

NPS Comments to PI Team—5/8/2007

(Reber, Connor, Wilson, Britten, Schweiger, Albright)

Key: ROMN= Rocky Mountain Vital Signs Monitoring Network

Responses in red below after discussion with Jeff Albright 5/22/07

Questions:

1. I&M (Billy/Brent/Dan/Mike)
 - a. do you have digitized aerial photos for ROMO?
 - b. Get WBD for NPS, other ways to delineate watersheds (Billy)
 - c. Get NHD modifications to ROMO, NWI, veg map (Brent)
 - d. what level of wetland/riparian area classification... intermediary to I&M field work, but at watershed scale
 - e. who is Baker (USGS) regarding data on beaver in mountain systems
2. Kalkhan
 - a. regarding fuel model.
3. Nate Williamson
 - a. Contact Nate for BAER assessments, possible fire perimeter data.
4. Jeff Connor
 - a. Seral state/range of historic variability information
 - b. Invasive aquatic biota distribution data to map them, including distribution of chytrid fungus
5. Larry Gamble
 - a. Adjacent land use
 - b. Ranger logs of parking space, transportation (bus) loads?
6. Mary Kay Watry [Mary Kay Watry; 586-1285](#)
 - a. Fish distribution data? Whirling disease and mud snail distributions?
 - b. Are there “natural” physical breaks in the distribution for different species? Could/should this be mapped to modify distributions?
7. Ellen Porter
 - a. Air quality data/maps
8. Kelly Burns (USFS)
 - a. Maps of blister rust in limber pines, time series maps?
9. Forest Service
 - a. Vegetation type and seral stage for SRE
10. CSFS
 - a. budding mistletoe issue on north boundary of FLFO
11. Cooper
 - a. Talked with Katie regarding wetland classification. Done for 20 of 120 watersheds, used heads-up digitizing from stereopairs – did not digitize aerial photos. Would be useful to use Cooper’s fens/wet meadows/riparian classification.

Preliminary selected indicators for ROMO/FLFO

I. Landscape condition

Vegetation composition, structure & soils (about biotic condition)

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Ecological systems types: extent and proportion of major ecosystem types (dominance, evenness, etc.)	Vegetation. Soils: SSURGO; 10 m DEMs; aerial photos; wetlands? RNA plots; Fuel treatment	Veg: Landfire existing veg types; or SW ReGap (30 m); or NLCD 2001 (30 m). Soils: SSURGO, STATSGO; DEMs 10/30 m	Grain: 30 m Aggregate to sub-watersheds within Park boundaries; secondary domain SRE	Potential riparian zones, wetlands/fens Major aquatic types (a la TNC freshwater)	Construct potential natural vegetation from abiotic factors (topography, soils); Experts: T. Veblen, M. Kaufmann, B. Romme, B. Baker, D. Cooper, Dan Binkley	Are RNAs useful for reference condition?	Decide on major ecosystem types; Maps of wetlands/riparian areas? Can park vegetation be reliably cross-walked to Use Landfire or NLCD data?

Comments on above measure:

General- this is an important measure

- 1) Are you planning to acquire more photos or use what park already has? (ROMO contact to get photos=Ron Thomas; 586-1292). ROMN bought a backup set of air photos used to develop NPS veg map (Cooper currently has). **No, not planning on acquiring more photos, will coordinate with Cooper and Thomas.**
- 2) Wetland classif/mapping project underway (for some wetland types) in 1/5th of ROMO. Planning to use that, or to extend same mapping exercise to more of park? **Would use the classification and wetland maps developed by Cooper/Katie, but since these are for only part, we would need to build on NPS veg map complemented by topographic position indices derived from 10 m DEM. Could then use aerial photos to concentrate on riparian zones to complement NWI to provide more information about evidence of beaver habitat, etc. Also, potentially cross walk to Cowardin classification. Contact Chris Lea (Denver NPS 303.969.2807) for more information on veg map.**
- 3) FLFO is very interested in getting wetland classif/mapping info from project, if possible.
- 4) For ROMO, already have a cross-walk from veg map to Natureserve ecol. systems classif.- should use that (contact=Billy). Project could do same cross-walk for FLFO? **Yes, we intend to cross-walk veg map of Natureserve ecological systems classification – also it would be interesting to cross-walk Landfire and NLCD veg types to know how well they agree/disagree.**
- 5) How to deal w/scale differences (veg map vs. SSURGO)?
- 6) How to construct reference condition (gradient of conds)? Planning to use Sowa/Diamond approach w/ SSURGO abiotic factors? **Yes, we plan to develop a reference condition/gradient with SSURGO and abiotic (physiographic) features.**
- 7) In addition to ROMO RNA's, a few sentinel reference sites exist for wetlands (Cooper). RNAs should be good reference areas (no designated trails or overnight camping allowed, good conds relative to invasives and wildlife), but not much data for them right now other than veg map, remote sensing, anecdotal info. Some research data for Big Meadows. Can project help answer general question: How good are the 3 RNAs as reference areas (can make future research recommendations here?) **Yes, we plan on comparing RNA vs. rest of park – what are resources and conditions on them? Contact Judy Viste/Jeff Connor for data for RNAs.**
- 8) Dan Binkley at CSU is a good contact on ecological systems.

Extent and proportion of ecosystem structure/seral stages	Vegetation; fuel treatments; Fire	USFS Common veg unit; FIA Beetle kill Forest fire	Grain 30 m; Domain w/Park; secondary	Model old growth forest in ecoregion based on	Compare to late 1800s Experts: T. Veblen, M. Kaufmann, B.	Where are forest fuels? What watersheds are most susceptible to	Are seral stages available for RMNP???
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	perimeters	perimeters Forest treatments?	domain SRE	accessibility?	Romme, B. Baker, D. Cooper	beetle kill/fire/erosion cycle?	
<p>Comments for above measure: General – fills an important hole since ROMN is not addressing this 1) Mohammed Kalkhan (sp?) at CSU has or is doing some fuel modeling with the ROMO veg map data (possible NPS contact=Karl Brown;225-3591). Thanks, will check with Kalkhan fuel modeling. 2) Landfire generates some modeling layers of interest for this measure? We will cross-walk/compare to Landfire fuel loading datasets 3) Nate Williamson at ROMO (586-1434) worked w/others to take fuels data from veg mapping program, cross-walk it into appropriate fuel models and then did some model runs. Check with Nate for info on that. Thanks, will do, also will ask about fire perimeter data, historical patterns, also possibly Cara Paintner 970.267.2121 4) Park has good seral stage/historic range of natural variability info (contact=Jeff Connor)</p>							
Landscape dynamics (broader landscape changes)							
<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital Signs</i>	<i>Questions</i>
Degree of land use changes (housing density, impervious surface)	Zones; Park boundary	Zoning & master plans from nearby counties/cities	Parcel level; primary around park	Build-out analysis for adjacent areas? Model highly visible adjacent lands?	Historical trends: 1950 to 2000, 2050?	Have/will general ecotone change w/climate change? Effect of WUI – related treatments on other park resources?	How to define ecological boundaries around park
Housing density change (number of housing units)	None	SERGoM housing density 100 m	1 ha resolution; primary around Park; secondary SRE	SERGoM	Historical trends (1950 to 2000)	What outside land uses will influence park management? What land use will affect viewsheds?	
<p>Comments for above 2 measures: 1) To see what park already has, and confirm usefulness to park, contact ROMO planner Larry Gamble(586-1320), who wasn't available to review this yet. Ron Thomas at ROMO also is a reference to see what park already has. Thanks, will coordinate with Larry about data and approach. 2) FLFO is very interested in these two. For one example, development may break wildlife corridor that exists between park and Mueller State Park to the east. Good, we intend to do parcel-level build-out (using zoning) and historical aerial photos (that we've digitized). 3) What is the 'greater park ecosystem' or buffer and how will modeling be done? Good question – we will be working on this (and part of NASA-NPS project as well).</p>							
Landscape connectivity			Domain Park, SRE, westwide	Forest carnivore (target species: bighorn		How are changes in habitat and connectivity related to bighorn sheep?	

				summer to winter use areas, puma, lynx, wolves)		Possible introduction of wolves? Role of park for Lynx? See Judy Viste's comments	
<p>1) Not sure if this should be high priority for project (ie., analyzing larger regional corridor for wolf migration), though down the road it could be if the park is working on partnership with USFS on how we manage "connected areas". At park scale, connectivity for elk, bighorn sheep, lynx would be very helpful.</p> <p>2) how will connectivity be measured?</p>							

II. Biotic condition

Freshwater & wetland communities (at watershed scale)

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Extent of major stream and wetland types	National Hydrography Data 1:24k	National Hydrography Data 1:24k	Grain 10 m; primary Park; secondary SRE	Find reach catchment areas; Generate channel type	Experts: K. Fausch, L. Poff, D. Cooper	Relationship of threats to condition	Settle on wetland classification
Connectivity/isolation of freshwater system types	National Hydrography Data 1:24k; Diversions, culverts	National Hydrography Data 1:24k; Diversions, culverts	Grain 10 m; primary Park; secondary SRE	Threats such as road, crossings,	Experts: K. Fausch, L. Poff, D. Cooper	Relationship of threats to condition	

Comments for above 2 measures:

1) ROMN has modified NHD coverages (editing plus addl. Attributes)- get this data from them (ROMN contact=Brent Frakes;267-2156).

2) What method used to delineate catchments- ROMN has some ideas (contact=Billy Schweiger)). Plan to base this on FLoWS approach (NHD 1:24K, 10 m DEM) but will also coordinate with Billy.

3) Whirling disease and mud snails are two condition threats of interest to ROMO. Will compile and display distribution of these – but not model threat or modeled distribution.

4) Park has a lot of fish distribution data (ROMO contacts=Mary Kay Watry; 586-1285- or could also talk to Larry Gamble or Ron Thomas). Question for ROMO staff: are physical stream breaks a notable factor in ROMO streams and does the park have location data for those breaks?

Beaver habitat (dams, suitability model)

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital Signs</i>	<i>Questions</i>
Extent of suitable habitat for beavers	National Hydrography Data 1:24k ?historical	National Hydrography Data 1:24k; Colorado	Grain: 10 m; primary Park; secondary SRE	Predictive model of suitable habitat for beaver;	Historical numbers of beaver? Experts?	How many beaver could RMNP support? Where would their habitat	? how large of a patch is needed?

	survey of beaver dams? Historical aerial photo interp of dams	Riparian Vegetation dataset; NWI		water <8 ha; streams <15%; riparian veg <200 m		be and importance for elk/willow dynamics.	
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Comments for above measure:

General – this is a very good measure w/lot of available data. A beaver habitat model would be very helpful to ROMN protocol development

1) FLFO has very limited beaver habitat, but had them in the park until recent years. Can this project provide any insight about likely reasons for their disappearance? **Not really... will look to see if some trend in beaver dams in historical aerial photos.**

2) Good sources of data include Baker (USGS) and Cherie Westbrook (Cooper's student) dissertation on beaver as hydrological/ecological drivers in mountain systems (Colorado River). ROMN has some of this data (contact=Billy Schweiger)

Invasive terrestrial plants

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital Signs</i>	<i>Questions</i>
Extent of invasive plants	NIIS (Stohlgren's group)		primary Park; secondary SRE				

Comments for above measure:

1) Use of NIIS sounds good. Park has 20 yrs of good data (contact=Jeff Connor, Ron Thomas). Park currently estimates 10,000 acres at high-risk, trying to contain problem to that area- protect the RNAs and "cross country zones".

2) FLFO very interested in this measure too.

Invasive aquatic biota

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital Signs</i>	<i>Questions</i>
Extent and proportion of non-native fish		DOW & USFS occurrence data	1:100K, 1:24k		Experts: Fausch, Poff		Data on culverts, diversions, dams?

Comments for above measure:

1) Park has good data on this (contact=?; Check w/Jeff Connor). **We will investigate data sources for mapping distribution of chytrid fungus (see Mary Kay's comment)**

III. Chemical and physical characteristics

Water chemistry

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Condition of alpine lakes	Water quality parameters of headwater lakes in each	Water quality parameters from headwater lakes (EPA, FS,	Individual lakes could be mapped at	DayCent-Chem for detailed modeling, or	Constructed from distribution of regional high elevation lake	Water chemistry, invasive aquatic species, aquatic biota: benthos and	Sampling frequency, how do RMNP lakes compare with other southern Rocky Mountain lakes?

	basin (major ions, pH, ANC, DOC)	USGS, States data sets – major ions, pH, ANC, DOC)	subwatershed; primary park, secondary SRE	simple ratios: DIN:TP or Henricksen's nomogram	chemistry: lowest quartile of measured nitrate concentrations for eutrophication; reference ANC based on parent material	algae, freshwater communities	
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Comments for above measure:

General – this is a good one to work on. ROMN has identified this as vital sign but won't be able to address it for some time

1) Caution from Billy: be careful with use of site level data and its inference

2) Any comparable treatments of streams within DayCentChem?

3) ROMO likes the “how do we compare with other southern rocky mtn lakes” question

4) FLFO is interested in water quality conditions/threats re: near park development (septic systems, sediment/nutrient pulses into park during storm events) **Note: we can address this from the build-out data collected in the landscape dynamics indicator.**

Atmospheric deposition and air quality

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Wet and dry atmospheric deposition, including mercury	CO98, 98CO, CO19 NADP sites, CASTNET	NADP regional isopleth maps (produced annually), or finer resolution maps produced by us using regional concentrations and PRISM	30 m best because of topographic complexity; primary park, secondary SRE		Constructed from literature, remote areas of world, and hindcasting	Wet and dry deposition	What are trends in deposition of pollutants to park?

Comments for above measure:

1) Already have access to NPS data and models? (NPS contact=Ellen Porter; 303-969-2617). For example, the NPS models take existing point data and draw inferences on broader area conditions for class II areas like FLFO. **Thanks, we'll build directly on ellen's work, examine the potential of recommending research to identify potentially sensitive areas, may warrant further study**

2) This could be tied into ROMN 'weather and climate' protocol development that is underway? (ROMN contact=Brent Frakes)

IV. Ecological processes

Carbon cycling (LOWER PRIORITY)

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital Signs</i>	<i>Questions</i>
Above- and belowground biomass	Land cover, vegetation maps, FIA data	Land cover, vegetation maps, FIA data	30m; primary SRE	Century? Some modeling needed to scale plot data up	From literature – Veblen and others	Biological integrity, vegetation structure and cover; hotspots of carbon storage	What is role of RMNP in regional carbon sequestration?

Comments for above measure:
 1) Not clear on what this is, a watershed mass balance model? Will park mgrs have a near-term use for this information? Probably need to build on simple veg type/seral stage model of estimated biomass...

V. Hydrology and geomorphology

Surface water dynamics

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Monthly and annual discharge in streams	Gauged data only; 1:24k hydro		3 or 4 gauged historical analysis of hydrograph; not spatially-explicit	Develop CART estimate of stream flow	Precip data from 1970-2000; Experts: L. Poff; D. Merritt	Possible changes in timing and amount of discharge under climate change?	

Comments for above measure:
 1) Ideally, this should be high priority for ROMO. Wondering about use of CART or Indicators of Hydrologic Alteration (IHA) type model on gage data for two rivers (Big Thompson @ park bdry, Colorado R @ park bdr) or maybe with Jill's long term data for Loch Vale? Park is always asked to consider impacts of within park development on downstream aquatics- maybe this base information could help, in addition to future forecasting scenarios re: climate change. Yes, move from lower priority to higher priority. With caveat that we will characterize hydrology at the long-term gauges (compare historical, current, last 10 years, etc.) for hydrologic regime (perhaps using IHA).

VI. Natural disturbance regimes

Fire regime (beetle, wildfire dynamics)

<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Extent of disturbance-	Vegetation;	Beetle-kill	Analyze by		Experts: Kashian		

dependent vegetation (lodgepole, spruce/fir, aspen)	Slope soils	locations from USFS aerial survey;	sub-watershed; primary park, secondary SRE	(Forest)		
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Comments for above measure:

- 1) Would NAIP data be helpful to evaluate beetle activity? **Yes, we have those digital data, but don't intend to do a systematic photo-interpretation. Will investigate USFS time-series maps of beetle outbreak.**
- 2) FLFO is also concerned about beetle kill (moving toward them from the east)
- 3) Blister rust impact on limber pines is another thing of great concern to ROMO- moving in from the north area. Kelly Burns(?) with USFS (Fort Collins) has some good Blister rust data re: limber pines. ROMO is concerned about GLAC like scenario of beetle kill + blister rust = potential for 90% mortality zones
- 4) Dan Binkley at CSU is good contact on recent forest health report (i.e., Aspen?)
- 5) FLFO has a budding mistletoe problem on their north boundary. Is something that can be folded in? (if we can come up with data source contacts, e.g. USFS or Colorado FS agency folks, we will pass those names along). **Will see if there are data on the**

VII. Socio-ecological systems

Visitor use							
<i>Measure</i>	<i>Data (park)</i>	<i>Data (ecoregion)</i>	<i>Scale</i>	<i>Modeling</i>	<i>Reference condition</i>	<i>Link to DM & Vital signs</i>	<i>Questions</i>
Visitor Use (additional funding needed) Accessibility – one-way travel time (minutes) from trailheads Definitely do, investigate ranger logs of parking lot use?	GPS trails Trail heads Roads # of parking spaces at trailhead lots Bus transit	DEM 30 m, 10 m Land cover	1:24k inside park	Using van Wagendonk or Imhof's hiking model;	Compare to different visitor use levels (1970 to 2000)	People At OneTime (PAOT) Wilderness Encounters	Incorporate known (or modeled) destination areas such as climbing, fishing (lakes) What types of resources are within different accessibility ranges? Or recreation opportunities.
Soundscape (additional funding needed)	GPS trails Trail heads Roads Other visitor use destinations, Use acoustic monitoring devices along	DEM 30 m, 10 m Land cover	1:24k inside park	Noise Model Simulation (NMSim), overlaid with access or visitor use simulation models	Use standards based on research on acoustic indicators.	Sound Pressure Level (dBA) % time human sounds audible, noise free intervals, % time natural sounds audible	What is the relationship between use and dBA? What is the relationship between use and % time human sounds audible? What is the relationship between use and noise free interval? How do the above indicators affect wildlife?

	visitor use areas to collect acoustic data						
<p>Comments for above 2 measures:</p> <p>1) NPS is interested in this, but wonders if this is something different than ROMO will get with Soundscapes project in 2008 and Peter's transportation-related visitor effects study that is in the queue for possible funding (waiting for PI feedback on this question). Will coordinate with Peter after determination of funding Soundscapes project is made. How would we use this information, even if duplicative, value added in synthesis of information.</p>							