Economic consequences of driftwood harvest in a changing climate: Integration of local knowledge and scientific data

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Abstract

The integration of local knowledge and science represents an opportunity to enhance the understanding of changes to the social-ecological systems in a manner that provides mutual benefits to scientists and rural stakeholders. In this project, the knowledge of rural Alaskans was used to identify social-ecological thresholds which were applied to model potential driftwood harvest from the Yukon River. Villages in rural Alaska are decreasing their dependence upon expensive fossil fuels by generating heat and electricity with wood-fired boilers fed by driftwood, a cheap and easily accessed source of fuel. However, the character of summer discharge in the Yukon River appears to be changing in a manner that negatively affects the driftwood harvest. Residents of Tanana, Alaska, typically harvest driftwood from the Yukon River during high flow events associated with spring break-up and the "June Rise," but these annual events have become less predictable in recent decades.

This study examined flood events in the Yukon River with the goal of understanding how actual or perceived changes in driftwood availability are related to river hydrology and how future changes in hydrology may affect the driftwood harvest. We combined information gathered from informant interviews, USGS gauging stations, U.S. Census data, and numerical models of past driftwood harvest rates to estimate changes in future driftwood harvest rates. We determined that neither average date of spring break-up nor the June Rise floods had changed significantly between 1977 and 2012, but the date of the June Rise had become much more variable since 1993. Our model indicated that hydrologic factors alone were responsible for a small (3%) decrease in the annual wood harvest. However, the installation of wood-fired boilers in the village in 2007 increased the annual community demand by more than 80%. Thus, greater uncertainty of accessing driftwood has been accompanied by a higher demand for this important fuel source. Modeling various climate scenarios illustrates how the driftwood model estimates that increasing hydrologic variability would be expected to increase vulnerability of the driftwood harvest. Examination of the economics associated with using driftwood versus fuel alternatives shows that other wood sources require more time and money to harvest. Furthermore, the use of oil or electricity as alternative fuels cost substantially more, but save considerable amounts of time.

This study demonstrates how increased variability in regional climates can have serious economic consequences for subsistence users, but can also increase the time demand of subsistence users, which is one of their most precious commodities. These impacts are important
because they affect the capacity of rural Alaskan communities to adapt to climate-related challenges that are increasingly affecting people across the Arctic. We also demonstrate the mutual benefits of integrated scientific studies to researchers and rural communities. Our research benefits the community by providing a potential tool that can be used to predict the timing and duration of driftwood runs, but provides the scientific community with a better understanding of regional ecological dynamics.

This paper will be presented in the Pathways of Resilience in a Rapidly Changing Alaska session.

**Keywords:** biomass, climate, driftwood, economics, flood, hydrology, local knowledge, social, ecological model, threshold, wood