A Method of Modeling Sagebrush-steppe Landscape Structure Using Fuzzy Classification Techniques

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Land Cover Mapping Efforts

- National Land Cover Data (NLCD)
- Gap Analysis Program (GAP)

Hard Classifiers

"All [hard classifiers are] based on a logic that describes the expected position of a class [based on training data] in what is know as 'band space,' and then gauges the position of each pixel to be classified in the same band space relative to the training class."

(IDRISI 1997)

Hard Classifier Examples

- Minimum Distance
  - uses mean and standard deviation
- Maximum Likelihood
  - uses mean and variance/covariance

Problems with Hard Classifiers

- Membership of a pixel to a class is unknown.
- Many training classes needed in habitats that exhibit diverse structural characteristics.

Soft Classifiers

"Refrain from making definitive judgements about class membership of any pixel. Instead they produces statements about the degree of membership a pixel has to each possible classification."

(IDRISI 1997)

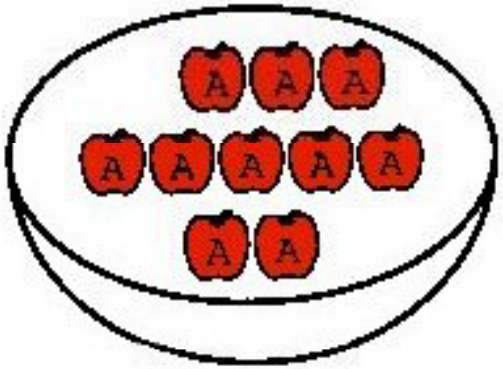
Soft Classifier Examples

- Bayesian Classification
  - based on Bayesian Probability Theory
- Fuzzy Classification
  - based on Fuzzy Sets

An Analogy

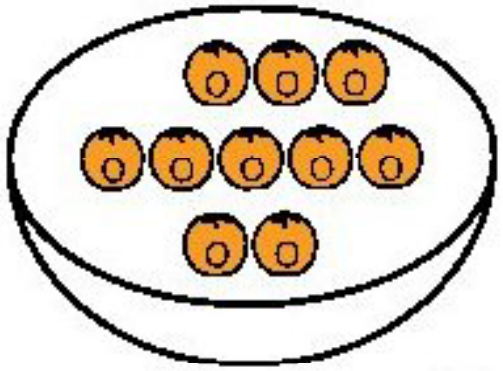
Hard classifier vs. Soft classifier

Apple



Apple = 1.0

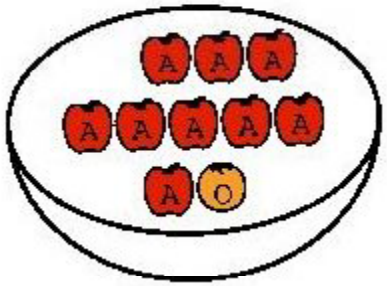
Orange



Orange = 1.0

Hard classifier vs. Soft classifier

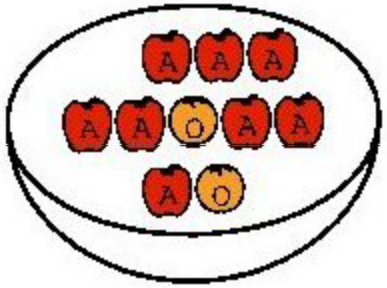
Apple



Apple = .90

Orange = .10

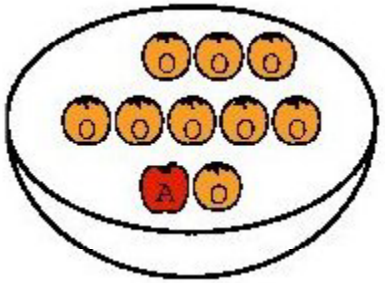
Apple



Apple = .80

Orange = .20

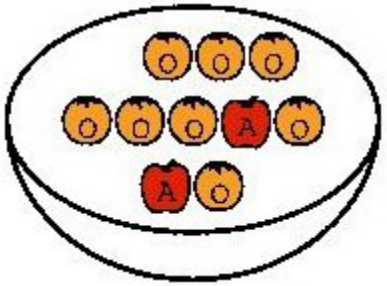
Orange



Orange = .90

Apple = .10

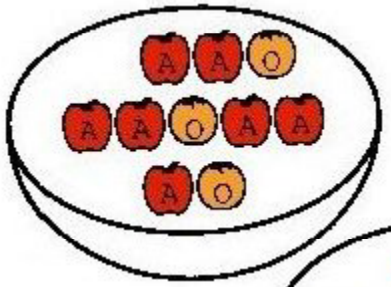
Orange



Orange = .80

Apple = .20

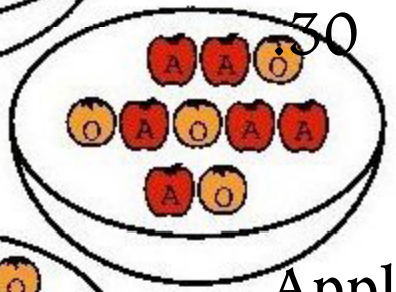
Hard classifier vs. Soft classifier



Apple

Apple = .70

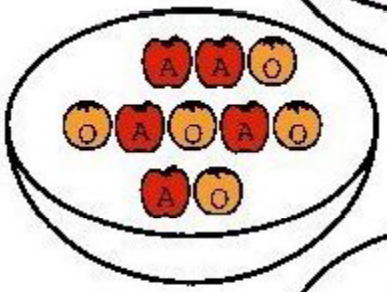
Orange = .30



Apple ?

Apple =.60

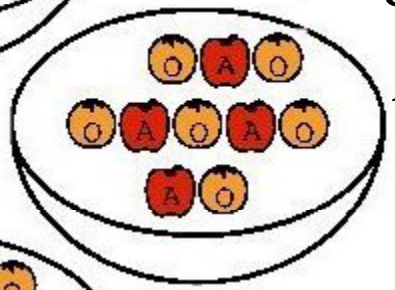
Orange =.40



????

Apple = .50

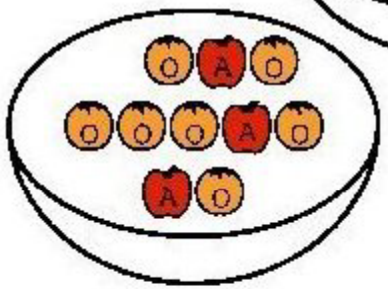
Orange =.50



Orange ?

Apple =.40

Orange =.60

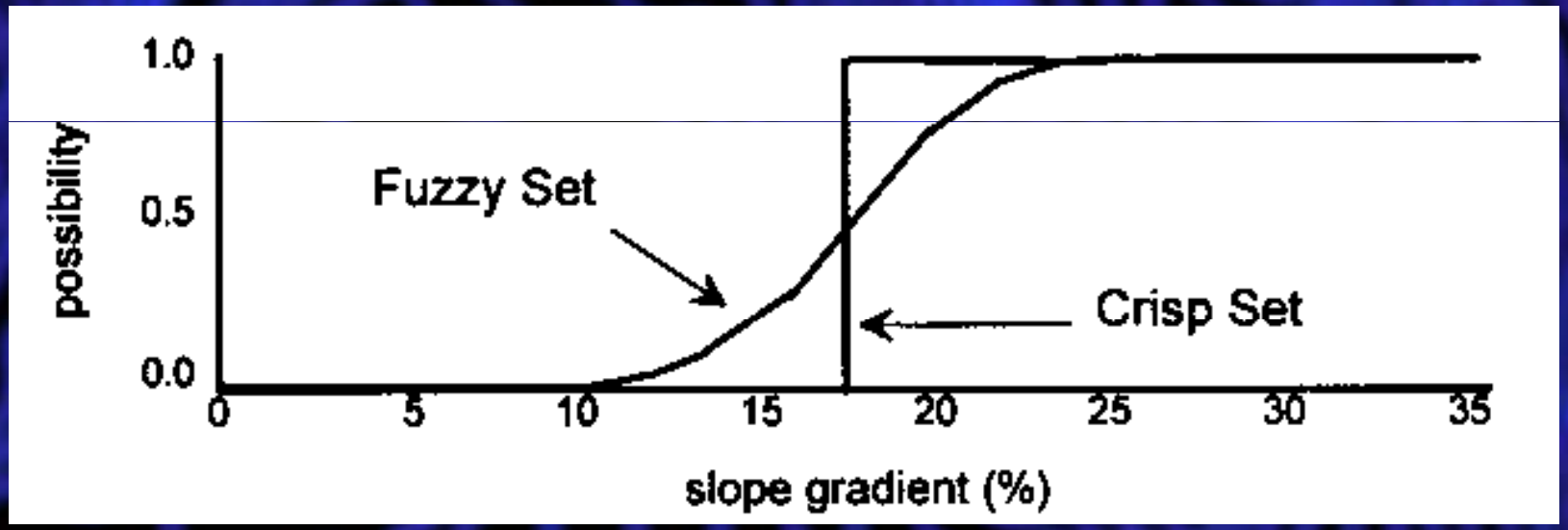


Orange

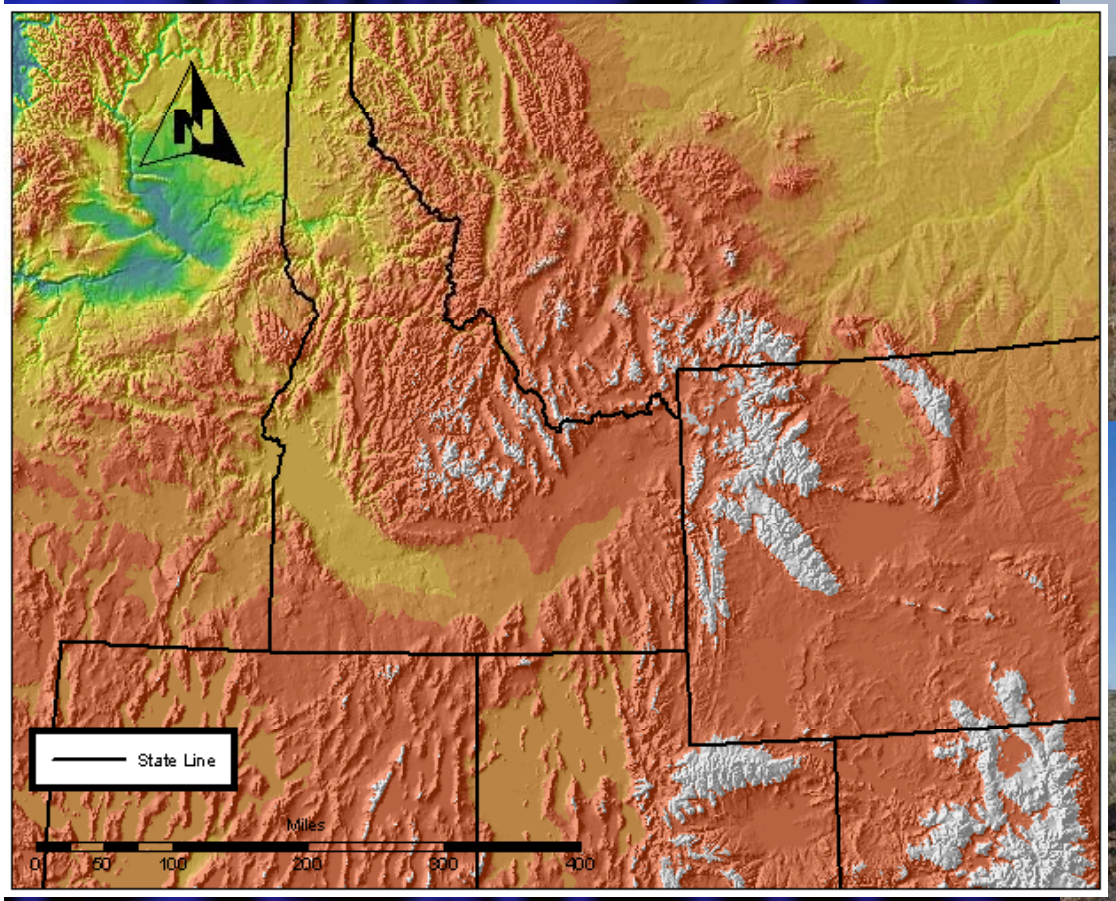
Apple =.30

Orange =.70

Fuzzy Sets


1.0
0.5
0.0
possibility
Fuzzy Set
Crisp Set
0
5
10
15
20
25
30
35
slope gradient (%)

Sagebrush-steppe



Sage Grouse

- Sagebrush cover
  - High (>25%)
  - Moderate (15-25%)
  - Low (<15%)

Connelly et.al 2000

Project Goals

- Improve classification accuracy of Sagebrush-steppe areas using fuzzy classification techniques.

Project Applications

- Identify areas of high (>25%), moderate (15-25%) and low (<15%) sagebrush cover.

Methods & Materials

- 1997 Landsat 5 TM imagery
- Training sites of dense grass and sagebrush

- Fuzclass procedure in IDRISI 2.0

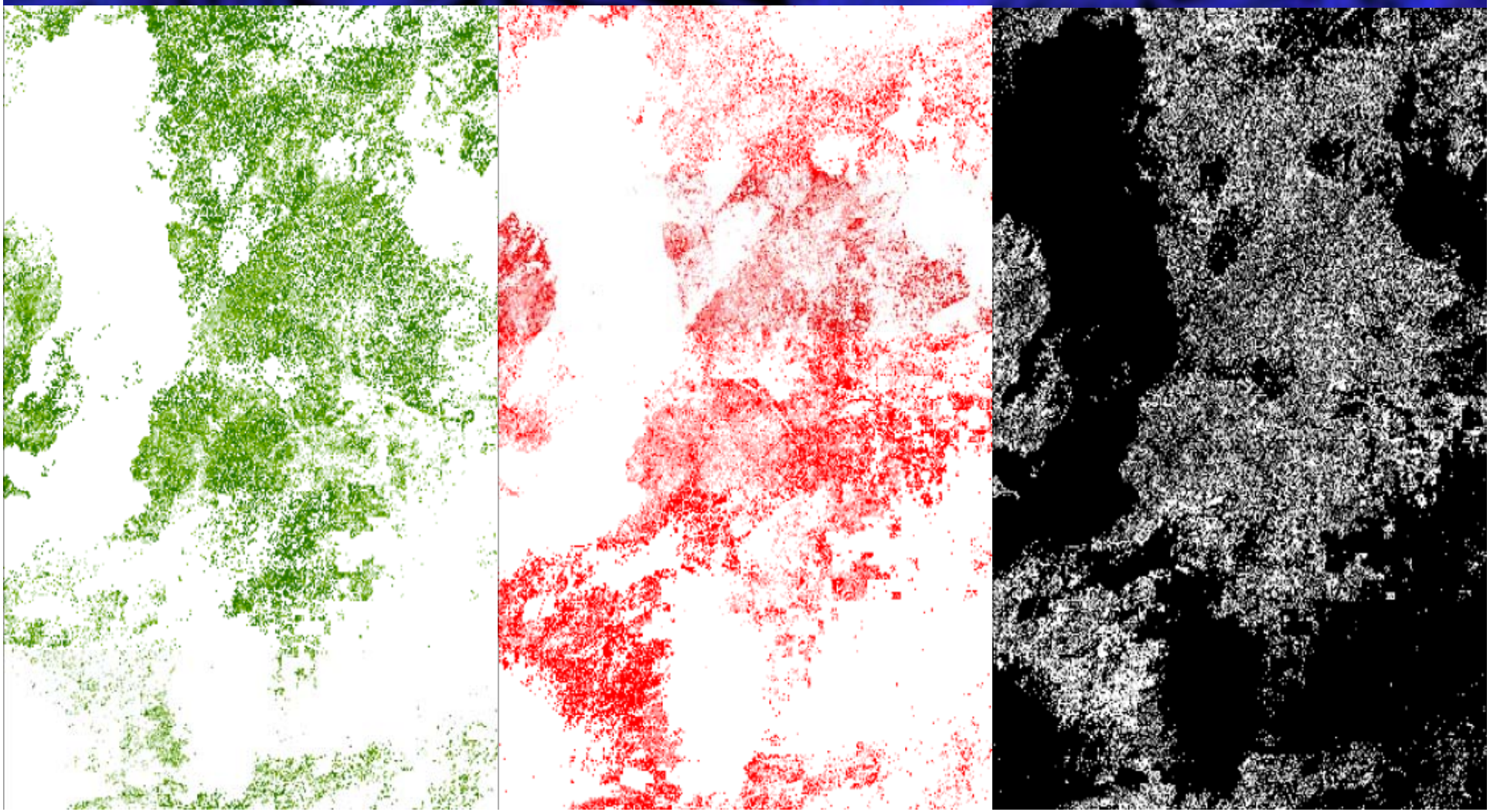
Results

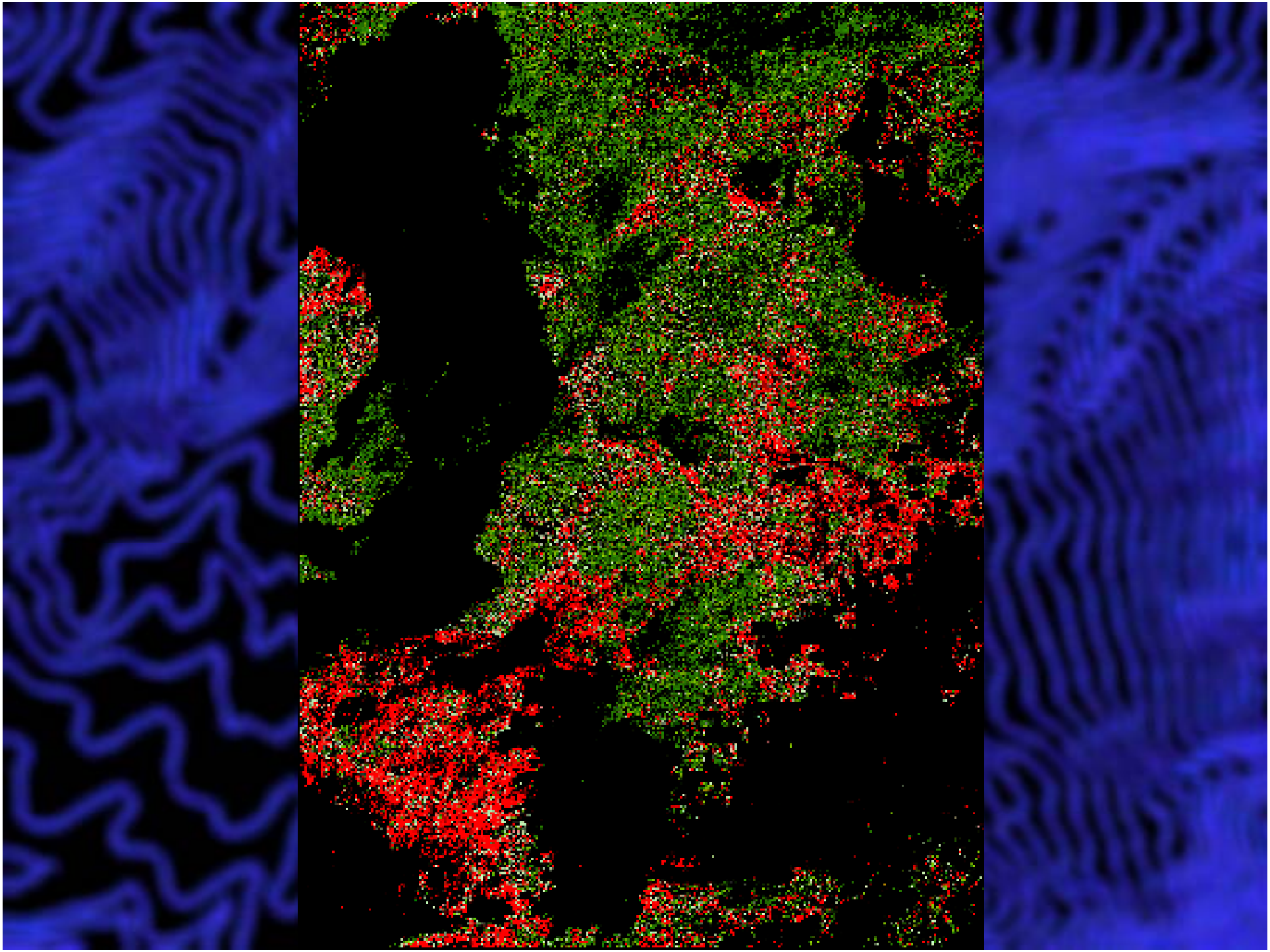
(membership = .0 - 1.0)

Sagebrush

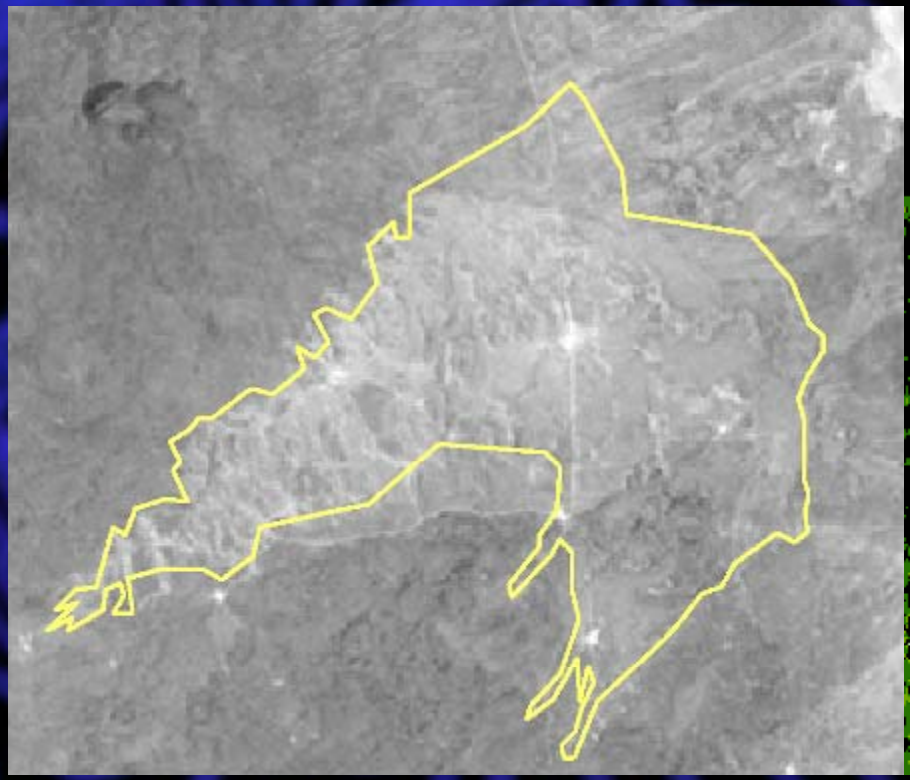
Grass

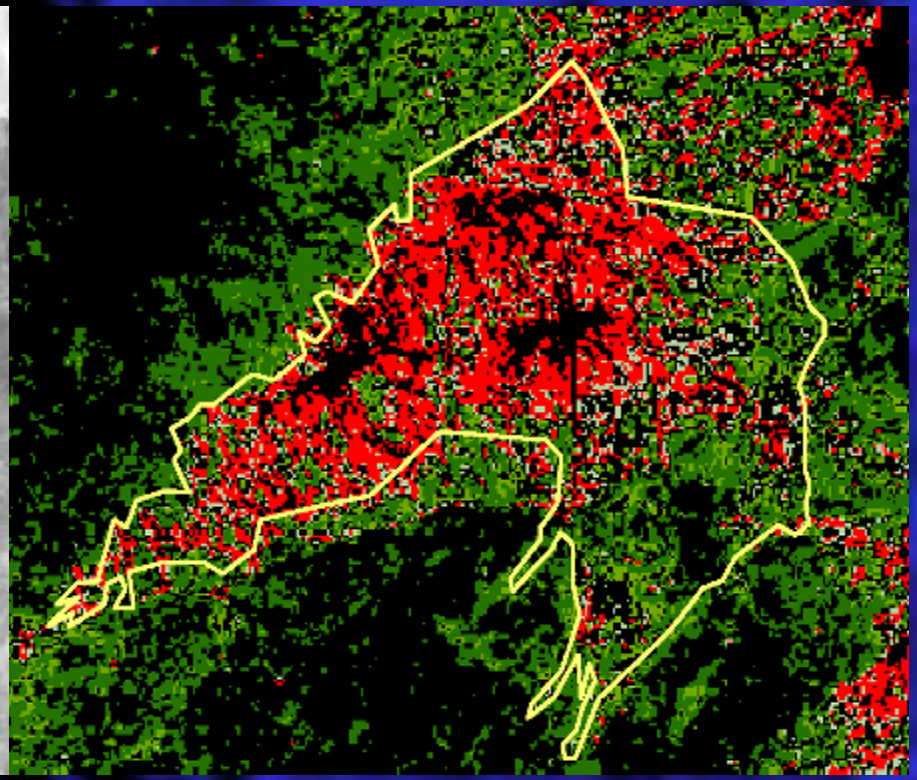
Uncertainty



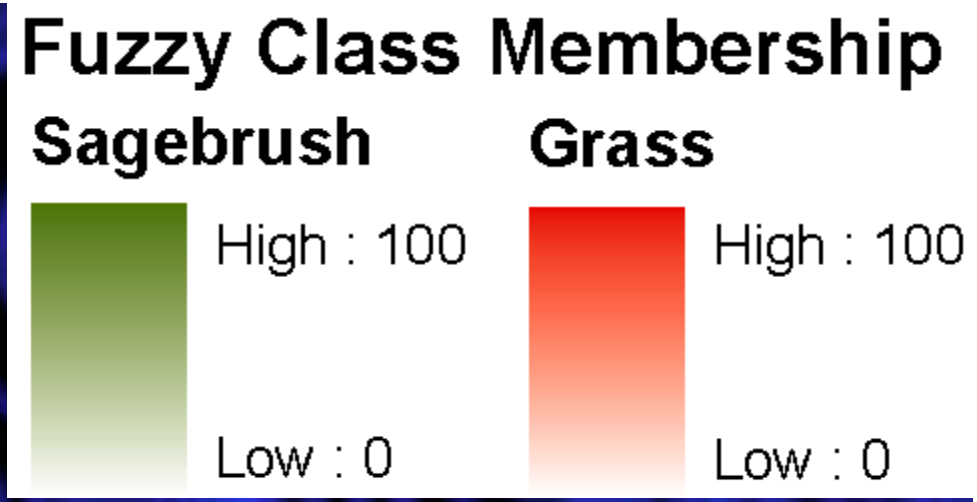


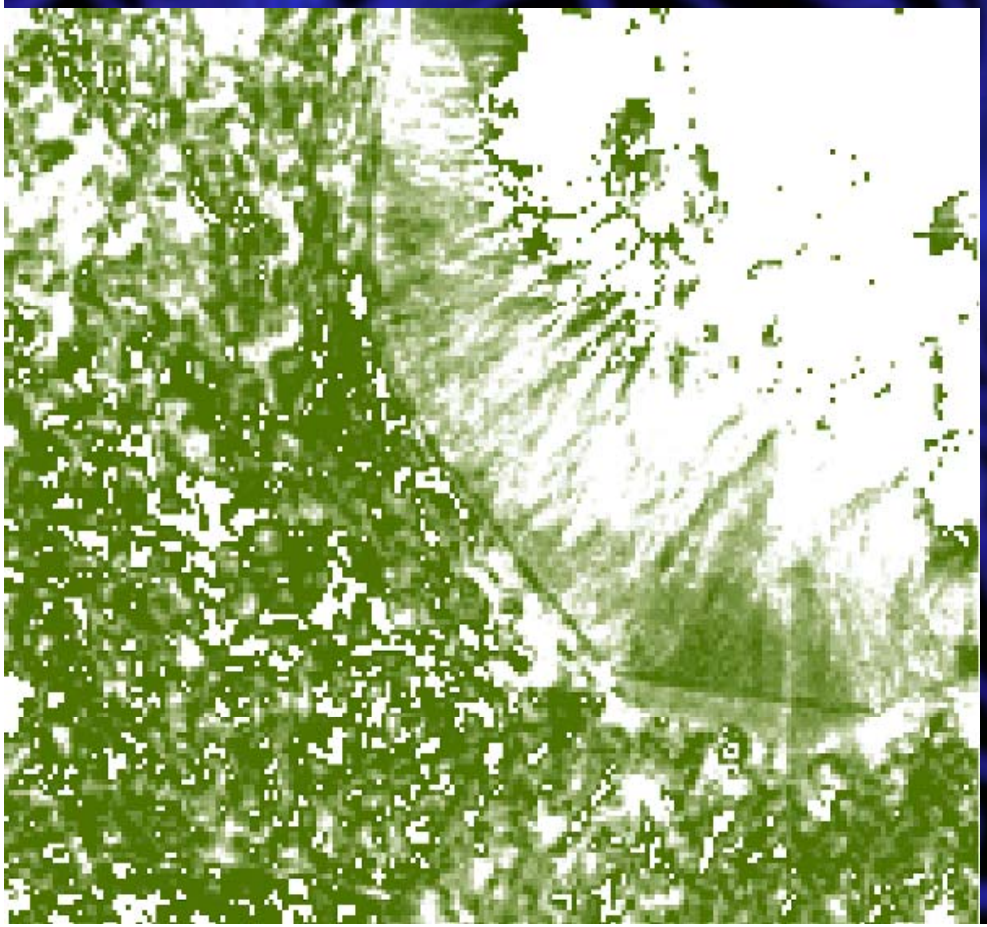
Results

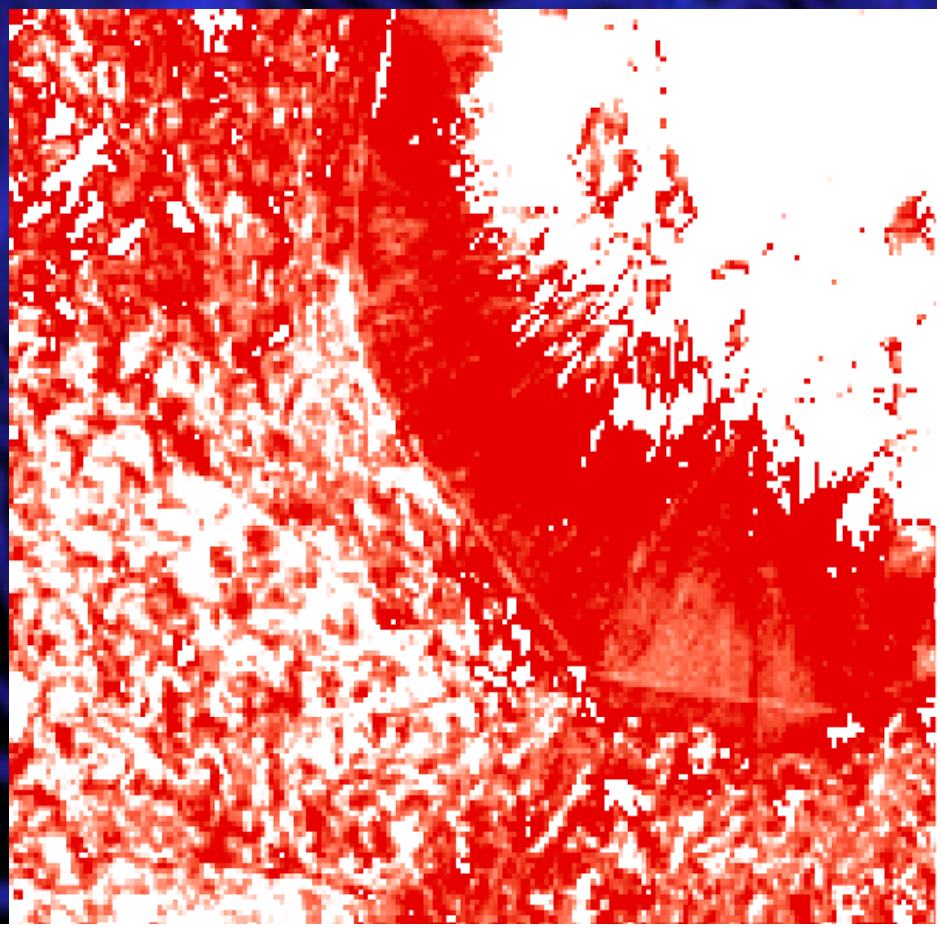




Results cont.







Summer 2002

- Collect field data to validate the model.
- Correlate membership grades to abundance of sagebrush and grass cover.
- Rebuild the model using 2000 Landsat data.

Questions?

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