

# Group 1

Report on break-out session 2

# Decision Support Tools

## “Wisdom meeting needs”

(both now & esp. in the future)

- What decisions should we focus on
  - 5 levers
- What kinds of tools do we therefore need
  - And what principles can guide us creating the tools?
  - Monitoring changes in distribution along with population (accessibility vs. availability)

# 5 levers

1. Industrial development
2. Harvesting
3. Species re/introductions
4. Changing subsistence resources
5. Optimizing research/ monitoring resources

# 7 Guiding Principles

1. Biology/ ecology isnt everything:
  - economics and social well-being!!
2. Hierarchy of decision making: different levels
  - Regional scales: Project-by-project in context
3. Scenario thinking:
  - “Memories of the future”
  - Make time frame of impacts explicit (2 years vs. 20 years)
4. Thinking in terms of risk: multiple options (low, med and high risk scenarios)
5. DST must include management action points: managers inside the system.
6. Need to identify thresholds
  - Eg body fat, calf weight >6kg, %harvesting rates etc

# An example – Lever 1 Industrial development

- Nunavut:
  - “inevitability” of industrial development
  - Mobile monitoring examples
- Different caribou scales
  - Individuals animals, vital stats., whole herd
  - Households, communities, region
  -

**CARMA 5<sup>TH</sup> ANNUAL MEETING**  
**DEC 3, 2008 - BREAKOUT SESSION 2 Group 1 notes**

**1. LIFE AFTER IPY**

- longish time frame – after March 2011

Bruno – little will chg for Bathurst – minimal funding now; minimal expected in future  
- by 2011, would like to see monitoring plans fully implemented at community level so can rely on this happening annually/seasonally at the community level

**2. DECISION SUPPORT TOOLS – “wisdom meeting needs” – now and future  
CARMA and Agencies/Co-mgmt Boards:**

Roy – in future, better surveillance tools/methods – more practical – ex; question of absence/location (distribution, possibly abundance?) of caribou would be easier to answer, will answer specific questions about numbers (i.e., for harvesting) – mentioned drone planes, satellite monitoring

Kathy – need list of all the thresholds we know affect caribou (ex: calf weight 6kg, pop levels [red, orange, green], body fat, # of degree days/insects, summer range/winter range, development activity disturbance)

- integrate ecological and socioeconomic effects

Roy – vegetation data NDVI – herders/mgrs may be able to use these data – range/food source monitoring – tree line advancing N ... can watch this over time

V Michailov – Russia, simplistic support system for end-users (ecologists, env’talist, mgmt boards) – developed for all of Russia – minimizes requirements for end-user – also, system is transparent (therefore instills trust) – decision system .... you enter the desired outcome and obtain input variables for that (i.e. decide whether to hire more workers vs buy tractor – i.e. what animals should be removed in order to maintain structure of herd (male/female/ages) for future) – Craig is working with Jan to develop something similar for Canadian herds based on different scenarios

Chris – climate chg is inevitable – what levers can we control (key words in decision support

i) industry/land use

ii) harvesting

(these are the main 2 issues the PCMB is looking at)

Jo J – managers appreciate having a few options to choose from depending on the community’s level of risk aversion (low risk, med risk, high risk) – also need to be able

to model and evaluate different management options (i.e. different feedbacks into your model)

Roy – **iii)** introducing/moving species (bison, moose, caribou) to areas with low/no numbers

Dorothy – **iv)** issues of caribou declines leading to communities switching from primarily caribou harvest to, for example, moose and sheep – regime shifts, meat sharing etc.)

**v)** identify research/monitoring needs

**vi)** do we know for each of these decisions which direction the arrows go? ex. development  $\leftarrow \rightarrow$  caribou (not one way for long-term sustainability)

Decisions are made at diff't levels (heirarchy), so DSS must work at this level

### **Development**

- NU – huge resistance to excluding devt from calving grounds – therefore decision levers related to mobile monitors

### **Project by Project**

**\*\*Need to do this at regional scale (decision-making framework)**

- science matters but it isn't everything – BQCMB did assessment of economic utility of herd – consider life of mine (20 yrs) vs life of caribou as a whole

- identify other conservation partners (and research partners doing other work in the area that might provide info) to devp/increase political muscle

- dev doesn't have to be year round

- make time frame clear and explicit for when effects will be seen – next 2 yrs? 15 yrs?

- two metrics 1) distribution/availability; 2) abundance

Group 2 - Afternoon

CARMA - Future



# How to Frame a Proposal for CARMA funding

- Cumulative Effects Assessment of landscape change on caribou:
  - No need to start from zero!
  - Include Climate change effects
  - Industry/development in the North
  - Increased access brings more people, more activity, more harvest
  - Movement north of other species (and pathogens)
- **Cumulative Effects Assessment Manual**
  - **Strategic level scenarios to model cumulative effects of changes in the caribou's environment**

# The Triggers

- Roads
- Resource development (mines, haul roads)
- Alien species northward – bison, deer, potentially new diseases, predators
- Fallout from climate change (e.g. implications from lack of sea ice)
- Climate change scenarios - wetter conditions – eg. 60% more snow on north slope

# The Potential Impacts

- Barriers to free range including migration corridors - fragmentation
- Conversion of habitat
- Fallout effects on vegetation (dust)
- Displacement due to disturbance (Zone of Influence)
- Deeper snow, icing of sno

# Decision Support Needs

- Inform land use and resource management at broad landscape scale and longer term time frame.
- Environmental Assessment Review Process – give means of assessing the trade-offs, consider multiple developments over long time scale ie. assess using a cumulative effects framework
- Wildlife Management Boards need information to make sound recommendations through the Environmental Assessment Review Process
- CARMA could provide leadership on Cumulative Effects
- Tools that can be used across herds

# The tool

- Coarse Scale - Another Manual /guidelines for doing cumulative effects assessment
  - Time frame and geographic scale (caribou may shift their range use over period of 40-50 years)
  - What data is needed
  - Project different development scenarios
  - Risk management – what is probability of risk increasing
- Fine scale - Best Practices: use at appropriate time frame and level/extent of development activity



## [2] WHAT DECISIONS, WHAT SUPPORT TOOLS?

"Wisdom meeting needs"

now AND esp

tomorrow

Roy: if we have better surveillance methods in 10 yrs  
(eg drones)

caribou accessibility/availability  
(not nec pop decline  $\rightarrow$  distrib).

Monitoring distribution (sustainable)

Kathy: list of thresholds we know

- calf wt 6 kg.
- pop levels (red/orange/green)
- body fat
- # deer days / insects.
- summer range / winter range.
- development activity / disturb.

integrate ecol thresh  
& soc-economics

[1]

Roy: using existing data to help herders.  
get reindeer to good habitat  
advancing treeline: projections  
10 yrs, 20 yrs in future.

Russian DSS  $\rightarrow$  development  
oriented for end user  
(environ, economists, mgmt boards)  
minimize req. for end user. (non-math users)  
transparent.

Soviet era:

Farming examples

buy tractor vs hire new people

Potato farming  
Lake Nitrogen / pollution.

Extent of hunting (Taimyr)  
to maintain pop'n level/structure  
How many males / females

Chris: key w

① Indu

② Har

③ clim  
of

PCMB  
two

Needs -  
risk  
opt

DSS m  
of m  
(fe

[2]



Chris: key word in DSS = DECISION.

① Industrial dev

② Harvesting

- HICES: integrate trade offs - global

③ climate decision is mostly out of our hands]. exactly

PCMB focusing on just these two issues.

Needs to be done in terms of risk. Best if it has multiple options (low risk, med risk, hi risk)

DSS must include effects of management actions themselves (feedbacks).

Goal: by 2011 we have comm. monitoring fully implemented:

- 2 x /yr condition survey  
- harvest monitoring.

③ Ray: moving/introducing species. (bison, moose, caribou)

④ Communities switching from primarily caribou harvest to (eg) moose, sheep etc. (regime shifts, meat sharing...etc)

Scenarios ...



OPTIMIZING RES/MON 5  
<sup>resources</sup>  
ID research / monit.  
needs

X Do we know for each of these decisions which direction the arrows go?

eg DEV → CARIBOU (one way)  
BUT <sup>can</sup> POP → HARV  
↔  
both ways.

to keep caribou  
in perpetuity (ever  
next 2 generations)  
might need to forego  
some dev.

6 Decns are made at  
different levels;  
(HIERARCHY),  
so DSS must work at these  
various levels.

DEVELOPMENT.

- Nunavut: huge resistance to excluding dev from  
CG  
∴ decn levers relate to mobile  
monitors,

Project-by-project.

NEED to do this at regional  
scale (decn-making framework)

Science matters, but isn't  
everything [BGCMB did econ  
util of herd... mine = 20 yrs



6

t these

cluding dev from  
mobile

regional  
frameworks)

t isn't

& did econ

d... time = 20 yrs

7

ID other conservation  
partners to develop/increase  
political muscle.  
(& other researchers, eg NARA = Tesh +  
bird spp.)

Dev doesn't have to be year round

Make the time frame clear &  
explicit for when effects  
will be seen. Next 2 yrs? 15 yrs?

Two metrics  
distribution / availabil.  
m1 abundance.

Dev can help pay for  
mobile monitoring



## Decision Support Tools

Organize knowledge & information  
to inform decision making

What  
~~Who~~ are the decision makers:

- 1) harvest
- 2) land use - resource dev.
- 3) consumption
- 4) policy (reg. + spp. introduction)

Where  
- local, regional, international

- Who
- regulatory boards
  - policy makers
  - hunters? → influence operations
  - industry
  - Russia - central vs. regional
  - indigenous participation

## Pathogen Risk Index

## Operational Planning Tool

long-term temporal scale  
↳ seasonal patterns of location/movement to avoid

short-term guidelines/mitigation

real-time location of animals  
avoidance day-to-day.

↳ careful short-term locations open to abuse - not done in Russia  
- removed for PCH

Analysis of Effects of Development  
project = predict effect of losing habitat (possible)

not easy to do (unlike harvest calculator)

habitat use predictions → RSF

Regulatory Boards - request:  
con. ratios



## Pathogen Risk Index

- predict infection levels in a herd based on climate, density, previous infection levels etc.

### \* look up re: consumption

- predict stress on herd.  
eg. climate → insect harassment
- influence harvest decisions?
- direct surveys / sampling
- long-term project (beyond CARMA?)

## Harvest Decision Support

- \* predict subsistence harvest needs  
↳ Fr (community demographics)

- \* predict carrying capacity?

- \* generic harvest calculator  
- web based?

- custom ~~ing~~ tailored to agencies
- interactive → customize for different areas
- can it be done ~~so~~ for all?
- Russia - post harvest census
- \$/animal

## Regulatory Boards request:

- Pop<sup>n</sup> size
- Trend (+/-)
- Productivity
- Sex Ratios
- Harvest Levels
- Mortality
- Harvest decisions

## Industry/Policy Makers

- Habitat use - <sup>specific habitat</sup> calling grounds
  - Migration patterns/areas
  - Conflicting use of areas
- fidelity of herds*

### Introduction of animals:

- pathogens in <sup>pop<sup>n</sup></sup> ~~in~~ resident & Translocated
  - what are risks? how to mitigate?
  - booklets to hunters → Russia
- Commercial use / movement across borders
- pathogen analysis



**3 Dec, 2008**

**Group 3 – Breakout Session #1, Wed Afternoon, Ryan Brook facilitator**

**1. Decision Making Tools**

- Wildlife managers, Co-management boards need these tools, especially need information on cumulative effects
  - E.g., Ongoing project: RSF models + Energetics models + ALCES for Bathurst Summer Range – a pilot project with the intention of expanding the integrated model(s) to other ranges
    - Outfitter locations, mining operations, NDBI, land cover classifications
    - Output: is the herd going to increase or decrease
- Mitch: comments re making “educated guesses” for models, ie the assumptions; there are problems with how to defend the estimates because industry can take estimates to task.
- So the tools that are needed immediately, very specific point-blank quantitative measurements of changes in behaviour that cannot be refuted
  - what happens to caribou when helicopter flies over at 500ft?
  - how long does it take before the caribou go back to feeding
  - these sorts of data will ultimately go into models, but it’s the sort of very specific (e.g., herd-specific), recent, information that the wildlife managers need

- need for information sharing, perhaps lumped by issue/topic
  - o key literature, annotated bibliography e.g. roads
    - best/key resources a put forward by experts in particular areas – managers don't
    - deernet.com (deernet.org?)
    - procite database Lakehead University – all on caribou
    - grad students doing lit searches for degree – is there is a way encourage and formalize and (reward) for the information being made widely available
      - making digital copies available and/or links to journals
- in order to make information available to multiple audiences, CARMA website with information available for all sorts of users, e.g., interest expressed in grade school children in communities being able to do their own research on things like “roads” – where are they, where are they planned, what is known about their impacts
  - o template for this idea – ALVIN (find the titanic, Mississippi drainages, Discovery Channel with analogous projects, museums)
- modeling exercises can help prioritize the specific pieces of information that are needed to deal with immediate issues
  - o model = a deliverable of value to co-management boards and others, but so too are the very specific pieces of information
  - o “strategic” **immediate** research needs that are required to deal with industry related activities that can't necessarily wait until the entire cumulative effects model(s) is complete and ready for wider use.

- Communications is necessary for the limitations of models as “tools” – do the people using the tools /impacted by the tools understand.
  - This learning process can highlight the value of the PROCESS of building the models. It’s not just the output.
- Tools that involve map outputs are useful for generating discussion, input, understanding, including with the community members on the land
- Returned to discussions in the morning concerning the need for multiple types of output/ reports for different endusers
  - Community vs technical reports
- The value of digital forms of maps, shape files etc widely acknowledged
- So, are these maps tools for decision making, per se, vs encouraging discussion?
  - Maps with “error bars”
    - different versions of maps for a range of values for variables

- Better decision making tool support = products that involve things that helpful to co-management boards ... this involves translating research output into information that is accessible by different audiences
  - Visual representation is one way to take tables and charts and funnel it/refine it into a readily interpretable product.
  - Data repositories that co-management groups, especially their respective biologists, can access and then explore the different implications of one decision vs another. And then, how to convey that information to board members.
  - But not all co-management groups have the same level of capacities
  
- Also, every jurisdiction, every industry rep, every group has a different interpretation. Are there some things that everyone can agree upon?
  - E.g., National Research Council in the USA – independent assessment of the factors involved in wolf control in Alaska
  - Wildlife Society White Papers: experts that write an independent paper, members vote on it, then it's put forward as an expert opinion on a topic.
  
- Concerns expressed about the involvement harvesters/hunters in things like Wildlife Society Papers because it may be interpreted by communities that it's just one more panel of experts imposing their opinions on us
  
- Also, this could be quite political
  - General feeling: CARMA just provides the information:
    - take the attitude of informing multiple audiences, rather than trying to sway opinion.

- E.g., if harvesting is X, then scenario 1 is most likely to happen whereas if harvesting is at Y, then scenario 2 is most likely.
- Co-management boards strive to incorporate both TEK and research science. And it's okay that they may be "separate stream" but when decisions are made, information pulled in from both streams.
  - discussion about how localized TEK may be and what is the most useful way to make good decisions
  - also importance of incorporating local community experts in the science – encourage understanding, but also improves usefulness of the science
- concerns about mis-use of some tools – setting harvest limits using models that were designed for other purposes, or that have assumptions built into them that haven't been tested/verified.
- Return to discussion of the need to make sure that users recognize that things are TOOLS, not magic balls, nor should they be the only tools used.
  - Need everyone to have reasonable expectations of what the tools can do.
  - Further, tools might not give end-users the results they WANT.
- There can be important social impacts of the outputs of some models:
  - e.g. suicide rate among farmers after Foot-and-mouth modeling indicated outcomes for necessary culling etc.

s



## **AFTERNOON SESSION – Version 1 Recorded by Christine**

---

### **Decision support Tools**

- 1) Organize knowledge and information to inform decision-making.
- 2) Where are decisions being made? Are we talking locally, regional, national or global / international?
- 3) What are the decision to be made
  - Harvest
  - Land use – Resource development
  - Consumption
  - Policy
- 4) Who are the decision makers?
  - Regulatory boards (bag limits, seasons)
  - Policy makers (politicians)
  - Hunters
- 5) Regulatory boards want to know:
  - Abundance (how many are there)
  - Sex ratios in population
  - Trends (increasing or decreasing) in population(s)
  - Harvests
  - Mortality / Survival
  - Productivity
- 6) Policy makers want to know:
  - Critical habitat (e.g., calving grounds)
  - Migration patterns
  - Where we can put or NOT put development
  - How to make a development “fit” into the habitat / migration needs of caribou
  - What are conflicting uses going on in the area, e.g., hunters use of an area versus proposed industrial development.
  - Translocation or re-introduction of animals into an area, i.e., what sort of pathogen risks are present if you want semi-domestic reindeer, sheep, cattle or horses introduced / re-introduced into a wildlife area.
  - How to mitigate risks of translocation / re-location
  - Commercial use – transportation across national borders for pathogen analysis may be prohibited, e.g., hoof-&-mouth disease.
- 7) Hunters want to know?
  - Can I eat it? (disease or parasites present)
  - Booklets to hunters (Russia)

### *CARMA Pathogen Risk Index*

Predict infection levels in a herd based on climate, density, previous infection levels, and habitat:

- Could provide a “heads-up” for consumers / hunters.
- Could predict stress on a herd, e.g., climate affecting insect harassment.
- Use index to influence harvest decisions? After “ground-truthing” the index predictions by for example direct surveys/sampling before major

harvest decisions/changes implemented. This portion would be a long-term project and possibly/probably beyond CARMA.

- Put into the "Harvest Calculator".

***HIGH PRIORITY – could be done now and successful***

*Harvest Decision Support*

Predict subsistence harvest (what are the needs of the communities – need community demographics).

Predict Carrying Capacity

A "Harvest Calculator"

- Web based?
- Fine tuned to agencies
- Interactive so as to customize for different areas
- Can there be a basic calculator that could be solution / start point for all?
- If there was a Pathogen Risk Index, then incorporate this into the calculator.
- Russia – They do population census after the harvest. Russians also check out how much money \$ income comes from commercial sale of animals to work out how many animals removed during harvest.

Policy makers need to be made aware that Land USE Decisions cannot be made lightly, because the consequences stay around for DECADES. In contrast harvest decisions can be changed from day-to-day. Also cumulative effects of Land Use decisions can have wide ranging effects.

***HIGH PRIORITY– most labour needed but VERY important***

*Analysis of Effects of Development*

Be able to predict / project possible effect of losing habitat to for example development.

Not easy to do an analysis of effects (as opposed to the harvest calculator).

Habitat use prediction – RSF (Resource Selection Function) could be a support tool to assist the analysis of effects of development

*Operational Planning Tool*

Long-term temporal scale to give seasonal patterns of locations or movement to avoid industrial development

**Versus**

Short-term real-time location of the animals

- Avoidance day-to-day
- Must be careful putting short-term animal locations on the net, as it becomes open to abuse by poachers, hunters etc.... because of abuse the Russian will not put satellite collar info out on the net and the Porcupine herd has removed this data from the web.

**AFTERNOON SESSION – Version 2 Recorded by Tara**

- Organize knowledge and information to inform decision making.
- What types of decision makers exist?
  - i. Those responsible for setting harvest levels
  - ii. Those responsible for managing land use → resource development
  - iii. Consumption Matters
  - iv. Policy Matters
- Who are we looking to support when making decisions?
  - i. Regulatory Boards
  - ii. Policy Makers
  - iii. Hunters?
  - iv. Industry (influence operations)
  - v. Russia
    - 1. central vs. regional
    - 2. indigenous participation
- Where are we looking when making decisions?
  - i. Local, regional, and international levels
- Regulatory Boards
  - i. People often want to know about:
    - 1. Population sizes
    - 2. Trends in population sizes
    - 3. Sex Ratios
    - 4. Harvest-levels
    - 5. Mortality
    - 6. Productivity
    - 7. Harvest decisions (how many animals are needed for the subsistence harvest; more on this below)
- Industry/Policy Makers
  - i. People often want to know about:
    - 1. Habitat use – critical habitats, such as calving grounds
    - 2. Migration areas & patterns of movement
    - 3. Conflicting use of areas
    - 4. Effects of a particular development
    - 5. Cumulative effects
    - 6. Fidelity to lands
- Introduction of Animals
  - i. People often want to know about:

1. Pathogen(s) in both resident population & translocated population
  2. What are the risks of transmission?
  3. How can we mitigate the risks?
  4. Booklets to hunters → Russia
- Commercial Use/Movement of Animals across Borders
    - i. Need to be able to conduct a pathogen analysis to assess risks listed above
    - ii. “Pathogen Risk Index/Indicator”
      1. Could use this to predict infection levels in a herd (age class, structure, etc.) based on climate, density, previously measured infection levels, habitat, etc.
      2. With zoonotic diseases, could protect people that consume the animals
      3. Could help us understand how the pathogens in a particular year might influence/stress a herd → insect harassment
      4. Could use this to manage harvest levels (tags of age class likely to be infected could be increased during the high-risk year)
      5. Could conduct direct surveys/sampling
      6. This data is not available yet, but would be a future project that needs to be ground-truthed (a long-term project for CARMA)
  - Harvest Decision Support (what is important to know?)
    - i. Predict subsistence harvest needs (community demographics)
    - ii. **Generate a generic harvest calculator:**
      1. Calculating harvest levels could be web-based, where blanks are present for the parameters to be inserted
      2. Caution that formulas for parameters should be customized for a particular agency; perhaps we could make the customization process interactive
      3. Is it possible to create a generic, yet customized, calculator...generic in its theory, but capable of being customized on a herd basis?
    - iii. What is the carrying capacity of the range?
    - iv. Russia
      1. Post-harvest census
      2. \$/animal
  - Operational Planning Tool
    - i. Guidelines for operations:
      1. Long-term temporal scale
        - a. Seasonal patterns of location; movements to avoid
      2. Short-term scale

- a. Real-time location of collared animals
- b. Avoidance day-to-day
- c. Caution that short-term locations of collared animals might be subject to abuse by poachers in areas with open access (the reason that real-time collar location maps are not available in Russia; maps also were removed for the Porcupine Caribou Herd)

- Analysis of Effects of Development

- i. Project effects of losing certain habitat(s) to development (a complex task when compared to the harvest calculator)
- ii. Habitat use maps based on resource selection functions (poor versus good habitats)