

Tasselled Cap Transformation

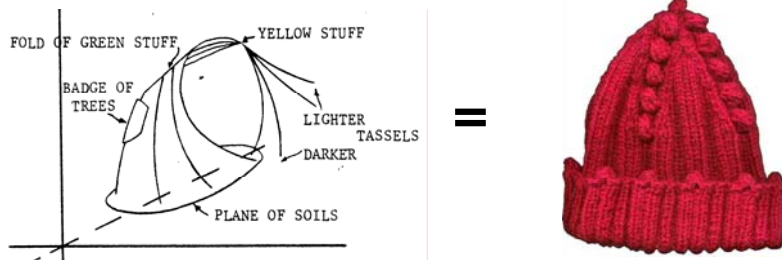
Liz Marcello
Geography 581
Winter 2007

Outline

- What it is
- Why we need it
- How it works
- Examples
- Shortcomings

Kauth and Thomas

- 1976
- A single triangular region shows vegetation in various stages of growth
- Define a new coordinate system to represent soil line and vegetation
- Formulated based on a small sample of soils from Fayette County, Illinois



Tasselled Cap: The Basics



Canberra, Australia

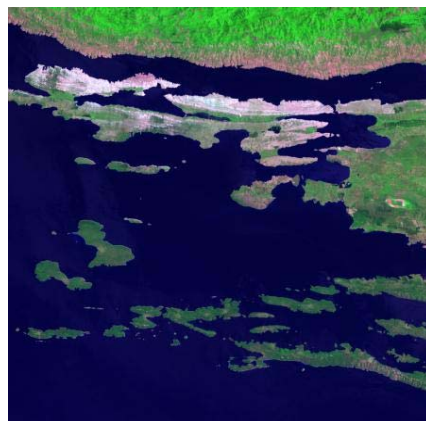
- Conversion of readings in a set of channels to composite values
- Aimed at analyzing vegetation

The new “rotated” coordinate system

- All axes of new coordinate system: brightness, greenness, yellowness, nonesuch
- Axes are uncorrelated so they can be represented in a four-dimensional space defined by Landsat MSS Bands
- Crist and Crist and Cicone added wetness in 1984

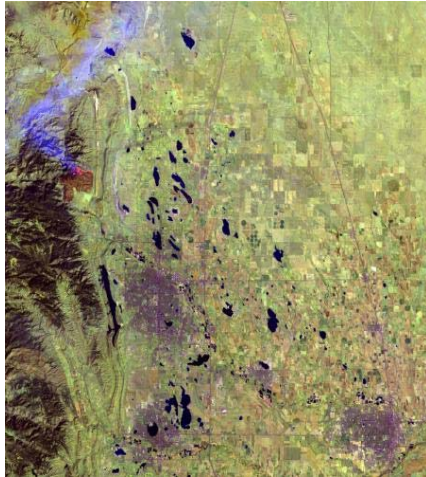
Brightness and Greenness

- Correlations between two visible and two infrared channels
- Brightness: variations in soil background reflectance
- Greenness: variations in the vigor of green vegetation



Kvameric Islands, Croatia

Yellowness and Nonesuch



Picnic Rock Fire, Colorado

- Yellowness: related to variations in the yellowing of senescent vegetation
- Nonesuch: atmospheric conditions
- Not widely used; transformation has been used to reduce four-band MSS data to two functions

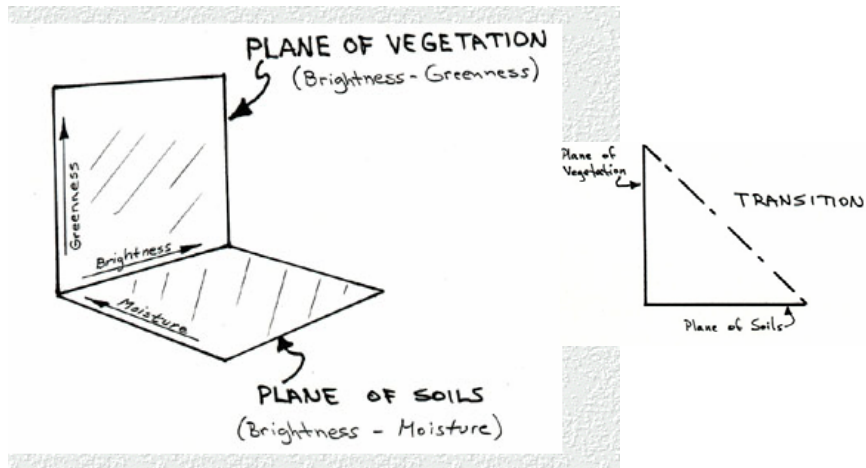
Wetness



Silt off the coast of Southern Louisiana

- Crist and Crist and Cicone
- 4 to 6 reflective bands of Landsat TM data sets
- Contained significant information in the third dimension

Greenness, Brightness, Wetness



Tasseled Cap Coefficients

Coefficients for the Tasseled Cap Functions of Landsat MSS data

TM Band	1	2	3	4
Brightness	0.4330	0.6320	0.5860	0.2640
Greenness	-0.2900	-0.5620	0.6000	0.4910
Yellowness	-0.8290	0.5220	0.6000	0.4910
Nonesuch	0.223	0.012	-0.543	0.81

Coefficients for the Tasseled Cap Functions for Landsat TM bands 1-5 and 7

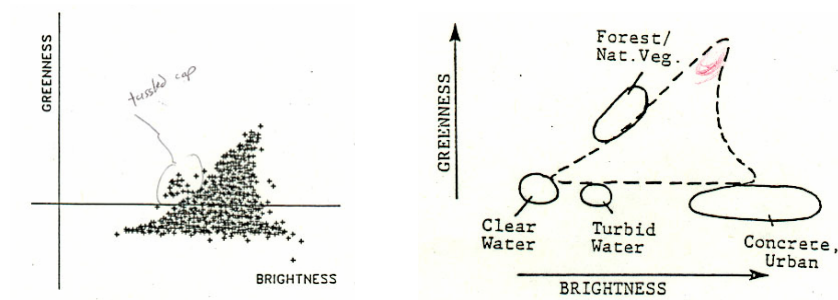
TM Band	1	2	3	4	5	7
Brightness	0.3037	0.2793	0.4343	0.5585	0.5082	0.1863
Greenness	-0.2848	-0.2435	-0.5436	0.7243	0.0840	-0.1800
Wetness	0.1509	0.1793	0.3299	0.3406	-0.7112	-0.4572

Accomplishing the Transformation

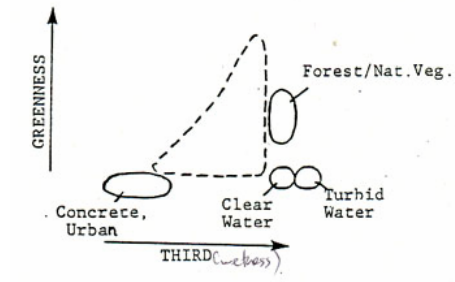
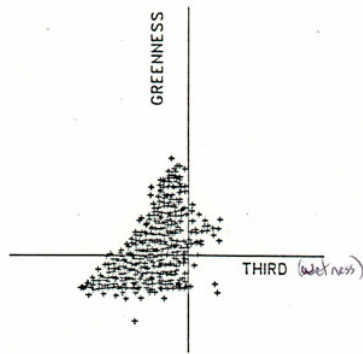
- $u_j = R_i x_j + c$
- The pixel values in the four MSS bands are multiplied by the corresponding elements of R_i to give the position of the j th pixel in the i th Tasseled Cap axis (u).
- c is used to make sure that the elements of vector u are always positive.

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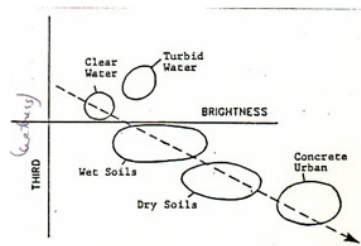
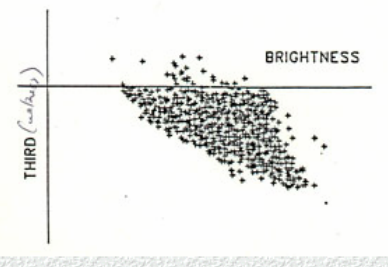
Interpreting a Landscape



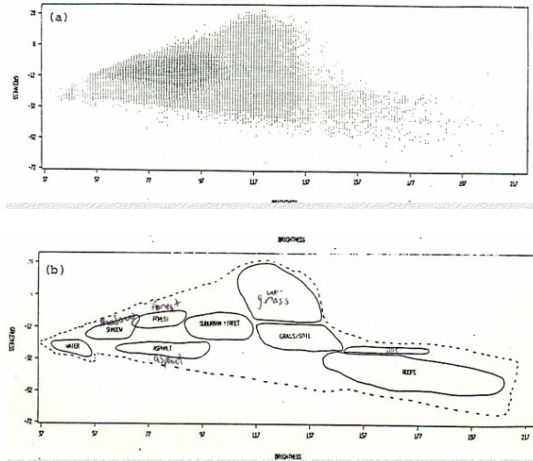
Interpreting a Landscape, cont.



More Landscape Interpretation

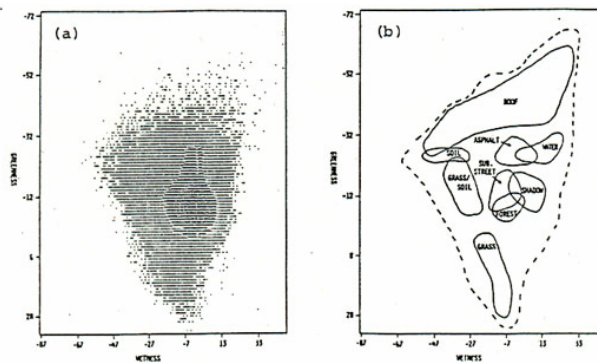


Landscape Scatterplots



Greenness – Brightness Dimensions of TM Urban Image

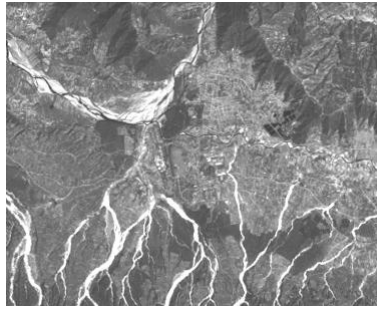
More Scatterplots



Scatterplot of greenness – wetness dimension and general surface features

Tasseled Cap Transformation in Action

Landsat 7 Image, Channel 7



Brightness Channel

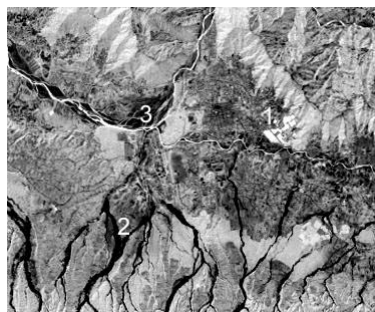


More Channels

Greenness Channel



Wetness Channel



Shortcomings

- Dynamic range compression
- Comparison of multi-date tasseled cap images
- Applicability



Manicouagan Impact Structure, Quebec, Canada

Questions?

- Sources:
 - The Storm Project:
<http://www.storm.uni.edu/rs/2001/EX8rs.html>
 - CSIRO Forestry and Forestry Products:
<http://www.ffp.csiro.au/nfm/mdp/bbproj/bgw.html>
 - Mather: Computer Processing of Remotely-Sensed Images
- Picture Credits:
 - USGS Landsat Project Images:
<http://landsat.usgs.gov/index.php>
 - Lakehead University, Canada:
<http://flash.lakeheadu.ca/~tsapic/tassel.htm>



Louis, the love of my life.