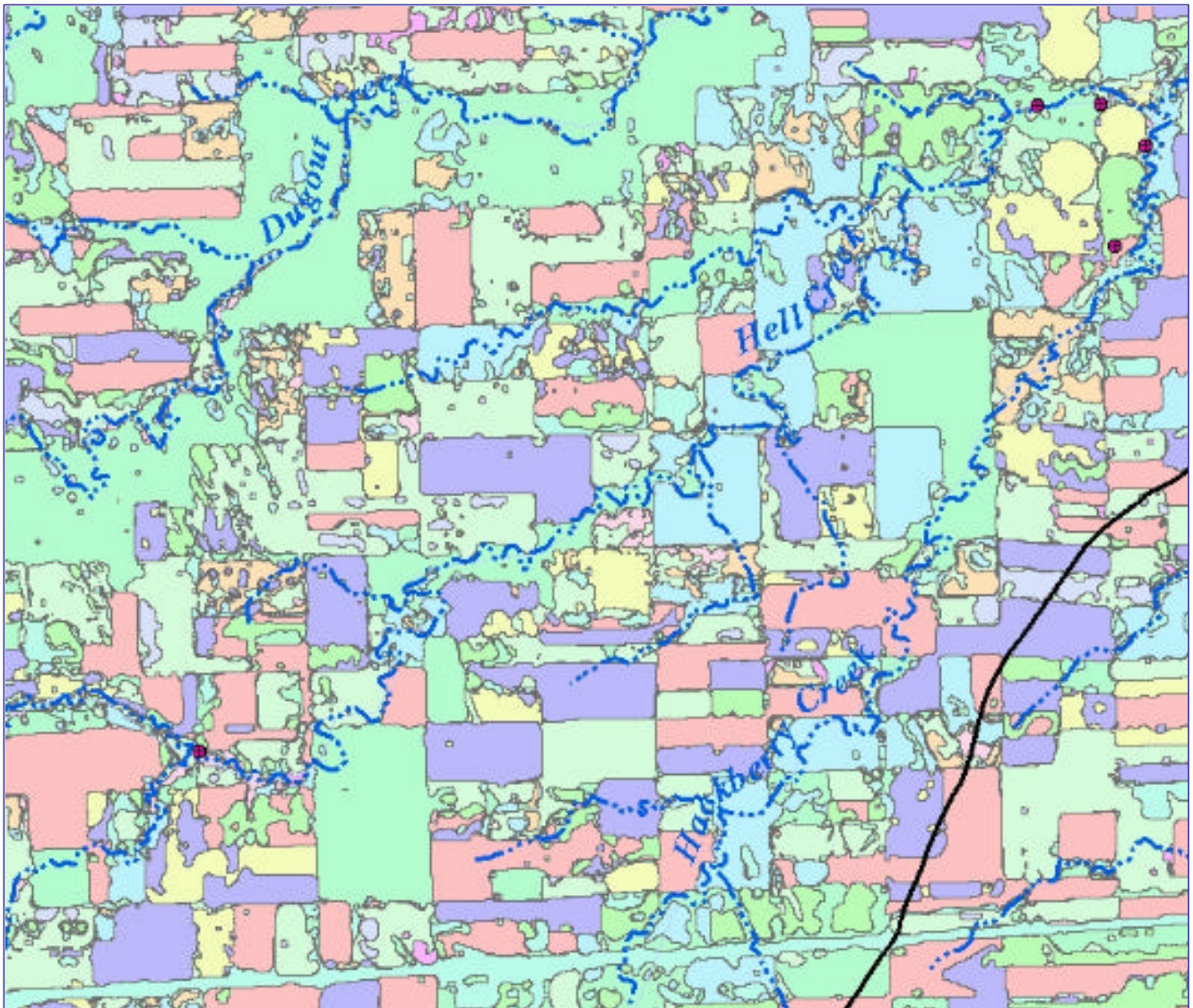


2001 Basin-Wide Land Use Determination and Irrigated Acreage Calculation

Tom Liebert



The Objective

Context of the project:

Water rights litigation with possible long term and severe consequences for agricultural water users over a 7,800 square mile river basin.

Land classification task

- A basin-wide map of agricultural land use
- An independent assessment of the spatial distribution and quantification of consumptive use for the 2001 growing season
- Irrigation map and statistics

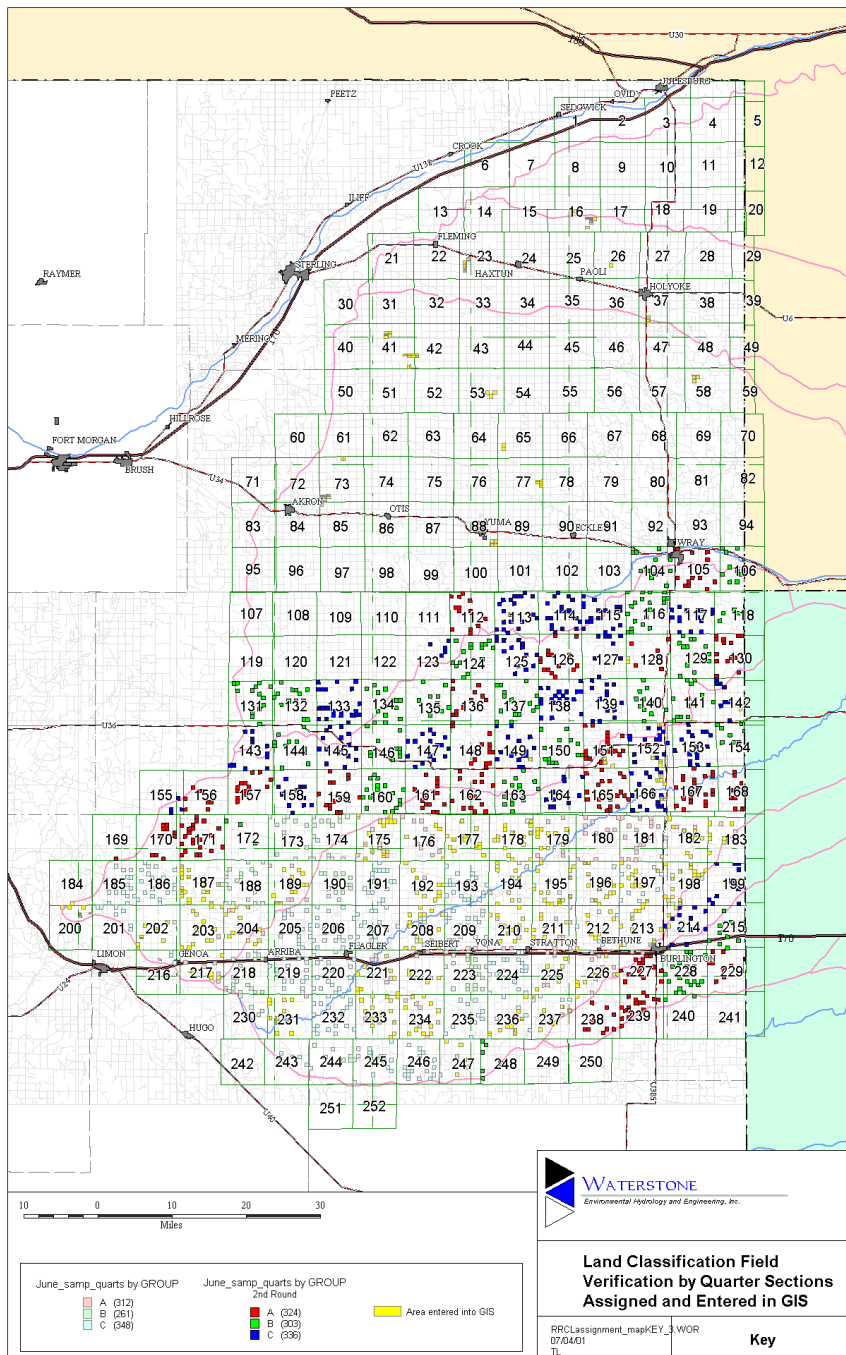


The Ground Truthing Effort

Field survey work plan

The ground truth work plan was developed to sample 10% of the Colorado portion of the basin.

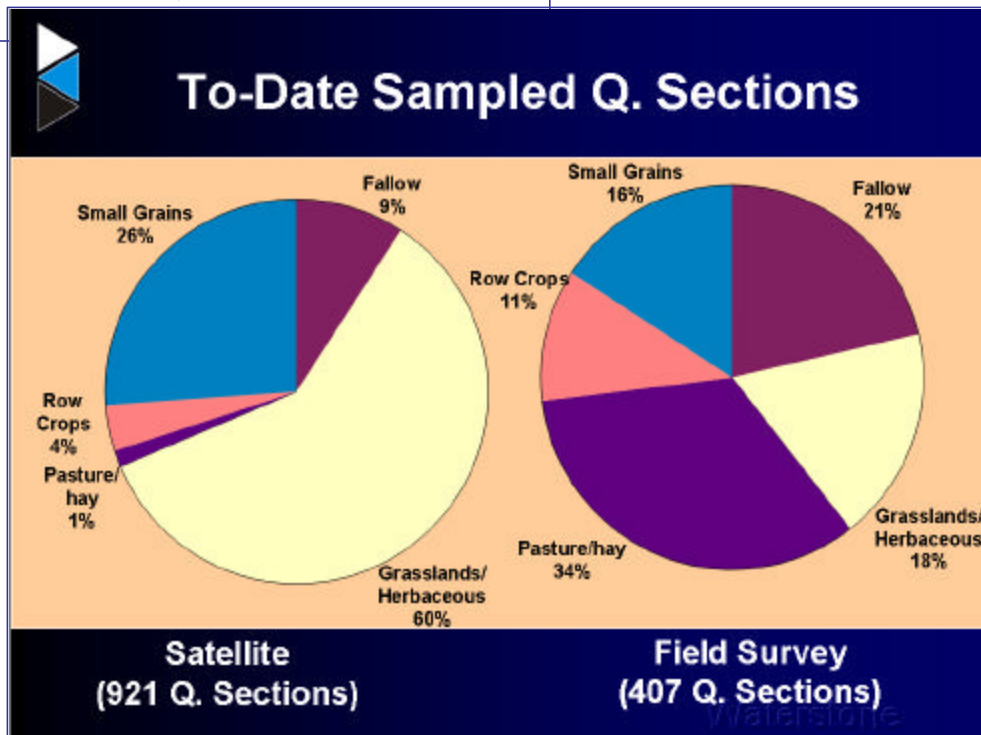
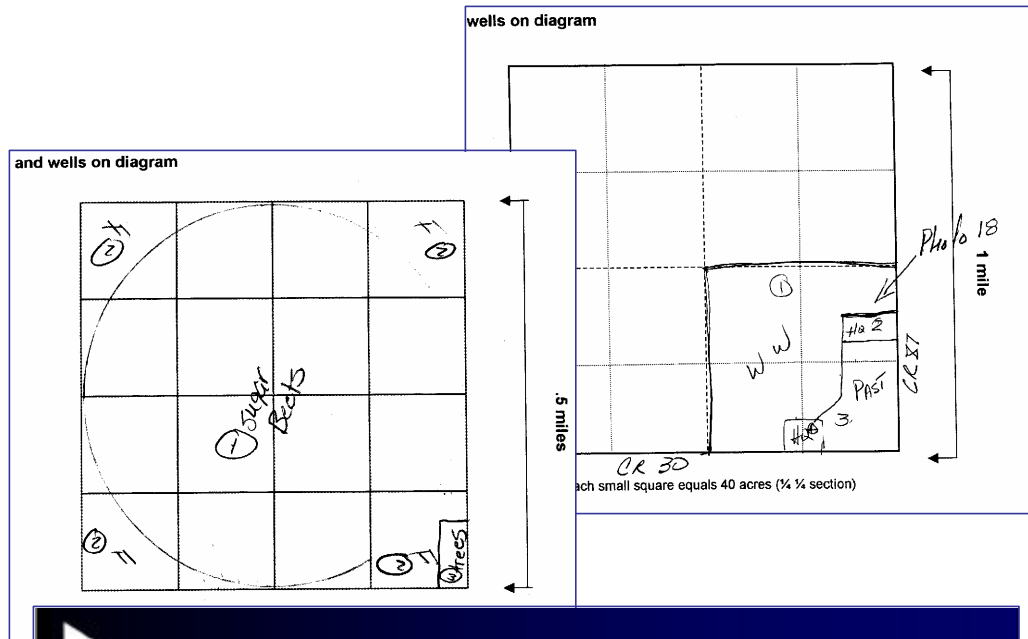
- The basin was divided into 'Maps' each roughly corresponding to a single township.
- 16 quarter sections were randomly selected from each township and the 'Map' was blindly assigned to one of 3 field surveyors.
- 11" x 17" color maps of each township were generated in batch mode and distributed to the field surveyors to identify their assigned quarter sections.



Data entry and QA

Extensive.

- 10% of the basin was sampled – nearly 5,000 field survey forms
- Accuracy paramount - biases identified and reduced early in the project.
- Data Entry and digitization, QA/QC:
 - Completed questionnaire for each selected quartersections
 - Field sketch was digitized into a GIS (data entry interface coded)
 - Tabular data was entered into a database (data entry forms)
 - Extensive QA via hand checking, db and spatial queries
- Used for independent statistical analysis, supervised classification, and accuracy assessment of unsupervised classification



Satellite Classification

Imagery land use classification

- Image selection, ordering and pre-processing
- Test area selected, unsupervised classification tested against statistical clustering
- Classification levels were identified
 - Level 1: Irrigated v. dry
 - Level 2: Crop types (small grains, row crops, fallow...)
 - Level 3: Specific crops (corn, millet, sorghum, wheat, alfalfa, rangeland, CRP...)
- Classes selected by separability and consumptive use
- Methodology:
 - Define ROIs (Regions of Interest)
 - Perform supervised classification
 - Perform accuracy assessment
 - Mask acceptable classes
 - Refine ROIs
 - Repeat as necessary
 - Perform unsupervised classification on unmasked areas
 - Perform accuracy assessment
 - Mask acceptable classes
 - Refine ROIs if necessary
 - Repeat unsupervised classification on unmasked areas

Accuracy Assessment

Field-scale v. pixel-scale

Need for a more complex method than pixel v. pixel. Developed a GIS method for counting by ground truthed polygons.

- Performed on smoothed/processed grid exported to GIS
- Ground truthed polygons were linked to the digital survey data
- Polygons were 'shrunk' with 'interior buffers'
- Pixels were counted by classification within each polygon and a majority match was considered "good"

Results

- Level 1: 97%
- Level 2: 84%