Multibeam Bathymetry

James Bradd
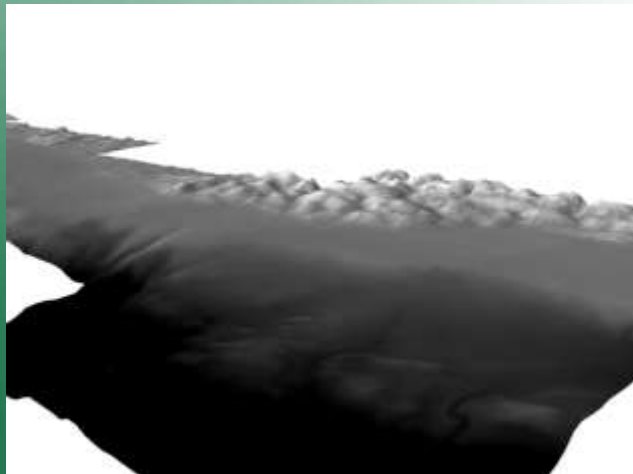Digital Terrain Analysis
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Research Question

How much kelp are we missing?

Overview of Methods

- Create DEM from multibeam echosounding

- Derive slope and aspect from DEM

- Include other datasets
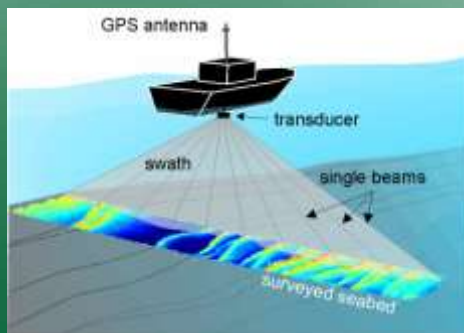   - Kelp Coverage (2004)
    - Grain Size

Software Used

- Virtual Box
- Poseidon Linux
- MBSystem
- ArcGis 10

Multibeam Bathymetry

- Developed to aid in underwater navigation
- Few Major Manufacturers around the world
- No data format standardizations
- Similar to surface returns of LiDAR (no "cloud")

Multibeam Bathymetry

- Sends out multiple echo beams
- Records return time, transducer elevation, pitch etc.
- Stores in raw format

Multibeam Proccessing

- UNIX based suite "MBSystem" only legitimate choice for free/casual users
  - Command Line Based
  - Assign MB format to raw data
  - Read information on that data
  - Aggregate into data lists
  - Grid data

Multibeam Proccessing

- Mbdatalist: Create lists of layers and ancillary files
- MBM_plot: Create shell script to plot to view your data
- MBM_grd: Create shell script to grid your data
- MBM_grd2arc: Convert grids to Arc ASCII DEM
- Mblist: prints X,Y,Z in tab delimited format

Multibeam Proccessing Alternative

- Mbdatalist to aggregate data
- Mblist output sent to text file
- Import ASCII 3d to ArcMap
- Point to Raster

Multibeam

- High accuracy compared to traditional sounding
- Swath allows more land to be surveyed by single boat
- Provide detail necessary for advanced modeling

- Difficult to process
- Expensive to capture
- Storage Intensive
- Little documentation
- No support from major programs
- Knowledge restricted to industry

Multibeam Problems Ecountered

- File size
    - Programs wouldn't run
    - Data wouldn't display
    - Processing took an immense amount of time

Multibeam Problems Encountered

- Time Consuming
    - Without investing major effort into scripting, it is a labor intensive proccess

Multibeam Problems Encountered

- Poor documentation
    - A decent guide is provided for optimal operation of Mbsystem
    - No support available
    - No FAQ regarding error messages

Solutions

- NOAA used the same data and created DEM's for the west coast
- Acquired the existing DEM's
    - Used the same proccess I was using to create mine according to metadata

Methods

- Acquire datasets
    - Current Kelp Distribution
    - DEM (to derive slope and aspect)
    - Grain Size (could be a limiting factor)

Methods

- Import/derive
- Clip to Shape
- Prepare for Open Modeller
- Create "Occurance File"

- Select Algorithm
    - Generic species distribution
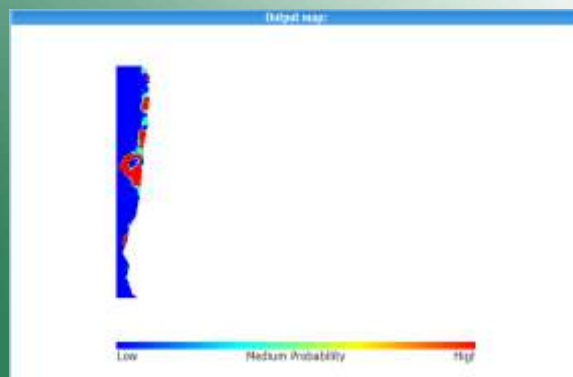   - Few inputs
    - Default Settings

Results

- Current Status
  - Limited
  - Isolated

Results

- Model Prediction
  - Much more widespread

Results

- Model Predictom compared to existing in adjacent states

Future Studies

- Use DEM's derived from multibeam to identify nutrient sinks

- Combine with current data to predict dead zones from prolonged upwelling

- Press ESRI to adapt the LiDAR tools for use with specific multibeam file types

- Add more inputs to the model and refine further

Conclusion

- Exploratory Experiment Accomplished:

  – Explored multibeam technology

  – Processed with the tools I had

  – Combine and plot many files together

  – Used derived datasets for use in environmental modeling

  – Provided slight indication that there are significant amounts of kelp forest not present off the Oregon Coast

Sources

- MBSystem Cookbook

- ESRI Documentation

- OpenModeller Documentation

- Duh, Geoffery Digital Terrain Analysis, 2010 Portland State University

- NOAA NGS