17 September 2013

Dear SDT (Updated),

Guidelines for the Chapter 4 writing assignment: *Research requirements*

Following the development of the material for Chapter 3, each WG is next asked to identify specific research, model development, and data sets needed to address each question (and their associated objectives). This more detailed analysis will provide the basis for developing the integrated research strategy presented in Chapter 4 of the CEP. The details of the specific activities involved in the research approach for each science question (and associated objectives) will not necessarily appear in Chapter 4, but rather be included as text, tables or other visuals in appendix material. In developing this additional material, each WG should consider as **overarching questions**: (a) what improvements to models are needed to address the questions/objectives (e.g., what improvement in models will take place as the result of ABoVE)? (b) What research is needed for these model improvements? And (c) what data sets are needed to carry out this research?

In addressing questions (b) and (c), each working group should then identify:

- ongoing and planned research in the ABoVE study region that is carrying out research/collecting data to address the ABoVE study objectives;
- datasets available or will become available over the next 5 to 7 years (including remotely-sensed data) that can be used during ABoVE; and
- types of research and data set development (including RS data) specifically to be carried out during ABoVE.

More specifically, consider as examples the following issues being addressed by Working Group 3 in developing their research requirements contribution:

1. What ecosystems landscape/geomorphological units should be studied to address the objectives?
2. Within northwest North America, what is the geographic extent of these units?
3. What field-based data are needed to address the objectives?
4. What geospatially extensive and explicit data are needed to address the objectives (e.g., topographic data, regional weather/climate data, maps of vegetation cover, maps of disturbance extent and severity, surficial geology data, extensive surveys from paleo data to present a regional context of past disturbance history, etc.)?
5. For questions 3 to 5: (a) what data already exist? (b) what data are being collected or likely to be collected between 2015 and 2020? (c) what data need to be collected by NASA as part of ABoVE?

Again, each WG contribution to the Chapter 4 material can be in whatever form works in organizing your necessary information, e.g. text, tables and/or other visuals. This material will be used as the basis for developing an integrated research strategy that cuts across and addresses all ABoVE research questions and study objectives. Please review for your reference the workflow, timeline and other information in the following pages.

Workflow

The WGs are tasked with pulling together this material into a 1st draft format over the next week – between now and the next telecon (Thursday 26 September). A complete compilation of this material is needed by the following telecon (Wednesday, 9 October) when we will begin the discussion of how we plan to put this all together into an integrated strategy. The development of this *integrated research strategy* (i.e. writing Chapter 4 of the CEP) will be the primary goal of the 3rd SDT meeting (15 – 17 October, 2013, in Ottawa, ON).

Feel free to contact members of other WGs if you feel they may be able to contribute to the research requirements your WG is responsible for.

If you need to arrange for a teleconference for your WG, please contact Peter Griffith. Also, Peter and Liz can provide support in using the databases they are developing to support the SDT.

Thanks all for the good discussion and solid work put in on this so far; we look forward to working on this with the group. As always, don't hesitate to be in contact if you have any questions / comments / concerns.

BOX 1a: Second-tier science questions for ABoVE Updated.

	Question	WG
1	How are environmental changes affecting subsistence & cultural resources, human health, and infrastructure – and their interactions – in the ABR and how are human societies responding?	1
2	What are the changes in the distribution and properties of permafrost in the ABR and what is controlling those changes?	2
3	How are disturbance regimes in ABR changing and what processes are controlling those changes?	3
4	How are ABR flora and fauna responding to changes in biotic and abiotic conditions, and what are the impacts on ecosystem structure and function?	3
5	How is the magnitude and fate of soil organic carbon pools in the ABR changing, and what are the processes controlling the rates of those changes?	4
6	What are the changes in the distribution of surface and subsurface water storages and the amount and timing of water discharge in the ABR, what is controlling those changes, and how are they affecting ecosystem structure and function and materials export in the ABR?	5
7	How do complex interactions affect the trajectory of ecosystem structure and function in the ABR and what will be the consequences for human societies within and beyond the region?	6

BOX 1b: Theme-specific and cross-cutting study objectives for each science question Updated.

Q	Objective	Cross-cutting?
1	A. Correlate remote sensing data with *in situ* observations to validate the use of RS for monitoring changes in important ecosystem services. This task is not trivial because the analysis will necessitate several levels of interpretation and/or use of proxies. For example, the potential RS data in Figure 1 are all high-level products. Furthermore, the relationship between changing environmental characteristics and provisioning of ecosystem services is not direct. (SC)	
	B. Identify ecosystem services individually—are some being impacted more than others? Are some more resilient that others? Rank in order of level of impact? Are there enough data to do this? (JK)	
	C. Evaluate tradeoffs between ecosystem services: the changing environment, coupled with altered human activity may result in the increase in availability of some ecosystem services, while others decrease. (LL)	
	D. Develop and validate a regional-scale coupled model of ecosystem and social processes that can be used to assess future scenarios of change, to help inform response options, and to illustrate how different responses to change might play out over 10-30 years. (SC)	
2	A. Advance our scientific understanding of how landscape-scale variations in air temperature, snow cover, disturbance, surface hydrology, soil properties, and vegetation cover interact to control the distribution of permafrost and permafrost degradation across the ABR.	
	B. Acquire and analyze the observational and experimental data necessary to develop and validate model frameworks that accurately project distributions of permafrost and permafrost degradation at landscape to regional and broader scales.	
	C. Quantify feedbacks of observed and projected permafrost changes to hydrology, vegetation dynamics, disturbance regimes, soil carbon decomposition and ecosystem services at local to regional scales.	✓
3	A. Investigate and quantify the spatial and temporal patterns of the primary natural disturbances in Arctic and Boreal regions (fire, insects/disease, and rapid permafrost thaw);	
	B. Identify the most important factors controlling disturbance regimes; and	
	C. Understand their consequences for ecosystems and landscapes.	
4	A. Identify and understand the combination of factors driving longer-term temporal and spatial changes in vegetation characteristics, including habitat quality, productivity and extent, as observed in the satellite data record.	
	B. Determine to what degree variations in ABR disturbance regimes are driving direct and indirect changes at both the ecosystem and landscape-scale, including successional rates and pathways within ecosystems, the age and compositional structure, and plant-animal interactions.	

	C. Document how changes in vegetation characteristics, surface water extent, and/or changes in faunal communities influence ecosystem processes and services, in particular net feedbacks to climate.	
5	A. Quantify destabilization rates of slow- to fast-turnover SOC pools in permafrost and non-permafrost profiles of the ABR, and link these rates with mechanistically linked biogeochemical and ecological data from spatially disparate scales;	
	B. Assess contributions of changes in above ground biomass, microbial activity, permafrost and hydrology to SOC in a diversity of soil profiles in the ABR to aid in understanding how SOC stabilization may function in a future climate, and link these data to biogeochemical fluxes and land cover at disparate scales; and	
	C. Integrate empirical approaches with theoretical and process modeling efforts to improve accuracy of SOC destabilization predictions and scalability.	
6	A. Understand and quantify the distribution, storage, and export of water and the transport of dissolved and particulate water borne constituents across the ABR through investigation of the processes controlling the spatial and temporal patterns of surface and subsurface water storage and flow.	
	B. Assess the impact of projected and observed changes in water discharge, storage, and hydraulic connectivity on ecosystem structure and function, biogeochemical processing of carbon and nutrients, and dissolved and particulate materials exports in the ABR.	
7	A. Provide opportunities for research teams to articulate the design of frameworks capable of integrating and synthesizing information on complex interactions among the dynamics of permafrost, hydrology, disturbance regimes, and ecosystem processes from ABoVE and other programs with the purposes of representing (a) how specific ecosystem services are influenced by the trajectory of ecosystem structure and function in the ABR and (b) the consequences for human societies.	
	B. Fund a subset of what are deemed compelling designs of conceptual frameworks that span a spectrum of ecosystem services that are considered important and feasible to address within the time span of ABoVE.	

BOX 2: Chapter 3 Working Groups Updated.

Working Group	Name	Working Group	Name
1. Societal	Steve Colt	**4. Soil Carbon**	Sharon Billings
	Jeremy Karchut		Josh Fisher
	Libby Larson		Forrest Hall
2. Permafrost	Scott Goetz		Bob Harriss
	Guido Grosse		Ruth Varner
	Dan Hayes	**5. Hydrology**	Peter Griffith
	Chip Miller		Mike Rawlins
3. Flora & Fauna & Disturbance	Natalie Boelman		Rob Striegl
	Eric Kasischke		Matthew Sturm
	Michelle Mack	**6. Integration**	Dave McGuire
	Juha Metsaranta		Stan Wullschleger

BOX 3: Elements of the writing process for Chapters 3 and 4 Updated.

- **Present/describe each science question and explain what is included and how it contributes to the whole of ABoVE** ✓
- **Explain what aspects of the compelling imperative for an Arctic-boreal vulnerability study will be addressed by each question** ✓
- **Theme-specific study objective(s) for each question** ✓
- **Briefly describe what types of research activities will be needed to address each question** ✓
- **Cross-cutting study objectives for integrated research question**
- **Research requirements: specific modeling, research, and dataset development needed to address each study objective**

BOX 4: Telecon schedule and workflow timeline Updated.

Date*	Task / Deliverable
~~**Wednesday, August 14, 2013**~~	~~Progress discussion on Chapter 3 writing~~
~~**Thursday, August 29, 2013**~~	~~Final draft of Chapter 3 text~~
~~**Wednesday, September 11, 2013**~~	~~Final draft of study objectives~~
Thursday, September 26, 2013	Progress discussion on research requirements
Wednesday, October 09, 2013	Discussion on integrated research strategy
October 15, 16, 17, 2013	3rd SDT Meeting