representation itself is not the objective; representation is a coarse-filter surrogate for biodiversity.

11. In the face of climate change, it makes sense to focus conservation planning on several very large, intact watersheds. Watershed reserves would be extremely useful in studying the hydrology of the Yukon and how it responds to and reflects climate change.

12. CPAWS should continue to collaboratively develop/spearhead a Yukon Conservation Strategy. As a first step it could incorporate the thinking and approaches emerging from this workshop into existing land use plans, e.g., southeast Yukon and Peel Watershed.

13. A critical but missing tool for conservation planning in the Yukon is a well-documented meta-database that is dynamic and accessible. Such a central clearing house would need to overcome data ownership issues.

14. The prospect of the Alaska Highway Pipeline could create an opportunity for trade-offs between linear development and protected areas establishment, as is occurring in the NWT. Relationships with First Nations and industry could be developed to better position CPAWS-Yukon to play a major role in furthering the conservation agenda in a pipeline scenario. Both an information gap analysis and a threats analysis would be valuable tools for conservation planning.

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1. Welcome and Introductions

Jim Pojar opened the meeting and welcomed participants. Participants introduced themselves. (See Appendix 1 for the list of participants.) Jim noted that this was a follow up workshop to one held a year previously. The workshop participants were selected for both their specialized and synoptic knowledge, with a particular effort to include researchers in freshwater ecology. The goal of the meeting was to frame a conservation plan for the Yukon, without regard to existing political constraints.

2. Summary of 1st Conservation Science in the Yukon Workshop

Jim Pojar advised that the first workshop had been a wide-ranging discussion of a variety of conservation planning questions. It reviewed the principles of conservation biology and their application in a Yukon context. Information gaps regarding Yukon ecology were identified. Participants also discussed the need for communications and engagement with local communities. Classification and mapping of soil and vegetation ecosystems and other systems of classification were reviewed. Priority research needs to support conservation goals were identified. Several research priorities evolved, particularly focal species monitoring and the development of cumulative impact thresholds.

It would take years if not decades to secure information adequate to support conservation planning decisions. However, the future of the Yukon's natural environment would be determined largely in the next five years or less, if trends in northern B.C. and Alberta were any indication. In Jim's opinion, there was adequate knowledge about some elements of Yukon's ecology to draft a conservation strategy. He was looking for advice about how to frame such a strategy.

> Participants in the 2004 workshop recommended that, in developing a conservation strategy, the approach *should empower community people with scientific knowledge to complement local and traditional knowledge and sense of place.*

The 2004 workshop also identified the key ecological components of a Yukon Conservation Strategy:

- Special elements
- Representation
- Ecologically functional (viable) populations of native species

- Evolutionary and ecological processes, including disturbance regimes, hydrologic processes, nutrient cycles, and biotic interactions
- Resilience to environmental change; functional connectivity; and evolutionary potential of lineages
- Large wilderness areas, big and wild enough to stir the human spirit, to encompass entire major watersheds, intact predator-prey systems, entire ranges of caribou herds and culturally important lands and waters; and to accommodate the effects of climate change.

Threats to the ecological integrity of ecosystems in the Yukon were identified. The cumulative impacts of various development scenarios needed to be assessed. This would require research into predictive models, the consequences of alterative development scenarios, and modeling to encourage improved management practices amongst alternative scenarios.

In the Yukon, there is still the opportunity to apply a “reverse matrix” approach to conservation planning. Most of the thinking about conservation theory has evolved in highly fragmented landscapes, i.e., where the “matrix” is significantly modified. In the Yukon, the matrix is largely undeveloped. More than 70% of the Yukon remains as wilderness in character. A reverse matrix approach would see areas of intense industrial activity embedded in a wild matrix (rather than networks of protected areas embedded in a significantly modified matrix).

A participant noted that an International Polar Year (IPY) proposal was being put forward that would focus on limits of acceptable change. IPY could be a big research initiative. The Canadian contingent, with a secretariat established at the University of Alberta, was still seeking federal funding. Examples of proposals were disturbance thresholds for caribou, multi-species indices, suites of birds and fish. One approach could be to determine thresholds based on community values or perceptions regarding limits of acceptable changes rather than on ecological impacts. A current project funded by Environment Canada in Yukon was exploring reverse matrix ideas. The results of such efforts could help inform the selection of indicators for determining the maximum development density in a reverse matrix design.

Participants in the 2004 workshop had discussed assessment and monitoring of ecological integrity, appropriate indices, and applyication of the precautionary principle. The Yukon *could* be an international benchmark for ecological health.

The prior year’s workshop also emphasized land use planning and communications as necessary tools for applying conservation biology principles and engaging Yukoners in conservation planning.

A participant noted the urgent need to inform children and citizens about the importance and value of conservation. The conservation strategy should include a strong communications strategy to counter the rhetoric of those who oppose conservation.

Desired Workshop Outcomes

- Recommendations or ideas about climate change and how to account for it in conservation planning
- List of special elements, including ecosystems
- Suggested suites of focal species, especially in the aquatic realm
- Recommended conservation approaches

The workshop outcomes would be used primarily by CPAWS to guide its conservation work in the territory. The outcomes also could be used to inform discussions with government and could be shared with the Yukon Science Institute. Recommended approaches and focal species could be applied to ongoing land use planning in southeast Yukon and in the Peel watershed.

One participant was interested in discussing impediments to conservation in the north. The state of the science was likely the least of the impediments. This topic was not on the agenda. CPAWS-Yukon preferred first to determine a conservation science approach to planning and then incorporate social and political considerations.

Participants discussed the challenges of applying conservation planning to a landscape with an intact matrix and whether a conservation plan would ultimately lead to more fragmentation than currently existed. Others emphasized learning how to manage the landscape better to allow for sustainable livelihoods. There is a social context that cannot be ignored. Aboriginal people do not view the land as “wilderness” because they have used it for thousands of years. Yet there are many conservationists in those communities whose best practices need to be promoted and encouraged. There are many communities and Yukoners who want to “keep it like it is.” Aboriginal people intuitively understand the concept of the reverse matrix.

A participant suggested that it would be important to map the conservation plan so that people could see what it would mean. CPAWS is developing such a map for the Peel Watershed.

Another participant suggested that a key question was determining thresholds of acceptable activity, especially outside protected areas and science could help answer that question.

3. Climate Change

Arguably the greatest threat to the ecology of the Yukon is climate change. Within 50 to 100 years there could be radically different assemblages of species in the areas currently identified as biodiversity hotspots. The pace and scale of climate change, especially in the North, could make obsolete most current conservation area designs. Cutting edge modeling exercises require massive data and there is not enough time to gather them.

> "Habitats will go before we even glimpse what taxa they contain, let alone map them." (Stuart Pimm. 2002 TREE 15: 262-263)

Aynslie Ogden presented a video of the results of a study on impacts of climate change in the Arctic. Changes in the Arctic appear to be more rapid than in other areas of the planet. Key findings of the 2004 circumpolar Arctic Climate Impact Assessment were:

1. climate change is occurring in the Arctic two to three times faster than in the rest of the planet
2. arctic warming will have major implications for the rest of the world, through its effect on ocean currents
3. arctic vegetation zones are very likely to shift northward and to higher elevations: trees will migrate north and up; fires will increase in frequency and severity
4. animal species diversity, ranges and distribution will change; some species – especially those that breed in the Arctic during the summer – could be pushed toward extinction
5. coastal communities and facilities face increasing exposure to storms due to the disappearance of protective arctic ice
6. thawing permafrost will increasingly disrupt transportation, buildings and other infrastructure
7. indigenous communities are facing tremendous cultural and economic impacts
8. elevated ultraviolet radiation levels are affecting humans, other animals and plants; young people will receive a 30% greater dose of UV radiation than any previous generation
9. reduced sea ice is likely to increase arctic marine transport and access to northern resources
10. multiple interacting influences are compounding the effects of climate change; in some cases the total impact will be greater than the sum of its parts.

Reversing the trend of climate change would take a century, even if emissions were capped immediately.

Aynslie presented her thoughts about the implications of climate change for a forest management plan in southwest Yukon. To address climate change in the context of regional forest planning, one must:

1. define and clarify biophysical and community characteristics and attributes
2. define and describe key climate-related attributes

3. establish sensitivity of key attributes to climate change
4. forecast future conditions for those attributes
5. develop strategies to accommodate future conditions.

The goals of the southwest Yukon forest management plan are:

1. functioning forest ecosystems
2. community sustainability and benefits
3. cooperative forest management and planning
4. building local capacity.

The study area is experiencing an increasing spruce bark beetle infestation consistent with climate warming. Detecting change and attributing it to ecological processes is an area of needed research.

Three attributes have led to the beetle outbreak: warmer winters, warmer summers, and drier summers. Those climatic factors have combined with a large host population (mature monoculture forest of. white spruce) to support an epidemic of the beetles.

Models are being used to forecast likely future conditions for the southern Yukon. Thirty-two different climate models are available. Uncertainty and variability must be accommodated in any future planning. Under those models, mean annual temperature will increase 3-7 ^{o}C and precipitation will increase 9-30% (despite local observations that summers are becoming drier).

Adaptation in natural systems is predicted to occur mainly through migration and reassemblage of species mixes. There will be winners and losers among species. Challenges to adaptation are limits to migration, dispersal capabilities and habitat availability. These are topics where conservation planning could be focused.

Strategic questions that arose were:

1. Build resilience to change or promote adaptation to change?
2. Protect current ecological communities or protect processes that facilitate adaptation?
3. Allow natural response or augment adaptability through human intervention/manipulation?

Discussion

A participant noted that elders are reporting a significant increase in variability and extreme events. The weather no longer is predictable.

A critical question is the location of the uncertainty – is it in the magnitude of the change or in the geographic distribution of events? If it is in the geographic distribution of extreme events, it makes planning much more difficult.

A difficult challenge will be determining whether some populations should be abandoned and resources focused where they are more likely to be successful.

Participants cautioned that the motives for abandoning a population should be clear and justifiable first from an ecological then an economic perspective.

Models of British Columbia predict that the conditions that currently support ponderosa pine forests will have shifted to north of Fort St. John by 2085. The trees themselves likely would not be able to migrate that quickly. One reforestation strategy: plant tree species now that will be suited to the conditions that we predict will prevail in 80 years.

Jim Pojar presented some slides demonstrating rising temperature trends in the Yukon and northern British Columbia. Annual precipitation in southwestern Yukon is rising, largely during winter months.

The climate change that we in the north are presently in the midst of has these characteristics:

- Large amplitude
- Very rapid pace
- Greater frequency of extreme events
- Global extent of patterns of change.

More extensive highly disturbed landscapes could be the consequence of such change. Land cover types are predicted to change as a consequence, e.g., from forest to grassland. In mountainous terrain, forests would move up in elevation. Not all species would be able to migrate quickly enough to adapt to changing ecological conditions.

Climate change impacts on Yukon ecology are predicted to be:

- Reduced alpine and arctic tundra zones
- More “insularity” at high elevations (“sky islands”)
- Higher/more northerly tree lines, but shrublands expanding rather than forest
- Reduced forested area
- New mix of forest species
- Expanded grassland distribution
- Changes in wetlands – perhaps reduction in bogs and increase in fens and marshes (grass/sedge wetlands)
- Increase (temprorary?) in overall river flow with peak flows occurring earlier in the season
- Increasing river temperatures
- Increase in “worst case” years, with conditions worse than the worst year for fish survival

University of Victoria climate researcher Richard Hebda has called the coming decade the “big squeeze”. Climate change habitat losses are more rapid than natural dispersal abilities. Such losses are exacerbated by unpredictable extremes. Recovery will be patchy and slower for mid- and late-successional species. There will be strong competition from invading exotics. There will be fewer places for some species to go on a converted landscape.

By 2080, according to some models, the climate for western redcedar could extend north all the way to Watson Lake. But the redcedars themselves probably won't be able to migrate that far so quickly (75 years). Even though the conditions for pine and spruce forests will move upslope to areas that will have been vacated by alpine vegetation, the trees themselves will be unable to move quickly enough. It appears likely that shrubby vegetation (scrub birch and willow) will occupy those niches and become prevalent. Forests will remain in southeastern Yukon but likely with more deciduous species. Increased insect outbreaks could mean increased losses of conifers and replacement by a mixture of species. The boreal steppe of southern Yukon is getting moister and warmer and also could be invaded by shrubby species.

Participants suggested that research that focused on the adaptability of species and the likely response of invasive species would be helpful to improve the models.

4. Reverse Matrix

A reverse matrix approach to conservation planning would invert the paradigm of reserves as nodes within a largely degraded environment (currants in porridge), to nodes of human habitation and industrial development within a supportive matrix of extensive conservation lands. Protected areas would still be embedded in such a matrix, and would be designed to meet conservation goals and to act as benchmarks and control areas for management activities. Many conservationists consider this model to be more appropriate in a place like the Yukon, where more than 70% of the landscape is still wilderness. **Fiona Schmiegelow** presented her thinking about the reverse matrix model.

Canada uniquely still has vast amounts of intact boreal forest. The boreal forest is an inherently dynamic system (i.e., driven by frequent, often stand-destroying disturbances) that is changing rapidly. Most conservation science and planning have not incorporated the distinctive attributes of the boreal forest.

> The orthodox matrix conservation model construes the matrix as developed lands or lands without conservation value. The result is reserve designs of interconnected protected areas buffered by transition zones that pose the question, *how much protection is enough to preserve ecological values?* Classic conservation planning has not yet determined how to maintain ecological processes or provide for resilience. Conservation Area Design (CAD) frameworks, which focus on ecoregional representation, planning for the needs of focal species, and capturing special elements, are worthy efforts but are insufficiently dynamic and do not automatically guarantee long-term conservation or maintenance of ecological integrity.

Achieving conservation goals requires very large areas, significant portions of ecoregions to be conserved (well above the Brundtland Commission's 12%).

The "matrix" has been construed as a hostile environment in classic CAD. But the true meaning of the word is "a supportive, nurturing environment from which other things arise". The real question is, *how much can we take away from the matrix and still have ecological integrity?* Human activities should occur within in a supportive or conservation matrix.

A reverse matrix model with adaptive resource management provides a model for achieving conservation goals. Adaptive management requires control areas or ecological benchmarks. In a reverse matrix model, adaptive management areas are paired with ecological benchmarks. This approach is pro-active, precautionary and comprehensive. Development proceeds in an iterative fashion based on lessons learned from earlier incursions. This approach leaves as many options open as possible. **It focuses on managing for abundance, not scarcity.**

The key elements of the reverse matrix model are:

1. Simultaneous assessment of conservation and resource values in advance of widespread development; aka land use planning in advance of development
2. Identification of appropriate ecological benchmarks. Benchmarks serve three major roles:
    a. ecological baselines (natural laboratories)
    b. anchors of a reserve system
    c. controls for management activities
3. Completion of a regional reserve design
4. Implementing active adaptive management

The challenges to developing a reverse matrix model are:

1. not all values are known
2. benchmark delineation must consider both pattern and process
3. components of both terrestrial and aquatic systems must be integrated
4. choosing the appropriate scale or unit of stratification – watershed? ecoprovinces? fire disturbance regions?
5. meaningfully accounting for large-scale, largely exogenous dynamics; e.g., climate change
6. identifying fine-scale elements or special features not captured by ecological benchmarks
7. meaningful partnerships are necessary for active adaptive management (testing hypotheses as to how the system might respond to various management interventions and about managing uncertainty over time)
8. uncertainty as a management philosophy must be embraced
9. a long-term commitment to monitoring outcomes of management activities and a willingness to adjust policy and practices over time are essential to adaptive management.

The Yukon has several advantages for developing and applying a reverse matrix model:

1. large intact wild landscapes provide the opportunity for proactive planning over big areas
2. some institutional flexibility due to the devolution of governance responsibility and development of new policy
3. aboriginal self government and co-management provide opportunities for partnerships in adaptive management
4. land ethic of manyYukoners is consistent with conservation goals
5. excellent capacities within governments and NGOs relative to population base.

Opportunities to apply the reverse matrix model:

1. in the southeast in Kaska traditional territory, via Kaska Conservation Initiative and Kaska Forest Resource Stewardship Council
2. in the southwest working with the Champagne Aishihik First Nation
3. in the Peel River watershed.

Proactive conservation planning is needed in anticipation of the Alaska Highway gas pipeline, a railway from Alaska to northern B.C., and other proposed developments.

Discussion
Participants discussed the feasibility of applying the reverse matrix model in the Yukon. Some thought that the momentum of current planning and assessment models made significant changes in approaches to planning unlikely. Others thought that the cumulative effect of First Nation land claims and planning processes would *de facto* create a reverse matrix design. The Deh Cho process and Sahtu plan in the Northwest Territories demonstrated that supporting community-initiated processes was more likely to achieve conservation outcomes than imposing a “top down” reverse matrix model. The Innu process was cited as an example of complementary scientific and community-based approaches that had resulted in a 50% reduction in the allowable annual cut.

5. Special Elements

i. List of Proposed Special Elements

The previous year’s workshop identified some distinctive ecological characteristics and special elements of Yukon:

- 23 distinct ecoregions in portions of 4 ecozones; 7 of the 23 are represented in protected areas larger than 2,000 km^2
- Diverse and intact mountain boreal, sub-arctic taiga, alpine and arctic tundra biomes

- Intact large-mammal predator-prey systems
- Continentally important resident populations of grizzly bear, Dall's sheep, woodland caribou, grey wolf, and wolverine
- Major North American flyways (including Tintina Trench and Shakwak Trench) with continentally important staging areas and internationally important breeding areas for waterfowl; 56 key wetlands for waterfowl production
- Continentally important populations of migratory species including peregrine falcon, trumpeter swan, tundra swan and many songbirds
- Hundreds of intact watersheds with pristine water quality and aquatic habitat
- The Yukon River and its tributaries support the longest salmon run in the world
- Endemic fish species resulting from complex glacial history
- 23 woodland caribou herds; 3 large herds free of disturbance
- Critical habitat for the 125,000 member Porcupine caribou herd
- Vast Beringian landscape with many endemic species and unique ecological conditions
- Rare plant species and species assemblages, often linked to Beringia and combinations of coastal, interior boreal and subarctic elements
- Frequent boreal steppe (grasslands)
- Nationally significant warm and cool mineral springs with tufa formations and rare plant assemblages
- Internationally significant complex of large pristine mountain lakes and associated ecosystems
- Several ecological hotspots, including the far southeast Yukon (lower La Biche and Beaver watersheds), Kluane National Park region, Old Crow Flats, and Fishing Branch watershed
- Vast intact wilderness areas encompassing entire mountain ranges and large watersheds without roads or permanent human habitation

ii. Criteria

Following the Partners in Flight approach, criteria for ranking the conservation priority of species as special elements are:

- Endemics (species and subspecies/varieties)
- Significant world populations in Yukon
- Significant world ranges in Yukon
- Population trends
- Species' vulnerability and threats
- Geographically or ecologically marginal (disjunct) populations

This is a global "stewardship responsibility" approach that would see jurisdictions take responsibility for endemic, significant, and vulnerable species or populations, rather than emphasizing jurisdictional rarity and perforce focusing on peripheral species that often are abundant elsewhere.

Discussion

A participant noted that many boreal species are widely distributed without concentration in any particular jurisdiction; e.g., wolverine. The idea of jurisdictions that have the bulk of a species' range within their boundaries taking responsibility for persistence of the species would not work for such a wide-ranging animal. The value of such species could be diminished by such an approach.

The Yukon wildlife viewing program has created for the tourism industry a list of species bird watchers and other naturalists are most interested in, called the Yukon "Advantage" species (Appendix 2). The list mostly does not include "listed" species at risk. They are more like "flagship" species, i.e., those in which the public are likely to be interested. A participant noted that the choice of species for conservation planning purposes depends very much on planning goals.

What is the role of special elements in a conservation strategy? Several participants suggested that conservation planning begins with coarse scale analyses, with finer filters applied to fill in gaps. Special elements are add-ons that help fill the gaps in coarse-filter or representation-based plans. Special elements help focus attention and resources on species or ecosystems of conservation priority. Species having a large impact in the system (keystone species), and high profile species (flagship species) provide "hooks" on which to hang a conservation plan. But there is scant information about many species and habitats. Some other special elements, e.g., early open water, are critical resources for migrating species and might be more helpful to focus the discussion.

Participants agreed that the purpose of the exercise is to identify species that are surrogates for ecological integrity.

iii. Value of Listed Species At Risk

Which of the officially "listed" species should be included in the development of a conservation plan? There are only two "red listed" mammal species in Yukon: Wood Bison and Bowhead Whale. There are seven "blue listed" species. Several of them are extremely rare; e.g., western jumping mouse with only three known occurrences. In principle and in the context of climate change, is there value in including them in a conservation strategy primarily because they are rare?

Discussion

A participant cautioned that with respect to peripheral species, in southeast Yukon and on the arctic coast, there are unique and productive ecosystems that harbour territorially rare species that are not truly peripheral. The Yukon has viable and significant populations of these species. There is a difference between continuous peripherals and disjunct peripherals. There also is a distinction between true disjunct peripheral localities and ecological hotspots that support disjunct populations that have occupied the hotspot for thousands of years. The latter were essential elements of the overall species population, not infrequent visitors or accidental outliers.

A participant suggested that some rare and disjunct populations would be captured by a coarse filter approach. It would make more sense to agree on the coarse filters first before discussing fine scale elements. **There was general agreement that listed species at risk are not a useful starting place for conservation planning.**

iv. Other Special Features

Jim Pojar proposed a list of biophysical special features that could be included in a conservation plan. The list was supplemented by participants' suggestions:

- Karst systems; caves, disappearing streams, and other karst features
- Big waterfalls
- Canyons and cliffs (physiographic edge habitats)
- Hoodoos
- Tors (free standing, sharp-edged, unglaciated bedrock features)
- Dunes
- Glaciofluvial landforms (eskers, kames, pitted outwash, crevasse fillings)
- Hot springs and mineral springs
- Mineral licks
- Pingos and palsas
- Rock glaciers
- Landslide complexes
- Some wetlands/wetland types (migratory stopovers)
- Boreal steppe
- Lakes with open water all winter, or early in spring
- Concentrated spawning areas (with underwater dunes) in streams
- Marine environments (beaches, scarps, spits, lagoons)
- Islands in rivers (islands that serve as nesting and breeding sites for waterfowl, and birthing grounds for moose)
- Groundwater discharge of quantity and quality to support aquatic species throughout the winter (persistent winter-open water in streams)
- High altitude lakes
- Short streams that connect lakes (important corridors)
- Key wildlife habitats (traditionally used and limited in availability)

<u>*Discussion*</u>
A participant observed that many of the elements listed are local or regional in scale and are not significant from a global context. At a global scale what is unique and special in the Yukon are the intact systems and species assemblages at a large scale.

v. Geological Special Features

John Meikle presented some thoughts about special elements in geology and landforms. There are five areas of interest:

- Bedrock geology
- Glacial history
- Process features
- Sharp breaks in topography
- Culturally significant features.

a. Bedrock geology

The Yukon has a diversity of exposed bedrock based on local weathering influences, such as resistant granites, maroon and green shales, and black shale and chert. Another major rock type with variable distribution is the carbonates. In some areas it is a rare outcropping; in other areas it is regionally prevalent. Various plants and insects are closely associated with the carbonates. Acidic shales are important features that affect ecosystems through water runoff. Ultramafic rocks are low in nutrients and support krumholtz type vegetation at low elevations. Salt licks are highly localized and important habitats. Volcanic features exist but are extremely rare. Vegetation associated with volcanic features differs in form from other locales; e.g., dwarfism. Isolated mountain blocks in plateau country are wetter than the surrounding terrain and other mountain systems in the territory.

b. Glacial History

Some glacial landscapes are overlain with till while others are till-free. Eskers and other glaciofluvial features are significant (e.g., sandy-gravelly terraces as key caribou winter habitat). Contemporary glacial forelands and snow patches support unique species; e.g., the pale poppy endemic to the Wrangell and St. Elias Mountains. These features have a significant bearing on the local environment. Ice and snow patches have been used by caribou for over eight thousand years. Their dung provides nutrients to local sites. Perched wetlands and rerouted rivers are other notable glacial features. The Beringian landscape supports numerous endemic species. Tors (unglaciated ridgecrest rock formations) support unique, very local ecosystems. Nunataks (areas that escaped surrounding glaciation) often support plants and other species that have persisted or have recolonized earlier than the surrounding areas.

c. Process Features

Volcanic ash sites are rare. Long, gently sloping fans/terraces that have developed over millennia are common in the Territory but rare nationally. Rock glaciers supply a lot of water to alpine environments in the summer. Minor landforms include slumps (common throughout the eastern Richardson Mountains) that provide breaks in the landscape for colonizing species rare in the rest of the landscape, and thermo-karst (karst-like terrain caused by melting permafrost) that leads to formation of constellations of small lakes. Pingos are ice-cored features that support dry shrubby habitats in otherwise moist environments. When they collapse they create wetlands. Dunes support rare plant species. Windblown silt sediment from the Kluane ice fields provides rich habitats in the front ranges of the St. Elias Mountains. Erosion and other transport features create unique landforms. There are many hotsprings throughout the Territory, but especially in the southeast Yukon. Wetlands in the mountainous or unglaciated areas are rare and important. Deltas also are important special features. Flyways and vegetated mountain passes provide important wildlife corridors. Globally unique ecosystems include the White River and other ash landscapes.

d. Sharp Breaks

Riparian cliffs are an example of sharp topographic breaks. These features provide vantage points for carnivores such as arctic fox and birds of prey, nesting sites for raptors including peregrine falcons and golden eagles.

e. Cultural Features

Cultural features have archeological and cultural significance. There are sites of paleo-significance, e.g., dinosaur tracks. There also are landscapes that are important for recreation activities.

<u>*Discussion*</u>

Participants suggested that braided streams should be included as a special feature. *Aufeis* is river overflow that freezes in winter and often provides unique microhabitats in the summer.

A participant asked how well mapped these features are. Bedrock geology is mapped at the 1:250,000 scale and is available digitally. Many of the smaller features are not well mapped. Rare, significant and threatened ecosystems (e.g., hot springs, south-facing grassy slopes, salt flats and sand dune communities) are being mapped by NatureServe. Mineral licks, nesting sites and other critical habitats for vertebrates also have been mapped. **It was agreed that it is important to decide which special features warrant more thorough mapping.**

How many of the special features are imminently threatened by resource development? It was thought that not very many are. A focus on special features could divert attention from prioritizing areas that are under greater threat. A participant observed that many of the special features are small scale or of a "rock and ice" character and less likely to be threatened by resource development. Nonetheless, some of them are internationally significant and might be under threat in the future. Sharp breaks are under threat because they are easy to turn into "rip rap". Braided streams and glaciofluvial landforms are threatened by gravel extraction.

It was agreed that special elements should be included in the conservation plan only after a gap analysis that considers other rationales for conservation planning.

vi. Aquatic Special Features

Are there aquatic analogues to these terrestrial special features? **Al von Finster** gave a presentation on climate change and Yukon lakes. When looking at fish habitat, it is necessary to talk about climate change because aquatic conditions depend on past glacial history and future climatic conditions. Unglaciated areas were impacted by the effects of glaciation (e.g., river diversions, ice dams, and glacial lakes). Fish species are still undergoing a post-glacial expansion into the Yukon. Landforms and the relationship between land and water created by the glaciers determine current fish habitat. There are a variety of lakes with different characteristics, such as depositional lakes. Under climate change, these shallow lakes will warm to the point that certain fish species no longer will be able to survive in them. An example are the compound lakes created by glacial debris that dammed a river bottom.

Glacial recession is ongoing and continues to create new habitats. Receiving waters have high turbidity and lower productivity. Winter lake outlets (polynyas) stay open through the winter. They are formed in lakes having deep water adjacent to the outflow. Inter-lake polynya also are important for migration of fish between lakes. Areas that previously supported significant fish populations are drying up.

<u>Discussion</u>

Should a Yukon Conservation Strategy consider rivers where salmon likely would return under climate change scenarios? While one participant thought chum salmon might increase in the upper Peel and other arctic rivers, another advised that fall chum spawn only in the winter in groundwater discharges. There might not be sufficient such areas to support many chum in the Peel.

Over time, the yield of water from non-glacial rivers will decrease, whereas the yield from glacial rivers is already increasing and there is an ongoing contraction of spawning habitat for some species, such as Chinook salmon. In some other rivers, as water levels drop they become more suitable for spawning. Larger streams will sustain spawning habitat over such change. Small creeks are most at risk from falling water levels. Eventually even glacial rivers will have reduced flows as the glaciers melt out.

A participant suggested it would be useful to map important aquatic areas based not just on salmon spawning but also on other species of concern, such as birds.

Karen Kidd addressed the major stressors of aquatic systems. These include:

- Climate changes
- Watershed development:
  - water extraction
  - industrial effluents/activities
  - nutrient inputs (eutrophication)
- Acid rain
- Ozone depletion
- Invasive species
- Cumulative impacts (perhaps synergistic)

Climate change is believed to be causing the following impacts on aquatic systems:

- Increasing surface water temperatures
- Decreasing surface water runoff
  - ephemeral streams, spawning beds
- Decreasing inputs of dissolved organic carbon
  - increased clarity of water
  - increased UV penetration
- Decreasing habitat for cold-water species
- Longer ice-free seasons

As a consequence of these climatic impacts, productivity for cold-water species such as lake trout and whitefish is declining in boreal lakes.

There is insufficient communication between terrestrial and freshwater ecologists. Aquatic systems share the following characteristics with terrestrial systems:

- Larger systems are more diverse
- Diverse systems have more redundancy/resilience
- Redundancy is higher at lower trophic levels
- There is less resistance to change/compensation at higher trophic levels
- Loss of top predators can trigger a top-down cascade of effects
- Species invasions can decrease diversity and alter ecosystem function

Critical aspects of aquatic conservation planning are:

- Protect water flow on a watershed scale
- Protect water quality
- Consider terrestrial and aquatic systems as a whole
- Manage watersheds as a whole rather than on a piecemeal basis
- Hydrological connectivity is extremely important
- Bringing shareholders together to develop watershed management plans is challenging

Species and habitats of concern in aquatic systems are those susceptible to climate change, such as:

- Cold-water habitats
- Cold-water species:
  - Lake trout
  - Whitefish
  - Cisco
  - Mysis
- High altitude systems
- Connecting streams

Approaches to monitoring of aquatic ecosystem health include:

- Using indicator species with these characteristics:
  - Localized distribution
  - Shorter life span/generation time, e.g., small-bodied fish are valuable in assessing watershed health and the effects of development
- Assessing the health of populations across a range of spatial scales
- Assessing cumulative effects
- Long term monitoring and data sets to reveal trends

Discussion

What indicators of development can be used to establish thresholds of aquatic integrity, such as km of road or number of stream crossings per km^2? Monitoring small-bodied fish can detect a change in fish population structure; e.g., the younger fish dropping out of the population. But knowledge could still be insufficient to set the environmental thresholds above which fish populations cannot be sustained. Thresholds represent critical information for making the reverse matrix approach work. Where information is inadequate, it might be better to try to maintain the processes that sustain ecosystems and enable them to adapt to change.

viii Beringian Special Features

Bruce Bennett presented a map of vascular plant distribution. The Ogilvie/Werneke Mountains and the Yukon/White Rivers have different conditions contributing to high concentrations of vascular plant species. The Ogilvie/Werneke system has a closer affinity to arctic systems. In contrast, the elements in southwestern Yukon had evolved prior to the most recent glaciation, i.e., 15,000 years ago. Some plant species currently found there had originally migrated from the south. Some were globally abundant but restricted and rare in the Yukon. There likely are some undiscovered endemic species in southwestern Yukon.

The Beringian connection was first proposed by Eric Hulten, author of The Flora of Alaska and Neighboring Territories. Working in Kamchatka he observed areas that were supposed to be glaciated but that lacked scouring. Hulten noticed a particular primrose species with poor dispersal abilities that did not tolerate salt water but that ranged across the Bering Sea. He began to look at maximum Pleistocene glaciations, and mapped the distribution of plant species.

During the time of the Bering land bridge, plant species migrated mostly from Asia to Yukon, not in the reverse direction. The Beringian Plain was a huge area (five Saskatchewans or four Montanas). The narrowest point extended the equivalent length of Fairbanks to Barrow, Alaska.

Among the most interesting plants are those between Eagle and Dawson. Some globally endemic species occur there, e.g., *Claytonia ogilviensis* (Ogilvie Mountain spring beauty) and *Podistera yukonensis* (Yukon woodroot). Some boreal species are at the limits of their range in the Yukon. *Oplopanax horridus* (devil's-club) characterizes a unique plant community with a distribution lobe extending north into southeast Yukon. Hotsprings have created habitats that allowed unique assemblages to develop. Some southern species (e.g., *Rhus radicans*, poison ivy) are found in the Yukon only associated with hotsprings in the southeast. The ridge that delineates the Yukon/NWT border defines the limit of Beringia in southeast Yukon, and is associated with many rare elements.

Glacial maps represent a snapshot in time, but glaciers are dynamic and have advanced and retreated over millennia. Features like Glacial Lake Nahanni and emergent refugia have helped create genetically distinct populations. The theoretical ice-free corridor along the east side of the Mackenzie Mountains was evidently glaciated at some time everywhere. But the botanical evidence also suggests intermittent and perhaps discontinuous ice-free conditions, with complex species assemblages connected to the north, perhaps in stepping-stone fashion, then pinched-off and isolated.

Discussion

Where is the best place in the Yukon to represent the Beringian landscape and have it persist through climate change? Several participants agreed that Vuntut National Park provides the best opportunity to preserve a Beringian landscape over time. However, a participant noted that although Vuntut was Beringian historically, it does not currently possess exclusively Beringian conditions. It consists of low elevation scrub birch and willow communities with intact Beringian communities on the higher ridges.

The Labiche Range in southeast Yukon supports a combination of Rocky Mountain and Beringian flora. Invasive species threaten the currently isolated boreal grassland habitats of southwestern Yukon.

Has there been research on phylogenetic distances or models of how plants had migrated during the Beringian period that could predict how plants could respond to climate change? Participants did not know of any such research.

viii Habitats and Ecosystems

Some of these were already highlighted in earlier discussions, e.g., karst landscapes. In the Yukon there is no comprehensive classification of ecosystems. Therefore, the range of habitats and ecosystems is not well understood. This makes it difficult to identify special or unusual habitats or ecosystems. A default approach would be to refer to the physical substrate ("enduring features") that helps define ecosystems.

Another approach is to focus on the very dry and very wet habitats that also likely support some unusual ecosystems or habitats. There are more than 50 "key" wetlands in the Yukon (Appendix 3) that could initially be used to identify special or representative sites (e.g., Peel Plateau). However, the key wetlands were identified on the basis of waterfowl productivity and therefore probably do not include the full range of wetland types.

These key wetlands total about 20,000 km^2 or 4% of the territory. Five have been designated for conservation (national park, national wildlife area, special management area). Six could become special management areas (land claim processes). The 40+ remaining key wetlands have no special conservation designation or status, they are merely acknowledged with map notations.

Important wetlands currently at **highest risk** are in four areas:

- Peel Plateau wetland complex
- Whitefish Lake/Bluefish Basin wetland complex
- Southern Lakes (many smaller wetlands)
- Liard Basin (six key wetlands).

6. Focal Species

Jim Pojar noted that existing conservation area designs from northern B.C. had been modeled on the habitat needs of a variety of species:

Grizzly bear
Wolf
Mountain goat
Woodland caribou
Moose
Stone's sheep
Dall's sheep
Rocky Mountain elk
Mule deer

Sockeye salmon
Chinook salmon
Chum salmon
Coho salmon
Pink salmon
Steelhead
Grayling
Bull trout

Were any of these useful for the design of a reverse matrix conservation strategy? Was the concept of focal species useful in a reverse matrix context?

Discussion

One participant suggested that focal species could help define the ecological conditions of the "matrix". Focal species were surrogates for the ecological integrity that would ensure the maintenance of ecological processes and allow resilience and adaptability over time. Presumably in the context of a reverse matrix these conditions would define the matrix.

What suite of focal species would allow assessment of whether all the key ecological processes had been captured? Selected species should be measurable, able to be monitored over time, etc.

Was the Yukon conservation planning process to be a "top down" or a "bottom up" approach? Why not both? Large scale monitoring and planning could be used to capture the big ecosystem elements while special elements could be used to capture small scale but important habitats.

Species are used for two different purposes in conservation planning: (1) for selecting areas to include within a conservation system plan, and (2) for long term monitoring of cumulative effects. The same suite of species is not necessarily useful for accomplishing both goals.

Wide-ranging focal species have been used to define the size and configuration of conservation areas in other regions. In the context of the reverse matrix, how would the matrix habitats be managed to ensure the persistence of grizzly bears over the long term? What set of activities in what intensity and at what locations would allow grizzly persistence? Grizzly bears would then be serving a monitoring purpose. They could also serve to delineate benchmark areas. In southeast Yukon, for the purposes of monitoring ecosystem change, small mammals like pine marten and red-backed vole might be more relevant.

Some participants suggested that woodland caribou are a useful focal species because they are charismatic, culturally important, wide-ranging, and they coould be indicators of old growth forest integrity. However, as umbrella species they are habitat generalists and they probably are not keystone species in most places. Woodland caribou also are unpredictable and sensitive to a large number of factors. Salmon probably are a keystone species in many habitats.

What about species assemblages – such as a suite of mammals or birds that was practical and measurable? Maintaining a functioning predator-prey system could be the measurable objective.

Participants identified six roles for focal species:

- surrogates for a suite of species or for landscape types;
- delineating the size and configuration of protected/conservation areas;
- monitoring or managing ecological health of the matrix;

- communication and marketing of conservation goals (flagship species);
- indicating or tracking climate change; and
- surrogates for processes representative of ecosystem function.

It was agreed that it might make sense to identify the suite of species that would fulfill all six roles. A matrix could be created that rated the six roles against various species to develop the best mix of focal species.

Participants brainstormed species that could address the goals of each of the six categories.

i. Flagship/Social Value Species[1]

- species at risk
- Caribou
- Moose
- large carnivores (caution re local attitudes toward wolves)
- harvestable species:
    - Chinook, coho, and sockeye salmon
    - Lake trout, bull trout
    - Arctic grayling
    - Northern pike
- raptors
- species of high spiritual value (ravens, wolves, swans)
- species on the Yukon "Advantage" species list (see Appendix 2)

It was suggested that refining the list of species could be done in consultation with local communities about the species of value to them. Alternatively it could be done on a Yukon-wide basis by focusing on what was missing from the list.

ii. Species that help define the size and configuration of high value conservation lands (perhaps protected areas)

- woodland caribou
- grizzly bear
- wolverine
- salmon
- lamprey
- inconnu
- transboundary species (e.g., migratory songbirds)
- gyrfalcon
- bald eagle

[1] This list could be split into separate lists for flagship species of significance beyond Yukon and for species harvested by local people.

A participant suggested that a subset of the above list is needed to capture species that live at a much smaller spatial scale; e.g., important nesting sites. Another participant noted that conservation goals require the protection of landscapes large enough to support evolutionarily-viable predator-prey interactions, fire regimes, etc. It was suggested that those large landscapes could be the starting place for building a conservation plan, with the six categories of focal species used to supplement delineation of the primary areas.

iii. Climate-sensitive species

- mule deer (subject to the limiting factor of increased snowfall)
- lake trout
- salmon
- selected Beringian species

It was noted that changes in land cover (e.g., increases in grasslands and shrubby species) would be important in tracking climate effects, and that this could be done from satellite imagery and aerial surveys.

Yolanda Wiersma had developed a list to illustrate the degree of uncertainty and variability associated with the selection of focal species. Completely different suites of species could be developed depending on the purpose for which the species were to be used; e.g., umbrella versus iterative reserve selection. Of that list, participants identified the following species as potentially sensitive to climate change:

- northern flying squirrel
- mule deer (also indicative of road density)
- western jumping mouse
- polar bear
- taiga vole (also indicator of Beringian habitat)
- slimy sculpin
- mountain goat

iv. Species that are easily monitored:

- vascular plants
- birds

It was agreed that the remaining lists should be developed outside of the workshop so that other topics could be covered. Jim Pojar offers this *postmortem* comment. Some workshop participants seemed reluctant to suggest focal species, to name names, preferring rather to discuss concepts and categories and roles of focal species. Was this dispacement activity? Was it because of lack of a common understanding of the topic, was it because of skepticism of the value of using focal species, or was it because of uncertainty about "focal for what"? Certainly there is an extensive literature on the topic but he assumed that participants were well versed in it, and that following the recommendations of the preceding workshop it was a given that the 2005 workshop would develop preliminary lists. But that desired outcome was only partially achieved. What we arrived at is a matrix approach with six functional roles (foci) against which species could be listed—and ultimately selected.

7. Representation

The Yukon Protected Areas Strategy used ecoregional representation as its primary stratification. However, there was no reasonably detailed ecological classification system to delimit fine scale boundaries. Essential ecological characteristics were used to define terrestrial ecoregions. Minimum reserve area and disturbance dynamics were reviewed to determine minimum areas. Criteria were selected to determine minimum viability for selected species. Those criteria are set out in a report called Natural Values Criteria for the Identification of Protected Areas in the Yukon, version 2.0. (2003) that had been distributed to participants.

That approach assessed representation ecoregionally, largely by using the following physical features and abiotic data sets:

- topography
- digital elevation models
- bedrock geology
- surficial geology/landforms
- glacial limits
- soil characteristics.

Jim Pojar noted that in the context of climate change "enduring features" (landform, soil) provide the only relatively stable indicator or proxy of ecosystems over the long term.

Discussion

A participant noted that within enduring features there is variability, such as in primary productivity, that would be missed by a strict enduring features approach. Within a reverse matrix context that simultaneously evaluates conservation and development areas, it is important to carefully plan for benchmark areas using criteria that go beyond enduring features. In an aquatic context, a pattern of lentic and lotic water bodies could be an enduring representative feature.

i. Watersheds

Hydrologic connectivity refers to the interconnection of ground waters and surface waters. Features of hydrological connectivity are:

- Key role of location in watershed and hydroscape
- Reserves vulnerable regardless of size and location
- Transboundary management strategies

Watersheds as reserves were discussed. Jim Pojar presented some work done by **Ken Lertzman** and others in British Columbia.

Watersheds are functional landscape units for many ecological and physical processes:

- hydrologic cycle
- nutrient cycling within and nutrient loss from ecosystems
- dispersal of organisms and their propagules
- soil forming processes
- mass wasting and erosion
- stream channel morphology and dynamics.

> Watersheds are logical, functional units of landscape that integrate ecosystem (terrestrial and aquatic) processes over time and space (O'Neill et al. 1986).

Proposed criteria for evaluating watersheds as reserves:

A) reserve content

1. ecosystem representation and diversity
2. species representation and diversity
3. size of reserve (strongly influences representation and diversity)

B) reserve context

4. location, shape
5. isolation/connectivity in surrounding landscape
6. trans-boundary processes – interactions between a reserve and its surroundings
7. regional and geographic setting (latitude, productivity, or maritime influence affect biota and processes within reserves)
8. scarcity/representation – gap analysis

C) emergent criteria

Arise from interactions among different components of a system that are not present in individual components. Emergent properties result from interactions between reserve content and context.

9. population viability – a consequence of the interaction between reserve content (size, landscape and species diversity) and reserve context (disturbance in the surrounding landscape, distance to nearest other habitat, presence of movement corridors among landscape elements)
10. ecological integrity
11. ecosystem processes.

These criteria can be used for any candidate protected area. Emergent criteria are satisfied well by watersheds as reserves, while ecological representation criteria are not met well.

Conclusions:

- reserving whole watersheds results in an opportunity cost of not preserving other areas
- there are no compelling arguments against using watersheds
- the strongest argument in favour of watersheds-as-reserves is that they represent functional ecosystems with the greatest likelihood of maintaining ecological integrity over the long term
- major undeveloped watersheds are regionally and globally significant conservation opportunities

Single Large versus Several Small is the real challenge: how to allocate conservation among reserves of varying sizes. *Fewer Larger and More Smaller* might be a realistic approach. It probably makes sense to focus on several very large, intact watersheds in the face of climate change.

Discussion
The trade-off issue is a real one in terms of weighing various options. Irreplaceability/vulnerability matrices have used elsewhere to develop a "conservation portfolio". High conservation value assigned to a single or rare occurrence of a species unduly influences the outcome of such comparisons. Irreplaceable units tend to rate highly; however, they might better be treated as special elements rather than the building blocks of a conservation design.

A participant suggested that a practical distinction between special features and representation is that special features are below the minimum spatial scale or resolution of mapping. Assessed from this perspective special elements are more like point data than representational features.

The work that already has been done under the Yukon Protected Areas Strategy is valuable for determining representation. It can be used as a baseline, to which can be added community values, climate change variability, and other indicators discussed above.

A participant noted that other jurisdictions have experience using vegetation communities as surrogates for biodiversity. A combination of vegetation types or communities coupled with enduring features might provide the best basis for representing landscapes in the Yukon, although the vegetation is changing as climate changes.

Watershed reserves could be extremely useful in studying the hydrology of the Yukon and how it responds to and reflects climate change.

Representation must go hand-in-hand with persistence over time. But remember that representation itself is not the goal; representation is a coarse-filter surrogate for biodiversity.

8. Conservation Area Design

Jennifer Morin described the Protected Areas Strategy (PAS) of the Northwest Territories. The NWT PAS had been launched six years previously. It was an outcome of the environmental challenges to the BHP diamond mine. It was a joint program of the federal and territorial governments and has a high degree of aboriginal community involvement. Representatives of all eight aboriginal regions, the two levels of government and two ENGOs (CPAWS and World Wildlife Fund [WWF]) sat on the strategy's advisory committee. The PAS process was community-driven. It had created a positive working relationship among ENGOs, aboriginal communities and the two levels of government. It had been very successful in identifying areas of cultural significance, less so with respect to ecologically significant areas.

CPAWS, WWF and Ducks Unlimited were working collaboratively to develop recommendations for protected areas within the landscape to be traversed by the Mackenzie Valley pipeline. Forty-two ecoregions have been identified in the NWT, 16 of which would be directly impacted by the pipeline. Both territorial and federal governments and the pipeline advisory committee had adopted the ENGOs' work plan for developing the protected areas network.

It is culturally difficult for ENGOs to bring conservation maps into aboriginal communities. Some aboriginal communities, e.g., the Inuvialuit, maintain that there are enough protected areas within their traditional territories. Nonetheless, the ENGOs are committed to putting ecologically significant sites on the table along with the culturally significant sites.

A report has been published that identifies factors that could be used to develop a conservation plan. Jennifer summarized the report's ten steps to conservation planning:

1. traditional land use & occupancy data and trails
2. areas of high conservation value as identified in government reports and surveys (e.g., studies of Environmentally Significant Areas)
3. critical habitats as identified in the Northern Land Use Information Series ranked by:
    a. abiotic factors according to their significance locally, regionally, nationally or internationally
    b. biotic factors according to the NWT or COSEWIC lists of species at risk
4. caribou data

Steps 2 to 4 were then combined in a map of important habitat and cultural sites.

5. a map of Normalized Differential Vegetation Index (NDVI) – a measure of biological productivity that identified ecological hotspots
6. a map of landscape unit heterogeneity (more landscape diversity = greater biological diversity)
7. the combined map of habitat and cultural values was given a 50% weighting, the map of NDVI was given a 40% weighting, and the

landscape unit heterogeneity map was weighted at 10%. These maps were combined to create a "conservation suitability" map. The traditional land use map created the connectivity between the areas of high conservation value.

8. the WWF representation analysis (based on enduring features) was applied to the resultant map
9. candidate areas were ranked for conservation suitability based on a measure of conservation value per square km
10. conservation suitability was compared to land and resource dispositions; e.g., existing oil and gas mineral rights.

The lapse of old mineral claims created a significant opportunity for conservation outcomes in the Slave mineral province. The report concluded that additional data on aboriginal traditional use and from caribou telemetry were needed. Areas documented as environmentally significant also needed to be field-tested and updated. A more complete literature review was required. An enhanced vegetation index at a meaningful scale would be helpful. A least cost overlay needed to be developed (i.e., greatest conservation value on the smallest land base.) Additional scientific expertise also was needed.

The forthcoming CAD work, commissioned by the territorial government, will probably be a 3-5 year, $1M project.

<u>Discussion</u>
Participants questioned how the proposed CAD would be implemented given the bottom up approach of the NWT PAS process. The intent is to present the CAD maps at the community level as information, to help inform community identification of culturally significant areas.

Participants agreed that the use of the term CAD was perhaps misleading in this context. It was more like conservation planning than a conventional computer-generated CAD.

There has been interest in extending the CADs done for the Taku watershed and Muskwa-Kechika into southern Yukon, under the umbrella of the Kaska Conservation Initiative. However, that interest has waned recently for a variety of reasons (cost, data requirements, opportunities elsewhere, and the need to account for climate change).

A participant noted that the Muskwa-Kechika CAD covers almost 13M ha (33M ac) including a large area for which there were few data. Using, housing and updating the CAD have become significant issues. Updating the CAD was complicated and difficult because the data layers do not build on each other. Updating one data layer does not ripple through the others; they must be updated manually. It is not a dynamic model. The Muskwa-Kechika advisory board also has funded a cumulative effects model. Determining how to pull multiple products at different scales together was proving to be extremely challenging.

9. Next Steps

CPAWS should continue to develop/spearhead a Yukon Conservation Strategy on a collaborative basis. The nature and scope of such collaboration are at this stage unclear, but presumably could involve Yukon Environment staff and databases, and other ENGOs (e.g., Yukon Conservation Society, Ducks Unlimited?). Content issues outstanding include dealing with focal species and implementing the reverse matrix. Process issues include how and when to engage First Nations, how to structure a collaborative team, and -interactions with regional planning processes. Substantive progress probably cannot be made without new focussed funding. As a first step, CPAWS could incorporate the thinking and approaches that emerged from this workshop into land use plans underway or emerging, e.g., southeast Yukon and Peel Watershed.

One of the most valuable outcomes of the Muskwa-Kechika CAD was a well-documented meta-database. This was a very important tool that was not dependent on a CAD. There is a lot of information about the Yukon that should be centralized and made accessible. This was seen as a government role by some participants. NatureServe was attempting to collect and organize at least some of these data. A conservation data centre is supposed to emerge, but data ownership is proving to be a barrier to this.

Much information (e.g., thermal regimes on streams in the Yukon) is being collected through the Yukon River Panel. This information needs a home that will make the data accessible.

Regional planning groups need such information. Some planning commissions have spent the duration of their mandates gathering data. The planning commissions are short term and there are no resources for maintaining or updating the plans.

The prospect of the Alaska Pipeline could create an opportunity for trade-offs with protected areas establishment, as is occurring in the NWT. Relationships with First Nations and industry could be developed to position CPAWS Yukon to play a major role in furthering the conservation agenda in a pipeline scenario. There could be a significant inflow of financial resources to the Territory. ENGOs need to plan for how additional funding could be used to advance conservation goals. An information gap analysis would be a useful tool. A threats analysis also could be very valuable for conservation planning. If needs were clearly identified, graduate students could be used to help fill gaps.

The group was thanked for their participation and the workshop was adjourned.

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Appendix 2 – Yukon "Advantage" Species*

Bird "advantage" species. These are species found in Yukon that are sought after by bird watchers. Many are common throughout the Yukon at certain times of the year.

Red-throated Loon
Pacific Loon
Horned Grebe
Red-necked Grebe
Trumpeter Swans
Tundra Swans
White-fronted Goose
Sandhill Crane
Harlequin Duck
Oldsquaw
Barrow's Goldeneye
American Golden-Plover
Hudsonian Godwit
Whimbrel
Wandering Tattler
Red-necked Phalarope
Surfbird
Arctic Tern
Golden Eagle
Northern Goshawk
Red-tailed "Harlan's" Hawk
Peregrine Falcon
Gyrfalcon
White-tailed Ptarmigan
Rock Ptarmigan
Willow Ptarmigan
Northern Hawk Owl
Boreal Owl
Three-toed Woodpecker
Black-backed Woodpecker
Boreal Chickadee
Varied Thrush
Gray-cheeked Thrush
Northern Wheatear
Bohemian Waxwing
Blackpoll Warbler
Brewers "Timberline" Sparrow
Golden-crowned Sparrow
Lapland Longspur
Snow Bunting
Common Redpoll
Hoary Redpoll

Western Advantage Species:

Blue Grouse
Great Grey Owl
Gray Jay
Mountain Chickadee
Mountain Bluebird
American Dipper
Townsend's Warbler
Gray-crowned Rosy Finch
Yellow-billed Loon
Brant
Snow Geese
Common Eider
Red Phalarope
Long-tailed Jaeger
Black Guillemot
Snowy Owl
Bluethroat
Yellow Wagtail
Smith's Longspur

Other Species of Interest

Common Loon
Osprey
White-winged Scoter
Surf Scoter
Sora
Lesser Yellowlegs
Spotted Sandpiper
Bald Eagle
Spruce Grouse
Ruffed Grouse
Great Horned Owl
Violet-green Swallow
Bank Swallow
Northern Shrike
Red Crossbill

White-winged Crossbill

Southeast Yukon Specialties

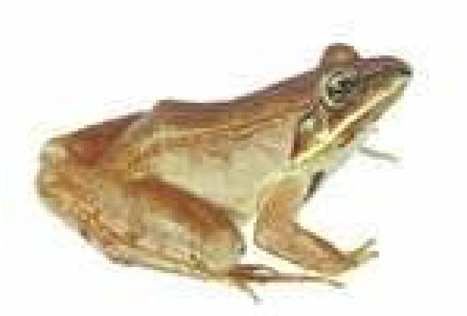
Pileated Woodpecker
Eastern Phoebe
Eastern Kingbird
Blue-headed Vireo
Marsh Wren
Cedar Waxwing
Magnolia Warbler
Cape May Warbler
Bay-breasted Warbler
Black-and-white Warbler
American Redstart
Ovenbird
Mourning Warbler
Canada Warbler
Western Tanager
Rose-breasted Grosbeak

Mammals

Collared Pika
Arctic Ground Squirrel
Grizzly
Lynx
Wolf
Caribou
Dall's Sheep
Fannin Sheep
Moose
Wood Bison
Mountain Goat
(Muskox)
(Bowhead Whale)
(Polar Bear)
Pine Marten

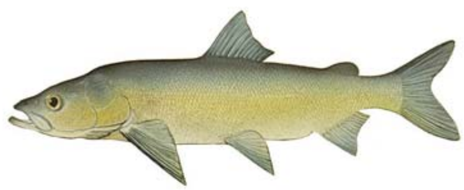
Amphibians

Wood Frog
(Northern Chorus Frog)
Boreal Toad
(Spotted Frog)



Fish

Inconnu
Chinook Salmon
Squanga Whitefish
Northern Pike
Arctic Grayling
Bull Trout



*Provided by Bruce Bennett, from his work with the Yukon Wildlife Viewing Program.

Appendix 3 – Conservation status and size of important wetlands in the Yukon. From Hayes, R.D. 2002. A strategy for conserving important wetlands in the Yukon, 2002-2007. Ducks Unlimited Yukon, Haines Junction, Yukon.

SITE #	NAME	STATUS	AREA (km²)
1	Coastal Plain	Ivvavik National Park	4593.0
2	Old Crow Flats North	Vuntut National Park	
	Old Crow Flats South	Special Management Area	4670.2
3	Bluefish Basin		493.5
4	Whitefish Lake Complex	Map Notation	1386.7
5	Tabor Lake		65.2
6	Jackfish Creek		444.4
7	Peel Plateau	Map Notation	1938.4
8	McQuesten Lake	Map Notation	71.2
9	Chappie Lake Complex	Map Notation	260.4
10	Horseshoe Slough	Habitat Protection Area (HPA)	48.4
11	Reid Lakes	Map Notation	74.9
12	Willow Creek	Map Notation	33.8
13	Lhutsaw Wetland	Special Management Area	69.7
14	Needlerock Complex	Map Notation	501.8
15	Upper Ross River	Map Notation	1088.0
16	Scottie Creek Flats	Possible Special Management Area[a]	261.3
17	Wellesley Lake	Possible Special Management Area[a]	1162.4
18	Wolf Lakes (Koidern Drainage)		26.9
19	Pickhandle Lakes	Possible Special Management Area[a]	46.0
20	Lake Creek Complex	Map Notation	12.7
21	Swede Johnson Wetland	Map Notation	38.9
22	Kluane Lake Outlet	Map Notation	6.6
23	Kloo and Sulphur Lakes	Map Notation	39.9
24	Dezadeash Lake Outlet and Floodplain	Map Notation	58.4
25	Lower Nordenskiold River	Special Management Area	63.9
26	Upper Nordenskiold River	Map Notation	46.7
27	Hutshi Lakes	Map Notation	15.3
28	Taye Lake	Map Notation	35.9
29	Lake Laberge Outlet	Map Notation	1.6
30	Shallow Bay, Big Slough, and Swan Lake	Map Notation	57.1
31	M'Clintock Bay and Lewes Marsh	HPA	49.9
32	Nares Lake	Map Notation	4.2
33	Tagish Narrows	Possible Special Management Area[a]	8.1
34	Chinook Creek	Map Notation	5.1
35	Little Atlin Lake (North End)	Map Notation	10.2
36	Little Atlin Lake Outlet	Map Notation	13.0
37	Teslin Lake Outlet	Map Notation	34.8
38	Morley Bay		21.3
39	Big Salmon, Sandy, and Quiet Lakes	Map Notation	118.0
40	Lower Nisutlin River and Delta	National Wildlife Area	358.7
41	Tuchitua East	Map Notation	70.7
42	Tuchitua West	Map Notation	77.6
43	Frances Lake (East Arm)	Map Notation	21.6

Appendix 3 (continued).

	NAME	STATUS	AREA (km²)
44	Frances Lake Outlet and Frances River	Map Notation	74.0
45	Twin Lakes		13.8
46	Lootz Lake	Map Notation	66.1
47	Siwash Creek	Map Notation	337.3
48	Toobally Lakes	Map Notation	145.0
49	Upper Whitefish River	Map Notation	128.1
50	Upper Crow River	Map Notation	84.4
51	Larsen Lake	Map Notation	20.9
52	Donjek River		10.4

[a] Areas currently under land claim negotiations as Special Management Areas.

Figure 1a. Location of significant wetlands in FN traditional territories in the northern Yukon.

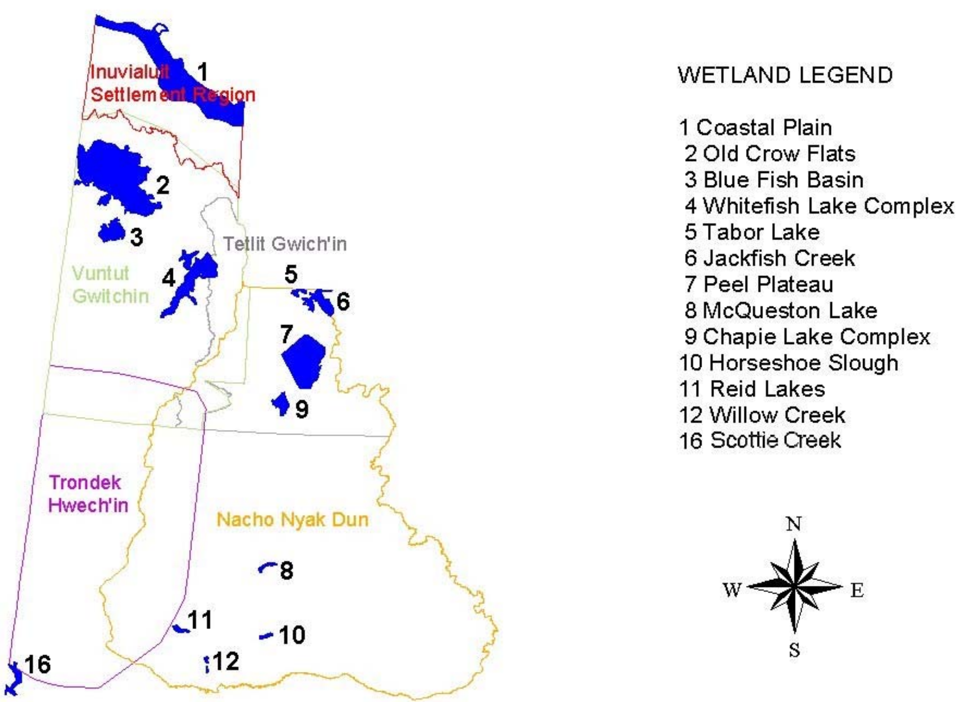
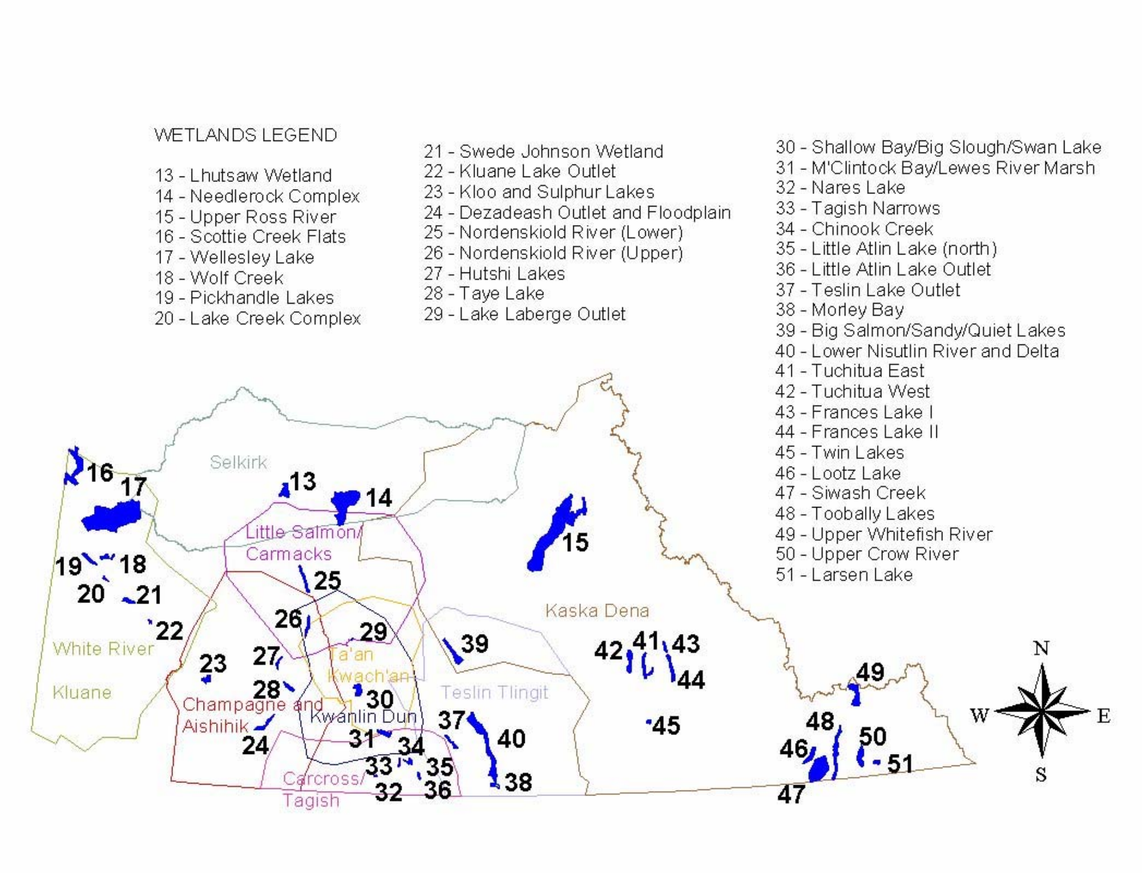


Fig. 1b. Location of significant wetlands in FN traditional territories in the southern Yukon.



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