Future Scenarios - Peter Doran

The future of Taylor Valley under projected warming is one of reduced lake ice cover, increased lake volume and reduced soil habitat in the lower valleys. A new model as part of a Maciek Obryk's PhD thesis is near completion and predicts that under current climate trends (last 10 years), the lakes will start to seasonally ice-out within the next few decades (Fig. 1). This will dramatically increase summer light levels and wind driven mixing, and alter many chemical and biological processes. In the longer term, as lake levels rise, Lake Hoare and Fryxell will merge into one lake which flows into McMurdo Sound (Fig. 2). That lake will be at 80 m asl. Lake Bonney will grow until it spills into the Hoare/Fryxell Basin. The height of the greater Lake Bonney will be ~125 m asl (interpolated bedrock sill is currently under the Suess Glacier). The lakes may quickly become joined depending on the resistance of that sill. At current rates of lake level increase, the joining of the lakes may occur in 400 to 500 years.

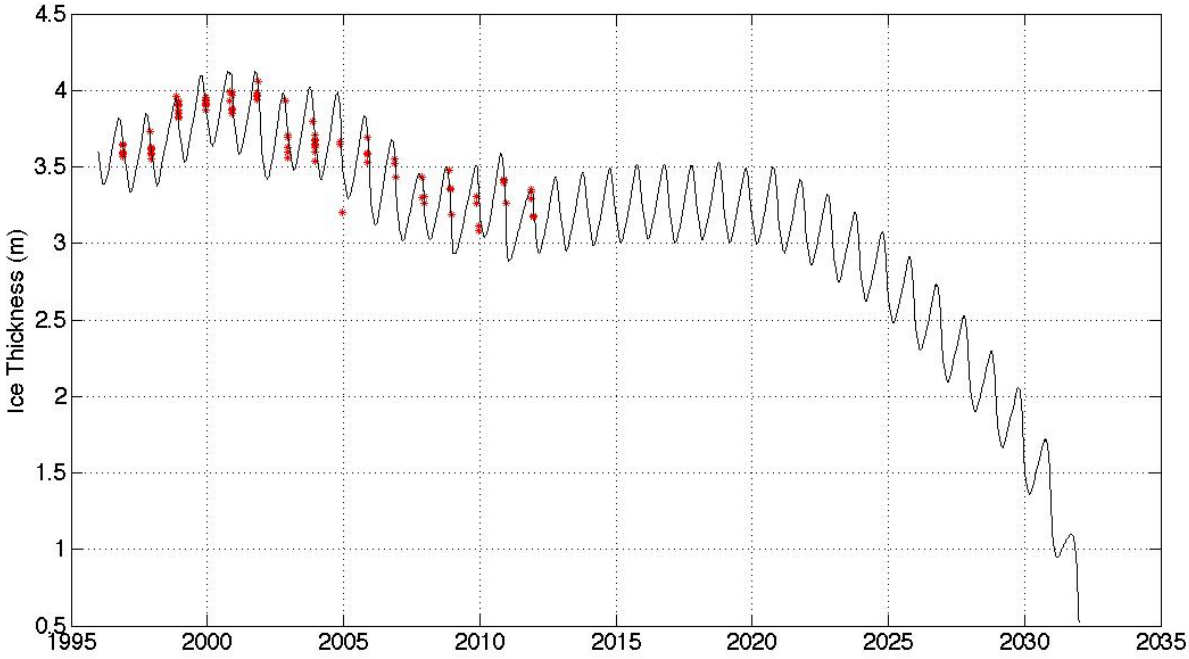


Fig. 1. The simple physics based ice cover model is solved using a one-dimensional heat equation dynamically coupled with atmosphere and the underlying water column. Future ice thickness prediction is based on daily averages calculated using 10-years of data (2002-2012). Red points are observations, black line is model prediction.

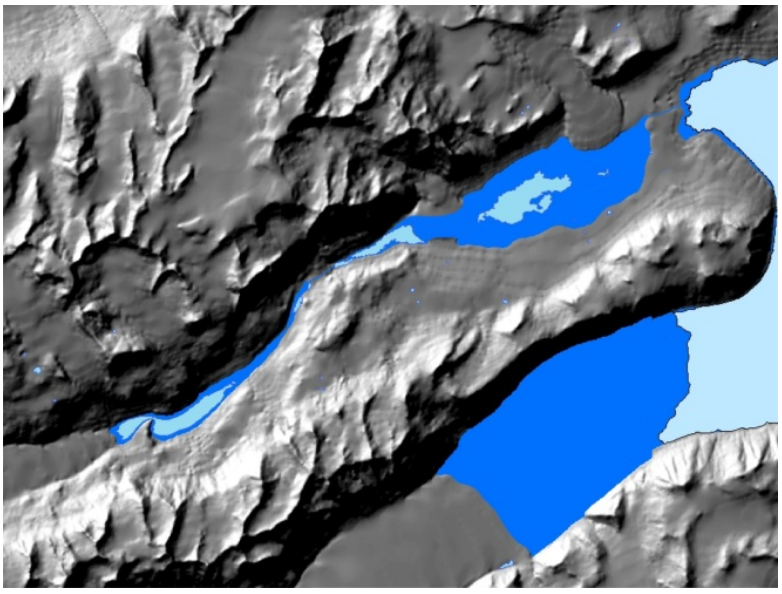
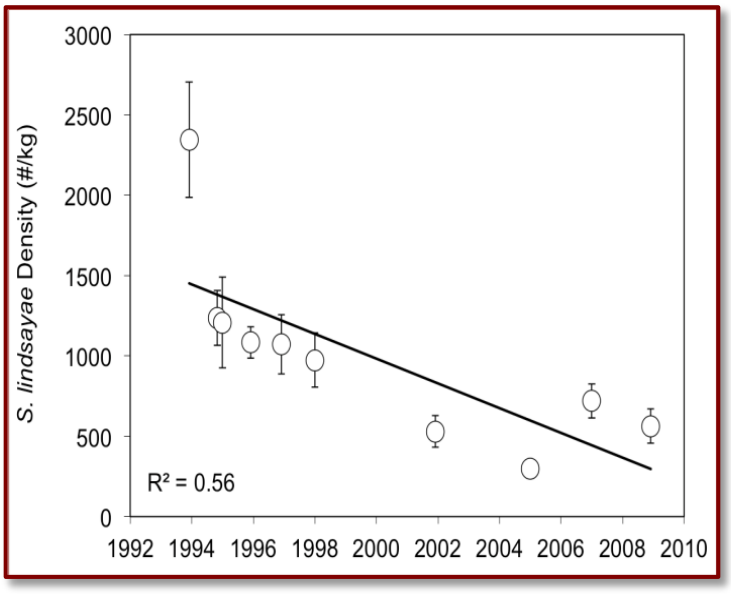


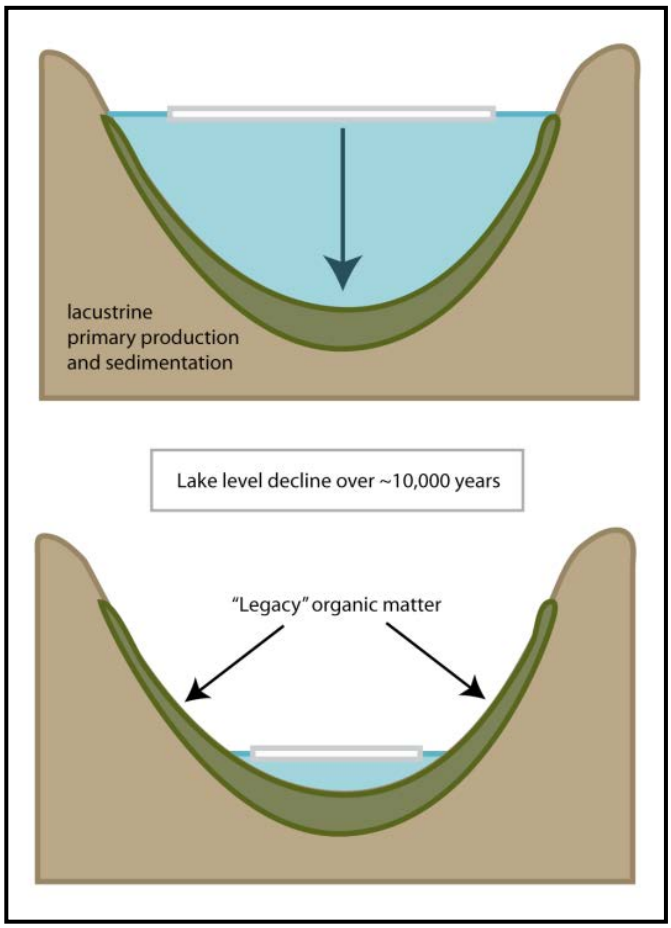
Fig. 2. Projected future of Taylor Valley based largely on a digital elevation model and knowledge of critical sill points. Sea level is depicted at 10 meters above present, which is viewed as a worst case scenario with WAIS collapse

Climate and Resource Legacies in Taylor Valley: The Influence of Paleolake Washburn on Soil Biogeochemistry and Biodiversity – Ross Virginia

Climate driven variations in lake levels since the Last Glacial Maximum have created "resource legacies" seen today as gradients of biogeochemical properties in soils and lakes. Associated with these gradients in organic matter, limiting nutrients, and salts are contemporary organism abundances and biodiversity.

Scottnema lindsayae is the dominant soil nematode in dry soils where its population distribution defines the limits of habitat suitability (function of organic matter, salinity, moisture) and its population variation is an indicator of environmental change.





Long-term soil studies along an elevation transect (ET) in Taylor Valley (1994-) and newly established long term plots in Miers and Garwood Valleys (MCM3) allow assessment of changes in soil habitat suitability and soil biota associated with changing hydrologic connectivity in the dry valleys. *Scottnema* abundance has declined in the ET and in control plots from other multi-year experiments from 1993 to the present.

An example of a soil legacy from lake level variation is the high spatial variation in soil salinity observed at lower elevations (25-100m elev.) near existing lakes. Soil invertebrate biodiversity and abundance are closely associated with salinity and soil water content, both of which are changing in response to recent pulse warming events in summer.