Data and Methods for GIS Analysis of Landuse and Conservation Practices in the Calapooia River Watershed.

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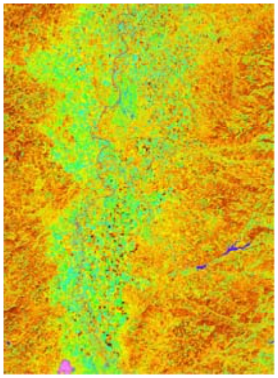
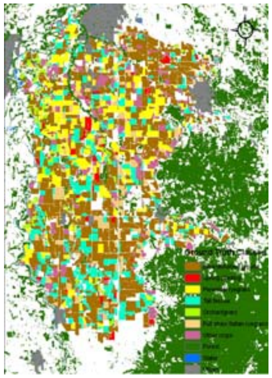
Map of Western Oregon Study Area, Including USGS 4th Field HUC Hydrologic Unit Boundaries (Outlined in Black with Basin Names), Edited Extent of Combined Landsat Image Footprints (Outlined in Pink), 2677 Ground-Truth Census Fields (Green), and Major Roads, Cities, and Rivers from ESRI-StreetMap USA (Default Symbology) at 1:750,000 Scale. Long-term water quality sampling is being conducted in the green zone by USDA-ARS scientists, while university collaborators are collecting data on key biological indicators, including insects, fish, amphibians, and birds.

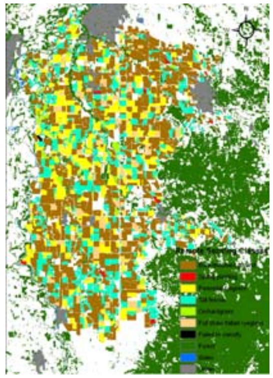


Landsat NDVI raster from 14 Oct. 2004 for Path 46 Row 29 covering Oregon's Willamette River Valley from Eugene on the south to Portland metropolitan area on the north at 1:517,500 scale. Current collection of Landsat data for this scene consists of 54 mostly cloud-free images, primarily from 1992 to the present. NDVI values were computed as (Band4 – Band3)/(Band4 + Band3), and Tasseled Cap Greenness, Brightness, and Wetness transformation were based on Mather's formulas for Bands 1-5 and 7.

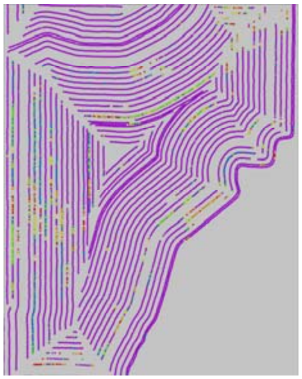
NAIP 2004 color ortho-photo with FSA-CLU polygons outlined in white, roads in red, and streams in blue for Linn County, OR, at 1:69,000 scale. Calapooia River runs from south to north on the west half of the photo. These FSA-CLU polygons were the starting basis for our field boundaries, but many of them have since been merged or subdivided to better match ground-truth observations.



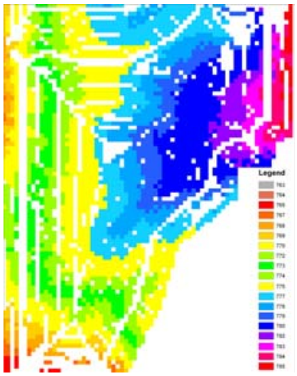
Ground-truth landuse classes from fall 2004 for 2677 grass seed fields in Linn, County, OR, at 1:190,000 scale. The census was conducted in both fall and spring, and has been repeated in the 2005-06 growing season. A similar survey of randomly selected fields in three neighboring counties was also conducted, and will be used to validate the multi-step classification procedure. A separate data set defining crops grown under Seed Certification from 1994 to 2003 covers about half as many fields as the ground-truth census, and will be used to extend the classification procedures over time.



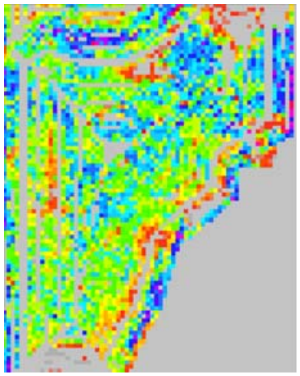
Remote sensing classification of 2677 grass seed fields in Linn, County, OR, at 1:190,000 scale. Pixels from a total of 13 derived bands from three acquisition dates in 2004 were classified on the basis of signal strength in ground-truth polygons, and these classifications in turn were used to derive fuzzy probabilities that each field polygon was one of six classes. These 13 different per-field fuzzy classifications were then joined in a multi-step classification procedure designed to minimize individual step misclassification. Overall accuracy of the 30-factor per-field classification method was 74.3%, exceeding the 63.3% per-field (and 57.4% per-pixel) accuracy of simple 13-dimensional isocluster analysis.



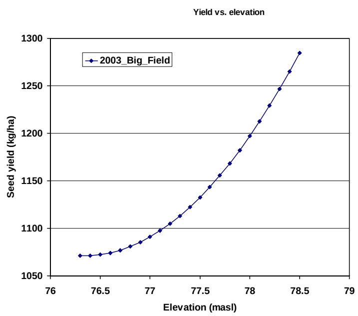
Combine yield monitor data points for 2003 grass seed harvest. Color of points indicates that values were kept or rejected based on deviation in travel speed (or distance between consecutive sample points) versus average travel speed on a given pass. Purple, blue, green, yellow, orange, and red indicate points for which travel speed fell within 1, 1.25, 1.5, 2, 2.5, and 3 standard deviations from the mean. Standard deviations were calculated separately for each individual pass. Another technique used in "cleaning up" the data was estimation of spatial offset between location of production and combine position when data was recorded (signal phase delay) using the Beal-Tian surface area ratio technique. Phase delay varied among fields, ranging from 5 to 14 seconds, and averaging 9.2, 9.3, and 10.6 seconds for three different growers with 45, 96, and 78 fields. Python scripting was used to implement most of the data validation steps.



Field elevation at sample points retained using travel speed within 2 standard deviations criteria. Raster pixel size is 10 m. Original DEM was 10 m horizontal resolution with 0.1 m vertical resolution. All three yield monitor images are at 1:3450 scale.



Combine yield monitor data converted to 10 m pixel raster for sample points retained using travel speed within 2 standard deviations criteria. No kriging or other smoothing procedures have been used. Regression of yield versus height indicated that lowest yield occurred at lowest elevations, with a plateau at low yields.



Yield in this particular field followed one of several possible patterns, a quadratic relationship with a plateau in yield at or near the lowest elevations in the field. Low yielding areas in such a field might suitable for conversion to riparian zones or other conservation practices. Of the 219 fields analyzed, 24 showed this pattern of lowest yield at low elevations, with a plateau at low elevation, while 44 others were lowest yield at low elevations with a plateau at high elevation. Highest yield at low elevations was seen in 31 cases, highest yield at middle elevations in 59 cases, and lowest yield at middle elevations in 28 cases. The remaining 33 fields showed little or no relationship between yield and elevation. Because many of the yield differences were small, further analysis will be required to determine cases in which growers would realize a net economic gain in removing portions of their fields from crop production.