

Delineating crop management zones within alfalfa fields using Landsat images

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Agriculture in Wyoming

- Contribution to economy (crops)
 - Hay is top crop in the State
 - 2 million tons worth \$390 million
 - 990,000 acres averaging 2tons/acre
- Difficulties farmers face ..
 - Short growing seasons
 - 3-4 alfalfa cuttings/year
 - Soil fertility, damages (wind)
- Successful growing season is important

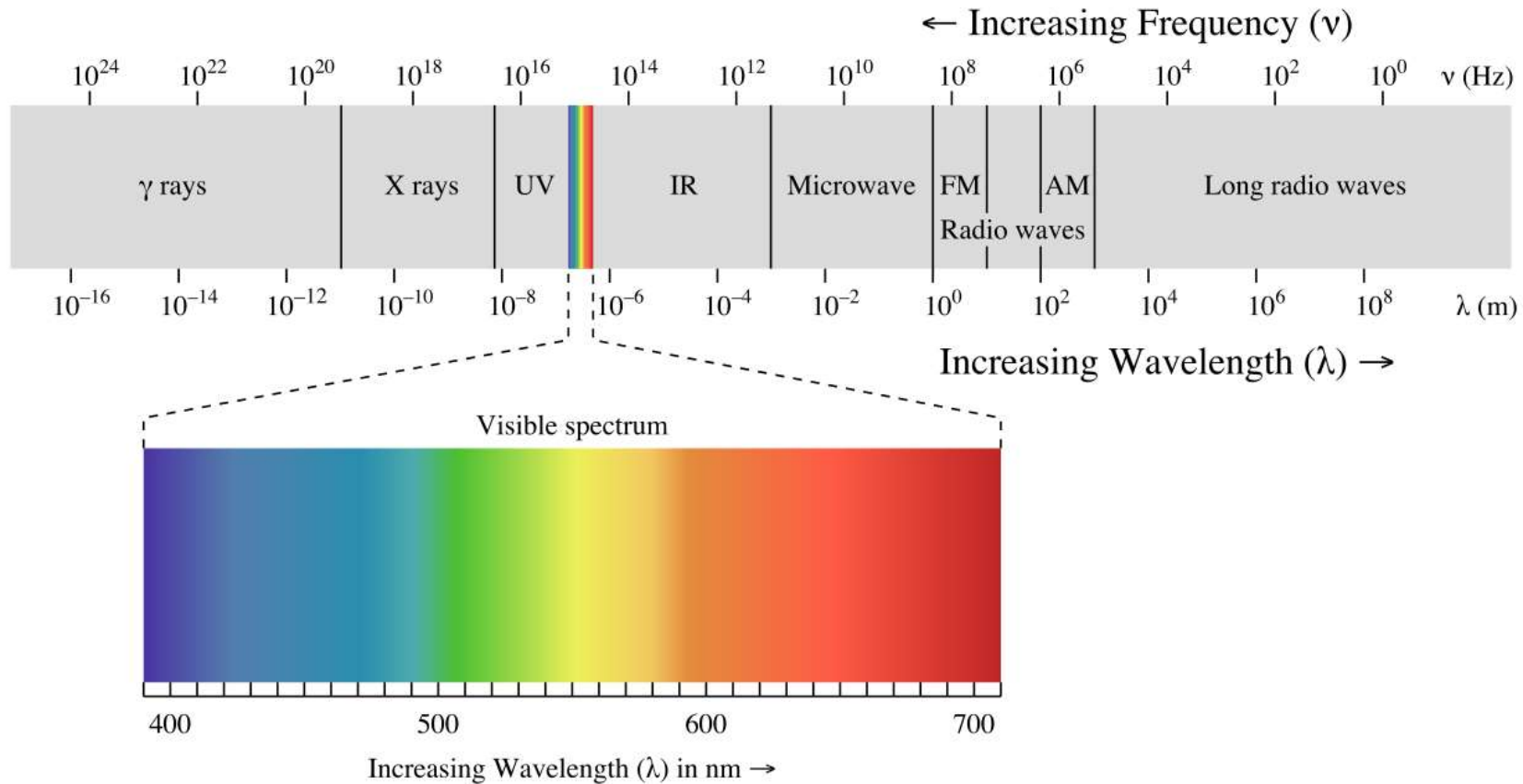
Crop growth in field

- Variability can reduce yield and profit
 - More in crops such as sugar beets, barley, wheat than alfalfa
- Cost related to variability
 - Equipment issues
- Remote Sensing offers a way to monitor the variability in crop growth

What is remote sensing

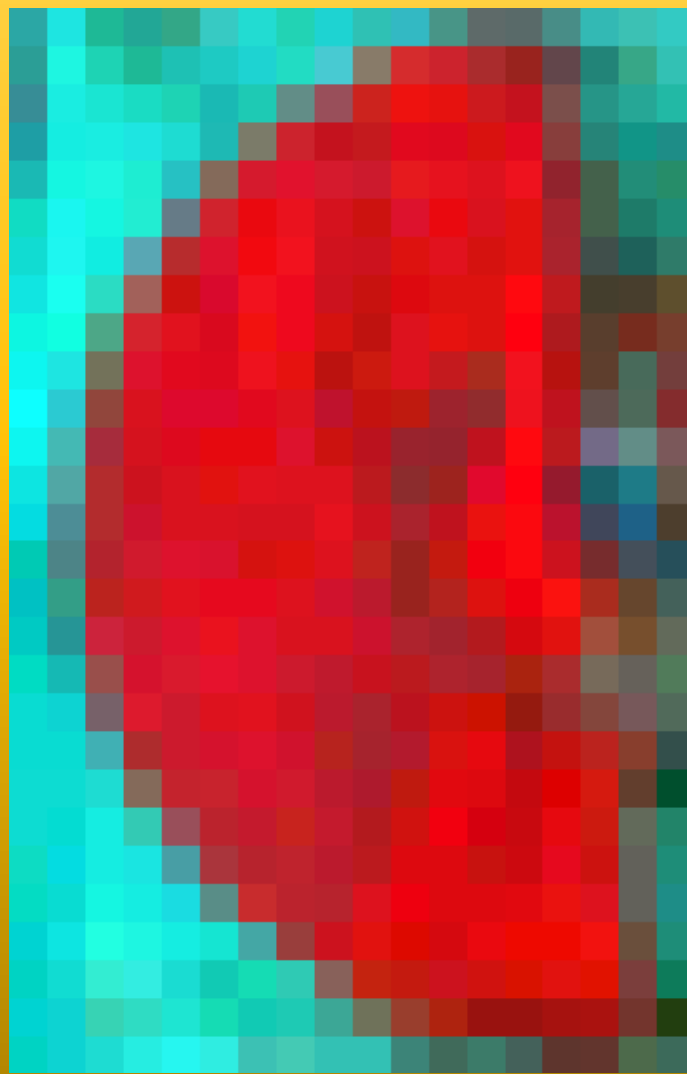
- Data collected by airplanes or satellites, and now hand-held sensors, and UAVs
- Data is in the form of images
- Visible and invisible portion of the electromagnetic spectrum

Remote Sensing



- Landsat 5
- 1986-2011
- 30m spatial resolution
- 6 bands
 - 3 visible (BGR)
 - 3 invisible (IR)
- Once every 16 days

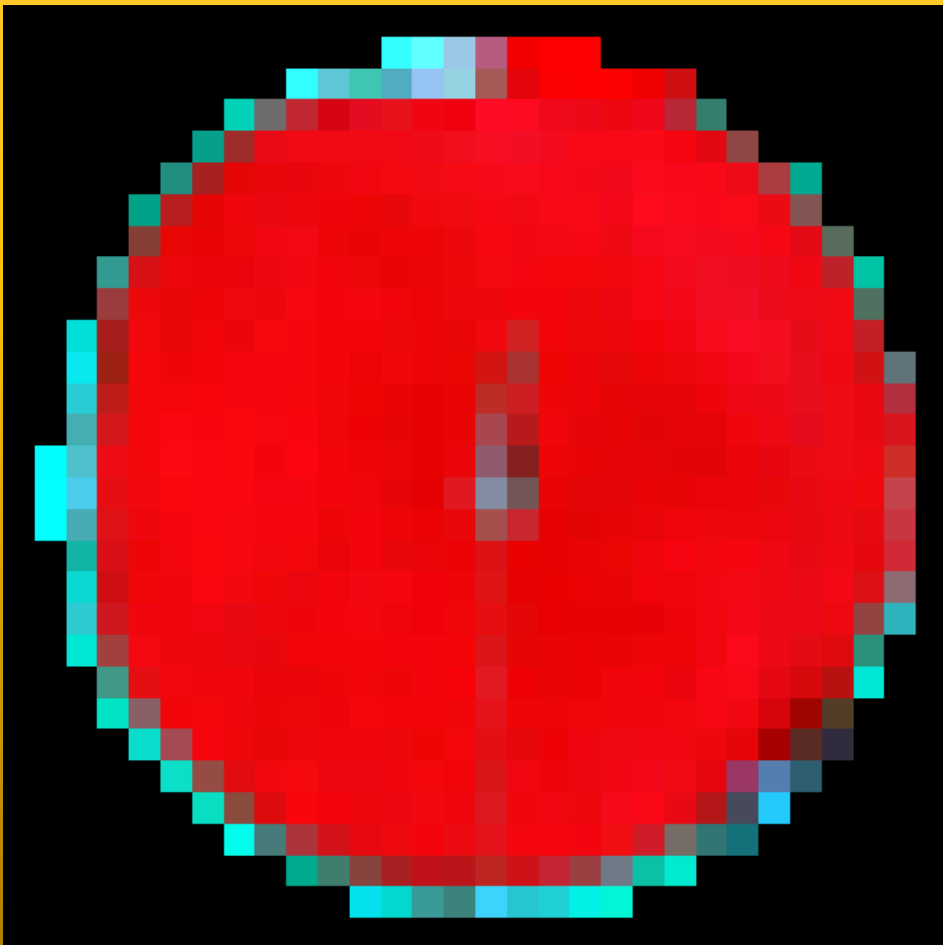
Examples: Visible, infrared 1, & infrared 2 images



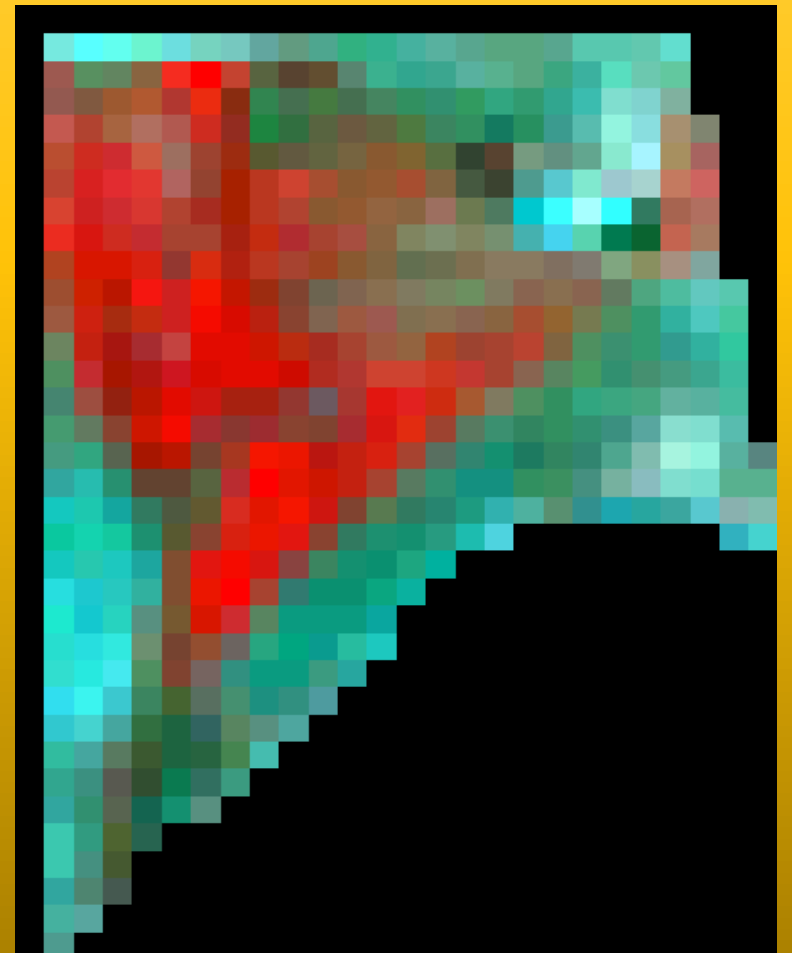
Images: USGS

Variability in crop growth

Uniform, Low Variability



High Variability



Images: USGS

Monitoring with Remote Sensing

- Is the variability happening in one year or over multiple years?
- If it happens over multiple years, in the same pattern – then fields have to be zoned
 - Precision agriculture
 - Each zone (high, medium, low) are managed differently

Study Area

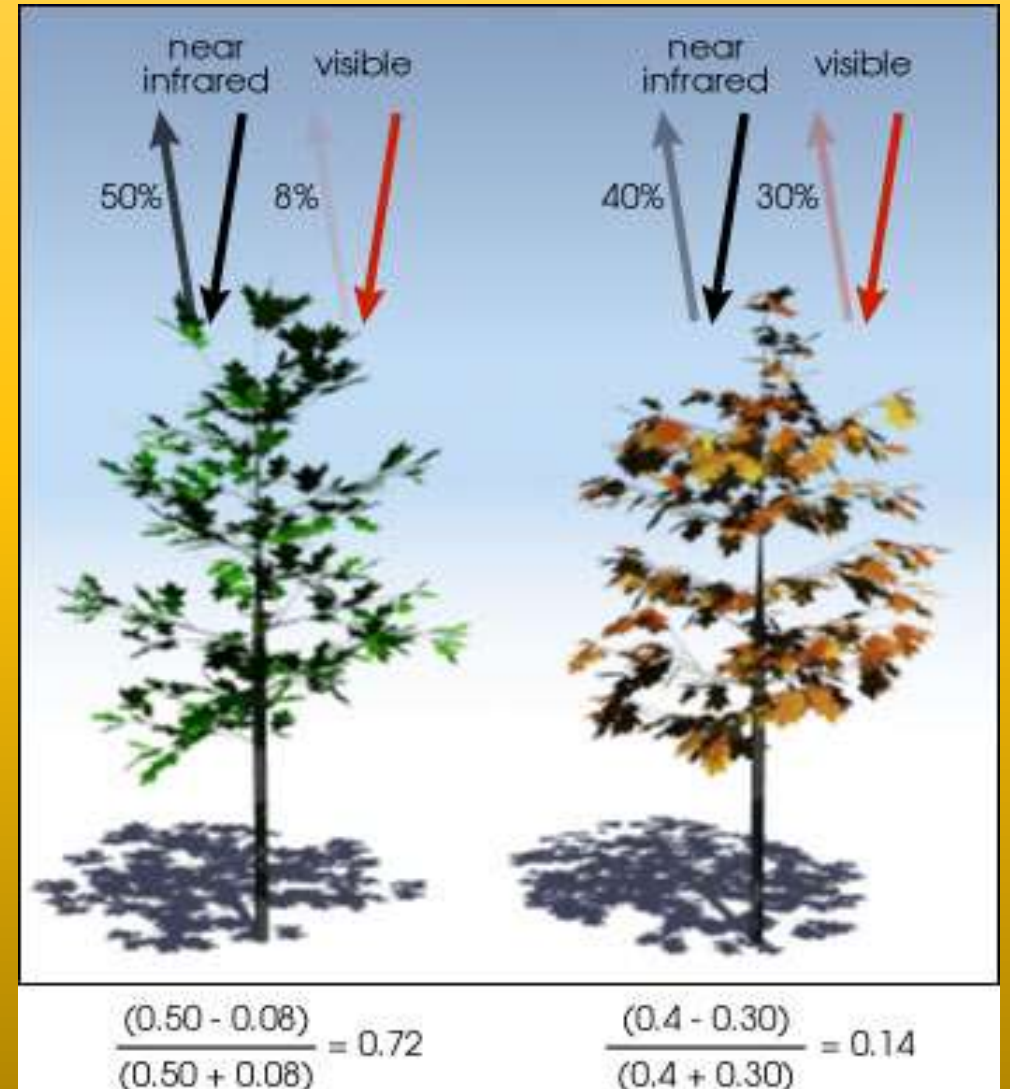
- Farm is located 3 miles west of Wheatland WY.
- Landsat images acquired on.
 - June 16, 2008
 - June 21, 2009
 - June 8, 2010
- Were downloaded from the USGS website



Courtesy: Google Maps

Processing

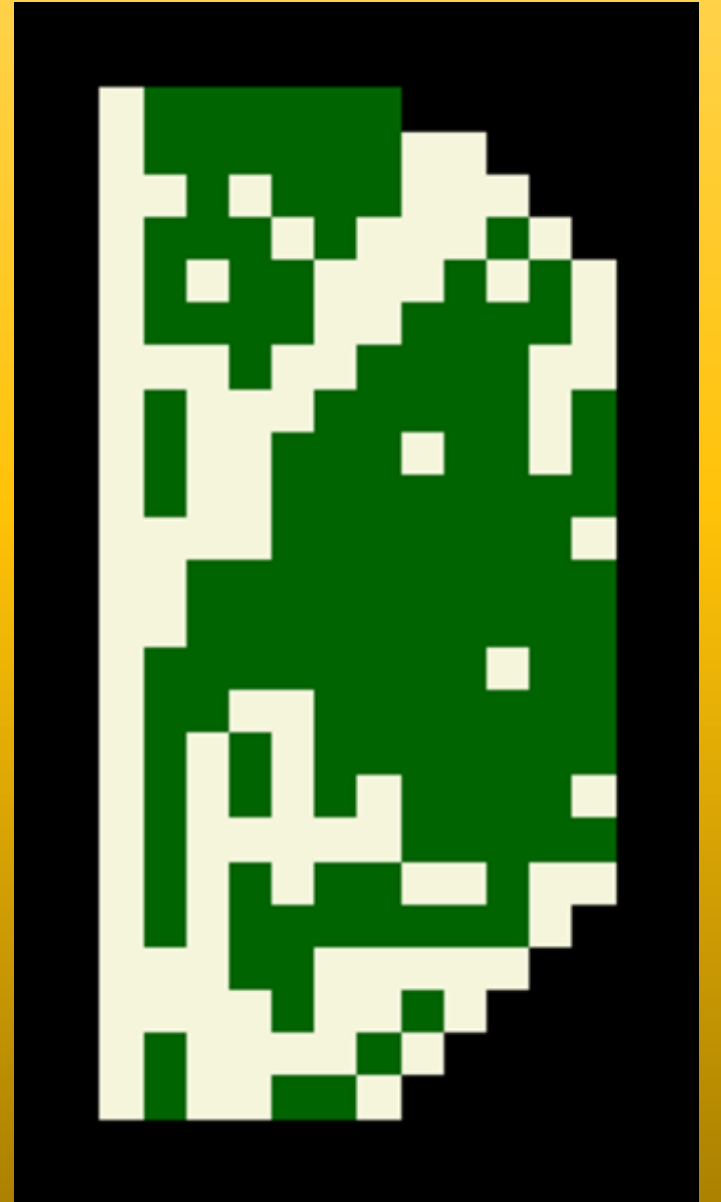
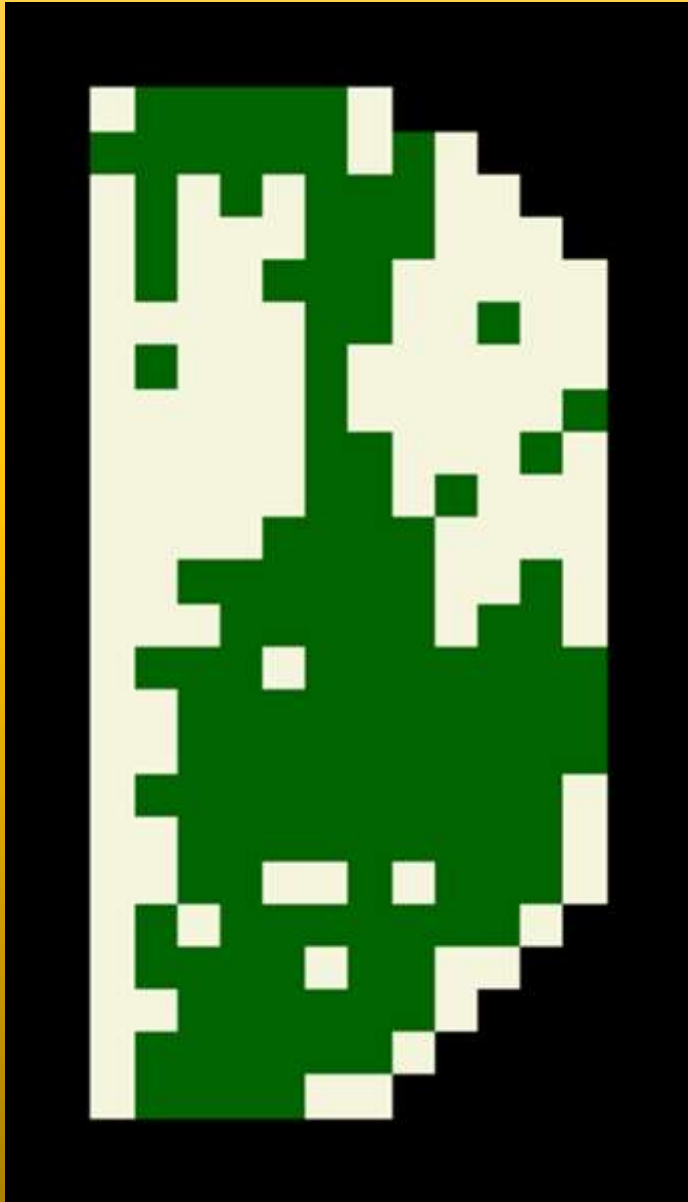
- Images were converted to
- Normalized Difference Vegetation Index
 - $(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$
- Measure of vigor (-1,+1)
- High vigor (growth) – towards + 1
- No growth, water, - towards -1



Processing

- NDVI images for each field was reclassified based on its median value
- IF NDVI > Median THEN Good growth
- IF NDVI < Median THEN Poor growth
- Pixels were assigned to good or poor growth classes

Fields regrouped into good (green) and poor (tan) classes for 2008, 2010 & 2011




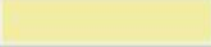



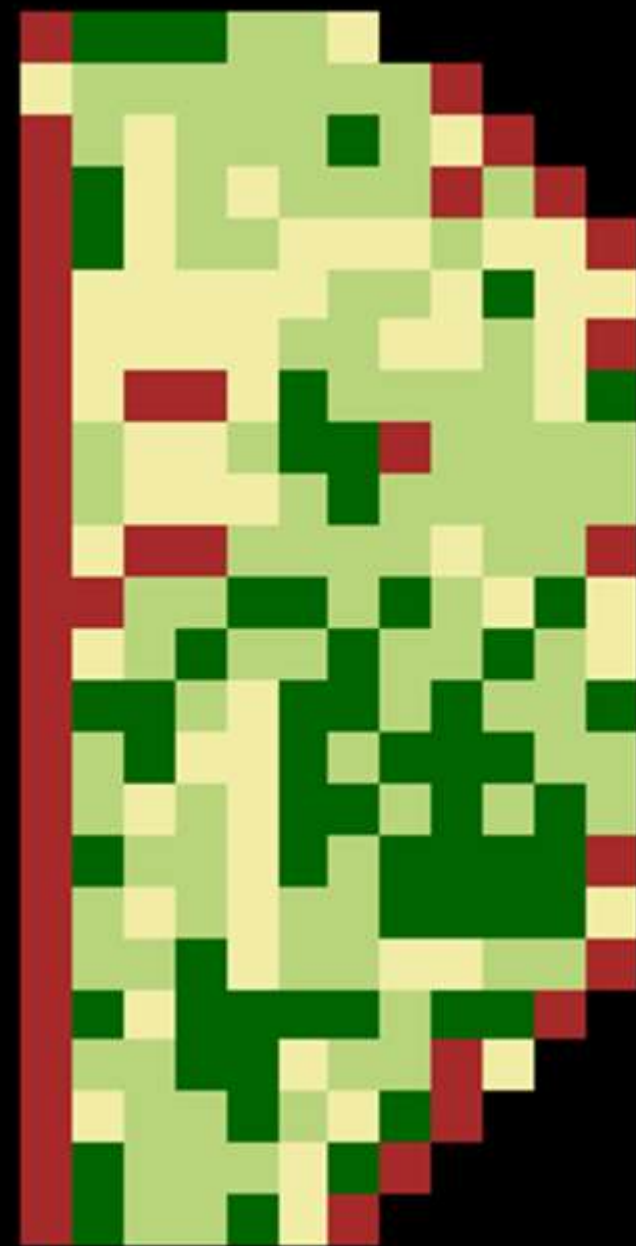
Combine multiple years of info -> single image

2008	2010	2011	Final image class
G	G	G	Above median 3 years
G	G	P	
G	P	G	Above median 2 years
P	G	G	
..			
...			
P	P	P	Below median 3 years

Final map

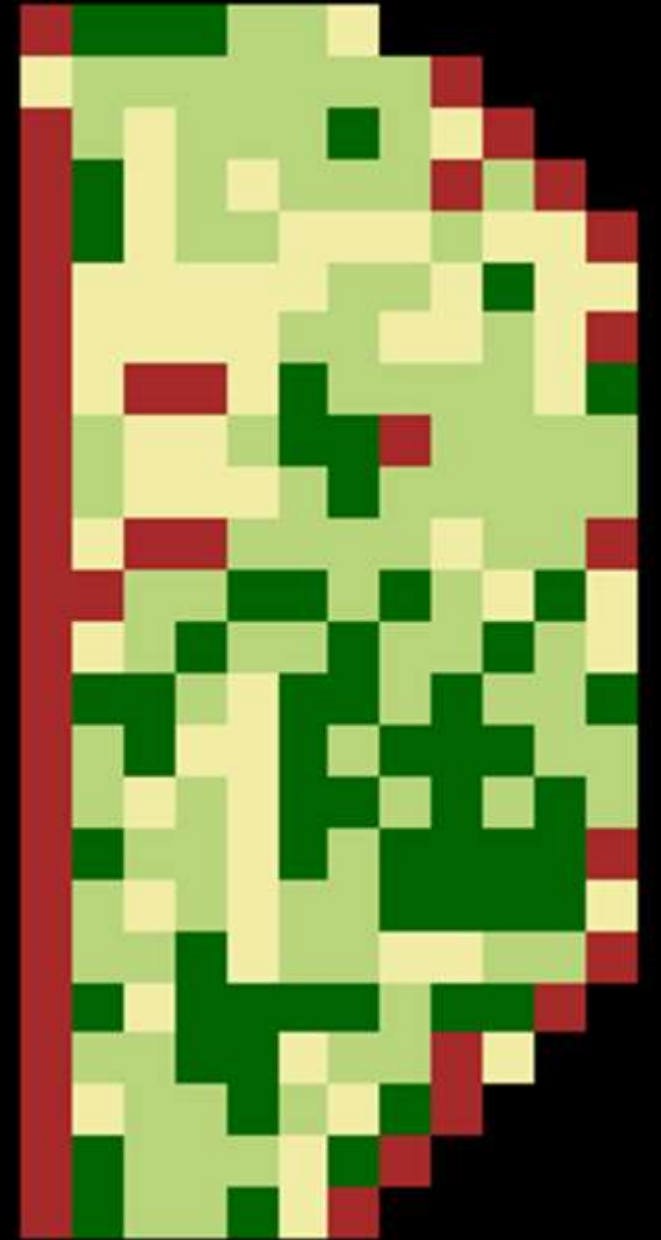
sj_3years_compare.img

Row	Histogram	Class_Names	Color	Area_a	0
0	186			41.3655	
1	60	Above median - all 3years		13.3437	
2	99	Above median - any 2 years		22.0171	
3	60	Above median - any 1 year		13.3437	
4	43	Below median - all 3 years		9.56299	



Recommendation to the farmer

- 22 acres had good growth in 2 years
- 13 acres had good growth in 1 year
- This image will help the farmer to collect
 - Soil samples
 - Apply fertilizer
- Instead of treating the entire field as 1 unit



Acknowledgement

- University of Wyoming Extension &
- WyomingView

