Mapping wheat growth in dryland fields in SE Wyoming using Landsat images

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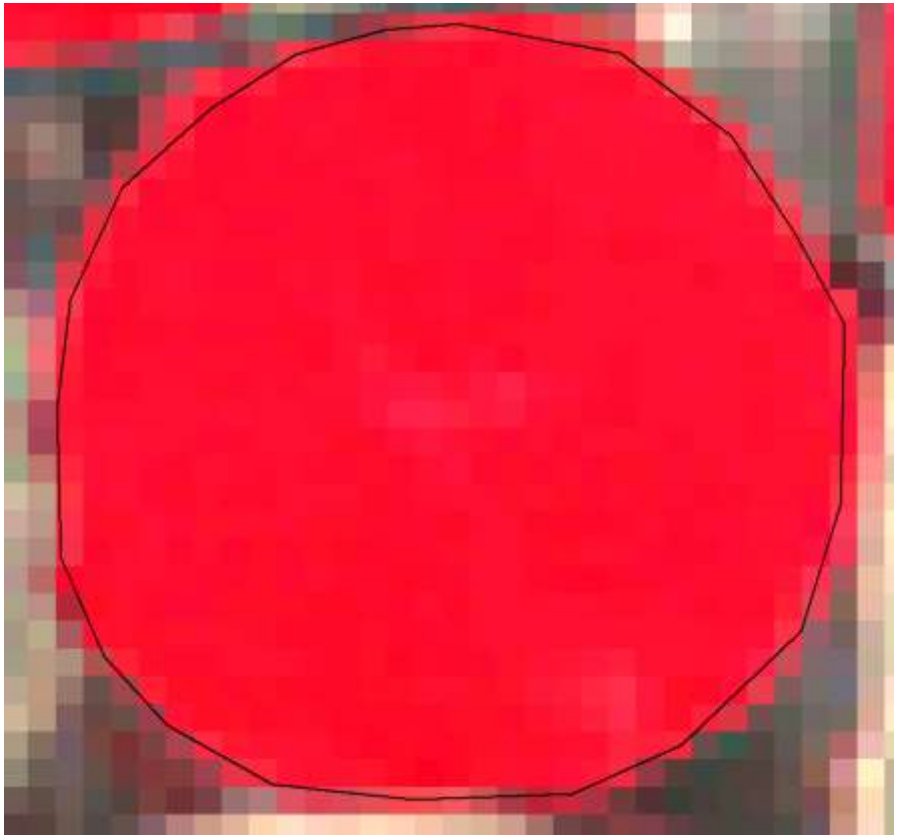
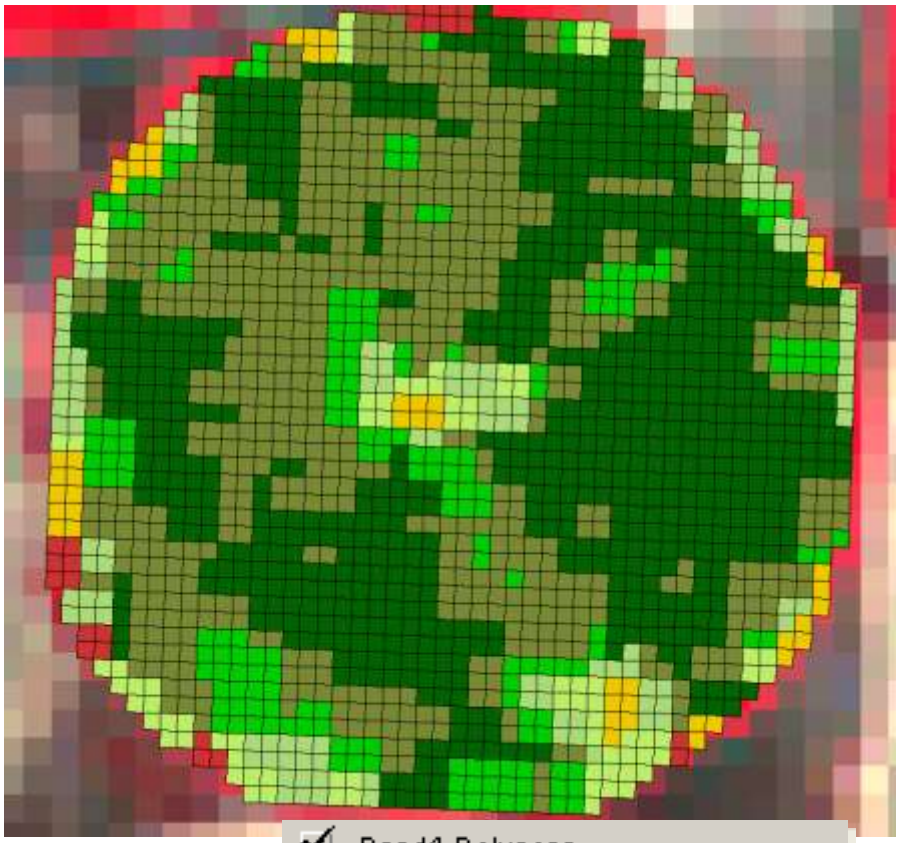
Introduction

- Farm management
  - Maximize crop growth (or yield)
  - Traditional: Treat the field as single unit
  - Precision ag: Divide the field into multiple zones
  - Need crop growth info from 3 – 4 years

- Remote Sensing can be a tool

Management Zones within Fields

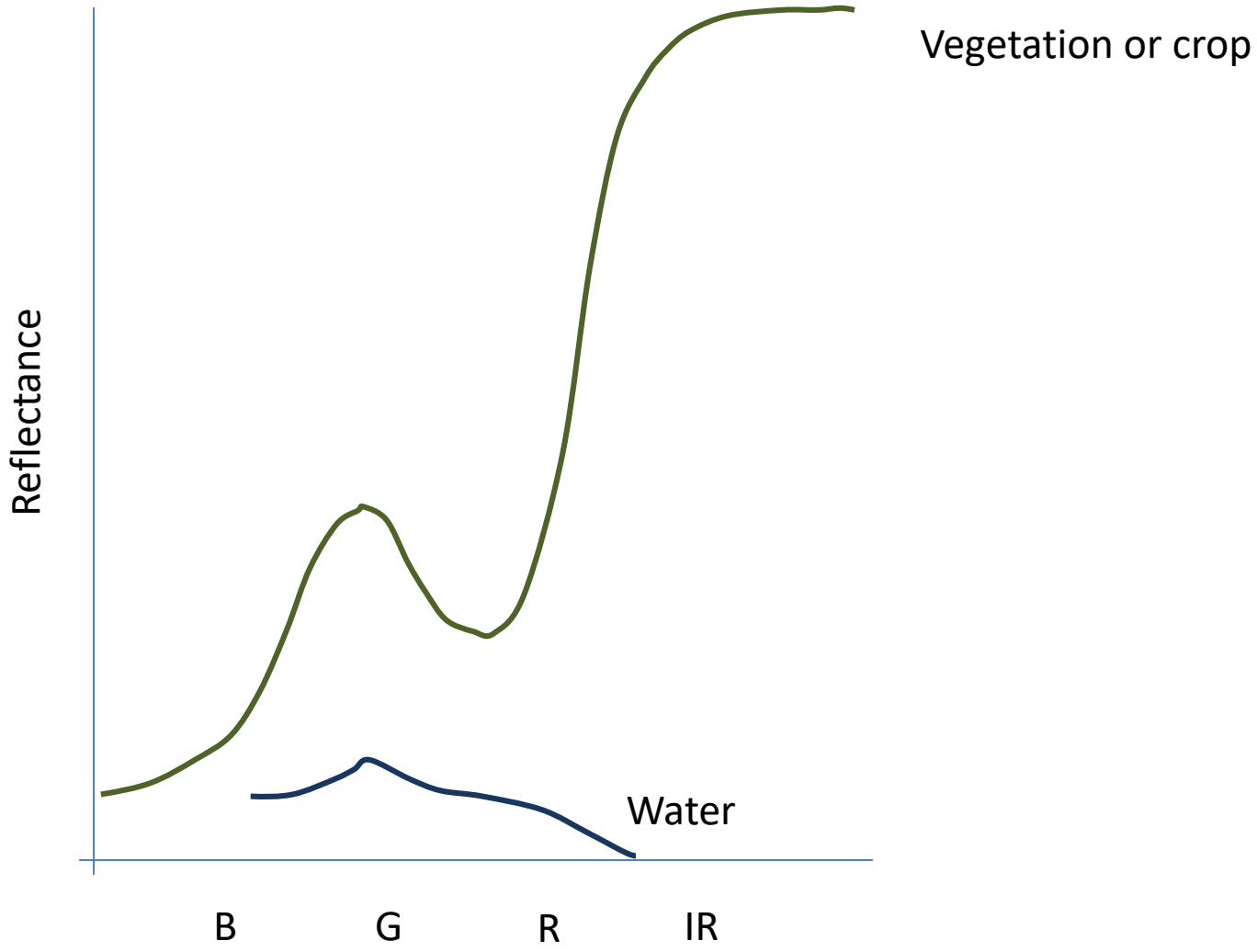




Leaf Level Reflectance

- Chlorophyll ***a*** and ***b***
  - Absorbs in blue and red regions of EMR
  - Reflects in green
- Reflects in the infrared regions of Electromagnetic Radiation (EMR)
  - Invisible to human eyes
- Electronic sensors are used to record these interactions
  - Are mounted in airplanes and satellites
  - Remotely sensed images

Spectral Reflectance Curves

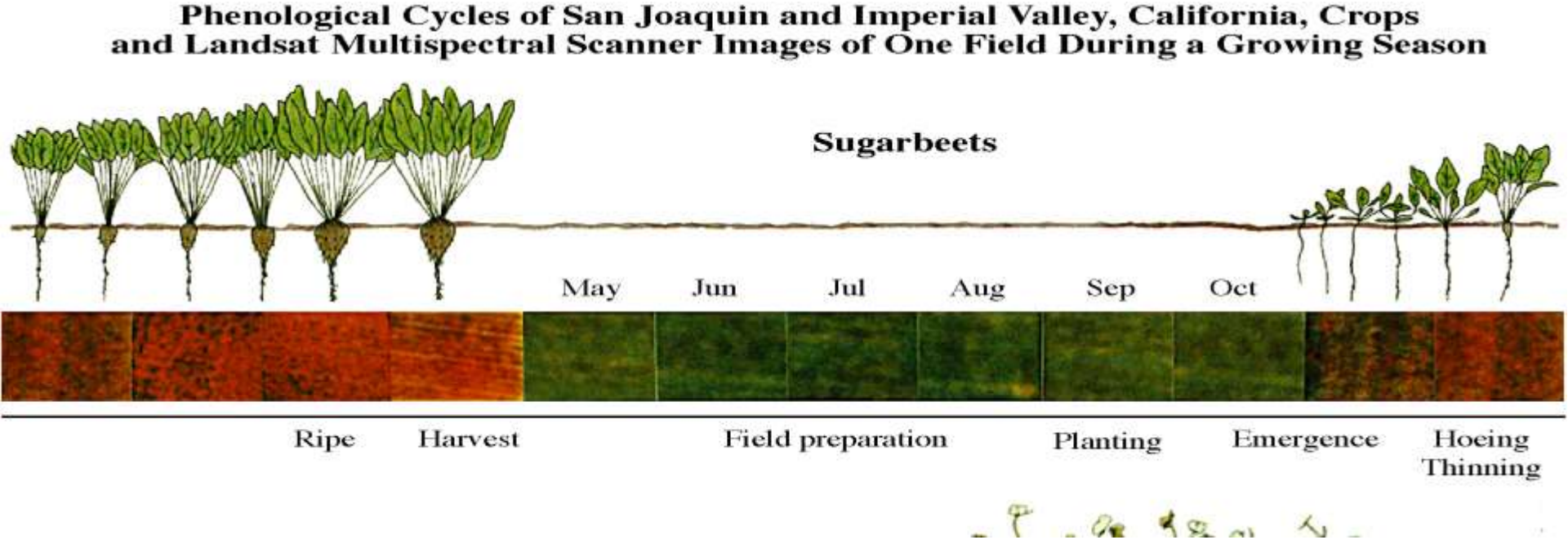


Vegetation Indices

- Spectral values in different EMR are converted to indices

- Normalized Difference Vegetation Index
  - Compares reflectance in infrared and red regions

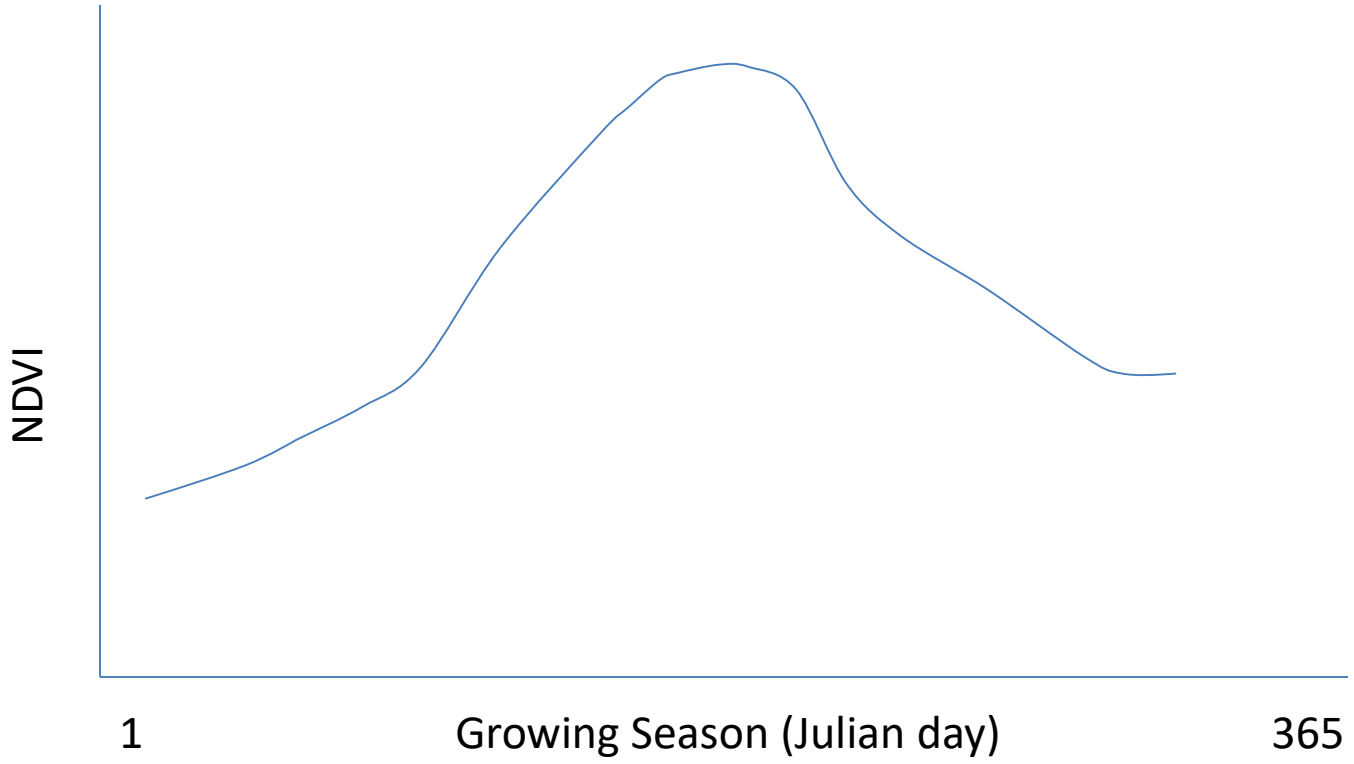
  - $NDVI = (R_{NIR} - R_{red})/(R_{NIR} + R_{red})$



Crop Growth Calendar of San Joaquin and Imperial Valley, California Crop and Landsat Multispectral Scanner Images of One Field During A Growing Season

Jensen, 2000

Monitoring Crop Growth



Compare crop growth from multiple years

Objectives

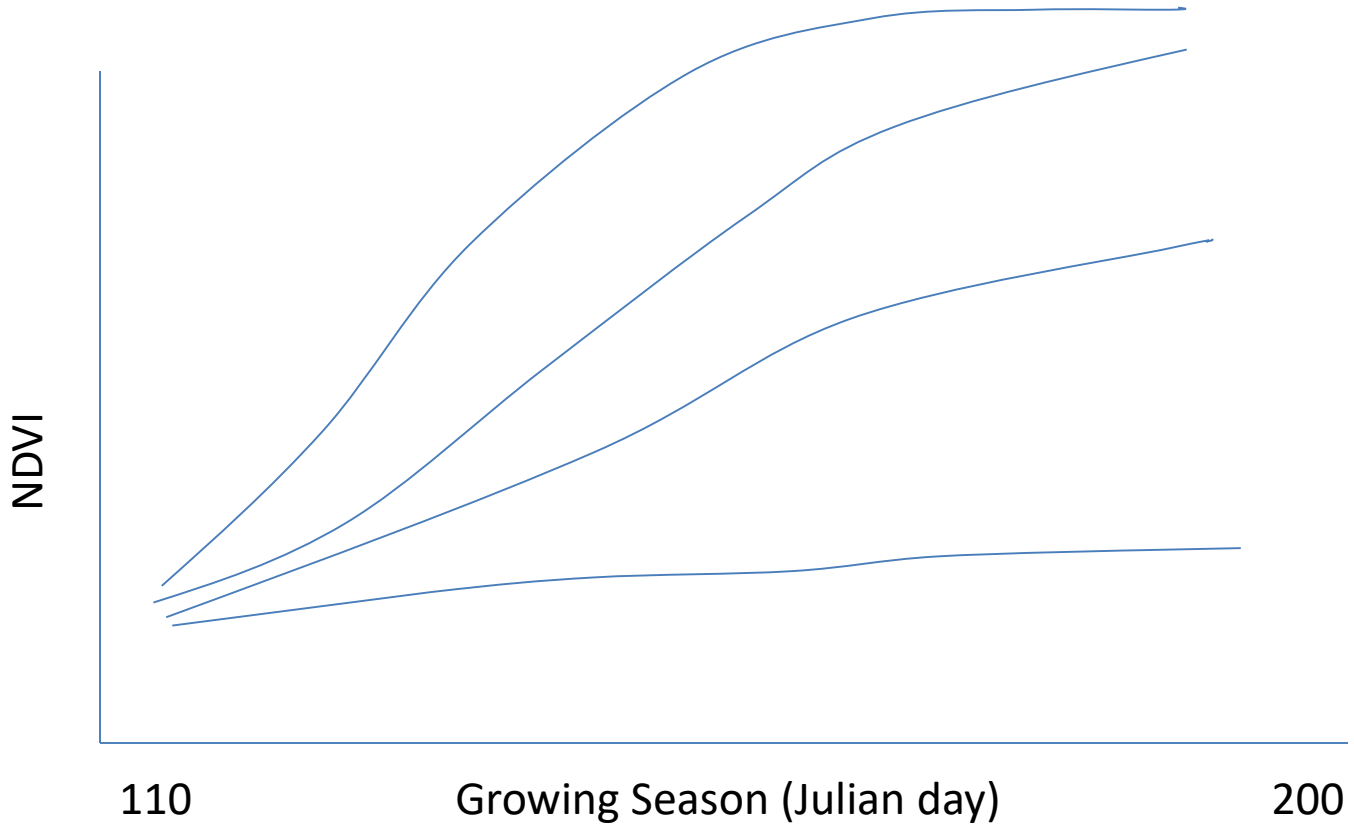
- Monitor winter wheat growth
  - Fields east of Cheyenne
  - Three different fields (area: 300ac, 350ac, 175ac)

- Cropping patterns
  - Association with these fields

Method

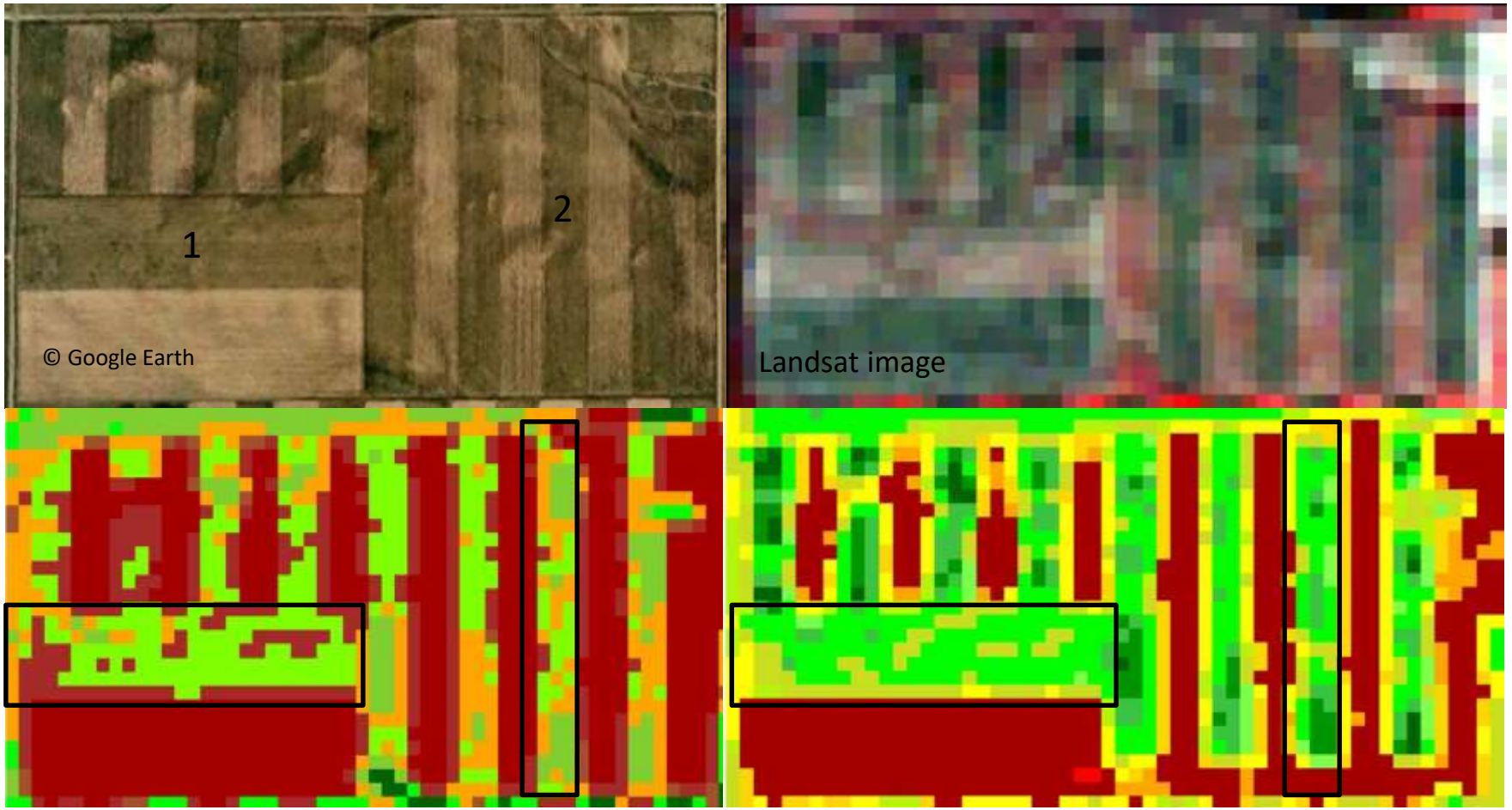
- Obtained Landsat images
  - 2007 and 2009 growing season
  - Landsat acquires an image every 16th day
- Standardized product (by faculty advisor)
- Subset by fields
  - Computed NDVI for each date
  - Stacked and classified them
    - Classification: grouping pixels of similar values/patterns

Method



Compare crop growth from multiple years

Results: Field #1

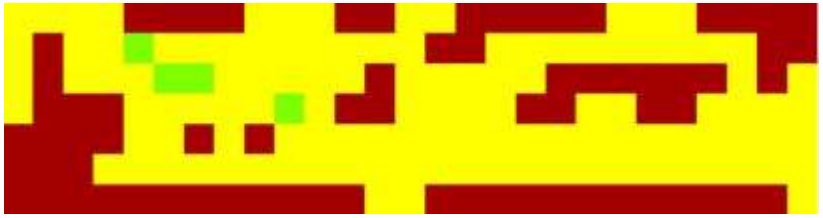


2007 Classified images 2009

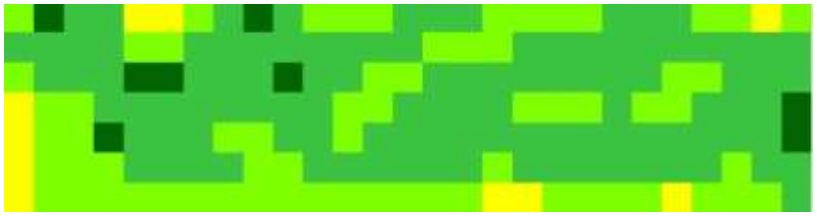
Field #1 - Subfield #1

Growth	2007	2009
Bare ground (brown)	15.8	0
Low (yellow)	25.4	2.2
Medium (lime green)	0.9	14.5
Medium-high (sage green)	0	23.6
High (dark green)	0	1.8
Total	42	42

2007

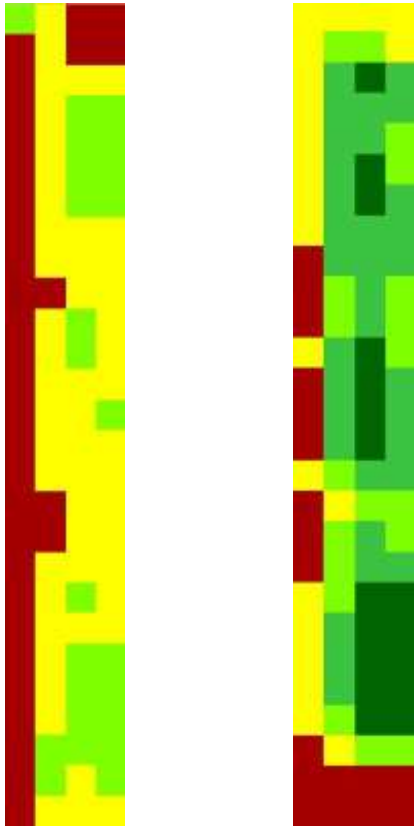


2009



Field #1 subfield #2

Growth	2007	2009
Bare ground (min. growth)	7.3	4.0
Low	11.3	4.7
Medium	5.3	4.2
Medium-high	0	7.3
High	0	3.8
Total	24	24

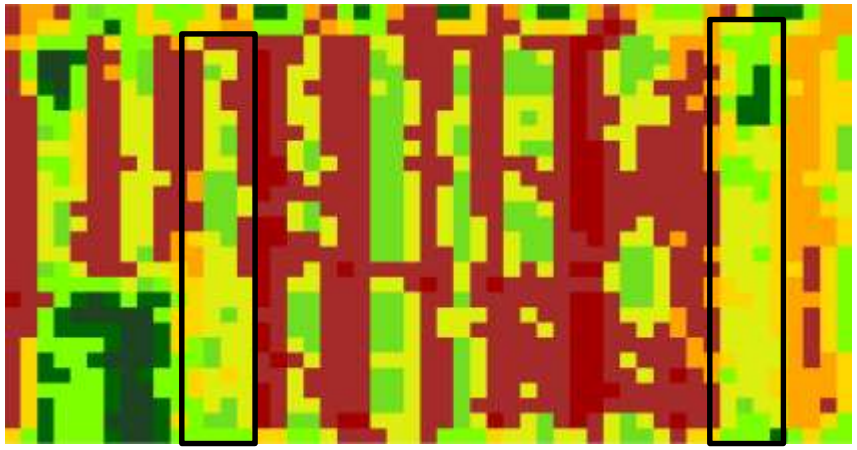


2007 2009

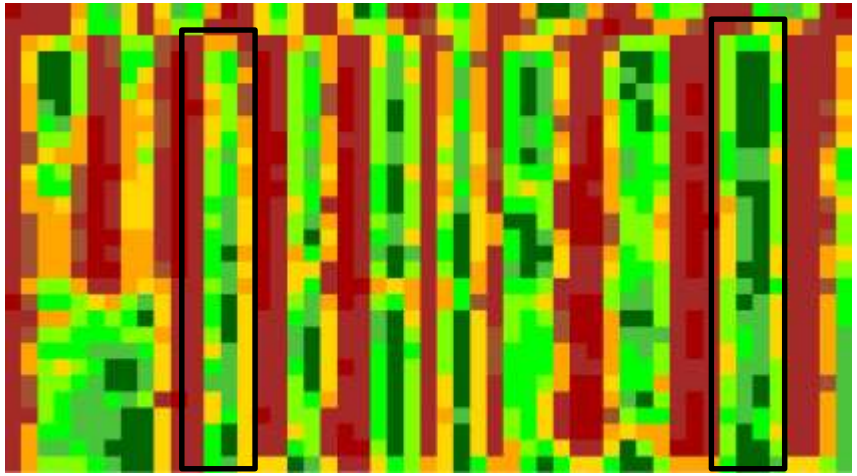
Results: Field #2

Classified images

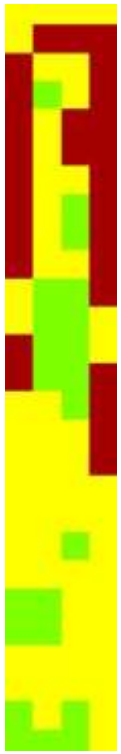
2007



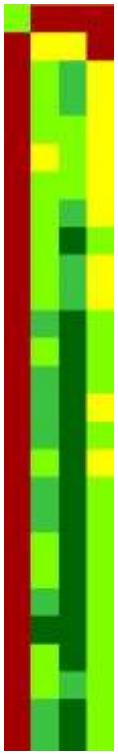
2009



Field #2 Subfield #1



2007

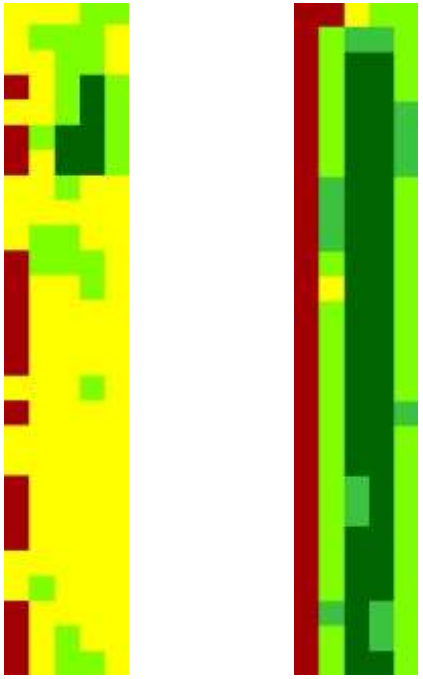


2009

Growth	2007	2009
Bare ground (min. growth)	6.2	6.7
Low growth	12.9	2.9
Medium growth	4.9	7.3
Medium-high growth	0	3.3
High growth	0	3.7
Total	24	24

Field #2 Subfield #2

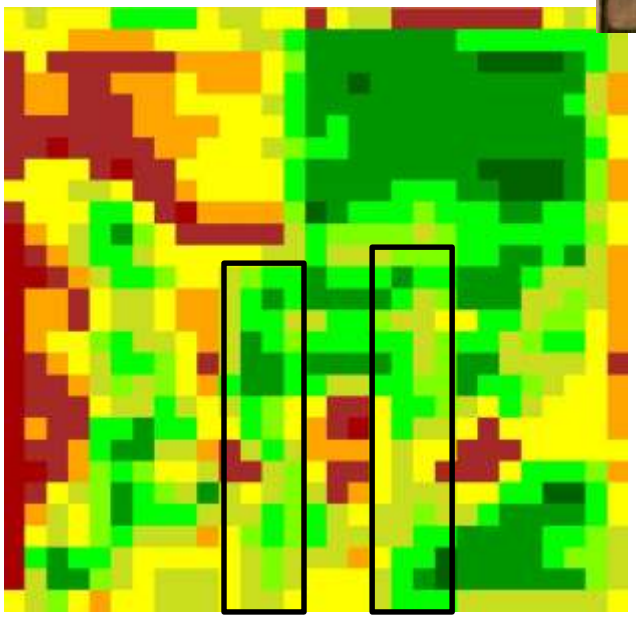
Growth	2007	2009
Bare ground (min. growth)	3.3	6.2
Low growth	19.6	.44
Medium growth	5.8	10
Medium-high growth	0	3.1
High growth	1.3	6
Total	30	30



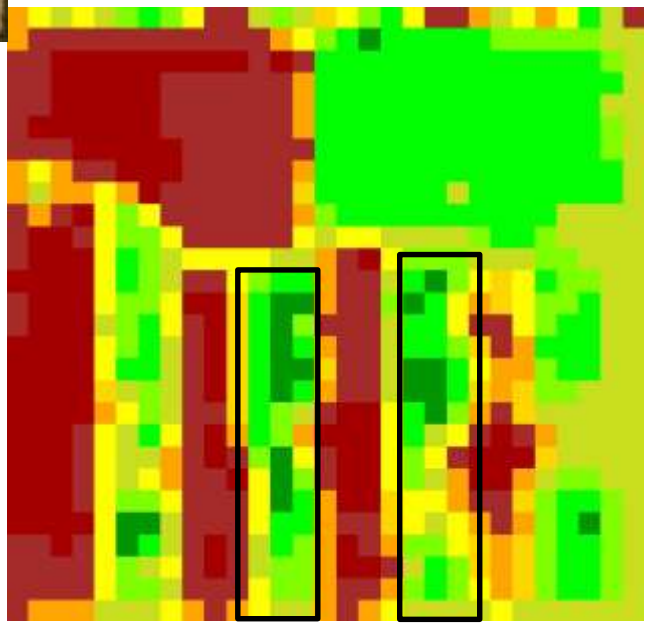
2007 2009

Results: Field #3

2007



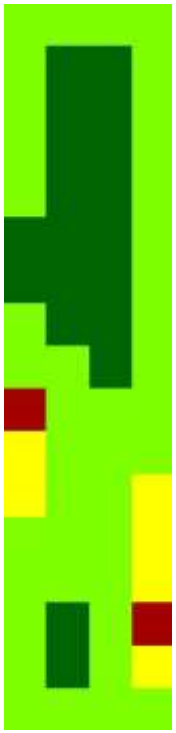
2009



Field #3 Subfield #1

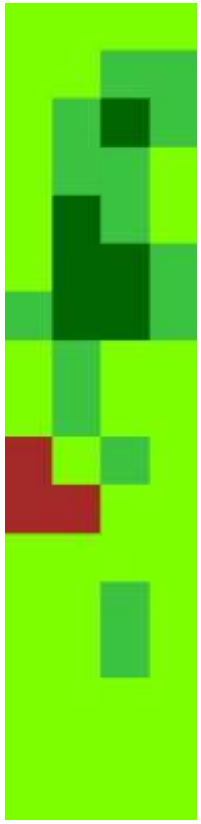
Growth	2007	2009
Bare ground (min. growth)	.22	.44
Low growth	0	1.3
Medium growth	9.1	9.1
Medium-high growth	4.4	0
High growth	1.3	4.2
Total	15	15

2007

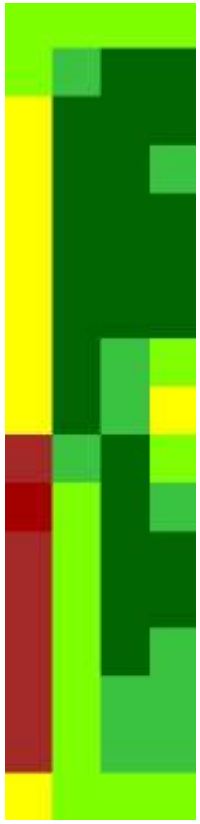


2009

Field #3 Subfield #2



2007



2009

Growth	2007	2009
Bare ground (min. growth)	.6	1.5
Low growth	0	2
Medium growth	9.7	3.5
Medium-high growth	3.3	2.4
High growth	1.3	5.5
Total	15	15

Conclusion and Recommendations

- Landsat is useful for obtaining crop growth info
  - Can go back in time (until 1984 for Landsat TM)

- Estimate area under different growth patterns
  - % field under high, medium and low growth
  - How they change from year-to-year
    - Both by % and location in the field

- This information can be used for developing management zones
  - High growth (less input)
  - Moderate and low growth (more sampling and higher input)

Acknowledgements

WyomingView

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