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Tool for Geogrid Output: WTOOLS

Display and Modify WRF Grid Information Using Google™ Earth

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Motivation

- 1) To view grids created by geogrid relative to the actual terrain and to available high resolution imagery.
- 2) To alter the landuse and soil type categories assigned to grid cells.

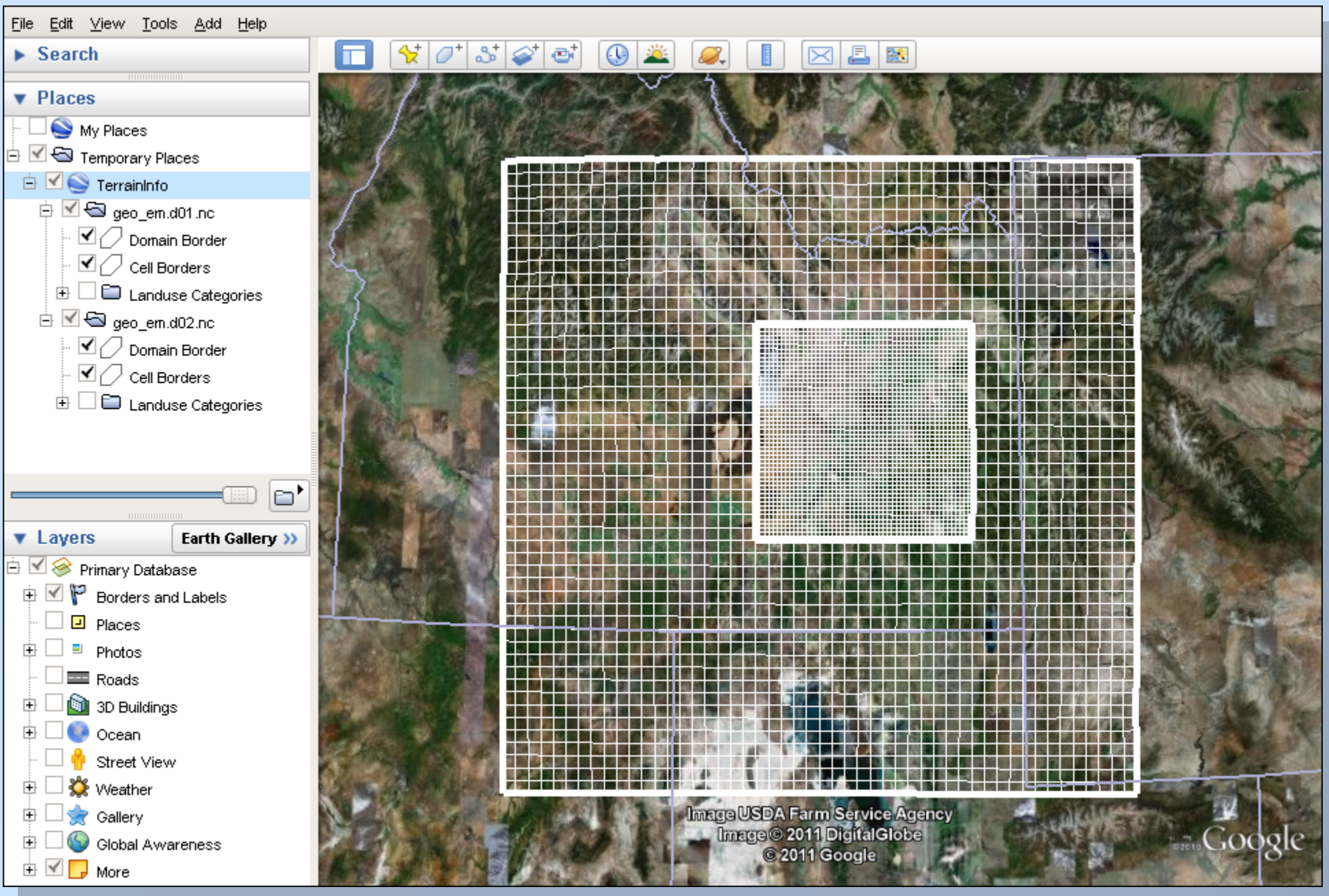


Figure 1 showing relative grid placements and individual cells. Useful when aligning domains and determining boundaries.

WTOOLS

- Programs, WrfToKml and KmlToWrf, leverage Google™ Earth's interactive and display capabilities for WRF data.
- Written in Java so portable without the need for recompiling.
- Asides from Java and jar file containing the programs, only one Java NetCDF library is required.

WrfGridInfo

- Generates KML format files containing WRF grid information.
- Multiple geo_em.d* files can be selected for output into the same KML file.
- Can create either uncompressed KML or compressed KMZ files.
- Relative placement of nested grids can be iteratively viewed in Google™ Earth and adjusted.
- Zooming in 3D can indicate whether domains border abrupt terrain, such as mountain ranges.
- Also includes ability to display soil type categories assigned to grid cells.
- Google™ Earth's high resolution imagery helps determine whether appropriate land use categories are assigned to grid cells.
- Can display WRF NetCDF grid data including geo_em.d*, met_em.d*, wrfinput_d*, and first timestep of wrfout_d* files.
- Showing cell elevation compared to Google™ Earth rendering indicates whether resolution of terrain data supplied to geogrid is appropriate.

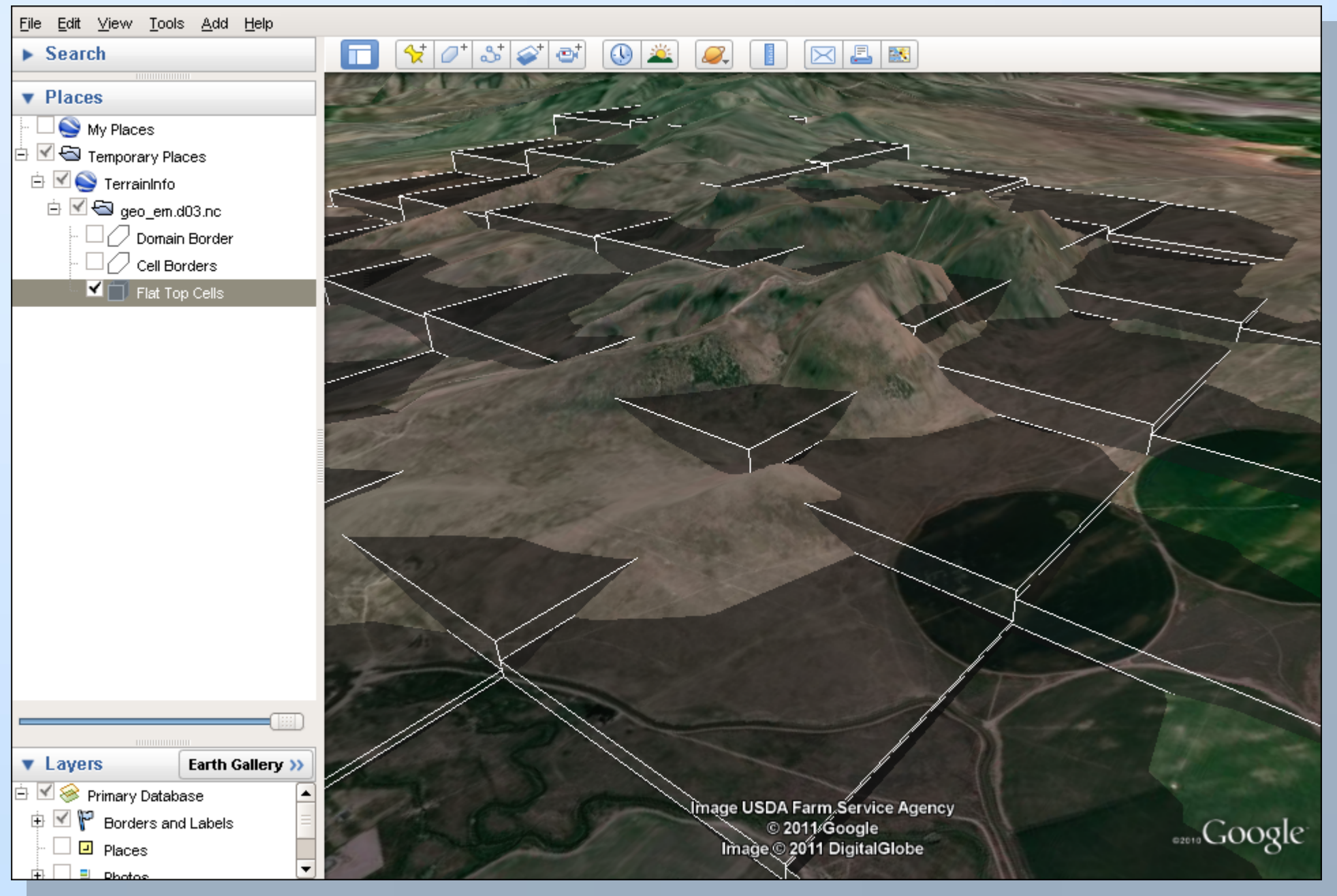


Figure 4 showing grid cell heights vs Google™ Earth rendered heights.

KmlToWrf

- Google™ Earth provides interactive creation of point, line, and polygon geometries that are saved and then read by KmlToWrf.
- Google™ Earth's zooming ability and high resolution imagery allow precise changes to WRF grid data.
- Different methods to determine whether geometries from Google™ Earth change a grid cell's category: touches the cell, has a point in the cell, polygon covers over 50% of the cell, or polygon encloses the cell.
- If landuse category changed to or from water, land mask variable is also changed accordingly, if present.

- Each geometry can be used or ignored so alternatives can be created but implemented differently, perhaps for sensitivity studies.
- Google™ Earth geometries are processed in the order they are saved so large polygons can change large regions and smaller geometries within them can either override or be set to “NO CHANGE.”
- Works for either USGS or MODIS IGBP sets of land use categories.
- Changes all of these variables, if present in the file: LU_INDEX, IVGTYP, LANDUSEF, XLAND, and LANDMASK.
- Works for soil type categories changing all of these variables, if present in the file: ISLTYP, SOILCTOP, SOILCBOT.
- Fractional categories, specifically, LANDUSEF and SOILCTOP, are set to 100% of chosen category.
- Reads either KML or KMZ output generated by Google™ Earth.
- Can alter WRF NetCDF data including geo_em.d*, met_em.d*, and wrfinput_d* files.

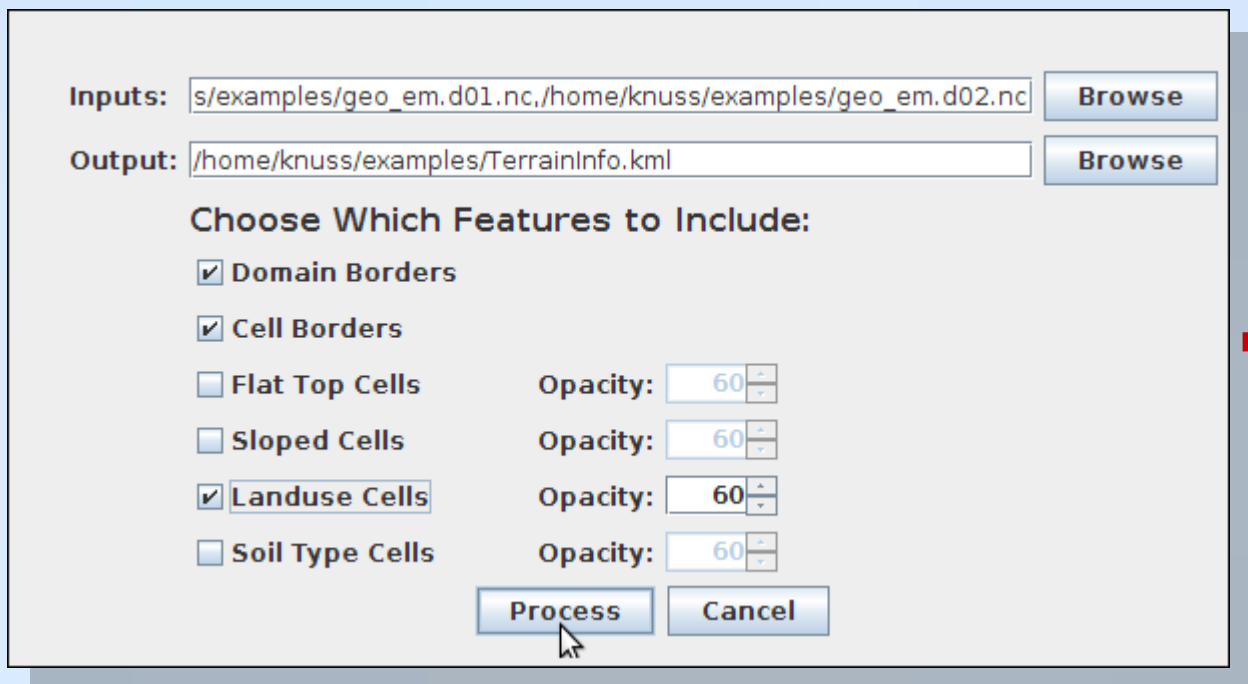


Figure 2 above shows WrfGridInfo screen. Multiple geo_em files chosen; domain borders and cell borders chosen for output. Colored, semi-transparent landuse categories are generated in KML file output.

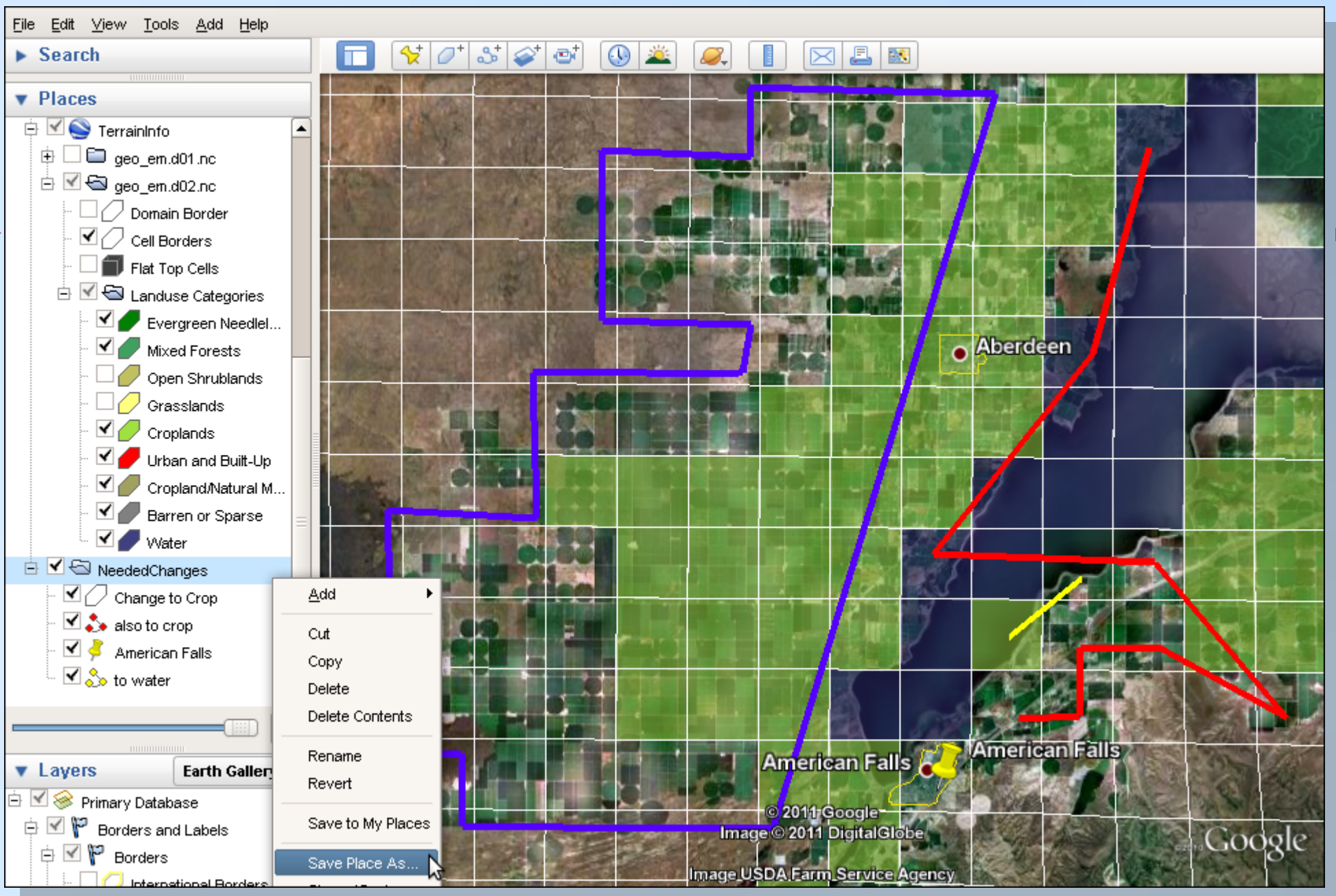


Figure 3 to the right shows point, paths, and polygon added in Google™ Earth to mark cells needing changes to landuse. Existing categories as produced in figure 2 are shown with some categories hidden for clarity. New geometries are saved as KML file for use by KmlToWrf program.

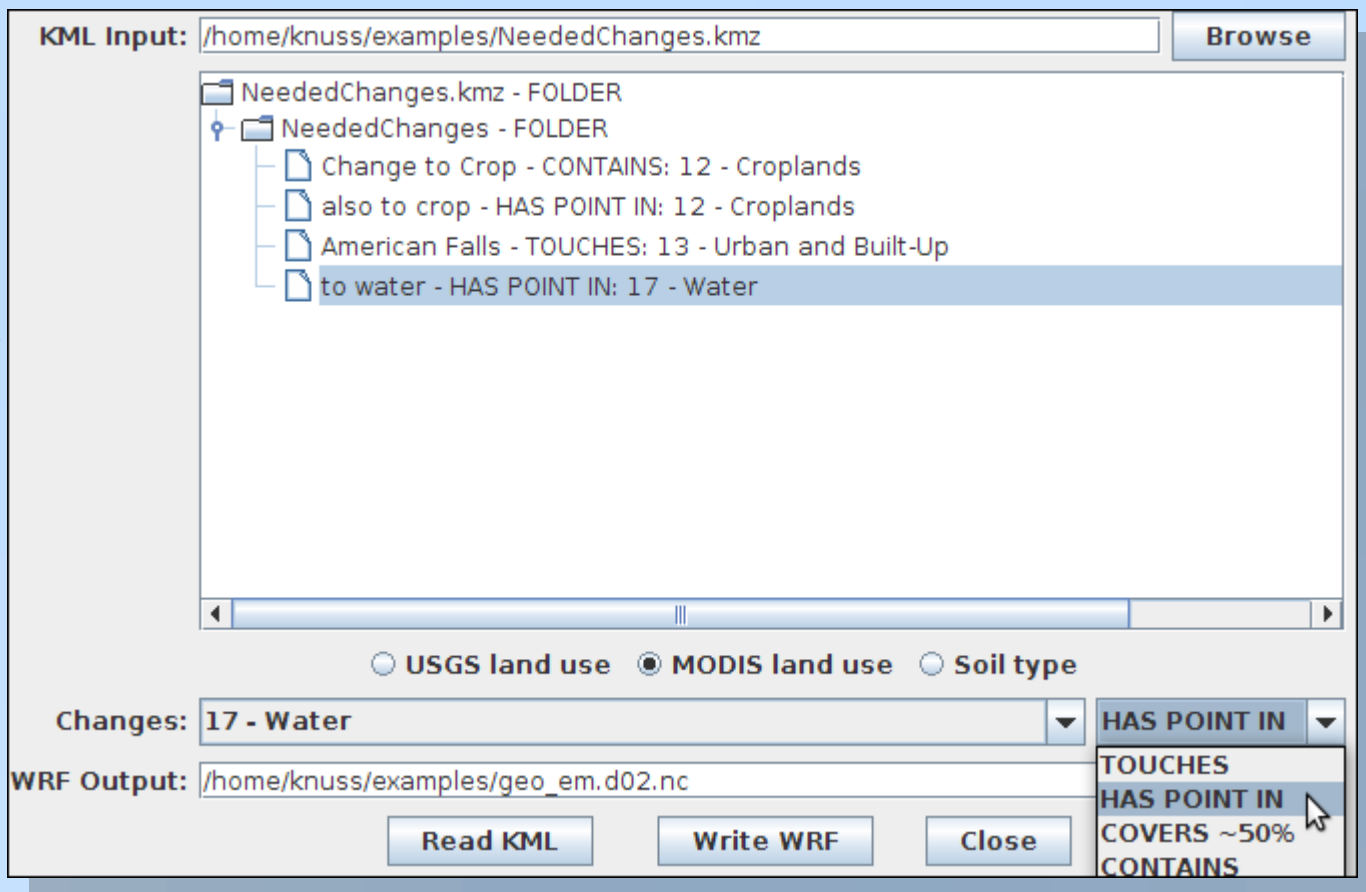


Figure 5 above shows KmlToWrf screen that has read KML file with added geometries and indicates changes to categories for each one.

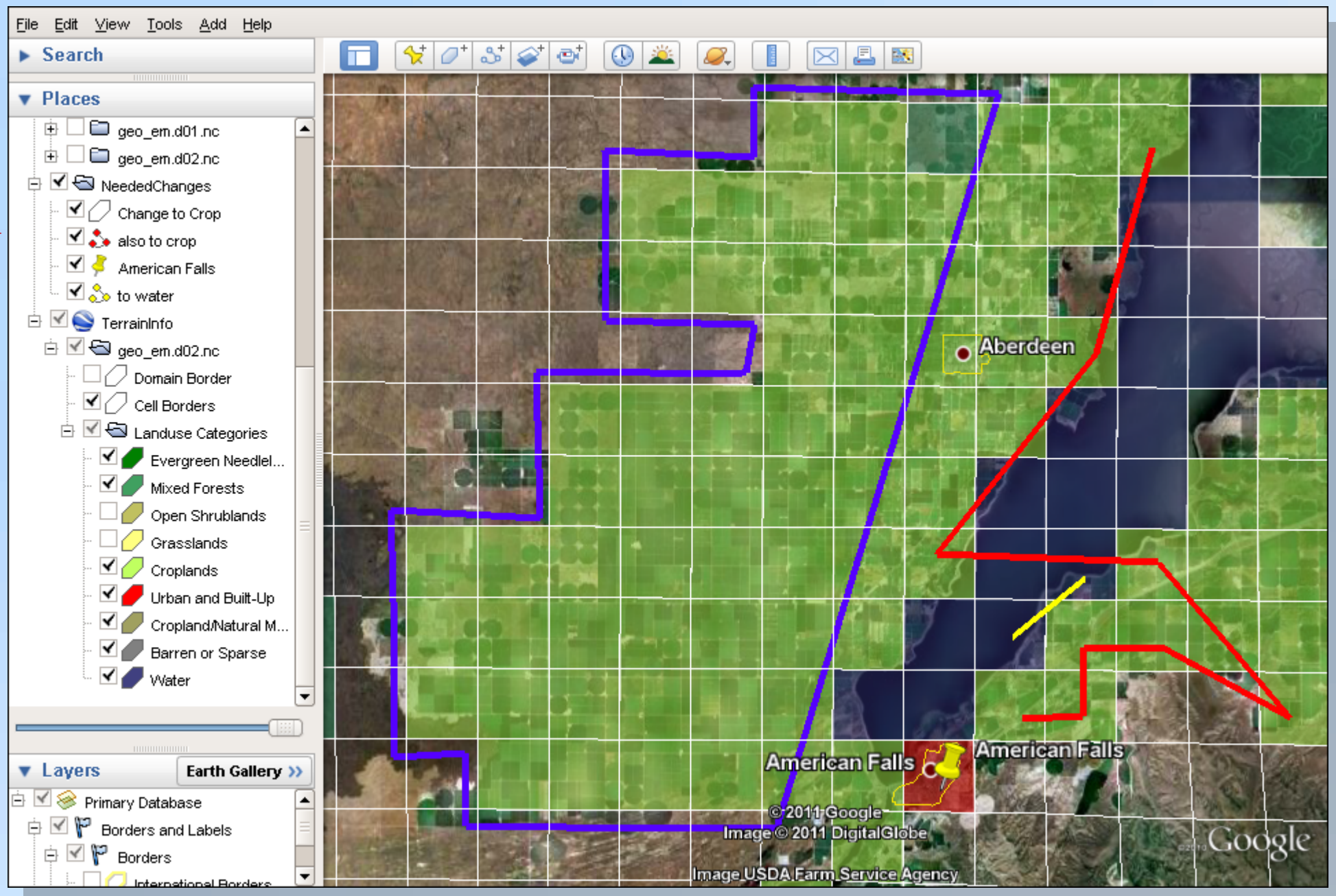


Figure 6 to the right shows the resulting changes that were specified and written, with WrfToKml subsequently run and new KML file loaded.