

Recovery and archiving of key Arctic Alaska vegetation map and plot data for long-term vegetation analyses

A proposal to NASA for data recovery
for the Arctic-Boreal Vulnerability
Experiment (Pre-ABOVE)



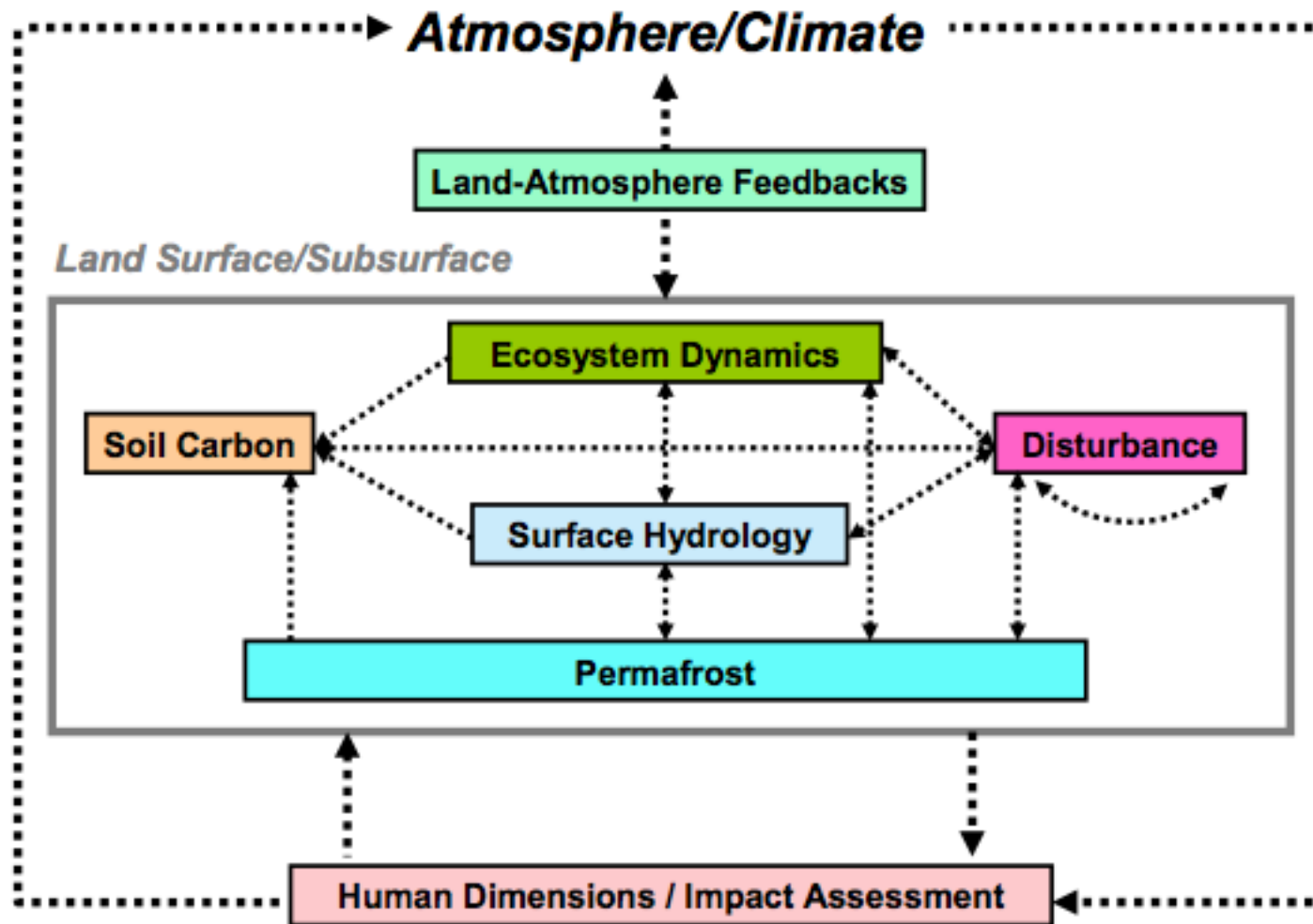
NASA ABoVE initiative

Similar in scope to previous large NASA field campaigns in the grasslands, (FIFE) and boreal forest (BOREAS).

Quotes from Vision statement:

- *Over the past 100 years, the High Northern Latitudes (HNL) have experienced more rapid climate warming than anywhere else on Earth..*
- *ABOVE will provide the opportunity to expand and coordinate a focused, interdisciplinary research to further understand the drivers and consequences of climate change in HNL regions*
- *When interpreted synergistically **with the results from field-based observations and monitoring**, the use of information derived from analyses of remotely-sensed data that will take place during ABoVE will substantially and measurably increase our ability to project realistic scenarios of environmental change in Arctic and Boreal regions and assign probabilities of risk to those scenarios.*

NASA ABoVE themes



Pre-ABoVE goal

“assemble, prepare, develop, refine, and/or integrate datasets for use in preparing for and conducting the ABoVE field campaign research”

Our Long-term Scientific Goal

- General circumpolar increases in tundra land and permafrost temperatures, vegetation “greenness,” and shrub abundance are now well documented but the patterns of change are rather heterogeneous at all spatial scales.
- ***Our long-term goal is to examine the causes of this heterogeneity in more detail and model the dynamics of tundra plant communities and vegetation productivity.***
- ***Towards this end, we propose to collaborate with NASA and other groups working in Arctic Alaska to assemble coherent and consistent plot, map, and remote-sensing databases that contain as much of the existing tundra vegetation-related information as possible for the upcoming ABoVE field campaign.***

Our Pre-ABoVE proposal: Recovery and archiving ground-based data for the ABoVE campaign

- **Specifically addresses the arctic portion of the ABoVE domain, i.e. the area north and west of the arctic treeline, with a focus on arctic Alaska.**
- **This is the primary area of our team's research during the past 40+ years, and where we can most significantly contribute to the ABoVE effort**
- ***This is and will be, by far, the best and most extensive baseline dataset of Alaskan tundra vegetation information in existence - there is nothing else that can compare to it.***

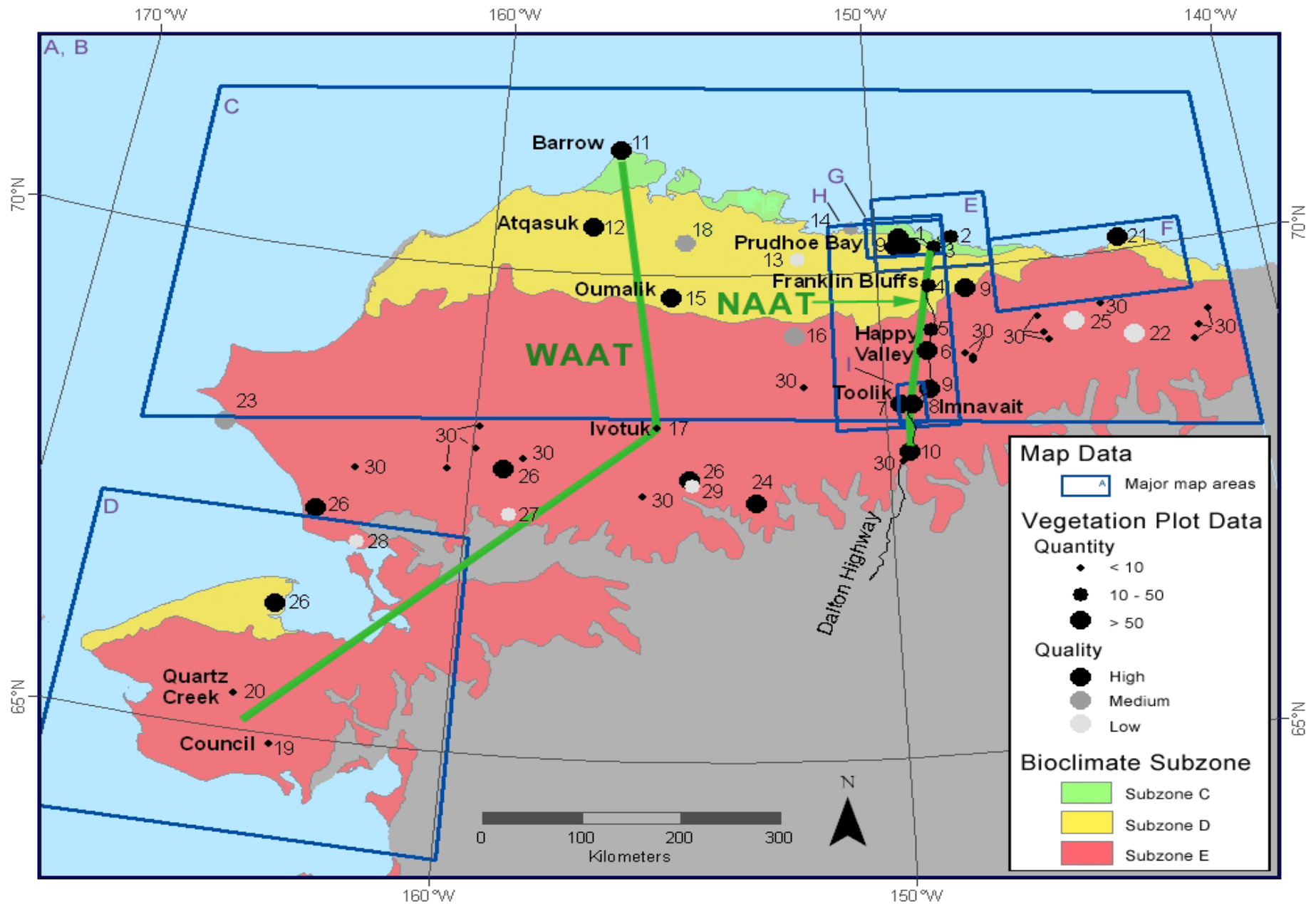
Components

- ***Component 1: Recovery of key plot data.***
- Key plot datasets in Arctic Alaska and the circumpolar Arctic that contain complete plant-species-cover information, environmental and soil data, and in many cases spectral data.
- Concentrate on the Arctic Alaska portion of these data and include our Canadian data as time permits. The plot data will be compiled in the Arctic Vegetation Archive (AVA).

Components

- ***Component 2: Recovery of key vegetation and geo-ecological maps for the Arctic, and creation of Landsat time-series databases at key research sites.***
- This component will have two parts:
 - a) Recovery of existing traditional maps and satellite data that depict land-cover at a series of key research sites in Alaska and larger regions, up to and including the circumpolar Arctic;
 - b) b) collaboration with NASA personnel to create a new hierarchical time-series of NDVI and land-cover change maps at a group of key locations along primary environmental gradients in the Arctic, where we have intensive ground information. This addresses NASA's request for "...subsetting and/or custom processing of satellite data for the study region..."

Key northern Alaska data sets



Key plot data sets

Plot datasets and smaller maps:

1. North American Arctic Transect/Dalton Highway/Prudhoe Bay (NAAT, Fig. 1)
2. Prudhoe Bay Oilfield: (Webber and Walker 1975, Walker et al. 1980, Walker 1985, Klinger et al. 1983a, b, Walker et al. 1986)
3. Howe Island: (Kade et al. 2005a, Reynolds et al. 2008)
4. Deadhorse: (Kade et al. 2005a, Reynolds et al. 2008)
5. Franklin Bluffs: (Kade et al. 2005a, Reynolds et al. 2008)
6. Sagwon Upland: (Walker et al. 1998, Kade et al. 2005b)
7. Happy Valley: (Walker et al. 1997, Kade et al. 2005b)
8. Toolik Lake: (Walker and Barry 1991, Walker et al. 1994, Walker and Maier 2008, Reynolds et al. 2012b)
9. Imnavait Creek: (Walker et al. 1987, Reynolds and Tenhunen 1996, Kade et al. 2012)
10. Pingos (Kuparuk, Prudhoe Bay, Toolik River & Kadleroshilik study areas): (Walker 1990)
11. Dalton Highway willows: (Schickhoff et al. 2002)
12. Plot datasets and smaller maps: Western Arctic Alaska Transect/NPRA (WAAT, Fig. 1):
13. Barrow: (Elias et al. 1996, Edwards et al. 2000, Villarreal et al. 2012)
14. Atqasuk: (Komárková and Webber 1980, Walker et al. 2003a)
15. Fish Creek: (Komárková 1985a, 1985b)
16. Colville River Delta: (Brueggeman et al. 1996)
17. Oumalik: (Ebersole 1985, Edwards et al. 2000, Walker et al. 2003b)
18. Umiat: (Churchill 1955, Bliss and Cantlon 1957)
19. Ivotuk: (Walker et al. 2003a, Riedel et al. 2005b, 2005a)
20. NPR-A sand region: (Komárková 1985a, b, Komárková and McKendrick 1988)
21. Council: (Reynolds et al. 2002)
22. Quartz Creek: (Reynolds et al. 2002)
23. Plot datasets: ANWR, Brooks Range:
24. Kaktovik: (Elias et al. 1996)
25. Arctic National Wildlife Refuge: (Walker et al. 1982, Jorgenson et al. 1994)
26. Cape Thompson: (Johnson et al. 1966)
27. Arrigetch Mtns: (Odasz 1983, Cooper 1986)
28. Lake Peters: (Batten 1977)
29. Arctic Network of National Parks, Preserves, and Monuments (Bering Land Bridge, Cape Krusenstern, Noatak, Kobuk Valley, Gates of the Arctic): (Jorgensen et al. 2009)
30. Kobuk River Valley: (Racine and Young 1976, Melchior 1979)
31. Noatak River: (Young 1973)
32. Killik River: (Murray 1974)
33. Brooks Range poplar groves: (Breen 2011)

- **Would follow the protocols for the AVA for the plot data.**
- **Includes a major data-management component for both map and plot data.**
- **Preliminary workshop in Taos NM would gather main data holders together to initiate the project.**

Key map data sets

Large map areas (blue rectangles on previous figure):

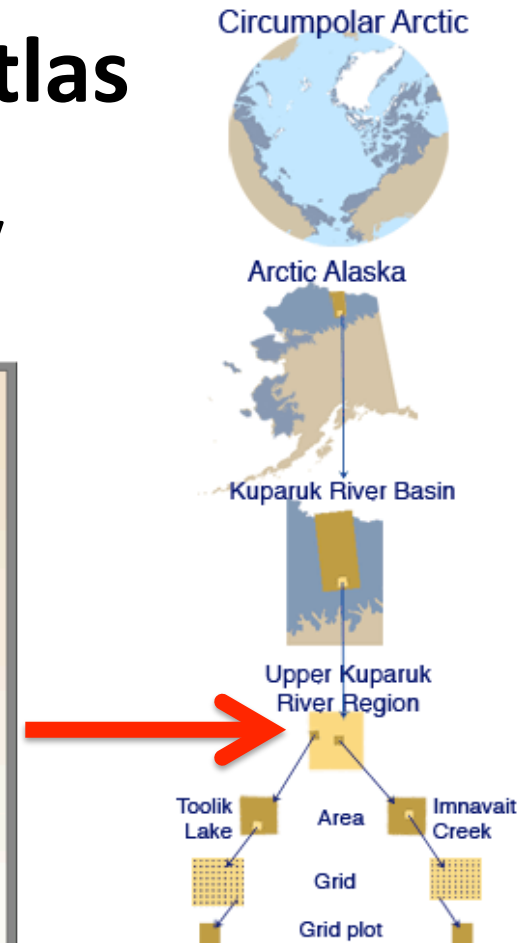
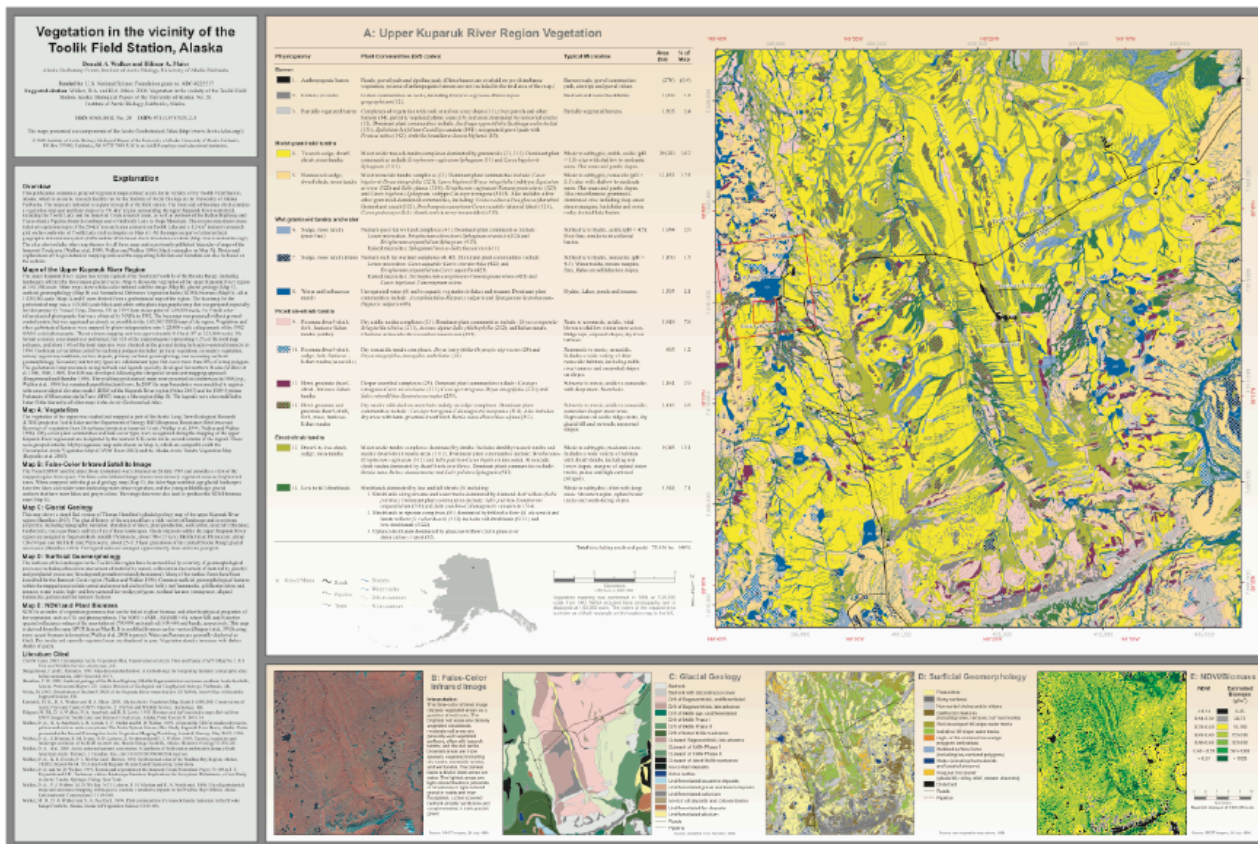
- A. Circumpolar Arctic: (CAVM Team 2003)
- B. Arctic Alaska Tundra: (Raynolds et al. 2006)
- C. Alaska North Slope: (Muller et al. 1999, Jorgenson and Heiner 2004)
- D. Seward Peninsula: (Swanson et al. 1985, Raynolds et al. 2002)
- E. Beechey Point Quadrangle: (Walker and Acevedo 1987)
- F. Arctic National Wildlife Refuge: (Walker et al. 1982, Jorgenson et al. 1994)
- G. Prudhoe Bay Geobotanical Atlas and other Prudhoe Bay geobotanical maps: Webber & Walker 1975, (Walker et al. 1980, Everett and Walker 1981, 1982, Klinger et al. 1983b, Walker et al. 1987, Raynolds et al. 2012a)
- H. Kuparuk River basin: (Muller et al. 1998)
- I. Upper Kuparuk River basin: (Walker and Maier 2008).



Hierarchy of map data sets in the Toolik-Arctic Geobotanical Atlas (T-AGA, Walker et al. 2008).

Toolik-Arctic Geobotanical Atlas

Focus at the Toolik Lake LTER site, Prudhoe Bay and the Dalton Highway



Hierarchy of map data sets in the Toolik-Arctic Geobotanical Atlas (T-AGA, Walker et al. 2008).

7 scales of mapping all together: 3 larger scales and 3 small scales than the map shown.