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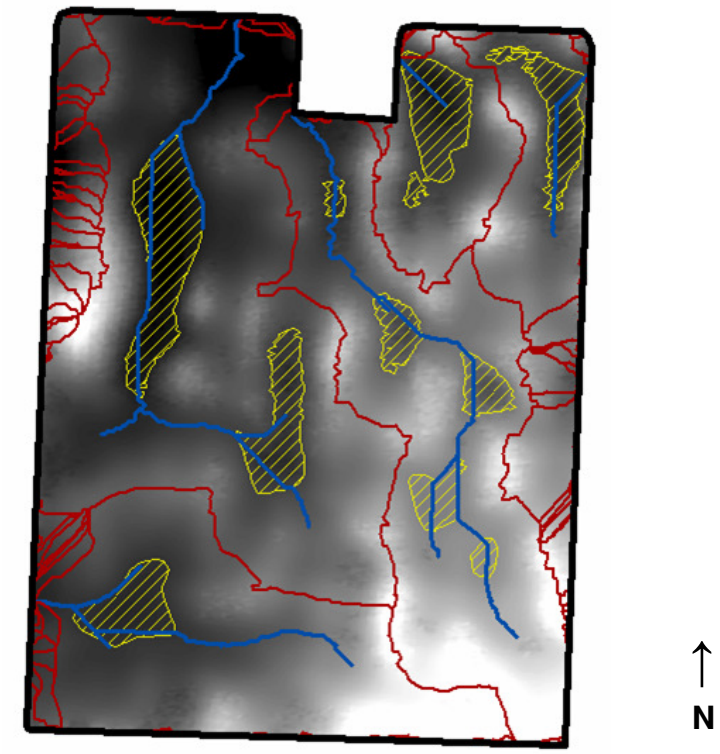
Drainage Analysis Example Using Landsat and LiDAR-Based Elevation Data

In order to complete a drainage analysis there needs to be data that show areas of higher and lower yield and areas of high flow accumulation or low ground soil. Yield monitor or Landsat maps can be used to show yield patterns. Areas of high flow accumulation or low ground soil can be mapped with different data. If LiDAR or similar resolution elevation data is available, a map showing high flow accumulation can be produced. If there is no suitable elevation data available, a soil darkness map (darker soil correlates to low ground soil in the vast majority of areas), SSURGO soil polygons, or your personal knowledge can be used. Either way, data to perform a drainage analysis at some level is available for all.

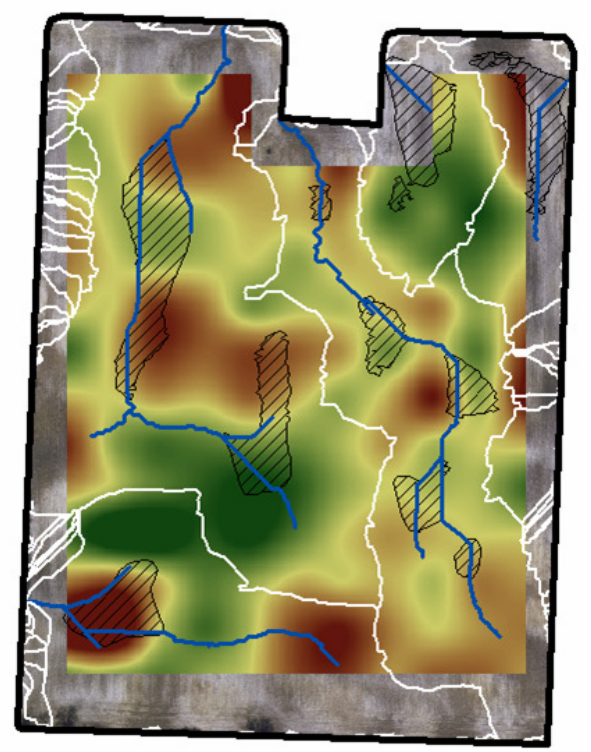
The map below uses LiDAR to show main areas of flow accumulation (blue lines; where water would converge more based on sinks/depression being filled [sinks are in yellow]) and, therefore, where low ground soil is. The flow accumulation lines produced should be a reasonable distance from basin boundaries (red lines) which are essentially ridgelines. Sinks/depressions shown are at least 100 square meters (any requested sink area, as well as, volume and/or depth can be mapped). The shades of black to white represent elevation values; brighter shades are higher elevations.



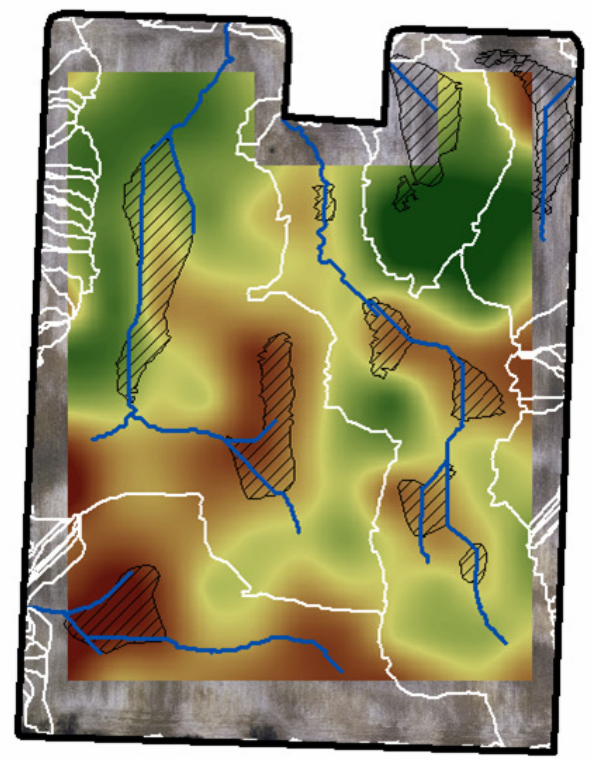
In the maps on the following pages, Landsat will be used to show areas of higher and lower yield for years with suitable imagery dating back to 2004. Landsat data is shown to the extent of the centroid (center) of valid pixels on the perimeter. Applying Landsat for crop imaging and yield prediction is explained in the Imagery/ yield prediction map section. All maps are classified as higher predicted yield value = darker green and lower predicted yield value = darker red (values ≥ 2 standard deviations from the mean [about 2.5 percent of data] are all classified the darkest green and values

≤ 2 standard deviations from the mean [about 2.5 percent of data] are all classified the darkest red); yellow is the middle of range of ± 2 standard deviations mean. Basin boundaries are now white and sinks are black.

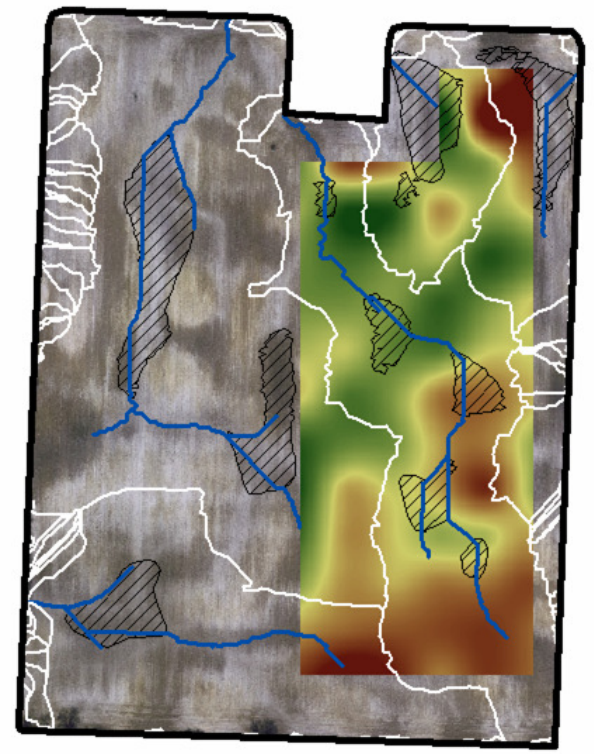
2010 soybean imagery



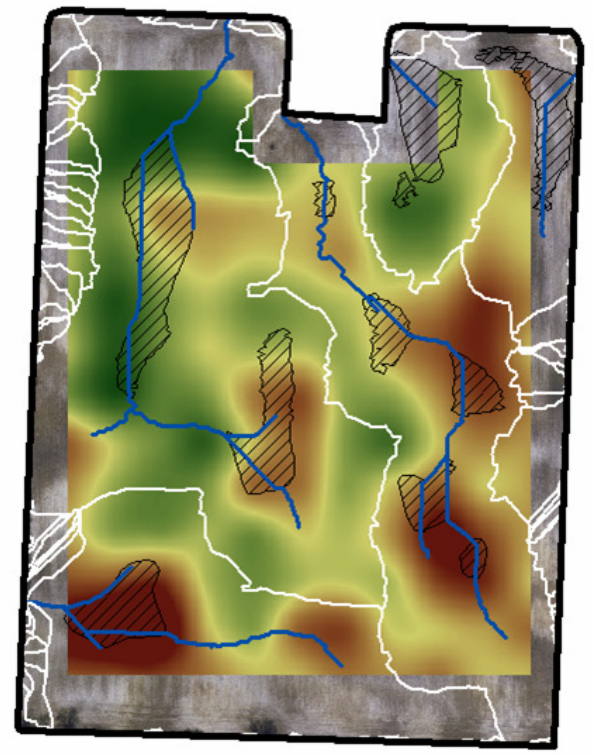
2009 corn imagery



2007 corn imagery
(only part of field planted corn)



2004 soybean imagery



Conclusion

Overall, the analysis shows that the field has drainage problems in many areas. The sink in the southeast has relatively low yield for all images, an area of the sink in the center of the field always corresponds to relatively low yield, and there are significant areas where the low ground corresponds to relatively low yield when compared to adjacent upslope areas. Yield loss for these areas can be estimated by either using Landsat data (which is available for all) or yield monitor data. A cost-benefit analysis can be made for a particular area or all areas based on price of drainage improvements compared to estimated yield increase.