



Mapping Changes in the Reservoir Surface Area Using Landsat Thematic Mapper Images

Christopher Steinhoff

Ecosystem Science and Management, University of Wyoming

Ramesh Sivanpillai

Department of Botany, University of Wyoming

Importance of Monitoring Reservoirs

Municipal Domestic Use



Irrigation



Watershed Sustainability



Livestock



Recreation



Importance Cont.

- Water Storage
- Fluctuations
 - Dry Year vs. Wet Year
 - Yearly Use
- Monitoring Fluctuations
 - Necessary for Management Decisions
 - Both Past and Present Data Equally Important



Sixty Seven Reservoir

- Background
 - Located in Sublette County
Approximately 6.5 Miles NW of
Big Piney, Wyoming
 - Privately Owned
 - Maximum Storage Capacity of
5,200 AF (Acre-Feet)
 - Used for Irrigation, Stock, and
Domestic Purposes
 - Not Gauged
 - No Past Data on Water
Fluctuations
 - What Can We Fill This Data
Gap with ?

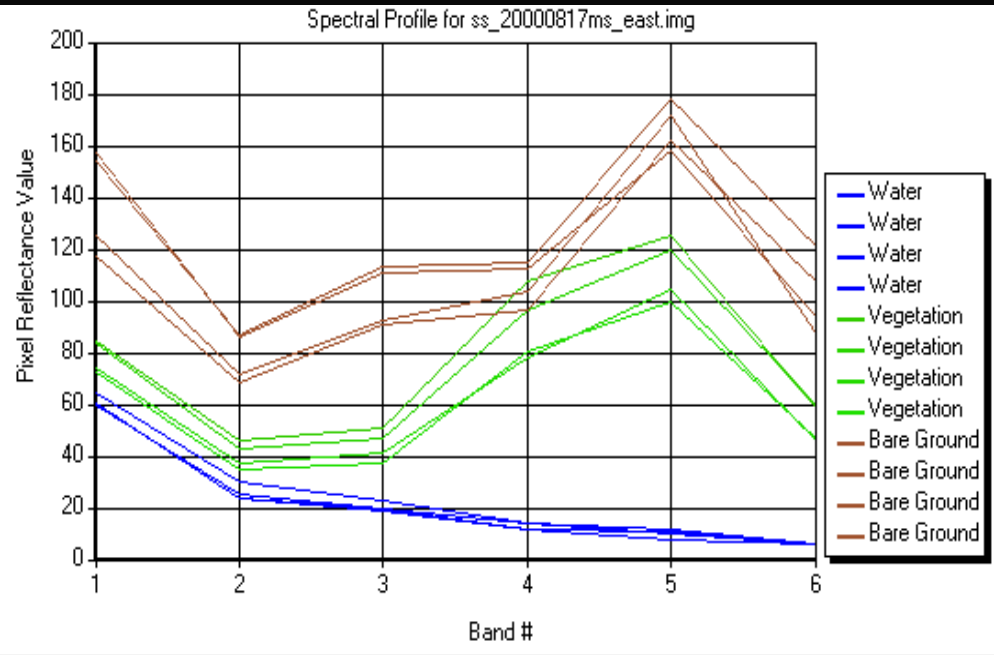


Remote Sensing

- Remotely Sensed Data Can be Used to Fill Information From Past
- Landsat 5 (Satellite)
 - Launched March 1st, 1984 by NASA
 - Multispectral Scanner Using 4 Bands
 - Thematic Mapper Using 7 Bands
 - Pixel Size 30m for Reflective (6) and 60m (1) for Thermal Bands
 - Every Location on the Earth is Imaged Once in 16 Days
 - Operational Until Nov 2011



Remote Sensing



- In a Remotely Sensed Image
 - “Features Reflect Different Amount of Radiation”
 - “Different Reflectance Patterns Can be Used to Separate Features”
- Using Statistics:
 - Unsupervised Classification for Generating Spectral Clusters
 - Determine the Clusters That Correspond to Water
 - Determine Surface Area in Each Image
- ERDAS IMAGINE 2011

Objectives & Methods

- To Determine the Surface Area Changes of Sixty Seven Reservoir Between 1985 and 2011 using Landsat 5 Data that Were Acquired in August
 - Images were Downloaded from USGS
 - Analyze the Spectral Differences
 - Ran Unsupervised Classification and Generated Spectral Clusters (100)
 - Determined the Clusters that Corresponded to Water
 - Computed Surface Area
 - Estimated Changes Over Time
-

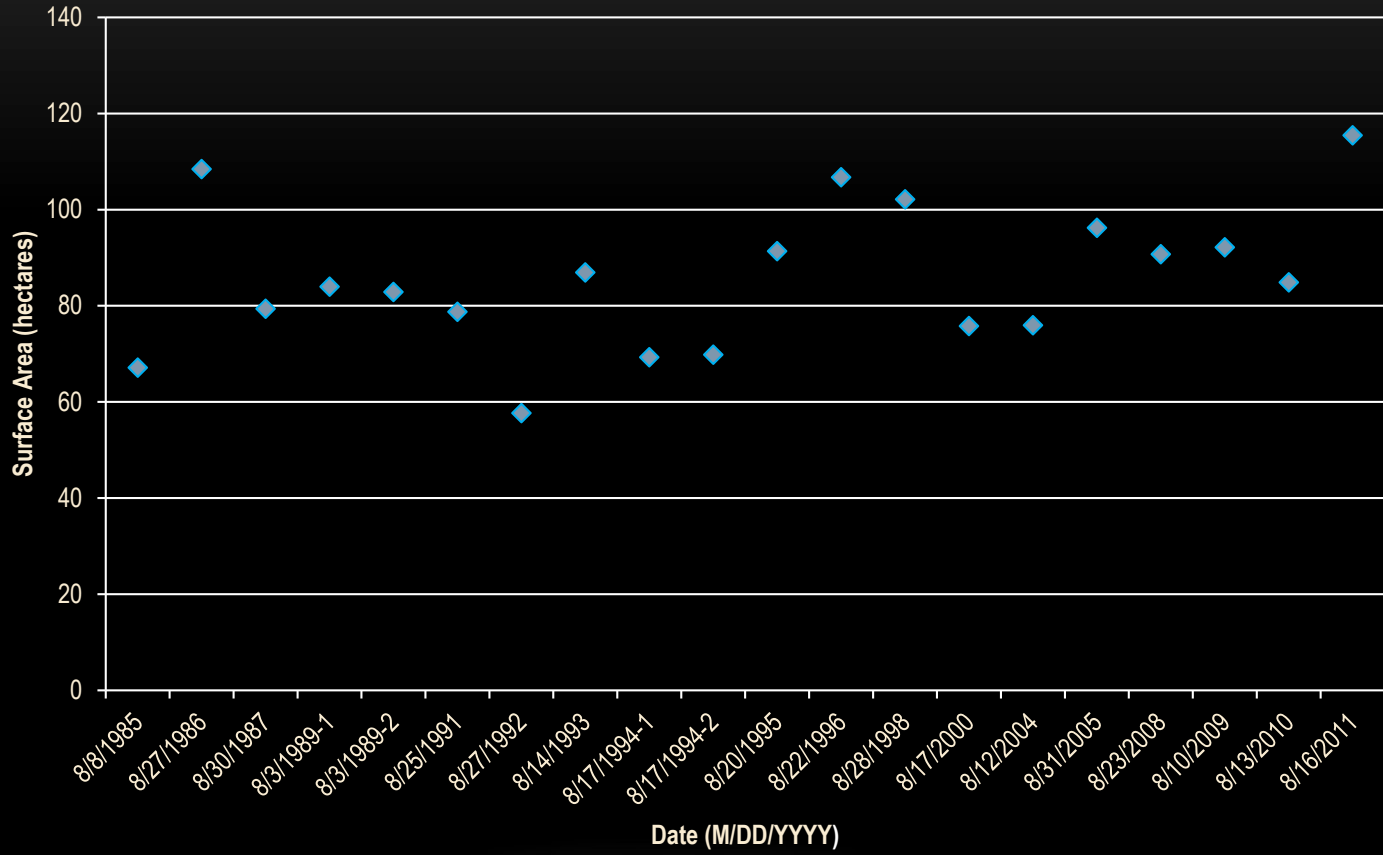
Image Classification



- Took Raw Images Collected by Landsat 5 (top) and Processed Them Using ERDAS to Delineate Water From Other Land Cover Types (bottom)

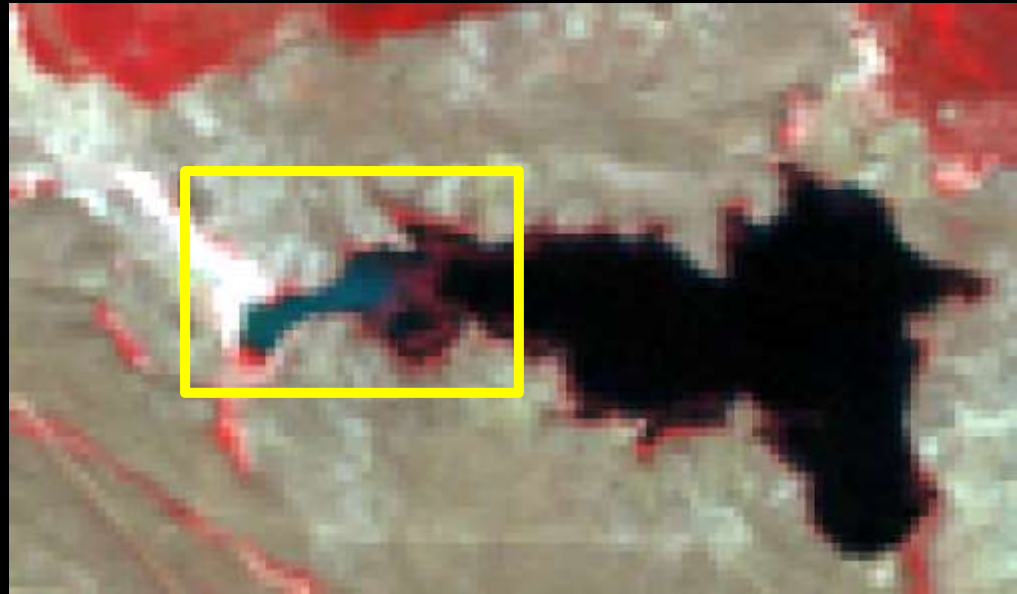


Surface Area



Interpretation Problems

- Underwater Vegetation and Shallow Areas are Difficult to Definitively Classify Without Field Data
- Clearly Define the Classes Before the Analysis



Consistency Problems

- Assigning Clusters to Water Depends on the Analyst's Training and Experience
- Consistency and Patience

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Row	Histogram	Color	Class_Names	Red	Green	Blue	Opacity
0	0		Unclassified	0	0	0	0
1	483		Class 1	0	0	0	1
2	152		Class 2	0	0	0.04	1
3	31		Class 3	0.06	0.04	0.09	1
4	32		Class 4	0.01	0.09	0.16	1
5	22		Class 5	0	0	0	1
6	17		Class 6	0.21	0.14	0.16	1
7	7		Class 7	0.17	0.1	0.13	1
8	4		Class 8	0.04	0.09	0.15	1
9	10		Class 9	0.18	0.27	0.33	1
10	6		Class 10	0.06	0.05	0.1	1
11	3		Class 11	0.22	0.27	0.31	1
12	5		Class 12	0.35	0.24	0.26	1
13	6		Class 13	0.21	0.23	0.27	1
14	5		Class 14	0	0	0.03	1
15	4		Class 15	0.11	0.09	0.11	1
16	3		Class 16	0.31	0.17	0.17	1
17	9		Class 17	0.07	0.05	0.1	1
18	6		Class 18	0.5	0.26	0.29	1
19	0		Class 19	0	0	0	1

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Row	Histogram	Color	Class_Names	Red	Green	Blue	Opacity
0	0		Unclassified	0	0	0	0
1	483		Water	0	0	1	1
2	152		Water	0	0	1	1
3	31		Water	0	0	1	1
4	32		Water	0	0	1	1
5	22		Water	0	0	1	1
6	17		Water	0	0	1	1
7	7		Water	0	0	1	1
8	4		Water	0	0	1	1
9	10		Class 9	0.18	0.27	0.33	1
10	6		Water	0	0	1	1
11	3		Class 11	0.22	0.27	0.31	1
12	5		Class 12	0.35	0.24	0.26	1
13	6		Class 13	0.21	0.23	0.27	1
14	5		Water	0	0	1	1
15	4		Water	0	0	1	1
16	3		Class 16	0.31	0.17	0.17	1
17	9		Water	0	0	1	1
18	6		Class 18	0.5	0.26	0.29	1
19	0		Water	0	0	1	1

Considerations for Future Work

- Image Analysis
 - Develop a Classification Scheme (Consistency Issue)
- Ancillary Data
 - Temperature Data
 - Evaporation (Loss)
 - Precipitation Data
 - Run-Off (Input)
 - Irrigation Records
 - Amount of Water Used for Irrigation (Output)
 - Within Growing Season Variations (May – Oct)

Conclusions

- Remote Sensing is A Useful Tool for Estimating Changes in Reservoir Surface Area
 - Especially Useful for Those Water Bodies That are Not Gauged
 - With Landsat We Can Map Within and Between Year Changes
- Does Have Limitations
 - Experience of the Analyst
 - Availability and Quality of Images

Acknowledgements

- WyomingView
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 - AmericaView/USGS
- USGS
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- University of Wyoming
 - Ramesh Sivanpillai

Questions?
