Calculating Errors of Interpolation Methods for Bathymetric Surveys

A Geographic Information Systems (GIS) Approach

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Introduction

- Globally high water demand
  - Drinking water
  - Irrigation in agriculture
  - Power generation
- Reservoirs used to meet this demand
- Reservoir lifetime is limited

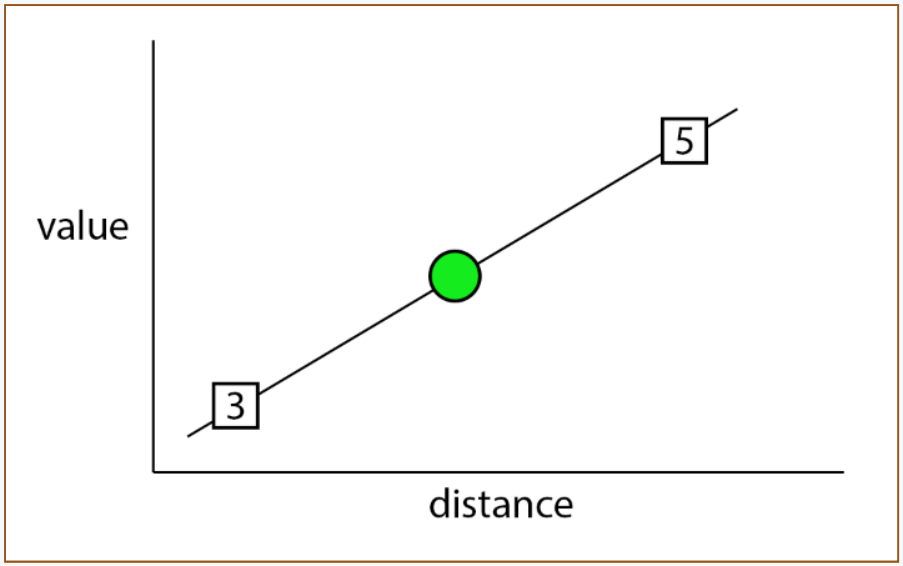
Sediment accumulation

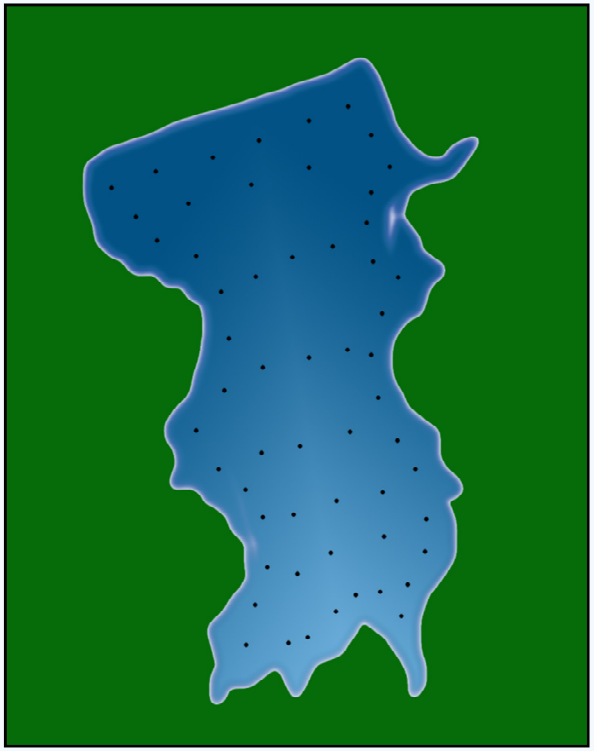
- Sediment decreases storage capacity and shortens reservoir lifetime
- Evaluation of reservoir sedimentation is important
- Imperative to manage surface water resources

Bathymetric Maps

- Map of the bottom of the lake
- Typically generated using point data

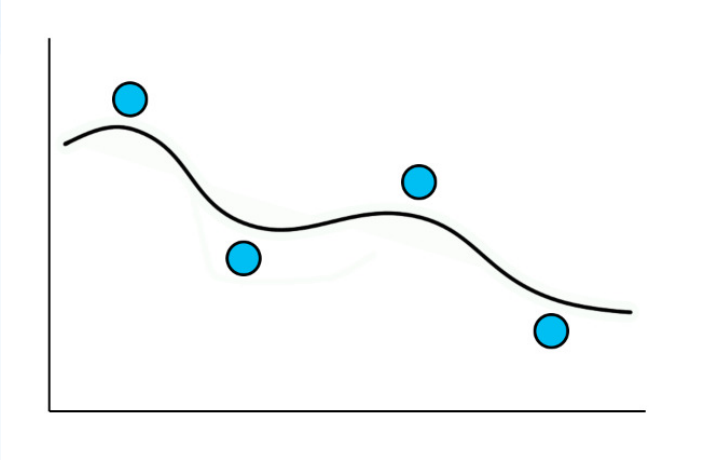
  Location (GPS) & Depth (elevation)
- Surface created by interpolation



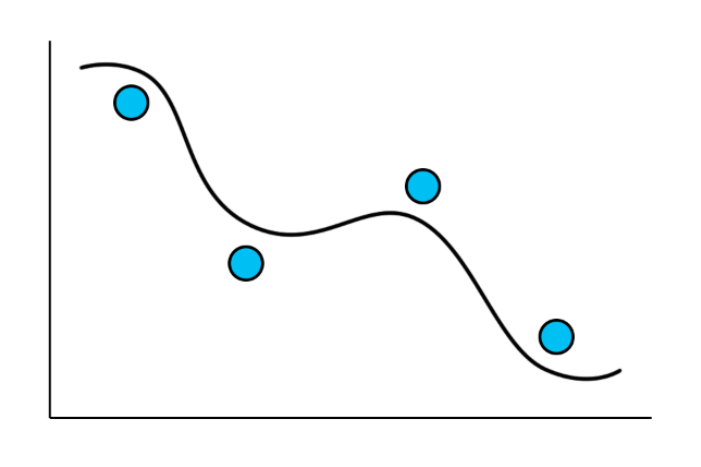


Interpolation Methods

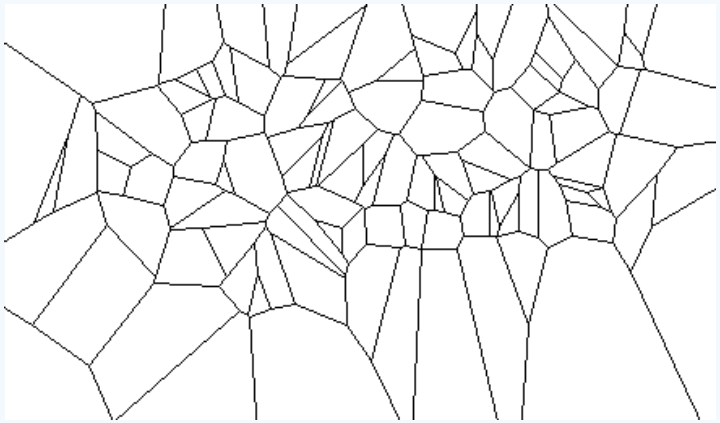
Inverse Distance Weighting (IDW)



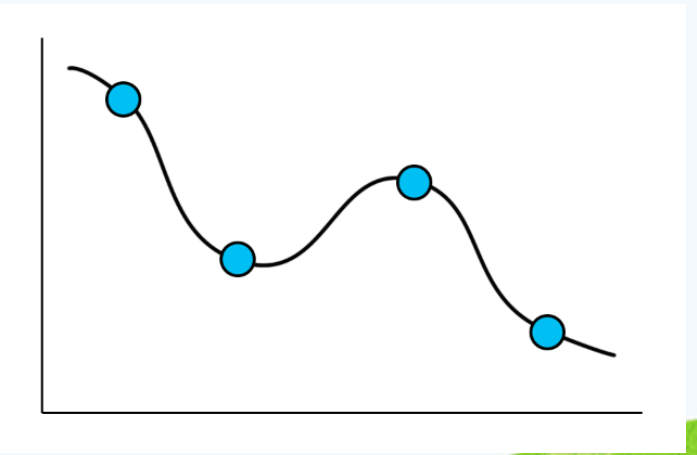
Kriging



Natural Neighbor



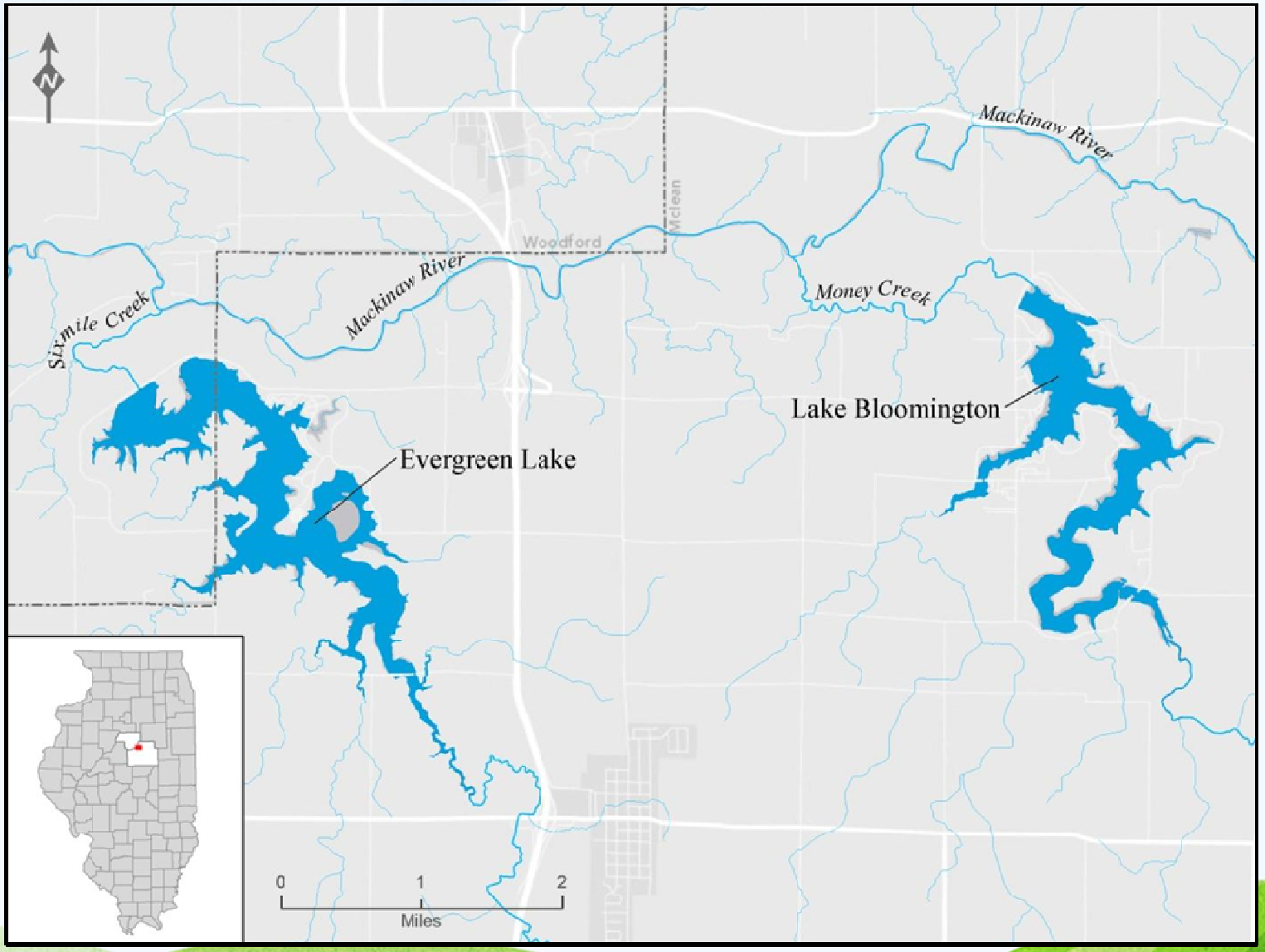
Spline



Objectives

- Compare point data with different densities
- Explore **error** associated with different methods of interpolation

Study Area: Central Illinois



2014 Equipment: HydroLite-TM set up

RTK-GPS

SonarMite BT echo sounder

SonarMite transducer

Trimble GeoExplorer GeoXT

Methods

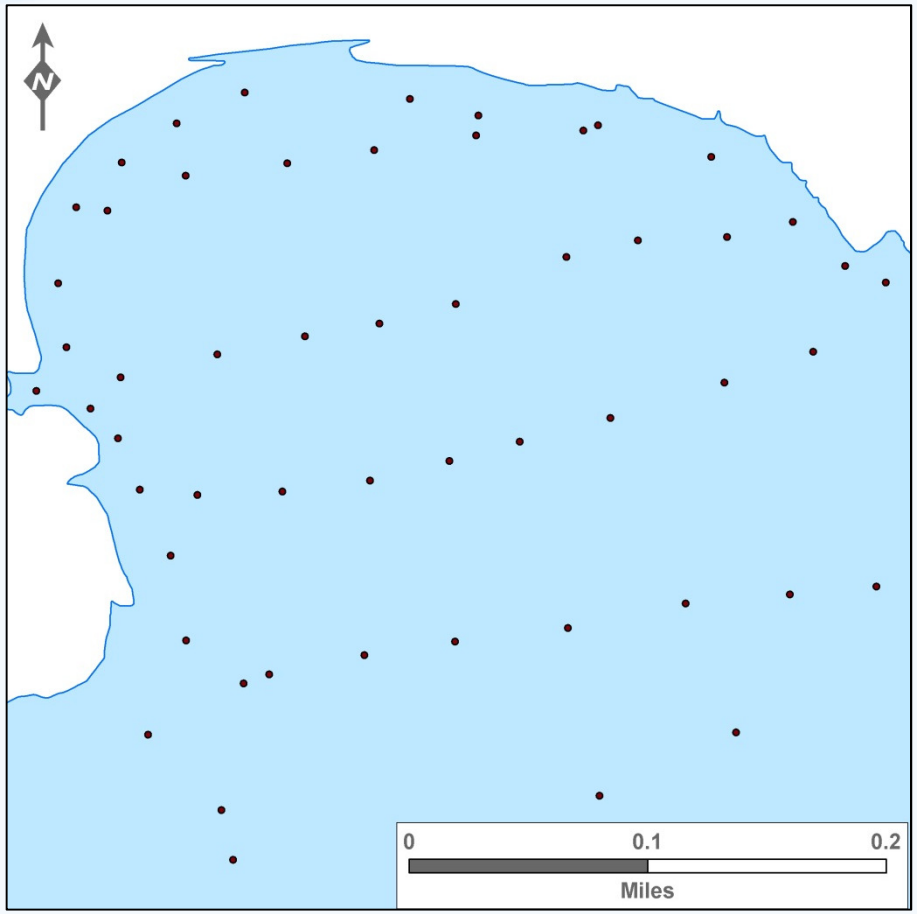
- Data collected and put into a GIS (ArcMap)
  - Hanson Engineers Inc. 1999 – low density
  - Collect current data 2014 – high density
- Designate 10% as observation sites by random selection
- Run the interpolation methods available in ArcMap
  - Interpolations create a continuous surface (raster grid)

Methods continued

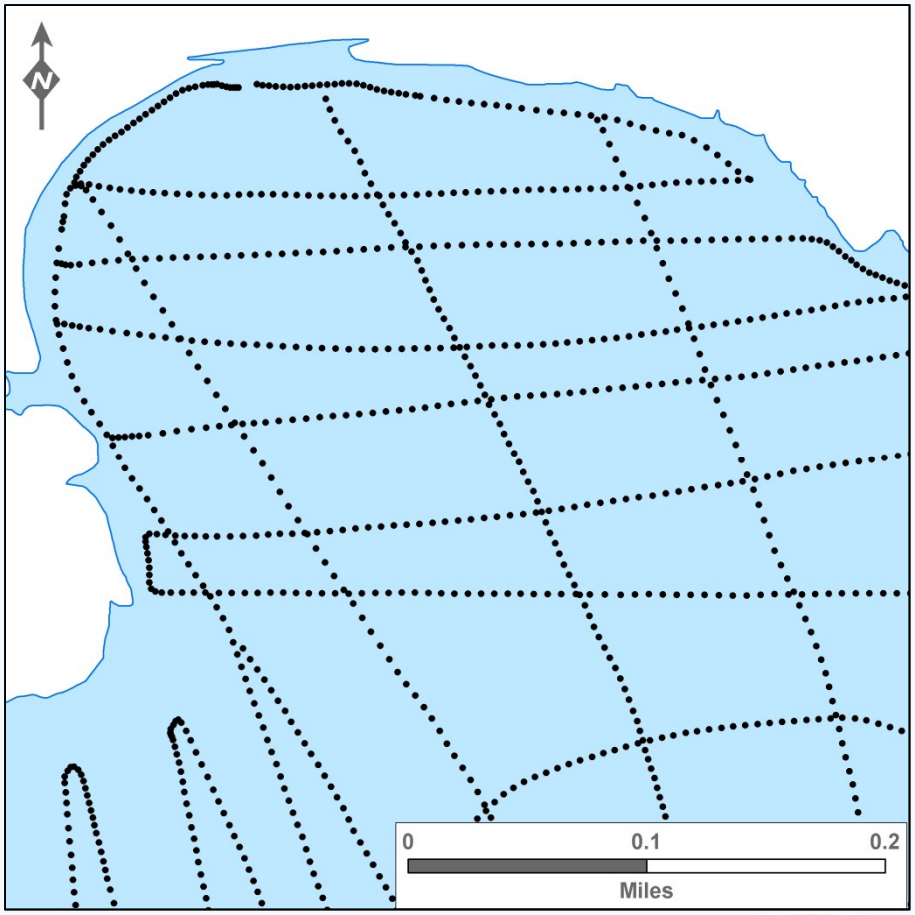
- Created model in ArcGIS to run multiple iterations
  - Calculate RMS at observation points for each method of interpolation's raster surface
  - Change the mathematical parameters until lowest RMS achieved
- Create final surface with the complete data set
- Ultimately, contrast 1999 and 2014 surfaces to estimate sediment accumulation

Point Designations

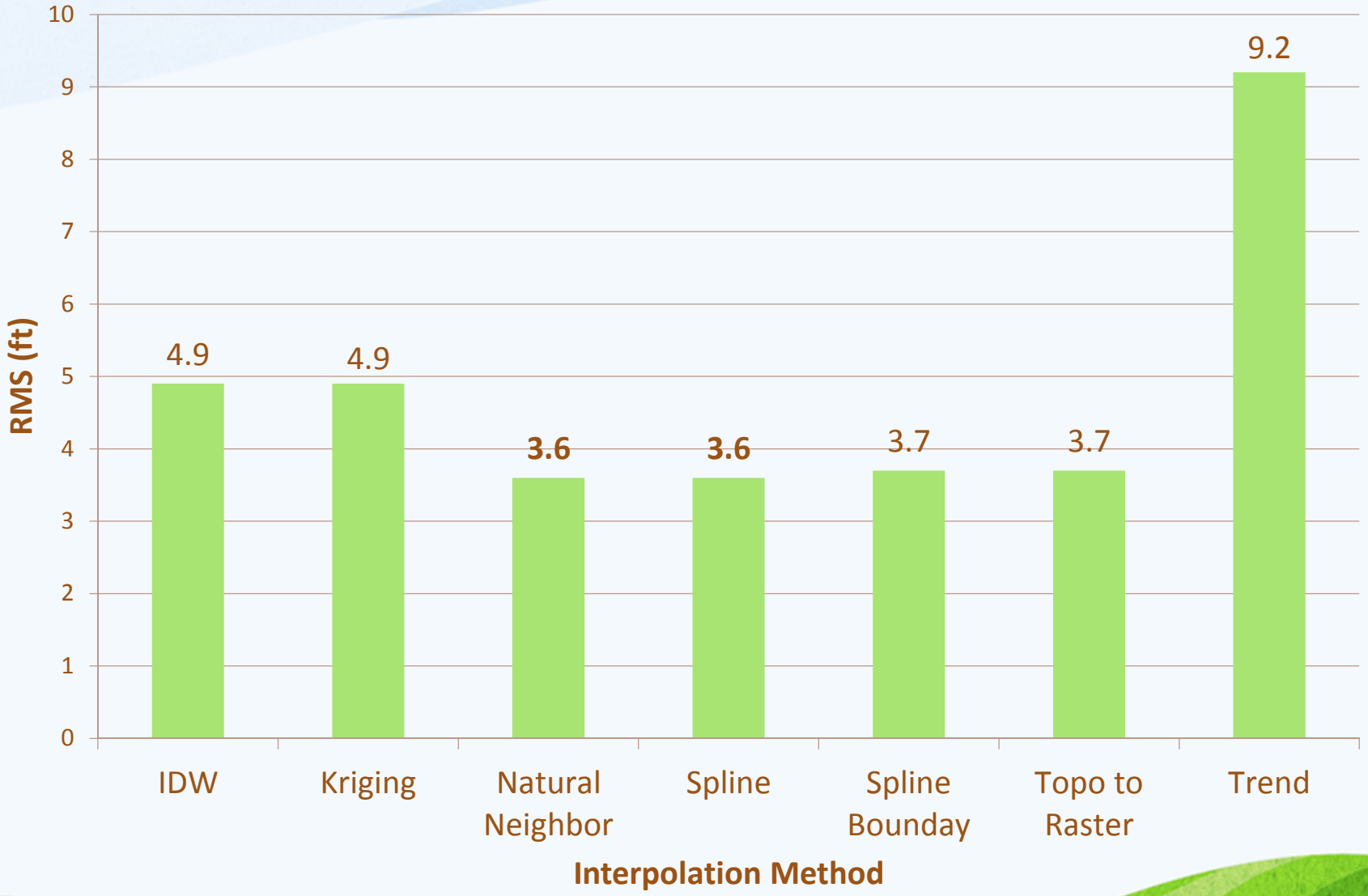
1999 Low Density Data



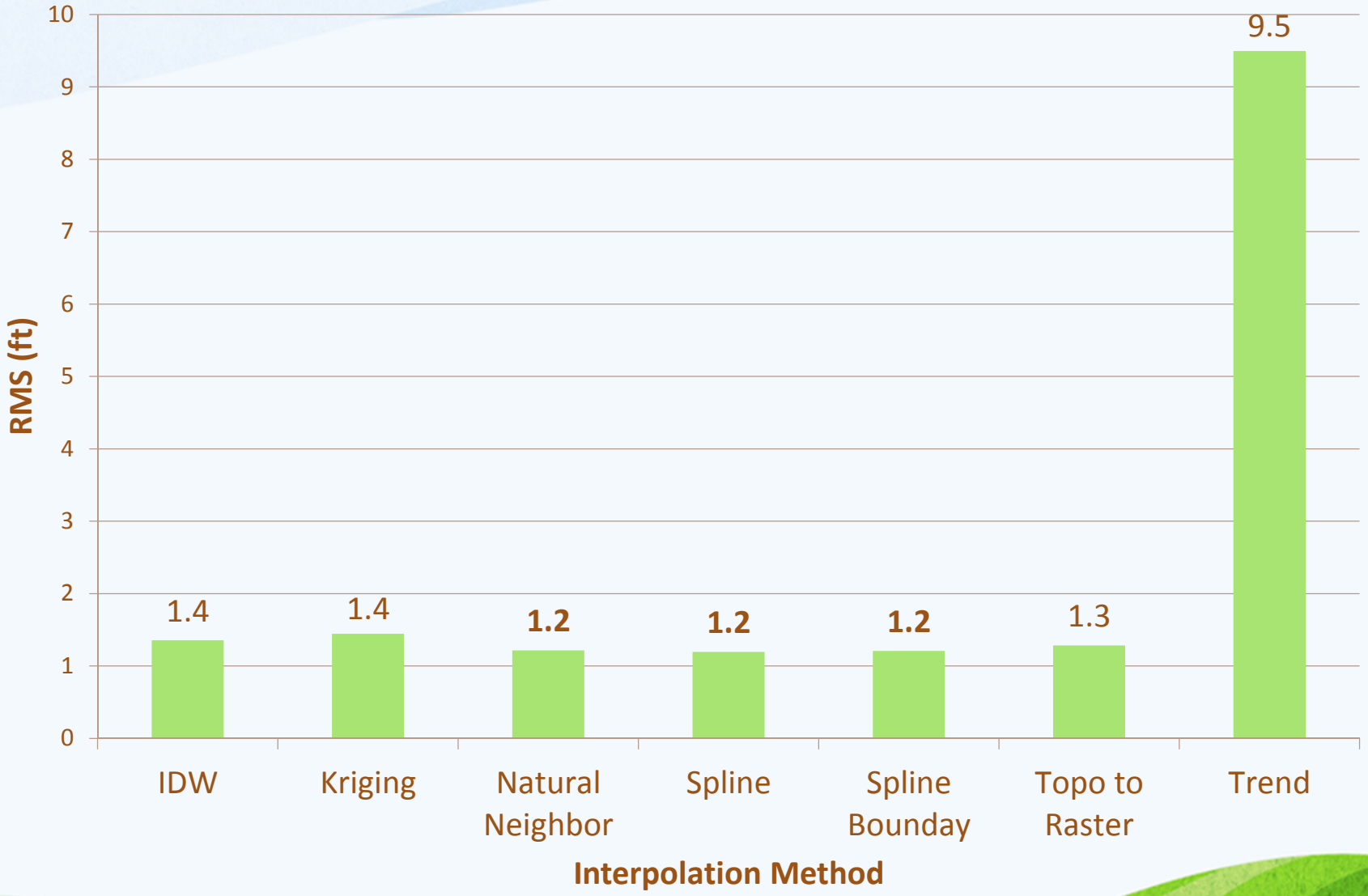
2014 High Density Data



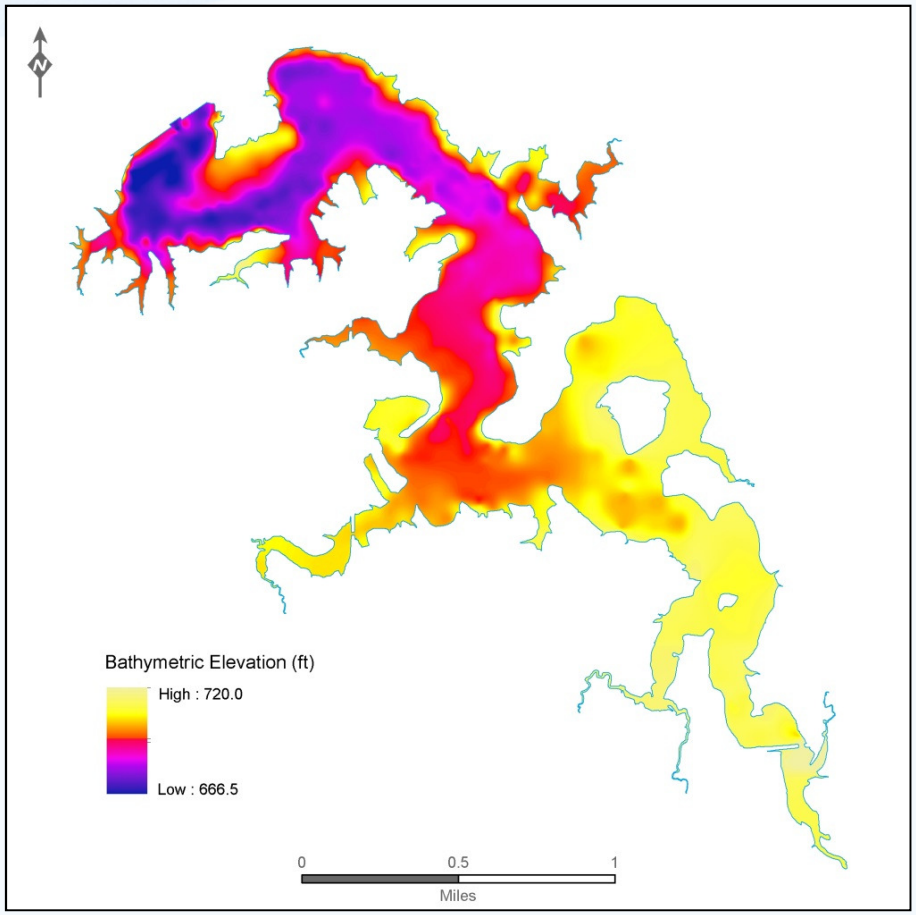
Results:
Low Density- Lowest RMS for Interpolation Methods



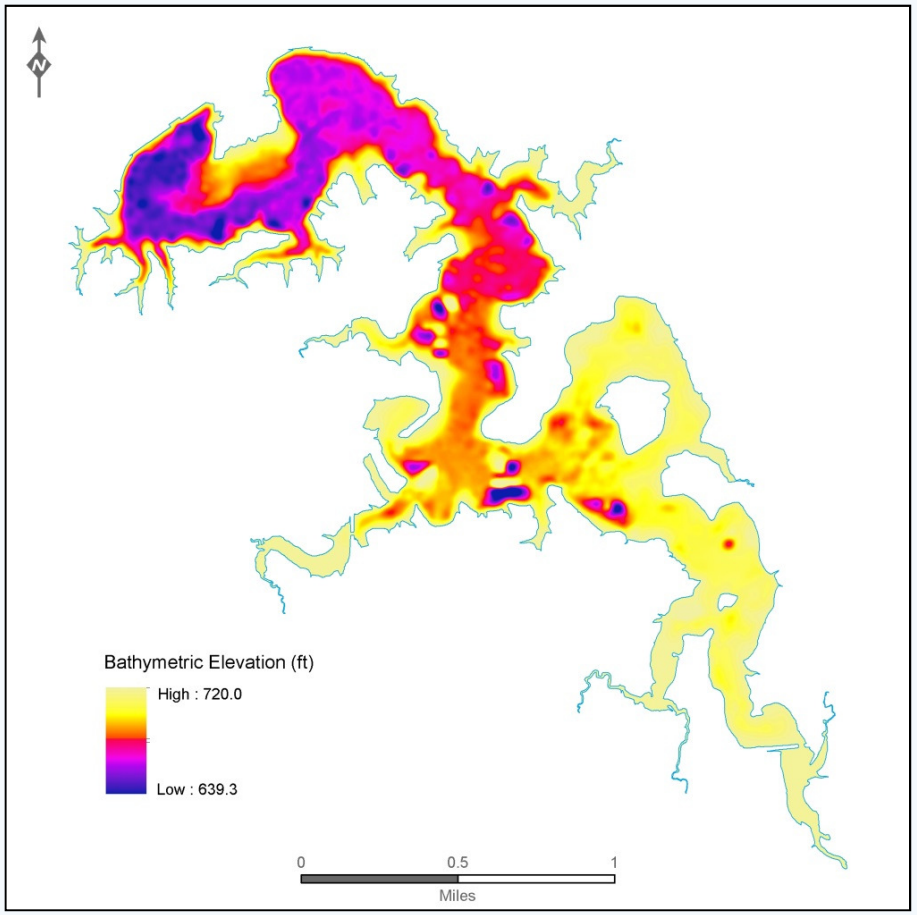
High Density - Lowest RMS for Interpolation Methods



Surface 1999



Surface 2014



Conclusion

- Bathymetrics can be very inaccurate
- Spline & Natural Neighbor, interpolation methods with lowest RMS error
- Will use these surfaces to calculate volume of sediment accumulation
- Higher point density can lower RMS errors dramatically (60%)

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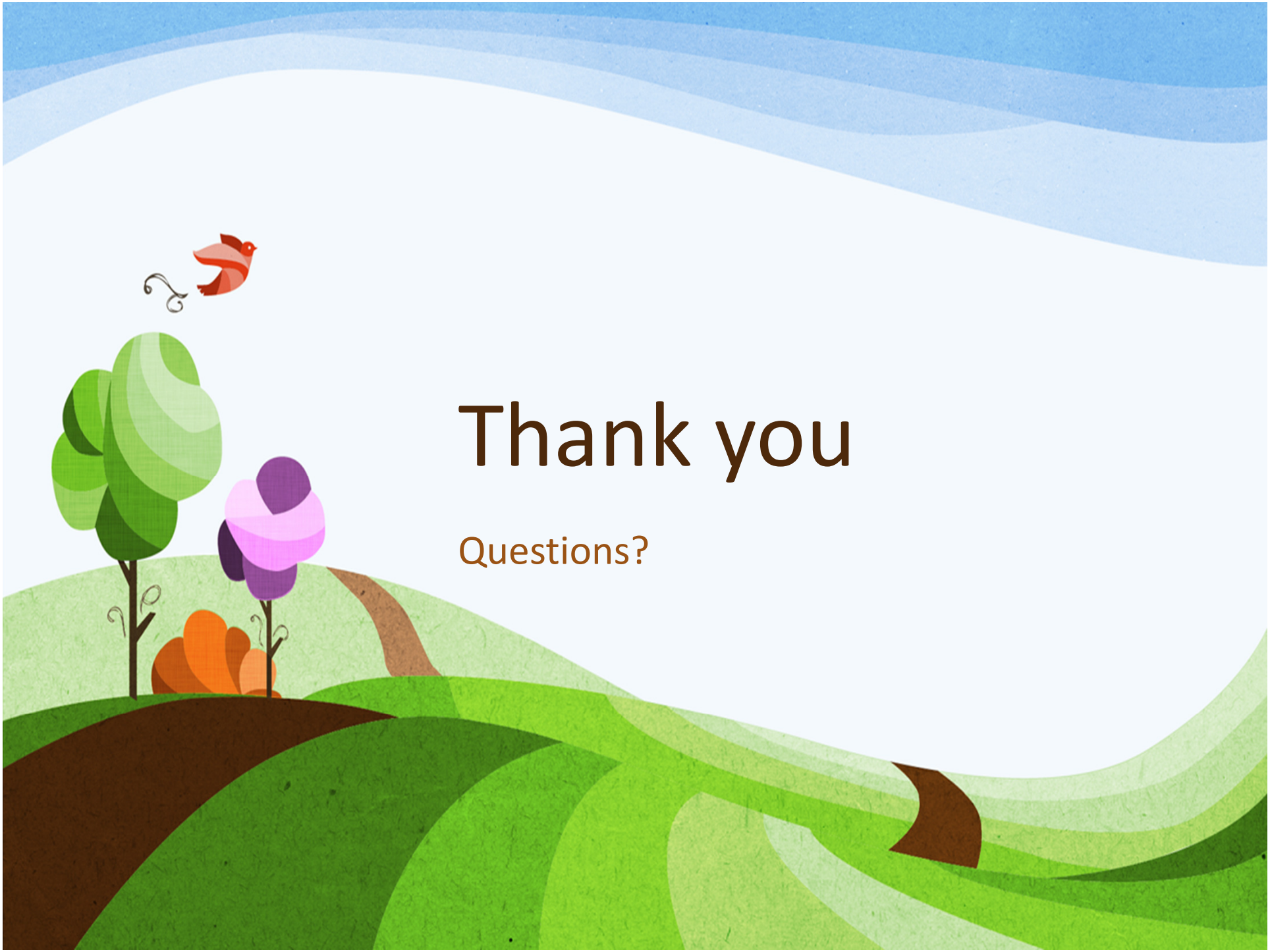
Thank you
Questions?