

On-Farm Network Conference
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Scheman Building, Ames, Iowa

Elevation Data

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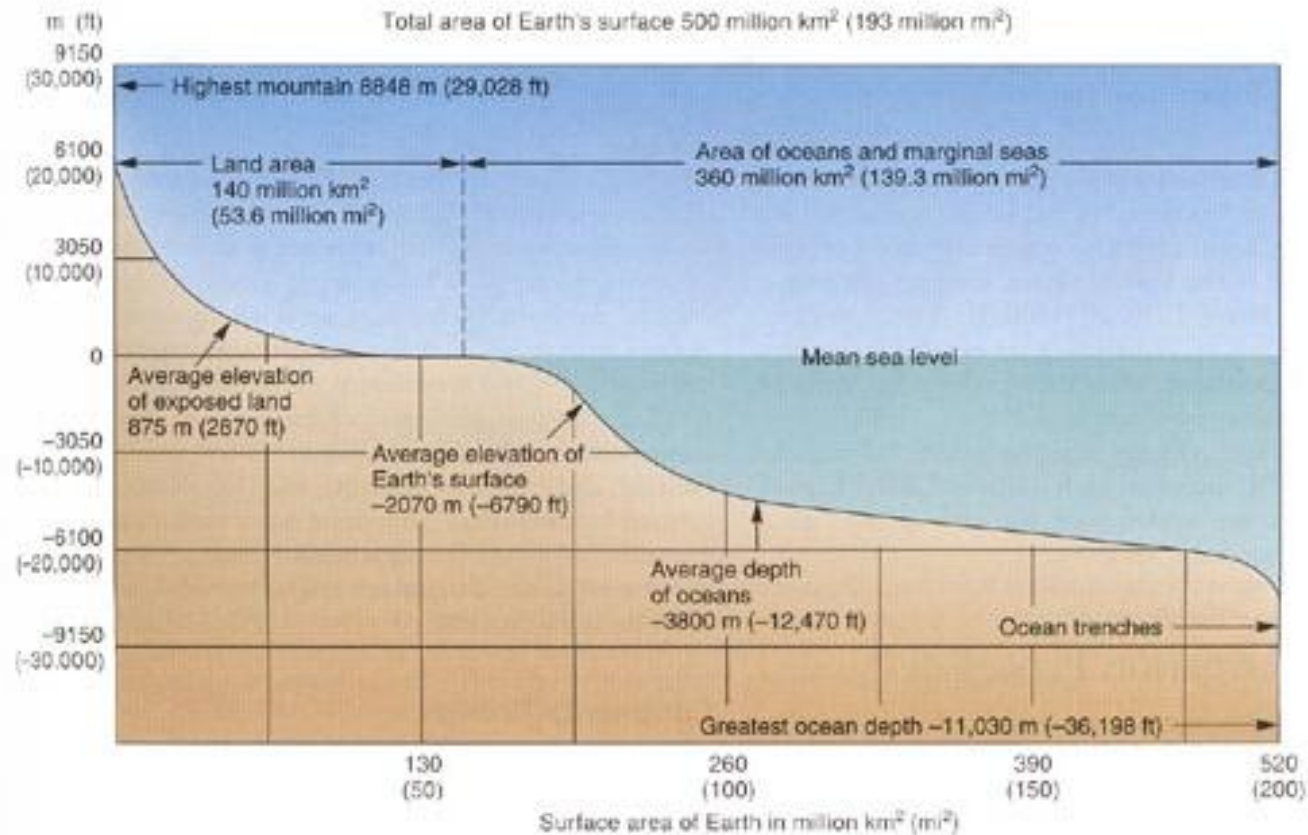
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- **Defining elevation**
- **Background information**
- **Obtaining elevation**
- **Creating elevation surfaces**
- **Elevation derivatives**
- **Questions**

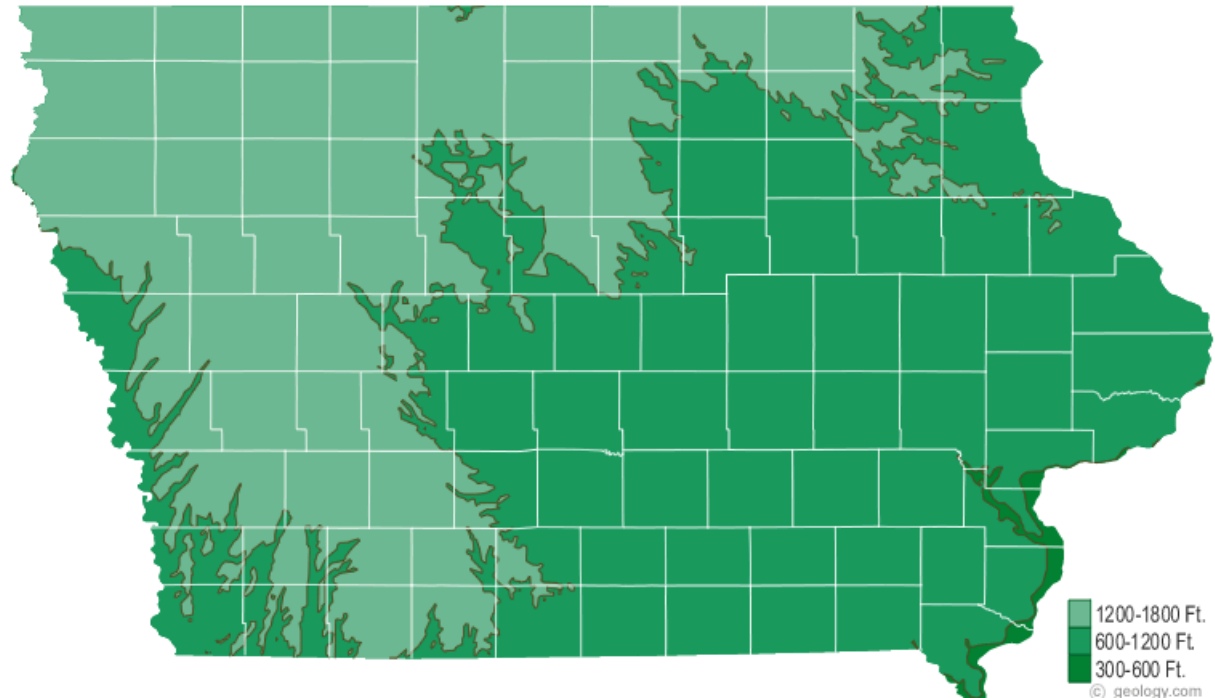
What is elevation?

- Distance of something above a reference point
- The reference point for the Earth's surface is sea level





- **Lowest elevation**
 - 480 ft in southeastern Iowa at the Mississippi River
- **Highest elevation**
 - 1670 ft at Hawkeye Point in northwest Iowa
- **Mean elevation**
 - 1099 ft



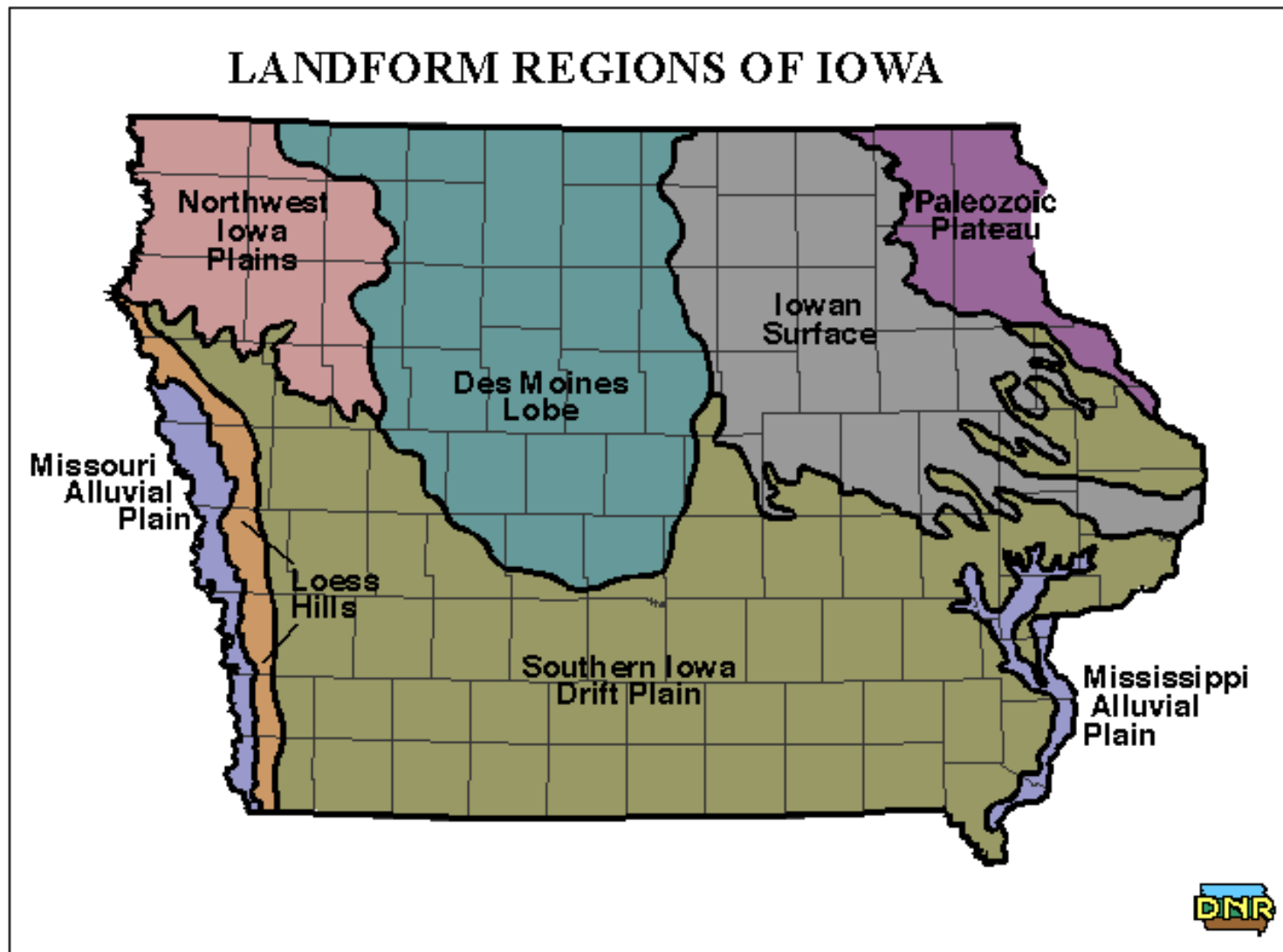
What influences elevation?



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- **Soil Forming Factors**
 - Climate
 - Biological organisms
 - Topography and landscape position
 - Parent material
 - Time
 - ???

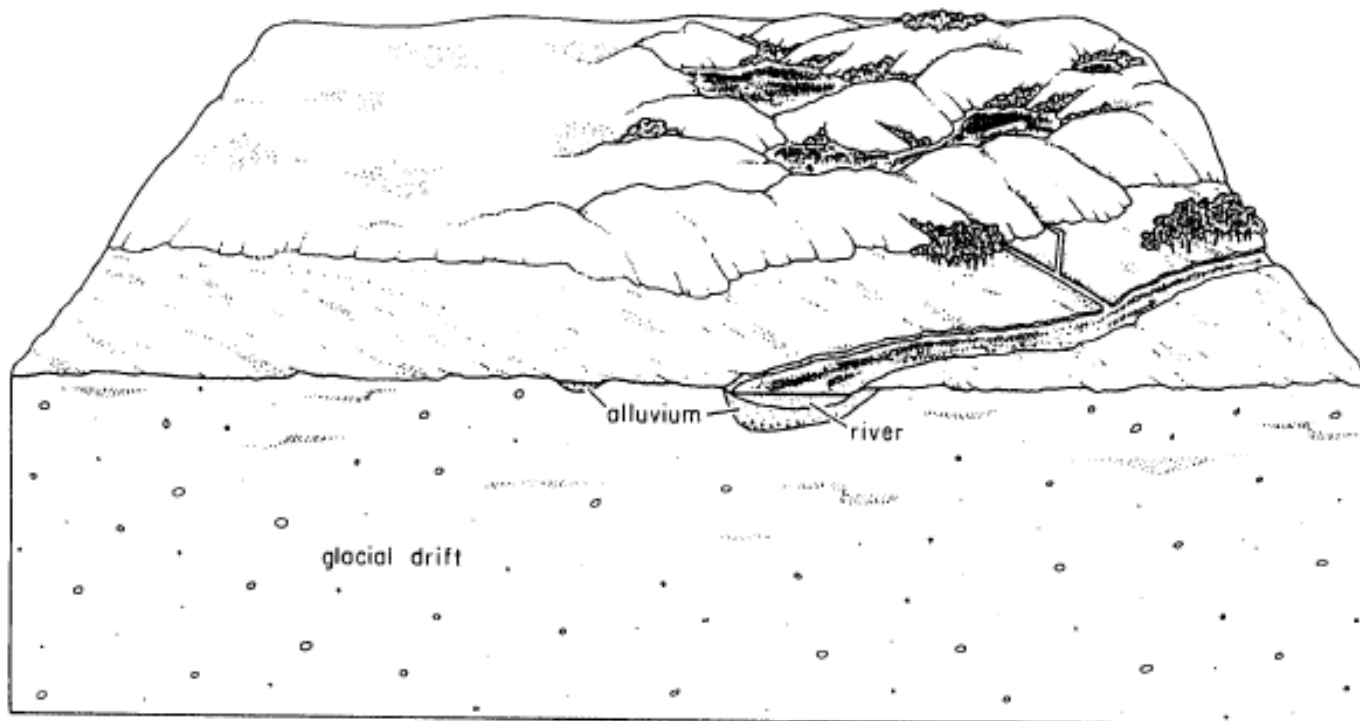
Parent Material of Iowa



Jean C. Prior. *Landforms of Iowa*. Iowa City: University of Iowa Press, 1991.

Des Moines Lobe

- Formed 12,000 to 14,000 years ago during the last glacial advance into Iowa.
- Predominate parent material glacial drift

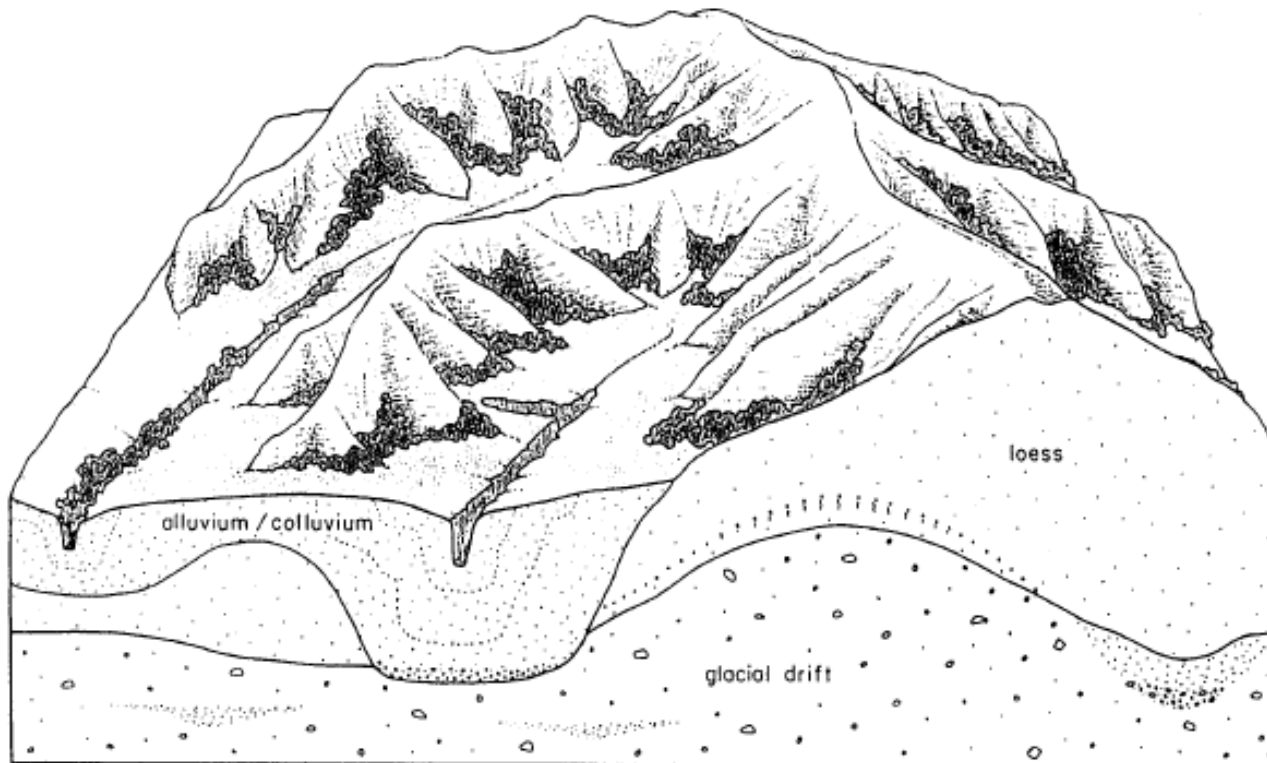


Loess Hills



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- Formed over the last 150,000 years by silt being blown from the Missouri River Valley, which is known as loess.
- Loess has been deposited over glacial drift and bedrock.

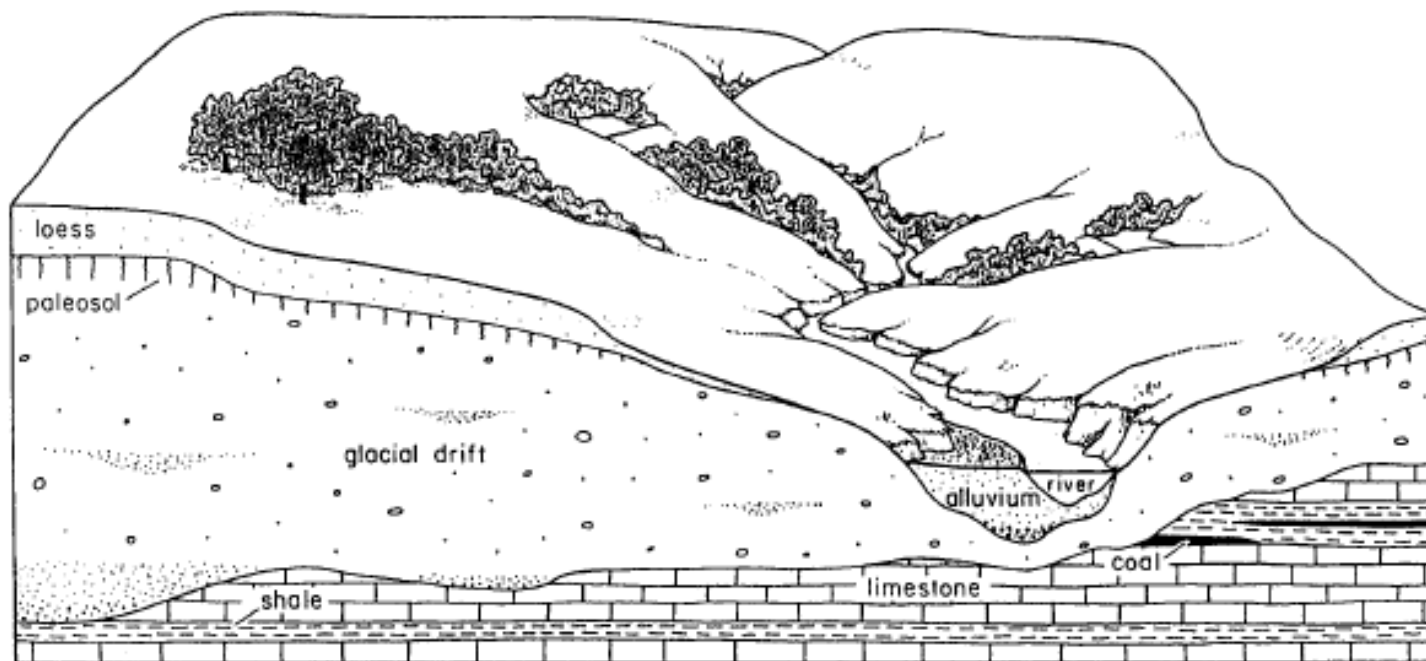


Southern Iowa Drift Plain



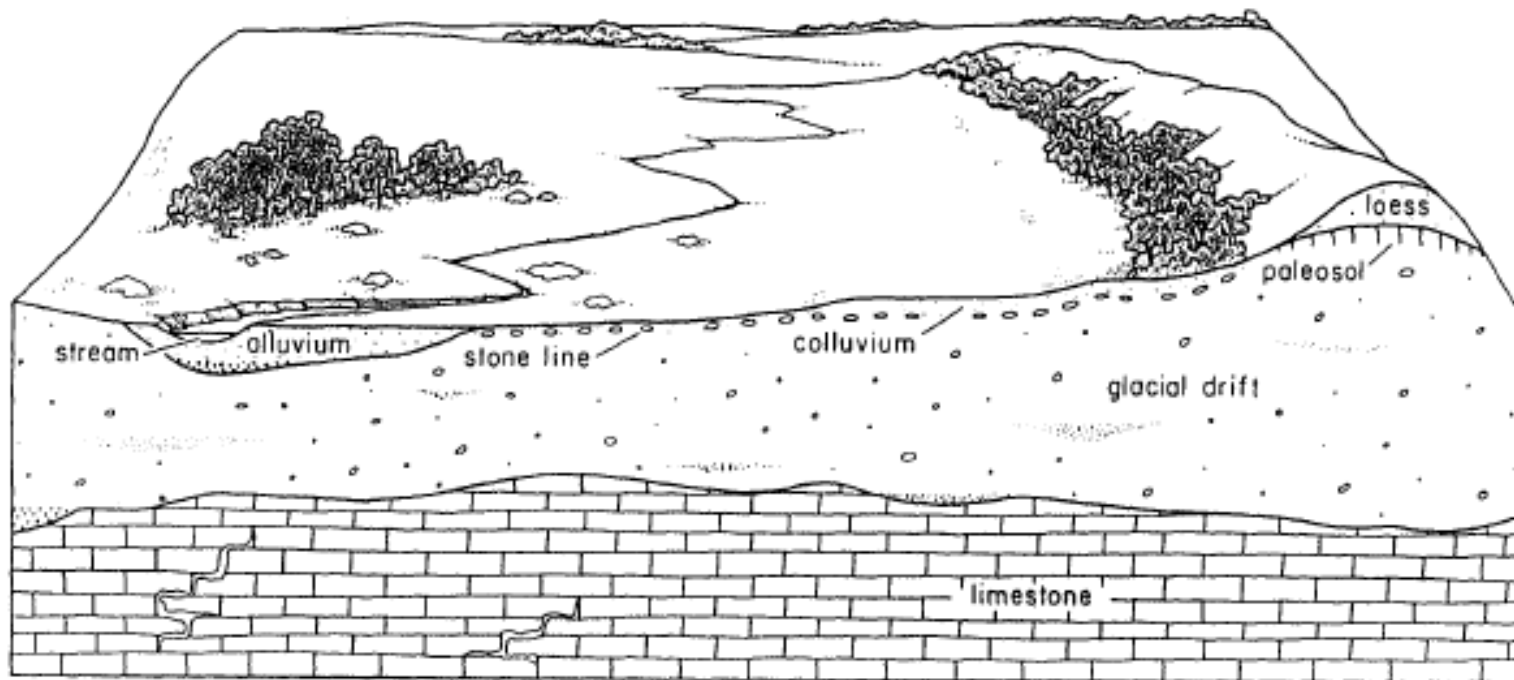
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- Erosion and stream development in glacial drift over thousands of years has created this area.
- Limestone, shale, and sandstone are underlying glacial drift and loess.



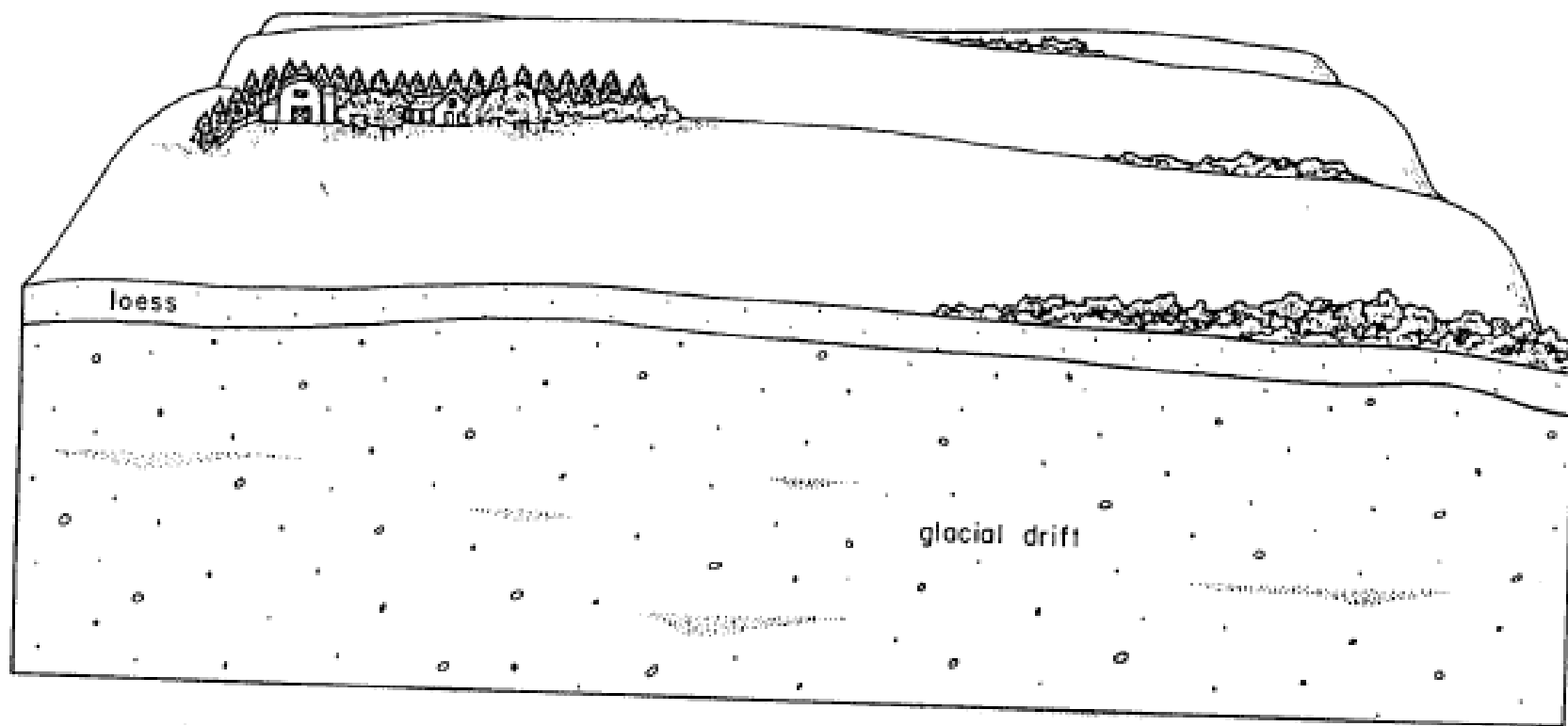
lowan Surface

- Area created by intense erosion in a cold, tundra-like environment.
- Glacial drift and limestone bedrock underlie region with some loess on elongated hills.



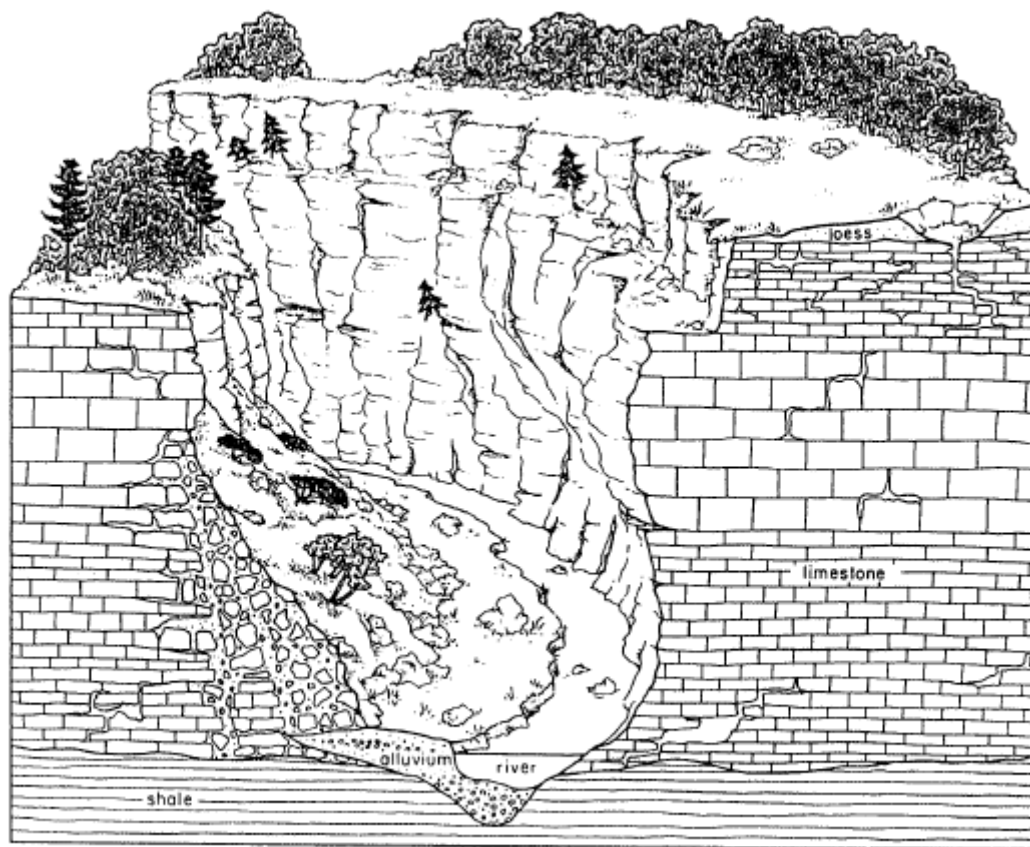
Northwest Iowa Plain

- Similar to lowan Surface with long gentle hills that are parallel.
- Glacial drift is covered by a thin layer of loess.



Paleozoic Plateau

- Bedrock outcrops and valleys that are steep and deep characterize this area.
- Formed 300 to 500 million years ago.

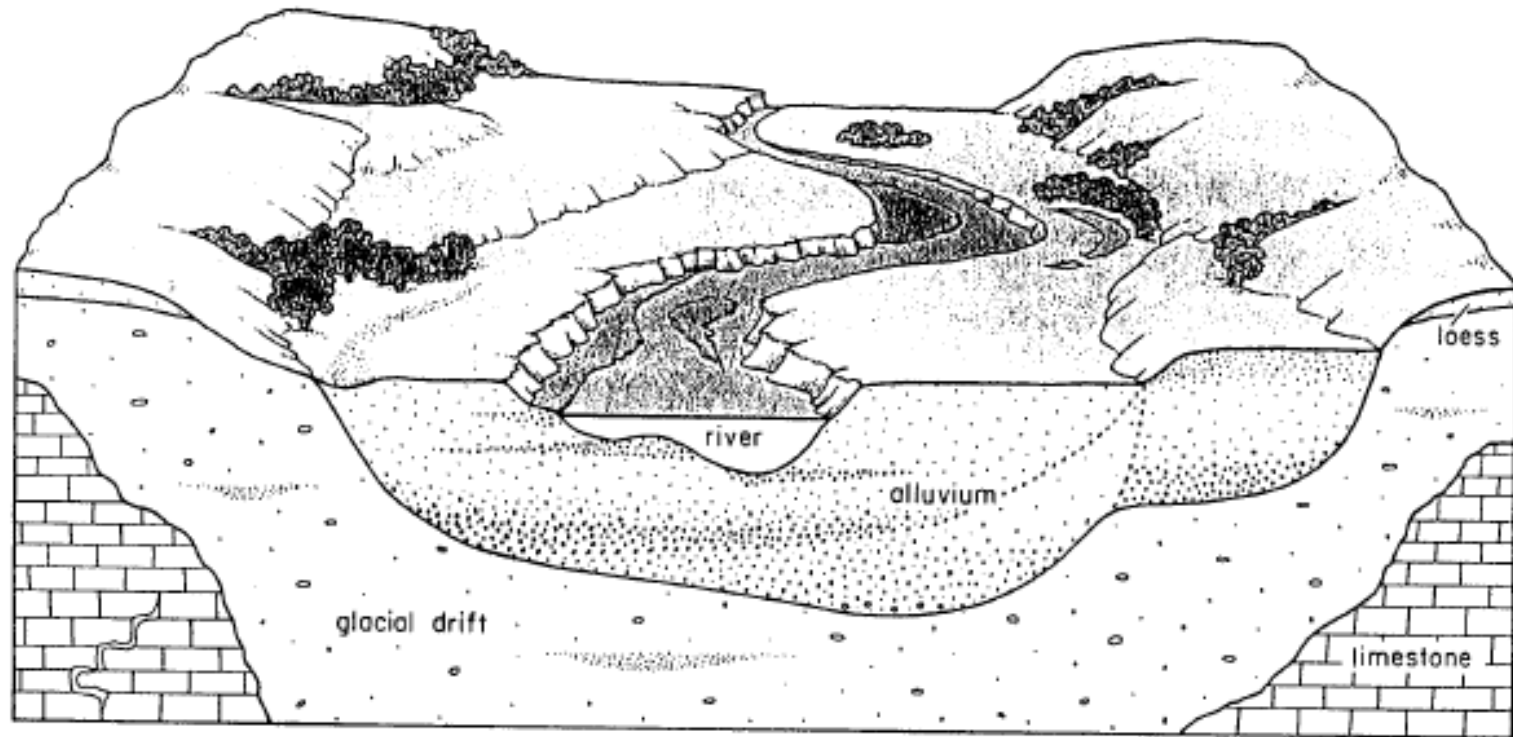


Alluvial Plains



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- Located along the rivers in the state where water has eroded parent material and flooding has left behind alluvium.
- Typical underlying material is glacial drift and bedrock.





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- **Questions**

Sources of Elevation Data

- **Producer equipment during field operations**
- **Iowa Soybean Association**
- **Consultants / Contractors**
- **USGS Digital Raster Graphic available at <http://ortho.gis.iastate.edu/>**



Creating an Elevation Layer

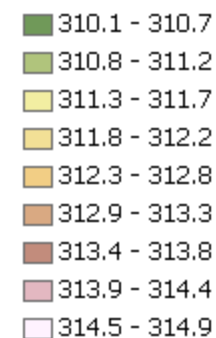
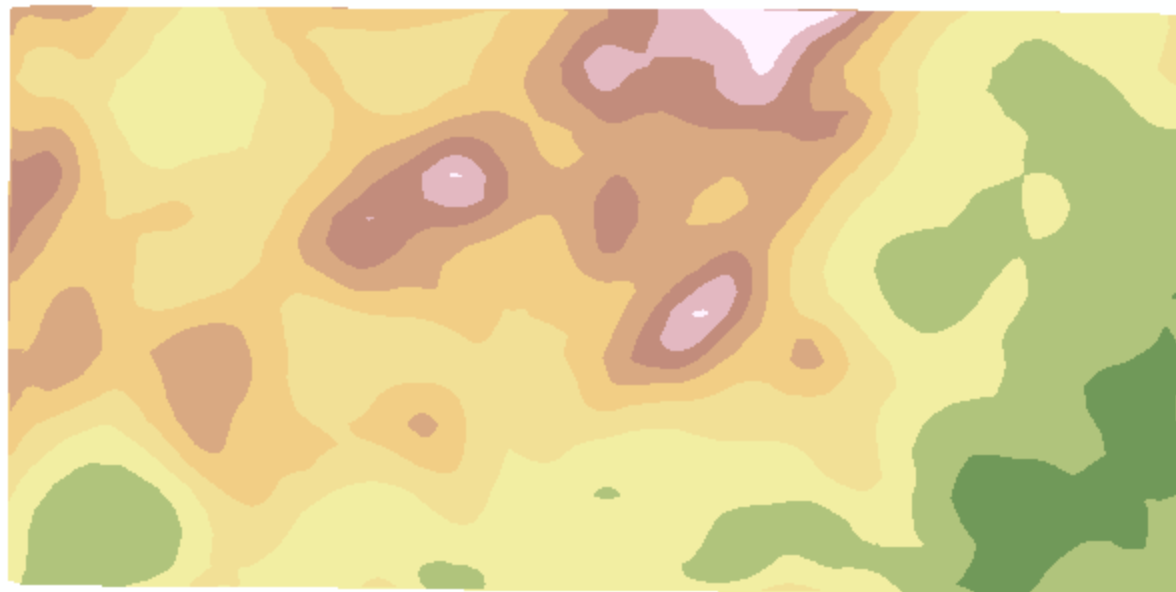


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- **Nearest Neighbor**
- **Inverse Distance Weighted**
- **Inverse Exponential Distance**
- **Trend**
- **Kriging**
- **Topo to Raster**

Nearest Neighbor

- **Nearest neighbor interpolation finds the closest subset of input samples to a query point and applies weights to them based on proportionate areas in order to interpolate a value.**



Inverse Distance Weighted

- Inverse distance weighted (IDW) interpolation determines cell values using a linearly weighted combination of a set of sample points.

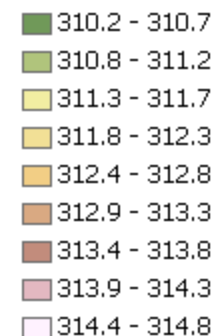
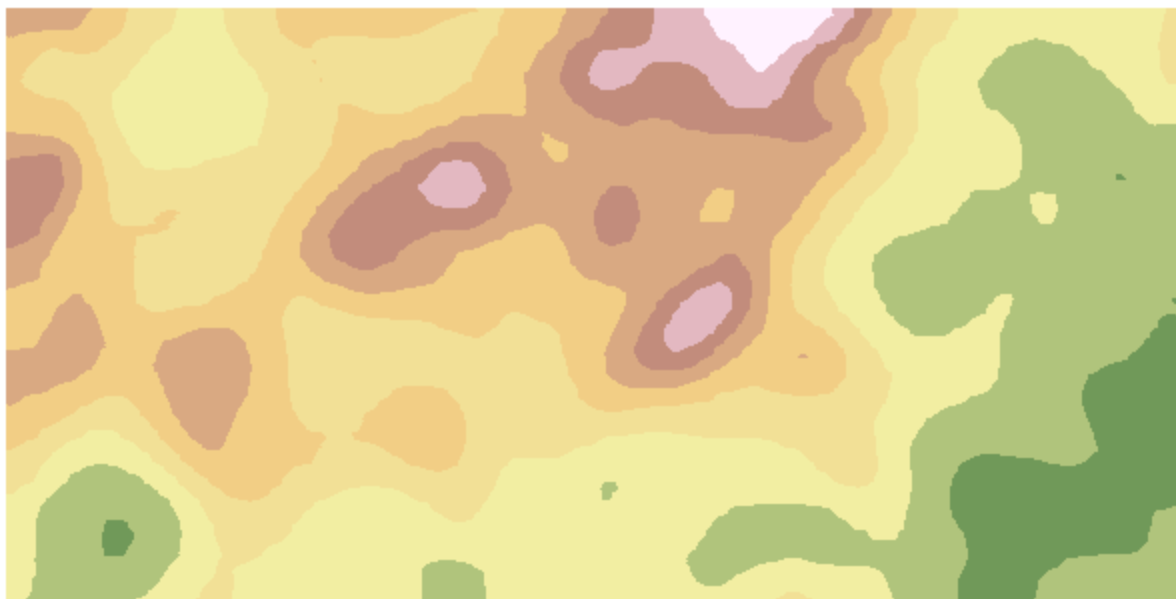
$$z_o = \frac{\sum_{i=1}^n z_i d_i^{-decay}}{\sum_{i=1}^n d_i^{-decay}}$$

z_o = interpolated value

z_i = attribute value at sample location i

d_i = distance between point i and o

decay = power which weights the distance



Inverse Exponential Distance

- Inverse exponential (Exp) interpolation determines cell values using an exponential combination of a set of sample points.

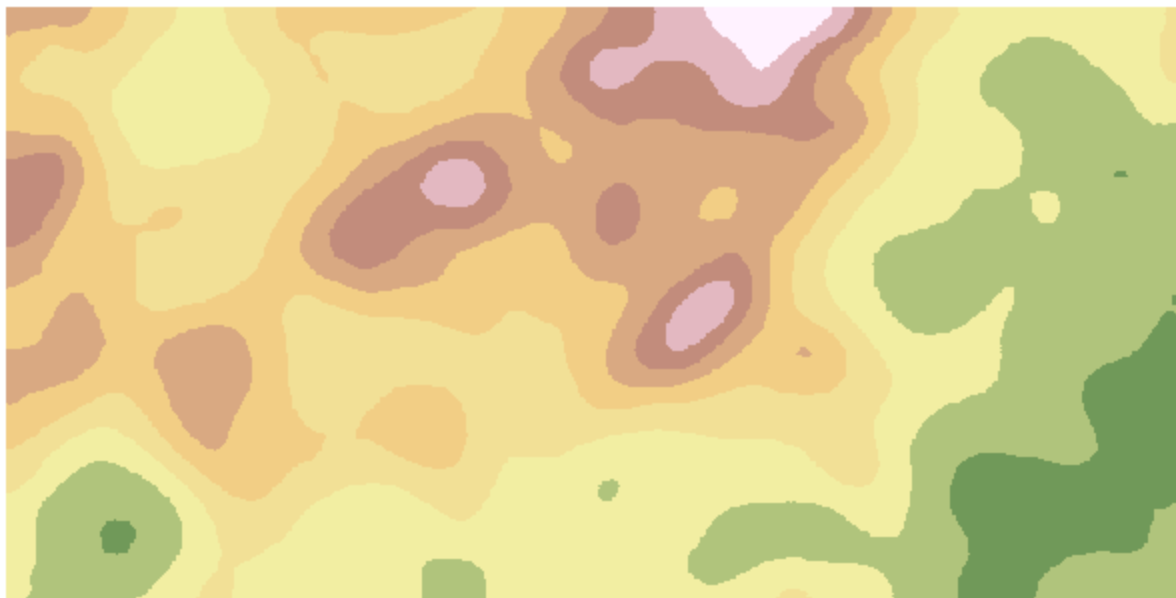
$$z_o = \frac{\sum_{i=1}^n z_i e^{-pd_i}}{\sum_{i=1}^n e^{-pd_i}}$$

z_o = interpolated value

z_i = attribute value at sample location i

d_i = distance between point i and o

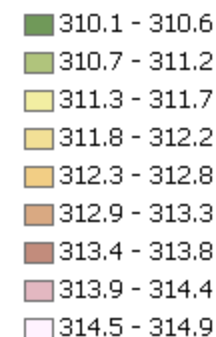
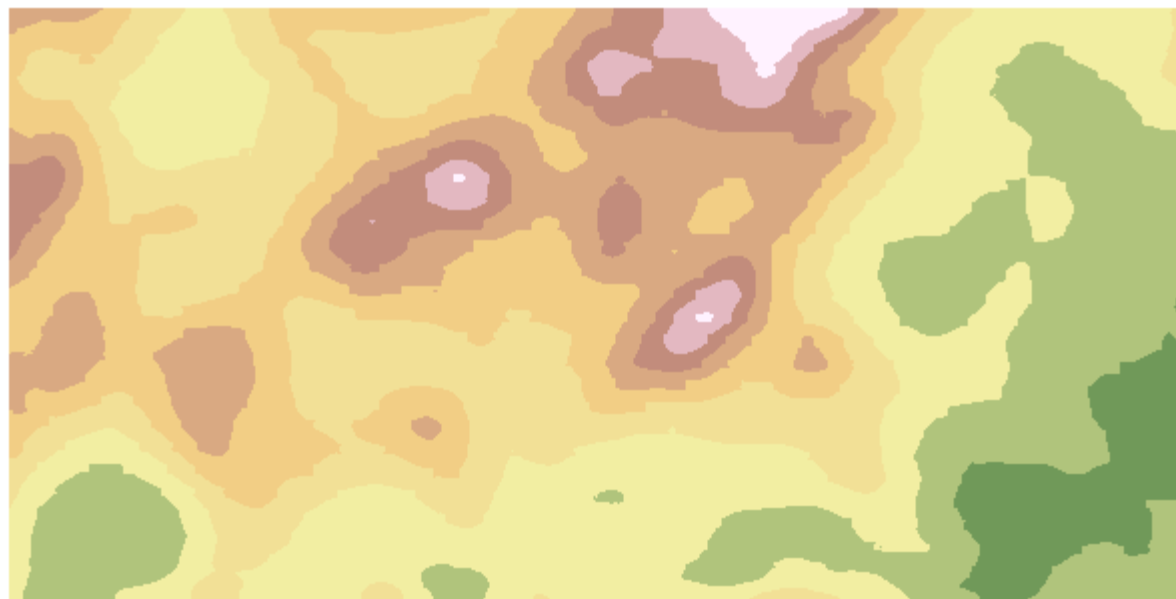
p = decay constant



- Trend interpolation used linear or logistic functions to fit a surface to the points



- **Kriging is an advanced geostatistical procedure that generates an estimated surface from a scattered set of points with z-values. An understanding of the spatial nature of the data is needed to select appropriate parameters for generation.**

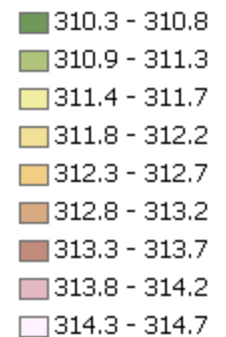
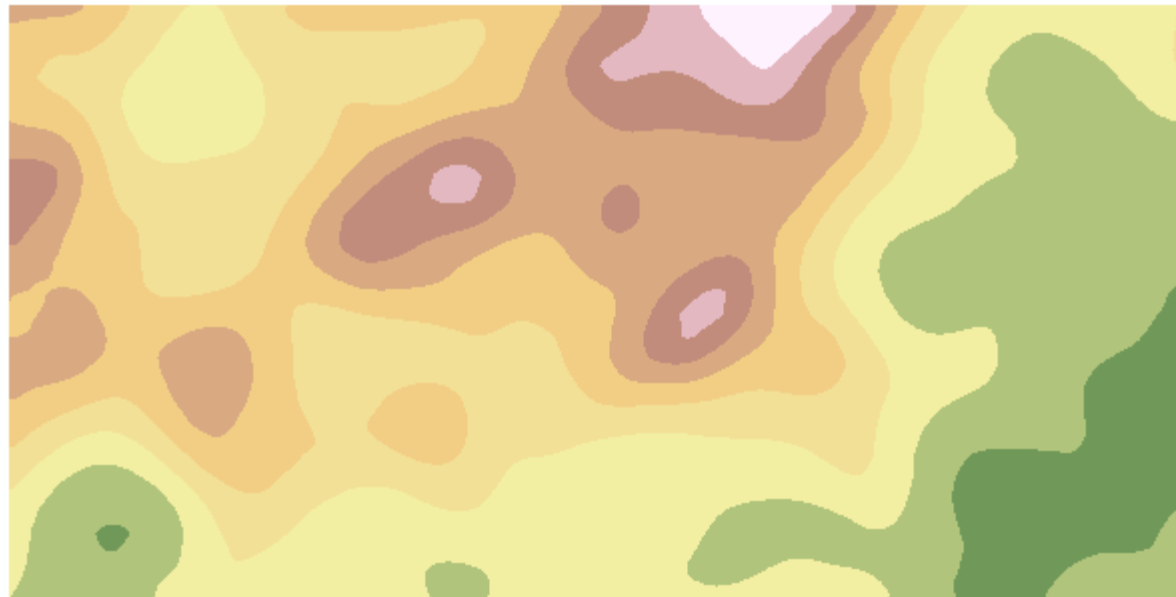


Topo to Raster



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- **Topo to Raster is an interpolation method specifically designed for the creation of hydrologically correct digital elevation models.**





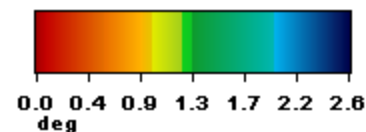
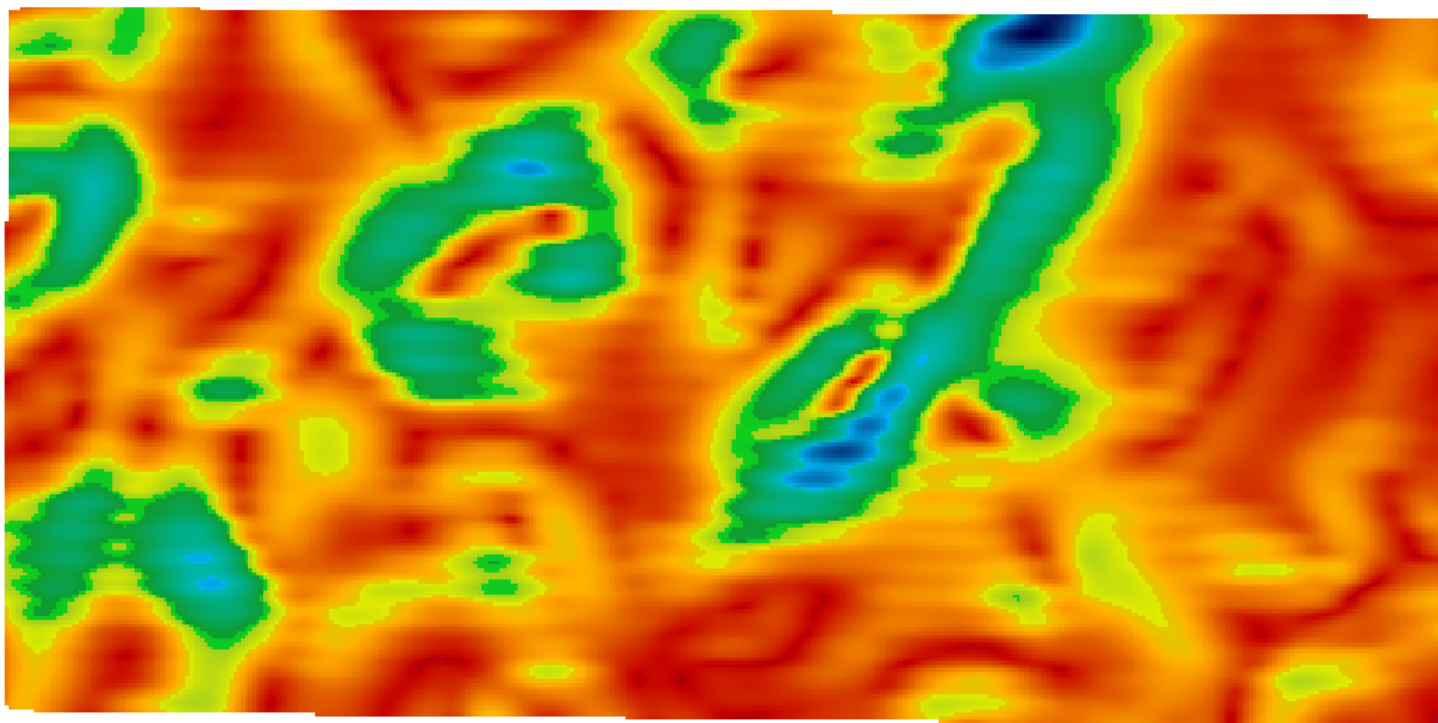
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- **Slope**
- **Aspect**
- **Contour**
- **Curvature**
 - Plan
 - Profile
- **Flow Direction**
- **Flow Accumulation**

Elevation Derivatives

- Slope identifies the rate of maximum change in elevation.

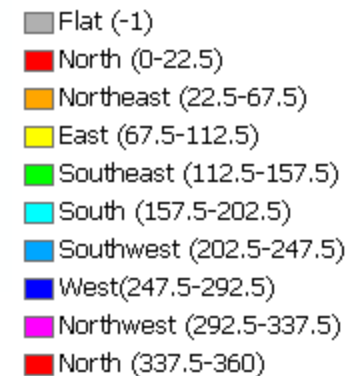
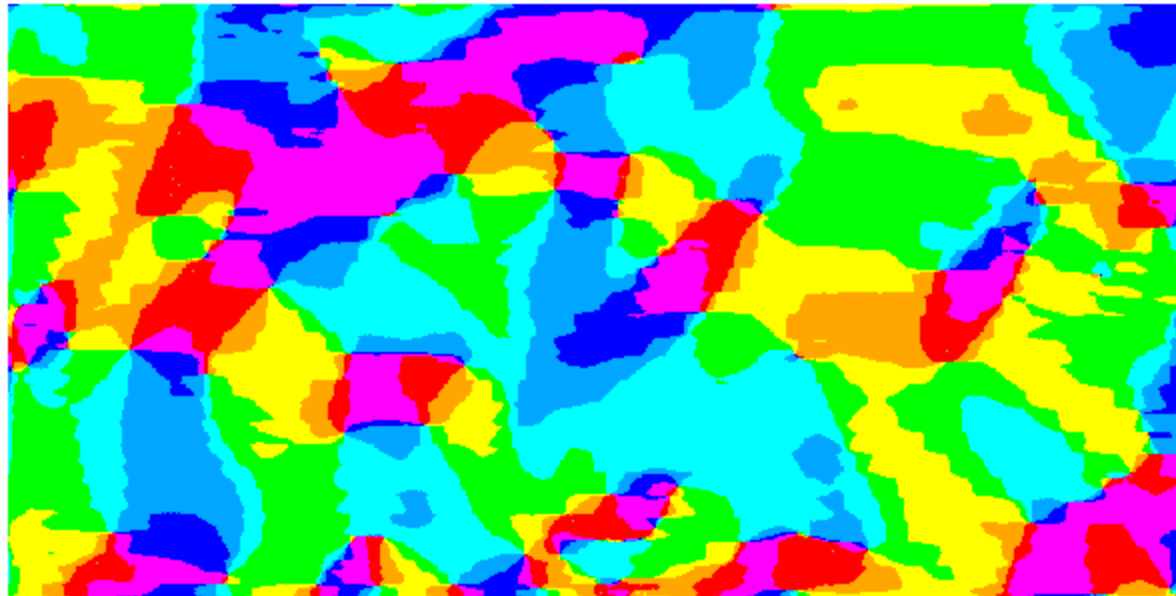


Elevation Derivatives



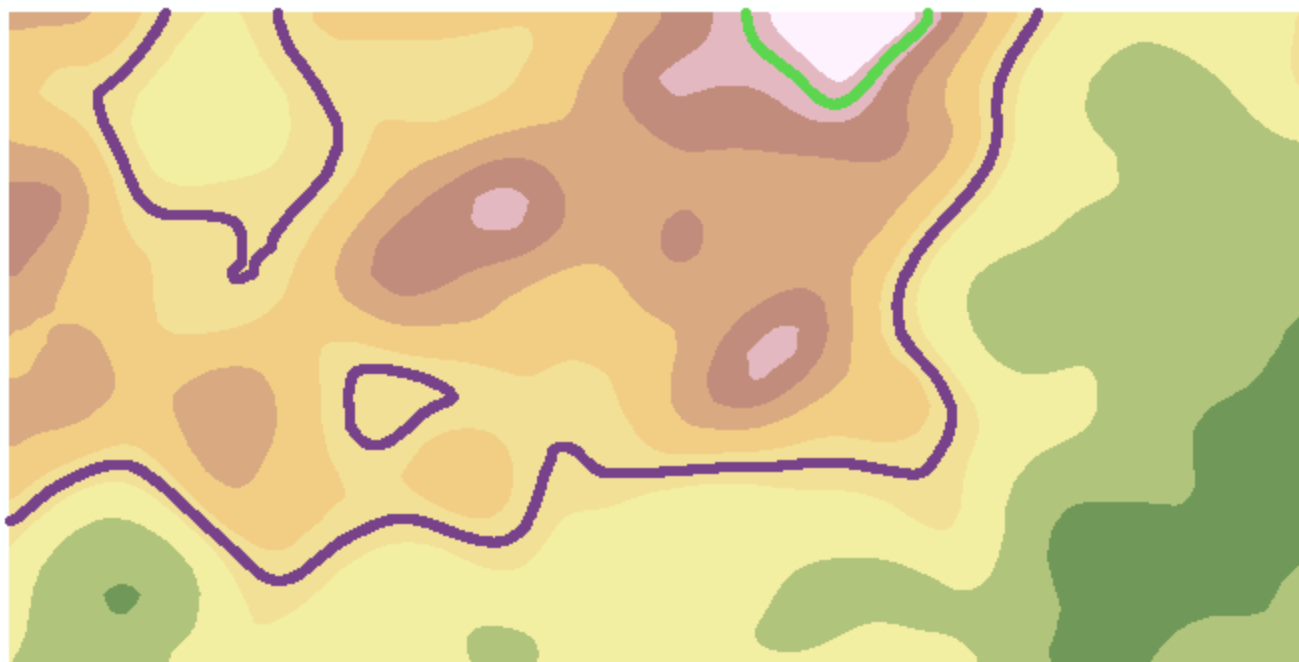
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- **Aspect identifies the downslope direction of the maximum rate of change in value from each cell to its neighbors. This is the direction that the surface faces.**

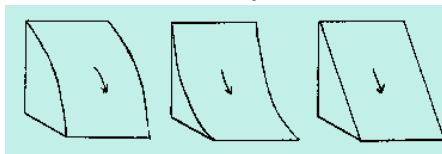


Elevation Derivatives

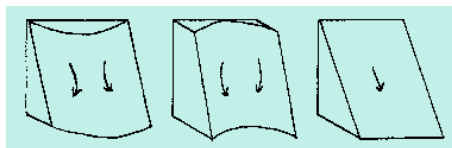
- Contours or lines of equal elevation for the elevation surface.



- **Curvature is the second derivative of the surface or the slope of the slope.**
 - A positive curvature indicates the surface is upwardly convex at that cell. A negative curvature indicates the surface is upwardly concave at that cell. A value of zero indicates the surface is flat.
- **Profile curvature is in the direction of the maximum slope.**
 - A negative value indicates the surface is upwardly convex at that cell. A positive profile indicates the surface is upwardly concave at that cell.



- **Plan curvature is perpendicular to the direction of the maximum slope.**
 - A positive value indicates the surface is upwardly convex at that cell. A negative plan indicates the surface is upwardly concave at that cell.



- **Flow direction is a raster indicating the direction of steepest descent from each cell.**
- **Flow accumulation uses the flow direction raster to determine the accumulated flow to each cell.**
- **Other layers can also be created but additional information is needed to create them**
 - Cut / fill
 - Watershed delineation

Questions?



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