Progress Report: ***Hydrology and Resilience of High Arctic Wetlands*** (Multi-year License #0200505R-M, issued to Dr. Kathy L. Young)

Background and Research Problem:

Wetlands are important ecological niches in High Arctic environments providing habitats for fauna and migratory birds. They have large conservation value for Inuit. Since the mid-90's we have improved understanding of patchy wetlands in the polar desert areas, and meso-scale wetlands situated in both polar oasis and polar desert environments. Since 2007, our studies at Polar Bear Pass (PBP), an extensive wetland system have progressed. Presently, we have good understanding of its climate, snowcover and melt progression across this wetland, pond hydrology and water quality, hydrology of hillslope valleys, and nutrient and carbon dynamics. However, we still need to address runoff from these large regional wetlands into polar oceans/ seas. Terrestrial discharge from arctic landscapes including wetlands is poorly understood (*e.g.* timing, quantity). This hinders our ability to assess the role of terrestrial freshwater in sea ice formation, currents, in addition to sediment and carbon delivery.

Project Objectives:

The project objective over the last few years has been to examine the inter, and intra-seasonal runoff processes from extensive low-lying wetlands: Polar Bear Pass (PBP)-central Bathurst Island and Alison Inlet (AI)-SW Bathurst Island into neighbouring seawater channels and relate it to seasonal changes in wetland snowcover, evaporation and storage employing both field and modelling strategies.

Progress Report (2013):

I and my students (John Siferd, Alison Milan and Gudjön Kristinsson) were in the field (PBP) from late May until early July. John Siferd returned in early August to retrieve water loggers, and download AWSs. Like 2012, I was blessed with a terrific group of students. As in other years, we carried out a detailed snow surveys across the diverse terrain of Polar Bear Pass (wetlands, hillslopes, valleys and plateau areas). Despite issues with ski-doos and broken snow probes we were able to complete our end-of-winter snow survey. Once the snow survey was completed we conducted daily snowmelt measurements. Automatic weather stations (AWSs) monitored climatic conditions on the plateau and the wetland.

Our findings show that there was more snow in 2013 than in 2012 and that snowmelt was delayed but it persisted for a longer period. This can be attributed to a cold spring/summer in 2013 (48 thaw days) vs 88 in 2012. In 2013, as in 2012 good streamflow measurements were difficult to obtain; the eastern sector outlet stream was about 4 km from base camp, while the other site was 7 km away. Travel to sites during melt was mainly by foot due to broken ski-doos and ATVs. Hence, we focused on obtaining quality stream discharge estimates from the eastern sector outlet stream in order to compare patterns of peak flow, duration, and timing to this site in 2012. We also continued to monitor our long-term hillslope streamflow monitoring stations (measured routinely since 2007). The 2013 snowcover and snowmelt estimates helped us to understand and explain stream regimes.

Preliminary results in 2013 suggest that meltwaters from the northern part of the Pass produce the first major peak in eastern outlet runoff, while a second pulse, delayed by a few days comes from the southern part of the Pass. This confirms our observations in 2012 and earlier snowmelt and modeling efforts (see Assini and Young, 2012). Across years (2012-warm summer vs. 2013-cold summer) we notice that like snowmelt, streamflow initiation and peak flow were delayed in 2013 but the duration of runoff was longer. Peak flow was also much reduced. These

results in 2013 compare with earlier streamflow studies in the 70's, a cold episode relative to the last 10 years of warming. These recent findings were reported at a Northern Studies Symposium held at York University, Nov. 6, 2013.

Finally, I wish to report that our long-term climate information (Fall-Winter) from PBP was presented at the ArcticNet Annual General Meeting, Victoria, Dec 2012. The water resources of PBP in relation to Cape Bounty Observatory, Melville Island were reported at the 19th Northern Research Basins Workshop & Symposium-Alaska, Aug. 11-17, 2013.

Cited References: *Assini, S. J. and K. L. Young (2012) Hydrol. Sci. J. DOI:10.1080/-262667.2012.666853.*

Plans for 2014:

I will be on sabbatical for 2014-2015. I do not plan to travel to the High Arctic next summer since I will be travelling to Antarctica and Iceland. I plan to resume my studies at Polar Bear Pass the following year. Hence, I do not require a scientific license in 2014.