Protocol Development Summary

Protocol: Terrestrial Landscape Patterns and Dynamics

Parks Where Protocol will be Implemented: Bering Land Bridge National Preserve (BELA), Cape Krusenstern National Monument (CAKR), Gates of the Arctic National Park and Preserve (GAAR), Kobuk Valley National Park (KOVA), Noatak National Preserve (NOAT)

Justification/Issues being addressed:
This vital sign refers to terrestrial landscape patterns, heterogeneity and dynamics. Landscape dynamics in ARCN are heavily driven by cold temperatures, arid conditions, and perennially frozen soils. Additional, important influences on landscape patterns and dynamics include: permafrost distribution, biogeochemical cycling, snowpack persistence, vegetation changes, ice dynamics, changes in lake/pond levels, slope and riverbank slumping, active layer thickness, solifluction, changes in channel morphology, distribution of waterbodies and habitat fragmentation.

Landcover classification and mapping is a cost effective method to assess status and trends in vegetation in ARCN's 19.1 million acres of remote, roadless areas. Landcover categories include several vegetated classes (i.e., forest, shrub, alpine), and unvegetated classes such as glacier, rock, and floodplain. Remote sensing and landcover mapping may be used, for example, to assess changes in the extent of boreal forest and shrub-dominated ecosystems (Sturm et al. 2001), loss of heathlands and lichen barrens, waterbody extent, and lake drying and formation (Stow et al. 2004). Changes in plant production in this vast area may impact every component of associated foodwebs, including humans, via changes to the accessibility and quality of subsistence resources. Current and future climatic change is expected to impact vegetation and landcover in ARCN parks. This will have cascading effects on other ecosystem processes, such as permafrost dynamics, nutrient cycling, carbon gain or loss, and primary productivity. Protocols and data collection associated with this vital sign will be integrated with other vital signs including Climate and Weather, Terrestrial Vegetation and Soils, Snow and Ice, Surface Water Dynamics and Distribution, Permafrost and Thermokarsting, Invasive/Exotic Species, Fire Extent and Severity.

Specific Monitoring Questions and Monitoring Objectives to be Addressed by the Protocol
Monitoring Questions:

- What is the distribution of vegetation across the landscape and how is it changing?
- How are changes in landcover and terrestrial vegetation composition affecting aquatic ecosystems and the distribution and characteristics of water resources?
- What are the cumulative effects of fragmentation and its effect on wildlife populations and migration?
- How is ARCN biodiversity affected by landscape-level changes in habitat type and distribution?
- Is treeline advancing north? How is shrubline changing in ARCN parks?

Monitoring Objectives:

1. Map and monitor long-term trends in the total and percent area occupied by major landcover classes in ARCN parks using remotely sensed imagery every 10-20 years.
2. Monitor areas where vegetation loss or shifts in landcover/dominant vegetation are occurring.
3. Provide landcover maps that can be integrated with other vital signs monitoring programs, specifically the Surface Water Dynamics and Distribution, Permafrost and Thermokarst, Terrestrial Vegetation, Fire Extent and Severity, and various mammal and bird assemblages vital signs.
4. Detect trends in peak NDVI, date of green-up, date of senescence, total days of greenness; beginning and end of snow melt, and date of first total snow cover (in conjunction with the Snow and Ice protocol).

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Basic Approach:

Landcover trends at the scale of the entire network are considered critical information for nearly all of the other vital signs. Because of this and the size and remoteness of ARCN parks, field sampling and mapping will be at a courser resolution than other non-Alaskan I&M vegetation mapping efforts, but it will be planned in coordination with the landcover mapping programs of other Alaska I&M networks. Landcover maps based on remotely sensed imagery will be generated on a decadal basis. These maps will be used to calculate changes in area of the various landcover classes. Most of the vegetation classification can be done using the network of ground-based vegetation monitoring plots, but additional semi-quantitative vegetation plots will be established to cover the range of vegetation and spectral characteristics. This protocol will most likely involve repeating the current mapping project contracted to ABR, Inc. (Ecological Land Survey and Synthesis for Arctic Network of National Parks) every 10-20 years. Effectiveness of this project will be enhanced by incorporating soil information as available.

Additionally, long-term landscape scale shifts in primary productivity may be monitored by using AVHRR (Advanced Very High Resolution Radiometer) and MODIS (Moderate Resolution Imaging Spectroradiometer sensors) in combination with aerial photography. The protocol may also include monitoring ATV trails via remote sensing (aerial imagery, IKONOS imagery) and limited GPS fieldwork using aircraft. The impacts of ATV use on vegetation condition will be assessed where appropriate.

Principal Investigators and NPS Lead:

The NPS Lead for protocol development will be the Terrestrial Ecologist to be hired in FY 2008. The Principal Investigator for this protocol is Torre Jorgenson of ABR, Inc. in Fairbanks, Alaska.

Development Schedule, Budget, and Expected Interim Products:

A current landcover classification and mapping inventory is being conducted by ABR, Inc. for all five ARCN parks. GAAR is the last park for field surveys for this project and all parks should have a completed map by FY 2010; projected budget for this project in FY 2008 is $_____. The schedule for developing the monitoring protocol is as follows:

Develop protocol	FY 2008 and FY 2009
Implement and test protocol	FY 2010
Peer review and finalize protocol	FY 2011