Watershed Analysis

Accessed from US Forest Service -- El Dorado National Forest (a)
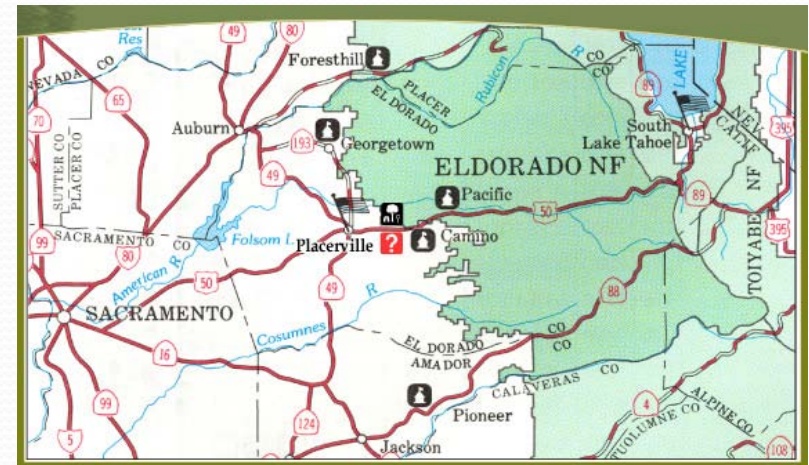
- The study area is the Upper American River Basin.
  - Predominantly Eldorado County, CA, and the majority of Eldorado National Forest.

Accessed from US Forest Service -- El Dorado National Forest (b)

Importance of Watersheds

- Watersheds provide water and other resources for woodland creatures that rely on specialized ecosystems and for humans.

- Researchers must determine the characteristics involved in maintaining and restoring watersheds.

  - Delineation of existing watersheds, and land use quantification by percentage of each watershed, are essential for determining these characteristics.

- As knowledge of watersheds is strengthened, land use can be further optimized as economic and sustainability concerns are balanced.

Accessed from The NorCal Explorer .

Research Questions

- Two pieces of information are essential when delineating watersheds.
  - Where is the source water coming from?
  - What is the geographical area of the watershed?
- Land use development within each watershed will be analyzed.
  - What percentage of each watershed is developed?

Cataract Falls, Marin County, CA, 3/15/2009.
Personal photograph collection.

Data Essential to Analysis

- The Elevation DEM (top) and the Landcover raster (bottom) were downloaded from the USGS's National Map Seamless Server, (a) and (b), respectively. The DEM contains the elevation and water content and the Landcover raster contains the vegetation properties.
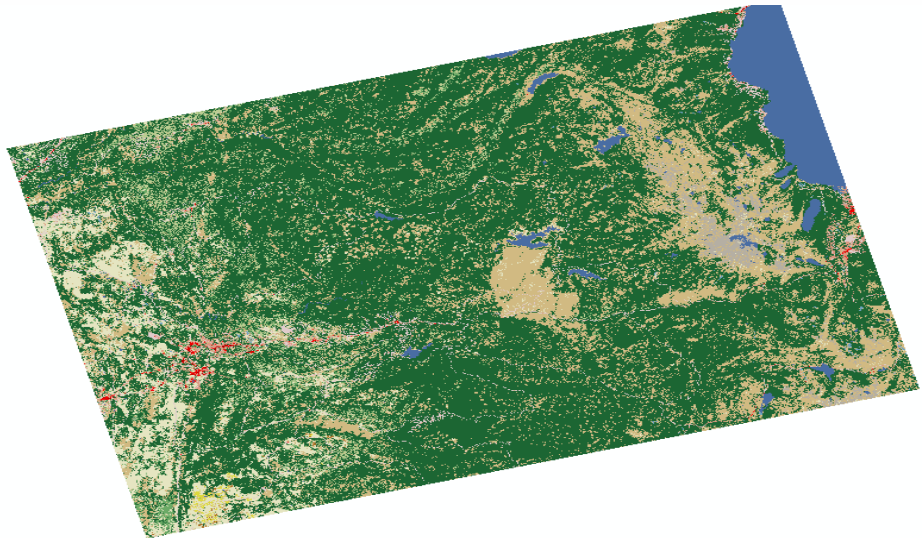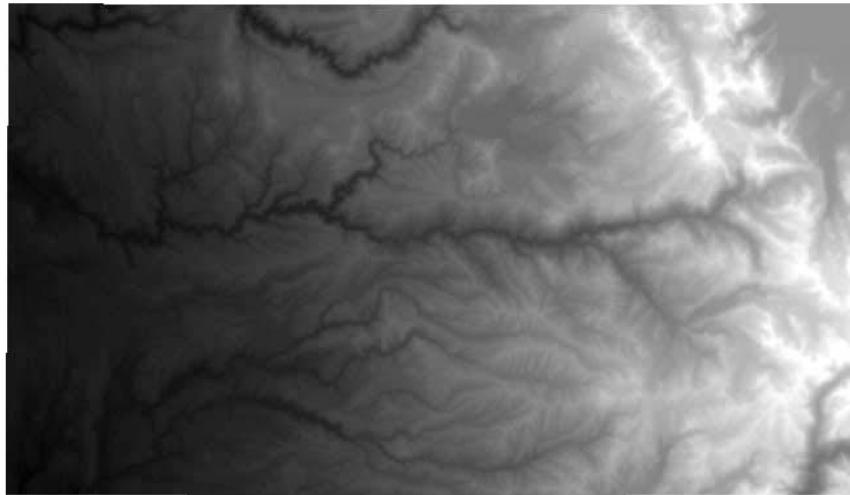
Land Use Reclassification

- Landcover data contained dozens of watershed classifications.
- Cells established as developed in the original landcover tiff file were represented by the following numbers:
    - 21 – Developed open space.
    - 22 – Mixture of constructed materials and low intensity vegetation.
    - 23 – Mixture of constructed materials and medium intensity vegetation.
    - 24 – Mixture of constructed materials and high intensity vegetation.
    - 81 – Grasses.
        - Included as developed land because of the assumption that the forest area is grassy due to logging.
    - 82 – Crops.
- Developed cells were reclassified with a value of 1, while nondeveloped cells were reclassified with a value of 0.
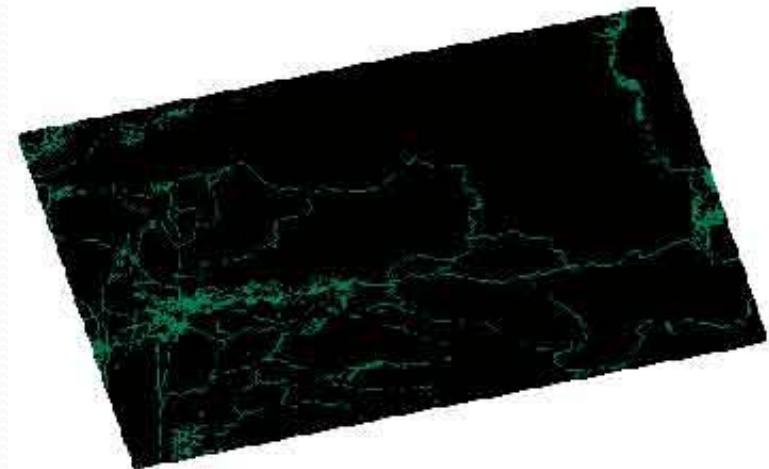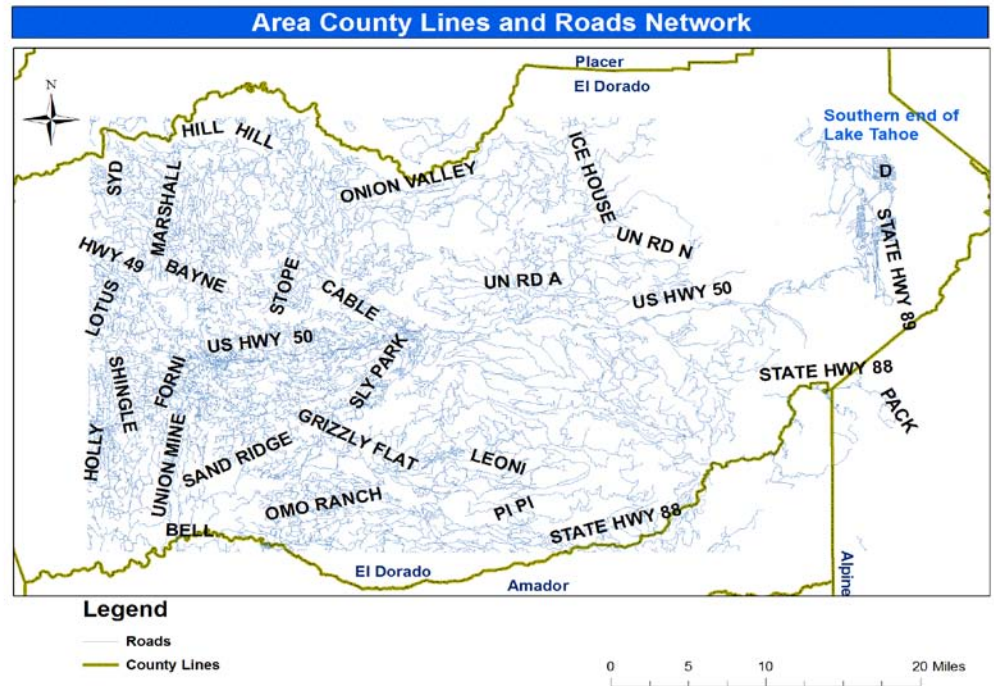

Legend

⬛	0 Nondeveloped
🟩	1 Developed

Data Essential to Map Orientation

- Roads are clearly displayed and prominent roads are labeled. The roads are not included on the final map display in consideration of map clarity. County lines are established. These layers provide clear geographical orientation.

Roads data was accessed from the USGS National Map Seamless Server (c). The original source of the County Boundaries is California Department of Forestry and Fire Protection, 2007, as specified in the data's documentation. County Boundaries data was accessed from Cal-Atlas Geospatial Clearinghouse.

Delineation of Watershed

• The first step in watershed delineation is establishing flow direction of the area's streams. The Flow Direction tool does this by calculating the steepest down-slope neighbor from cell to cell.

• The second step is to establish the area of each watershed. Every cell within the area specified between ridges is established as a contributor to the flow in the watershed.

Accessed from ESRI ArcGIS 9.3 Help Menu in the topic Delineating Watersheds.
Last Accessed: 12/4/2009

Methodology of Watershed Delineation

- Zonal analysis is performed on the Basin layer after reclassifying the landcover data and delineating the watersheds. This produced a table that was used to calculate the percentage of developed land in each watershed.

- The table was joined with the basin layer. The breaks in developed percentage ranges were reclassified to evenly distribute each range.

Basin Layer Including Reclassified Landcover Attributes

Legend

Percentage Dev
- 0 - 1.1
- 1.2 - 3.1
- 3.2 - 12.4
- 12.5 - 28.5
- 28.6 - 100

Complete Methodology

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┌──────────────┐      ┌──────────────┐      ┌──────────────┐
│  DEM raster  │      │ Landcover tiff│─────▶│  Reclassify  │
│              │      │    image     │      │  Landcover   │
└──────┬───────┘      └──────────────┘      └──────┬───────┘
       │                                           │
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│  DEM Flow    │─────▶│    Basin     │─────▶│Zonal Analysis│
│  Direction   │      │              │      │  as Table    │
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┌──────────────┐      ┌──────────────┐
│Join table to │─────▶│Calculate     │
│    Basin     │      │percent       │
│              │      │developed     │
│              │      │within        │
│              │      │watersheds    │
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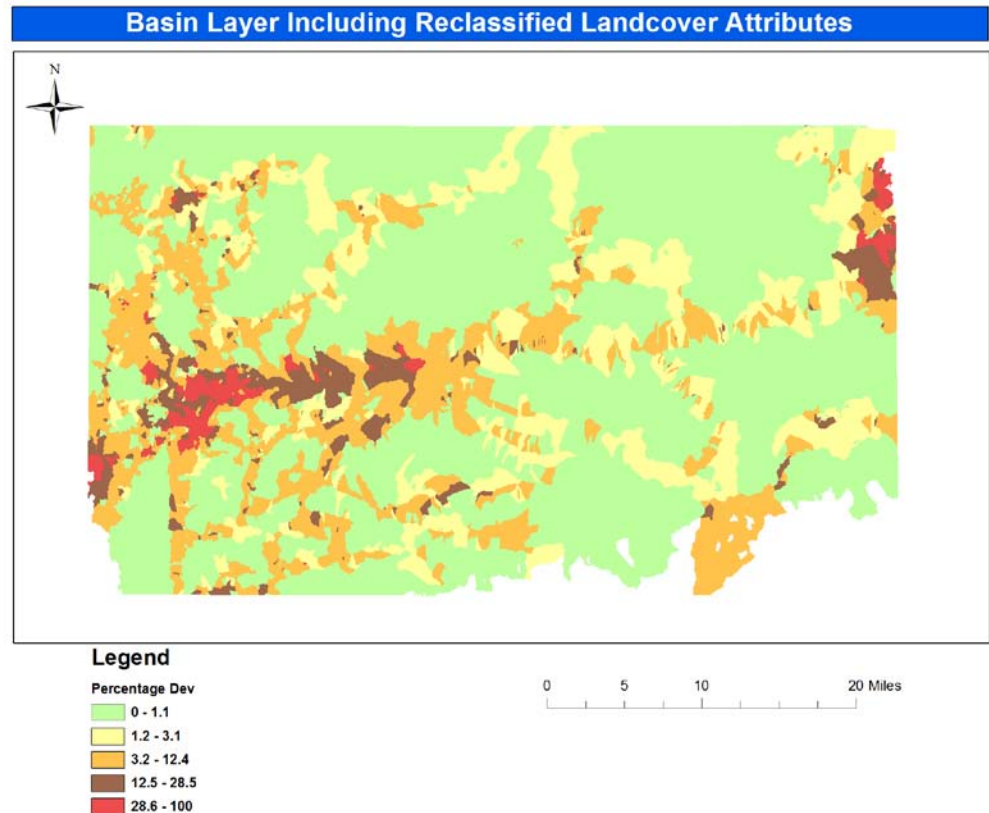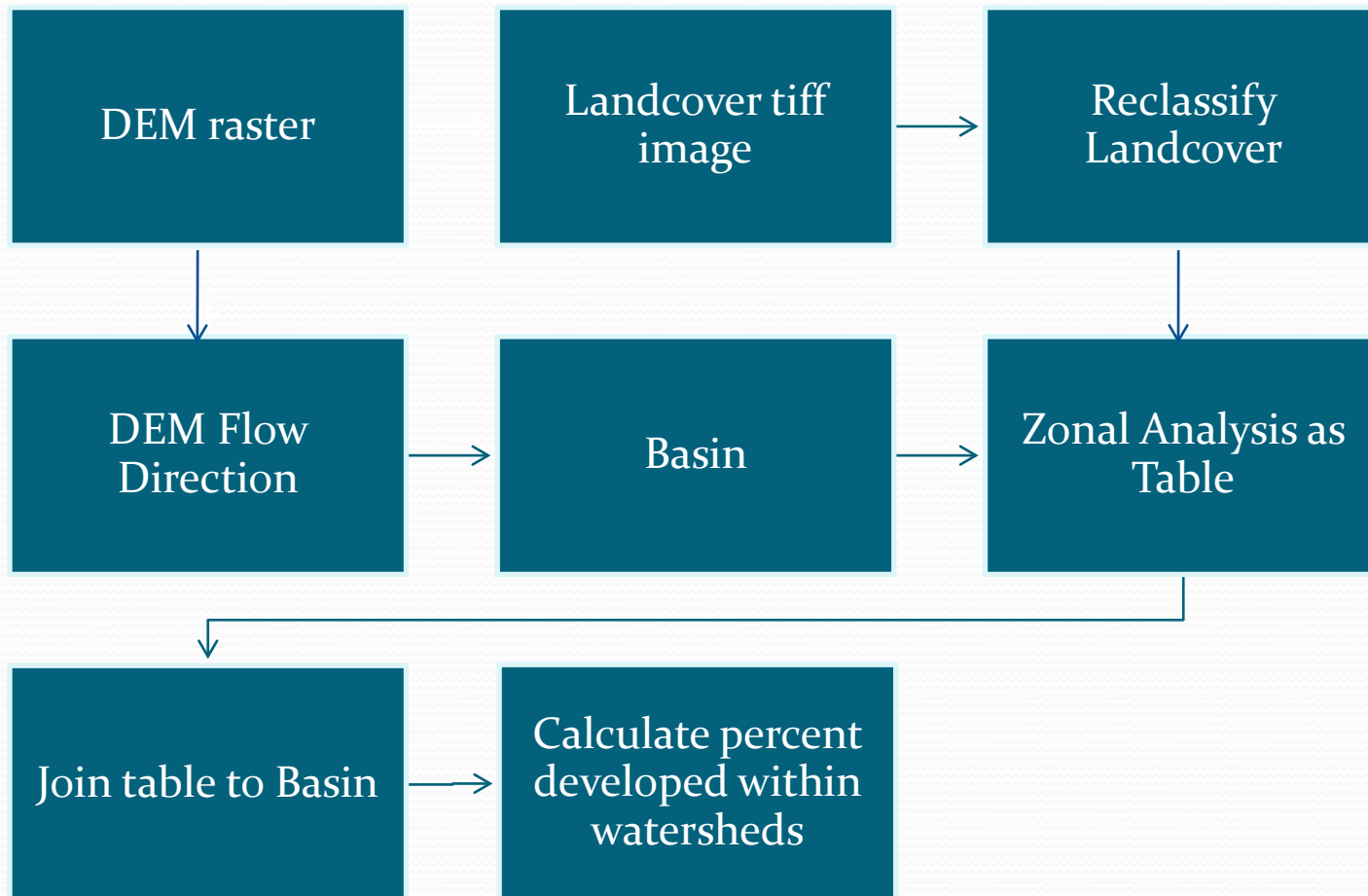
Results

- All research questions have been answered by this analysis. The basin layer established for the individual watersheds the geographical area covered, and the source of water. Degrees of development are also represented by the basin layer. The most heavily developed watersheds occur along Highway 50, as well as other major roads to a lesser degree. This confirms the validity of the developed landcover classification, since the land near major roads would logically contain a relatively high percentage of development.

Delineated Watersheds of the El Dorado National Forest Area
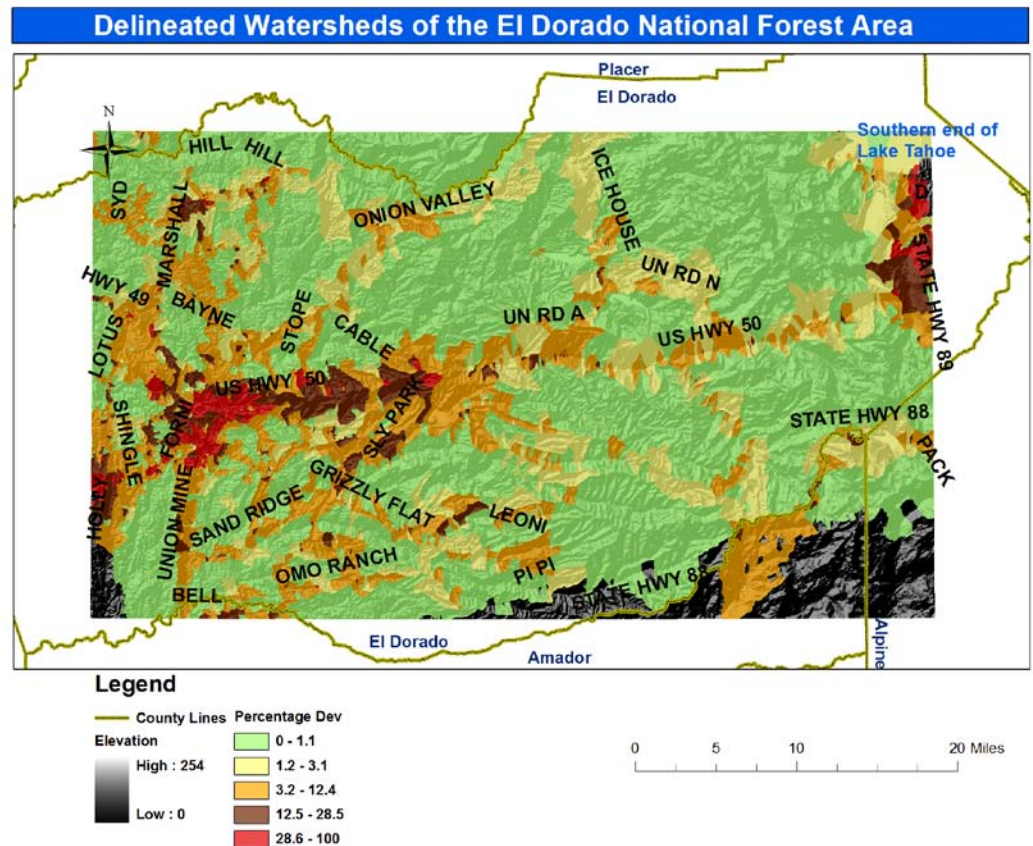
Conclusion

- A limitation of this approach is that the analysis does not distinguish between various types of land use. This is because the reclassifications of land use in the landcover data did not discriminate between "grasses," "crops," "mixture of constructed materials and vegetation," etcetera… If timber harvesting data, for instance, had been included in the analysis, there would have been a need to discriminate between land use types.

- The result of the analysis, shown in the map, shows that areas of land use can be located using the delineation analysis.
  - This methodology could be used locate areas of urban development that may be contributing to overland flow in the region.
  - The source of flooding and fish kills in a certain watershed could well be upstream logging that would be depicted on a map of analysis specifically concerned with logging.
  - Fire hazard assessment could also benefit from specific analysis using this methodology since forest that is extremely dense can be prone to fires.

- This analysis demonstrates in a general sense that the methodological approach is useful as a tool to locate specific types of watershed land use.

References

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