

Estimating intra-annual changes in the surface area of Sand Mesa Reservoir #1 using multi-temporal Landsat images

Cody A. Booth¹ with Ramesh Sivanpillai²

1. Department of Ecosystem Science and
Management and 2 Department of Botany
University of Wyoming

Water

- Arid environments depend on water
 - Driver for vegetation, livestock
 - Reservoirs/dams to store and release later
- Variations over time
 - Drought
 - Excess water
- Gauges – Measure inflow and outflow in reservoirs
- In Wyoming many reservoirs/water bodies are not gauged – no information exists on the amount of water stored

Remote Sensing

- Art & Science of collecting data without any physical contact
 - Example – human vision
- Data are collected by sensors in satellites, airplanes, UAS, Balloons, etc.
- Data are collected in the visible and infrared (invisible) portions of the spectrum

Landsat

- Series of Earth Observation Satellites
 - Landsat 1 was launched in 1972
 - Landsat 2 – 5 and 7, 8 (launched in Feb 2013)
- Landsat 5
 - Launched in 1984 and collected data until Nov 2011
 - 3 visible bands
 - Blue, green and red
 - 3 infrared bands
 - Near infrared 1 & 2, shortwave infrared
 - 30 m x 30 m
 - Imaged an area once every 16 days

Mapping intra-annual changes

- Study area: Sand Mesa Reservoir #1
 - Operated by WY Game & Fish
 - Shallow reservoir
 - Filters the water before it reaches Boysen Reservoir
 - Also serves as a wetland (wildlife habitat)
- Not gauged
 - Information on annual, and intra-annual changes are not available



Sand Mesa Reservoir #1

<http://www.fishingworks.com/lakes/wyoming/fremont/bonneville-sw/sand-mesa-number-1-reservoir/>

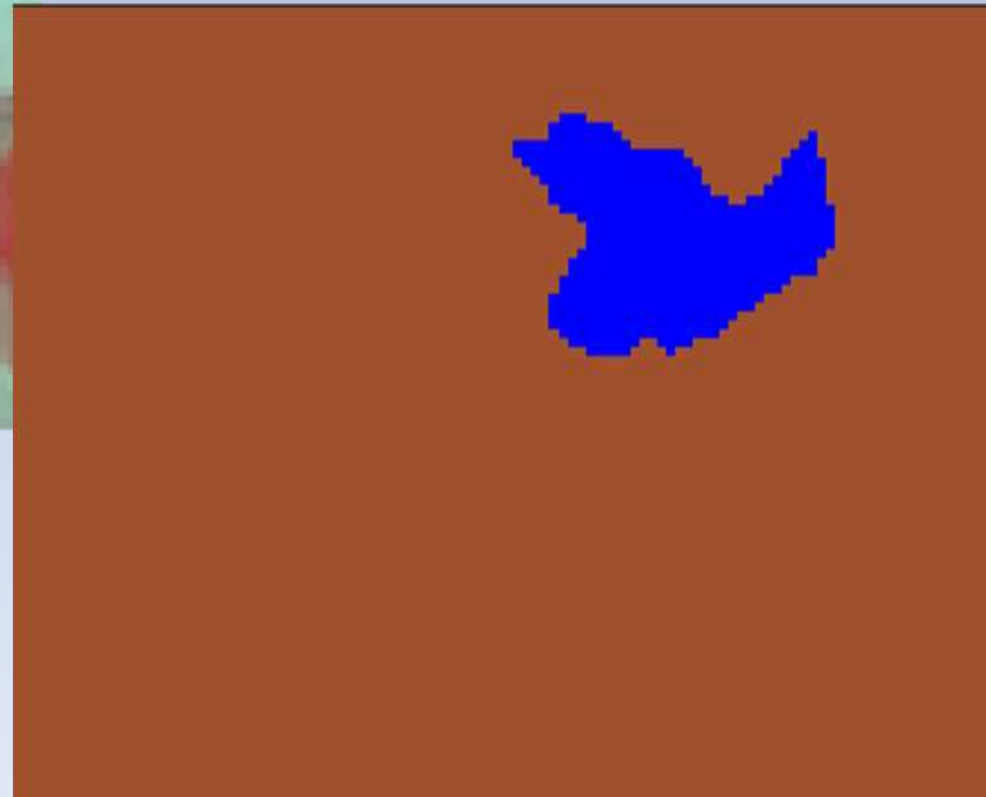
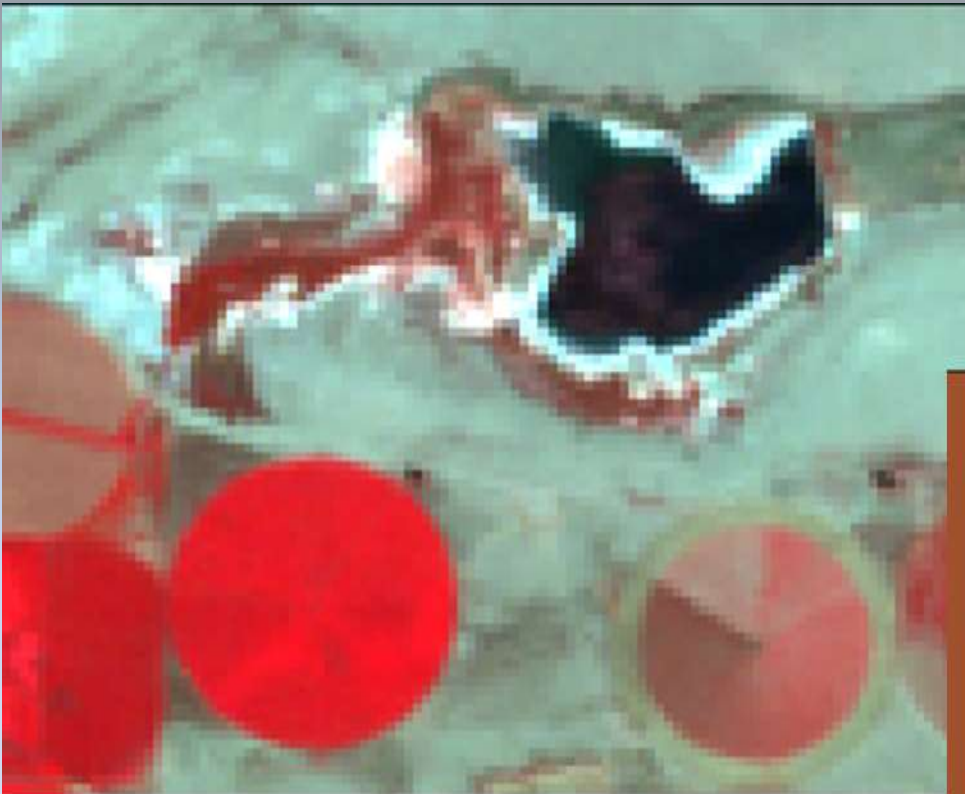
Mapping intra-annual changes

- Can remotely sensed data (Landsat 5) be used for mapping variation from summer to fall
 - Years analyzed: 2007 and 2009
 - 2007: Lander 11.02”
 - 2009: Lander 18.37”
 - <http://www.crh.noaa.gov/riw/?n=coopwateryear2007>
- Landsat images
 - 2007: Jun 27, Jul 13, Jul 29, Aug 30
 - 2009: Jun 16, Jul 18, Aug 3, Aug 19

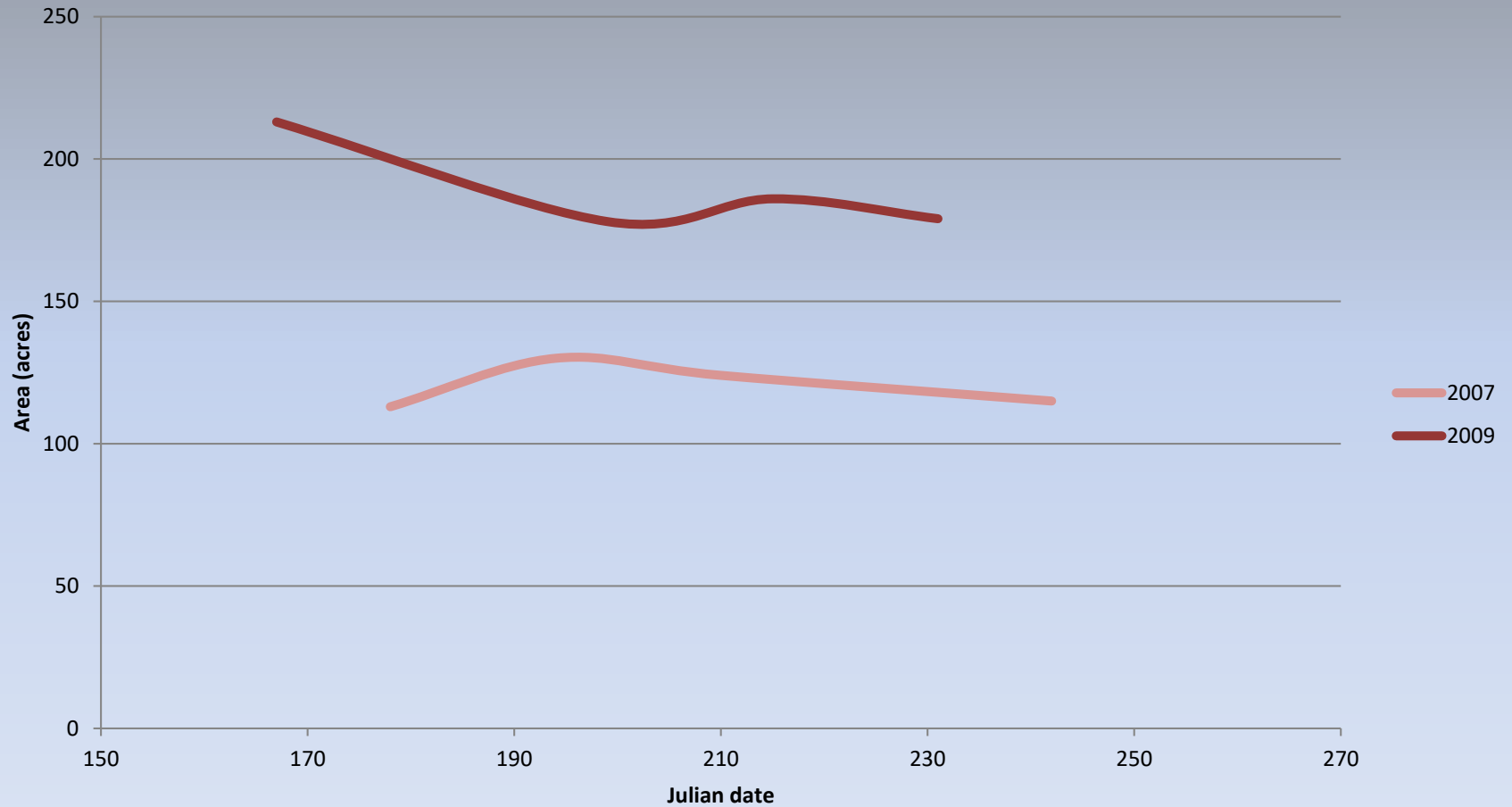
Methods

- Unsupervised classification
 - Spectral grouping of pixels based on their reflectance values
 - Similar features will have similar reflectance values
 - Assign the groups to thematic classes
 - Water, bare ground, vegetation
- Not possible to do accuracy assessment
 - No photos from 2007 or 2009
 - No gauges to compare values derived from RS data

Result: Output from classification



Results: seasonal changes in surface area



Discussion

- Mapping the mid-part of the lake was easier in comparison to the edges
 - Defining the edges
- Clear vs. turbid water
 - Some images had vegetation in the middle which did not interfere with the classification of water bodies
 - This might not be typical in other cases

Discussion & Conclusions

- How useful was Landsat to map changes in Sand Mesa Reservoir #1?
 - Difficult to separate from land from water
 - Floating/submerged vegetation was not a problem
- Advantage of Landsat is that it is collected every 16 days
 - Changes in other years can be mapped (1984 – 2011)
- Landsat 8 was launched in Feb 2013 – data will be available in June 2013

Discussion & Conclusion

- This study can be repeated for other shallow and small reservoirs, over multiple years
- Utility of Landsat data for mapping similar water bodies can be determined

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Questions