Little Rock Food Web

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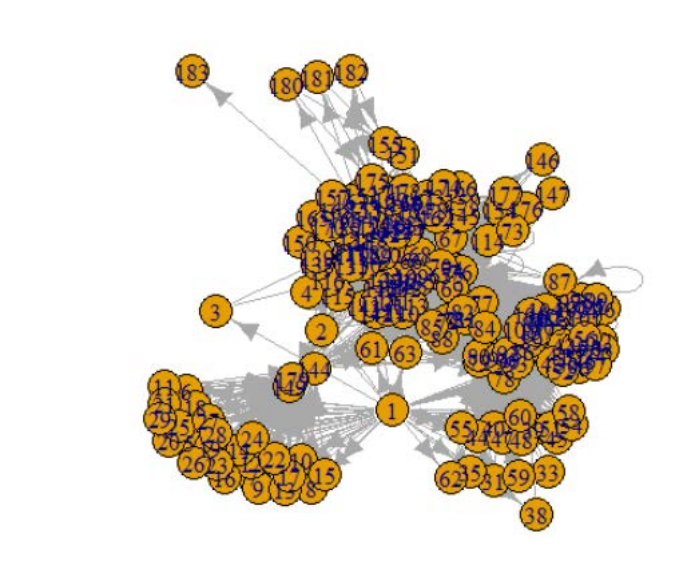
Overview

- Little Rock Lake
- Initial Graph Statistics
- Statistics After Removal of Nodes with:
  - Highest Degree Centrality
  - Highest Betweenness Centrality
  - Highest Closeness Centrality
  - Highest Eigenvector Centrality
  - Highest Katz Centrality
  - Highest Page Rang Centrality
- Summary

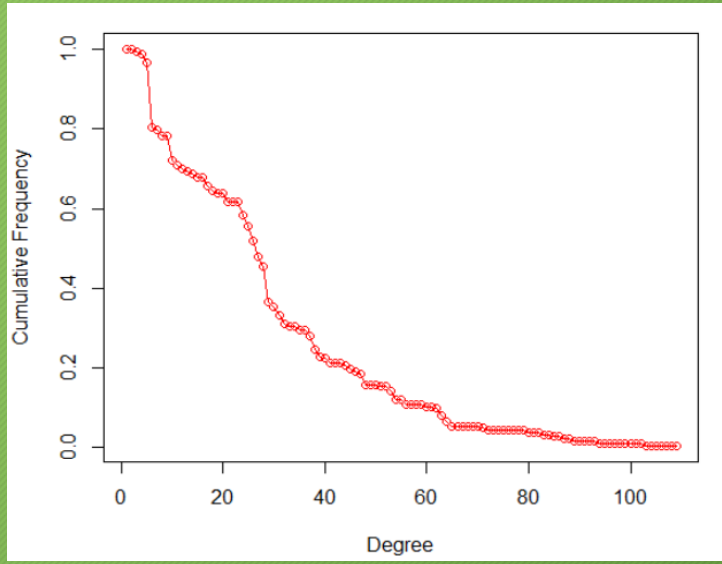
About the Lake

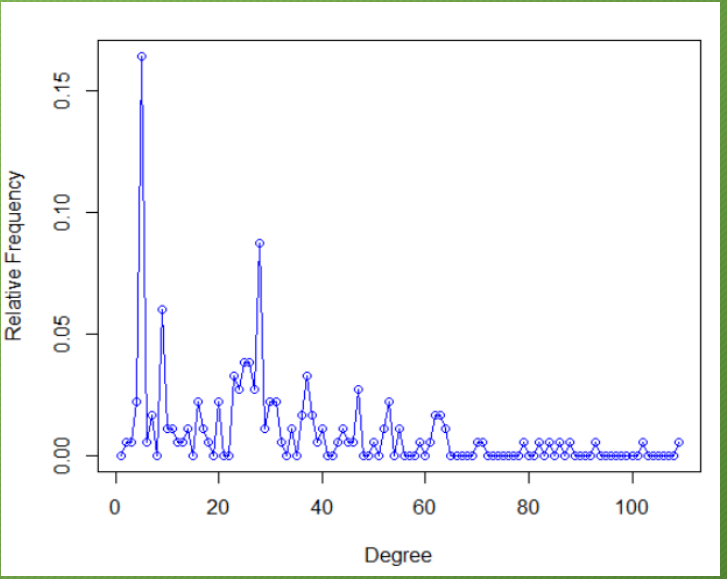
- Little Rock Lake – Wisconsin, USA
- Nodes in this network:
  - Autotrophs
  - Herbivores
  - Carnivores
  - Decomposers
- Food Chains:
  - Start Vertex – Predator
  - End Vertex – Prey

Graph Structure



- Hard to Interpret
- Node 1 – Predator, on Top of the Food Chain
- Scale-Free Graph Distribution



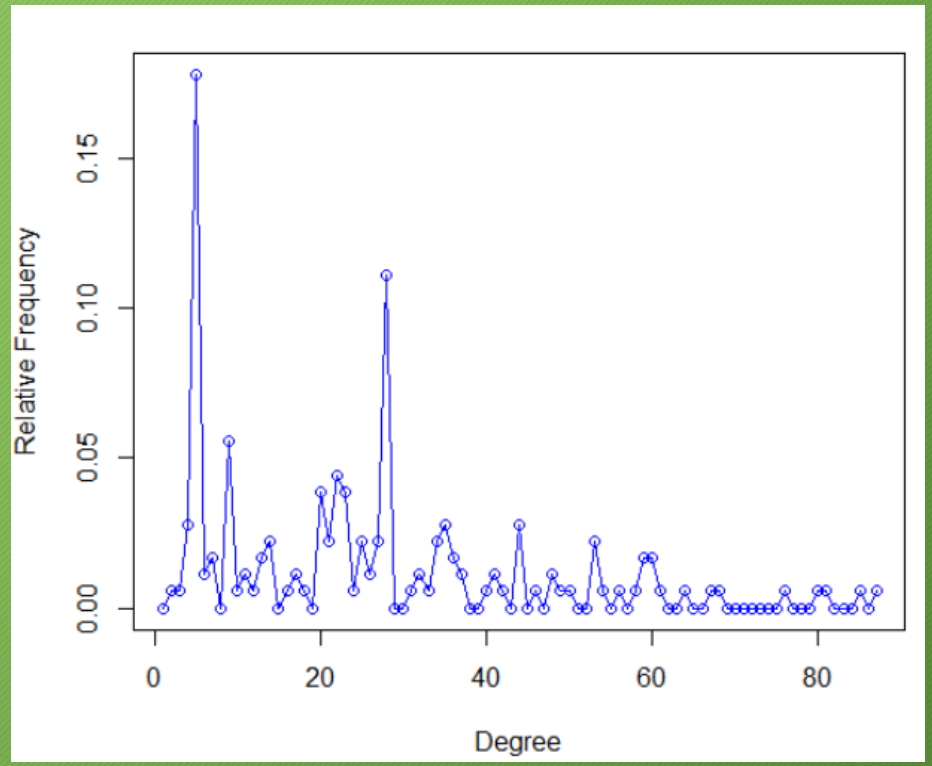


Graph Properties

- Directed, Connected Graph
- Vertices – 183
- Edges – 2494
- Vertex with Max Degree = 108
- Vertex with Min Degree = 1
- Edge Connectivity = 0 (if Undirected = 1)
- Vertex Connectivity = 0 (if Undirected = 1)
- Diameter = 6
- Average Path Length = 1.898
- Transitivity = 0.33

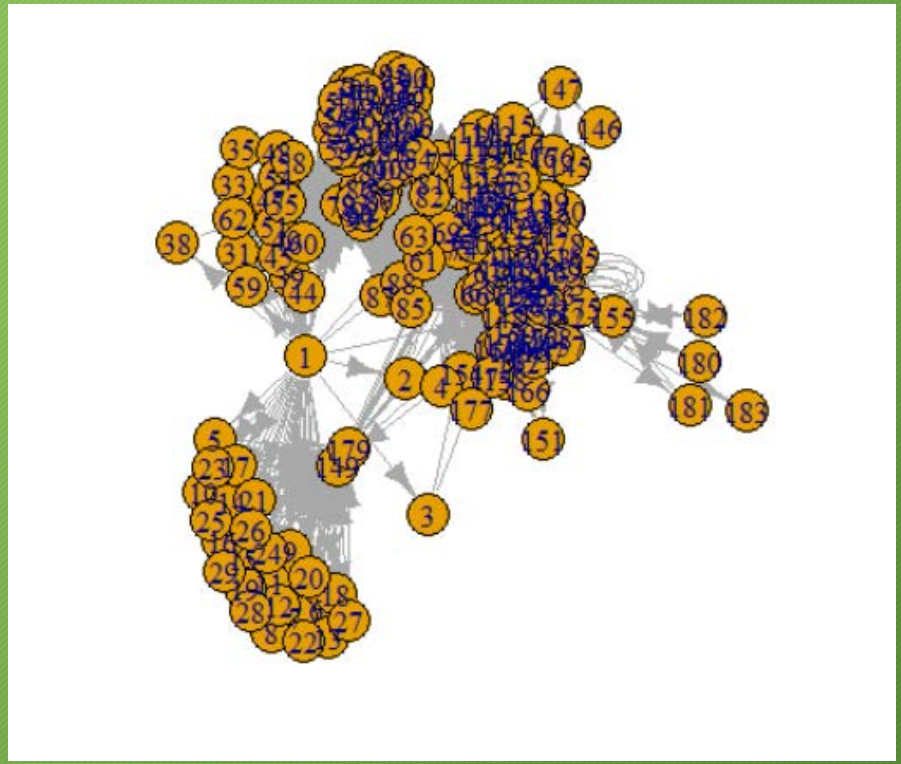
Removal of Highest Degree Centrality Vertex

- Degree Centrality = How Many Neighbors a Vertex has
- Highest Degree Centrality = Vertex with Highest Number of Edges
- Obvious Differences in Max Edges
  - 108(initially)
  - 107(1st Removal)
  - 91(2nd Removal)
  - 86(3rd Removal)
- Other Properties Remain Almost the Same



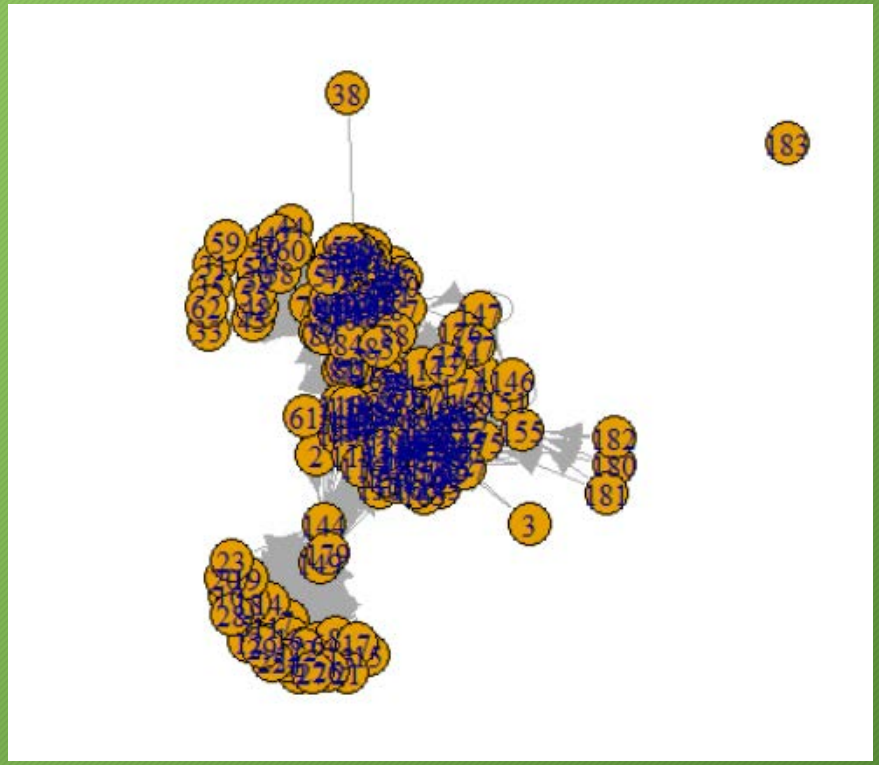
Removal of Highest Betwenness Centrality Vertex

- Betweenness Centrality = the extent to which a vertex lies on the shortest paths between other vertices
- High Betweenness Centrality = influence on the information (food) flow
- Diameter Down to 4 (from 6)
- APL Down to 1.53 (from 1.89)
- Other Properties Remain Unchanged



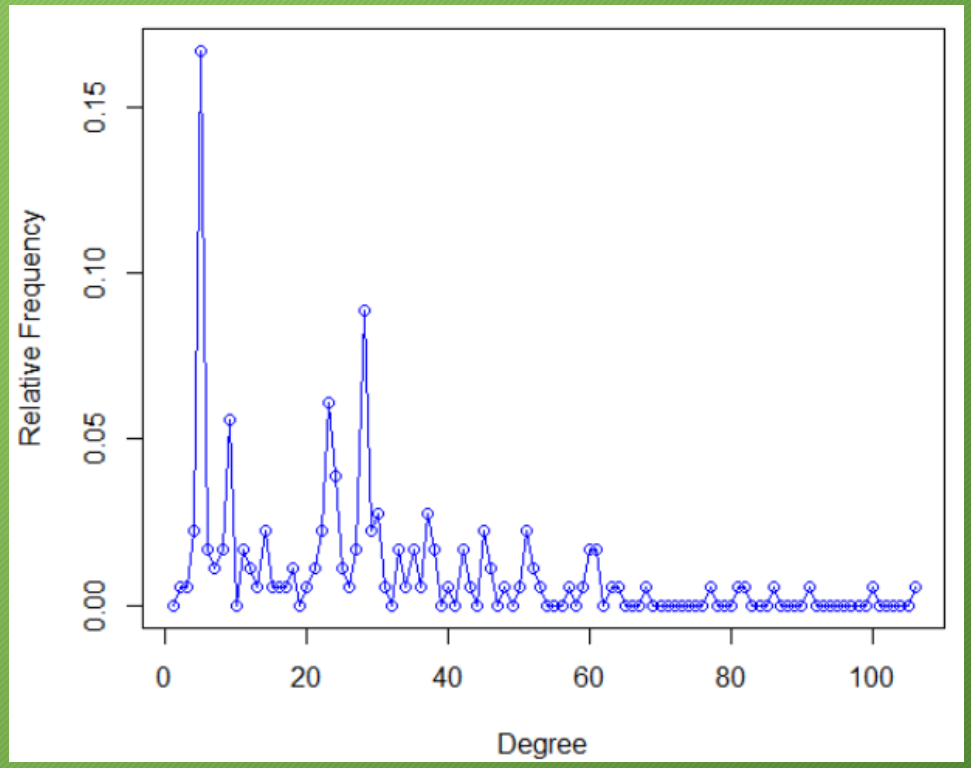
Removal of Highest Closeness Centrality Vertex

- Closeness Centrality = How Close a Vertex is to All the Others
- High Closeness Centrality = Quickly Spread Rumors and News Across the Network
- Vector 1 is Removed
- Vector 183 is Disconnected
- Other Attributes Remain Unchanged



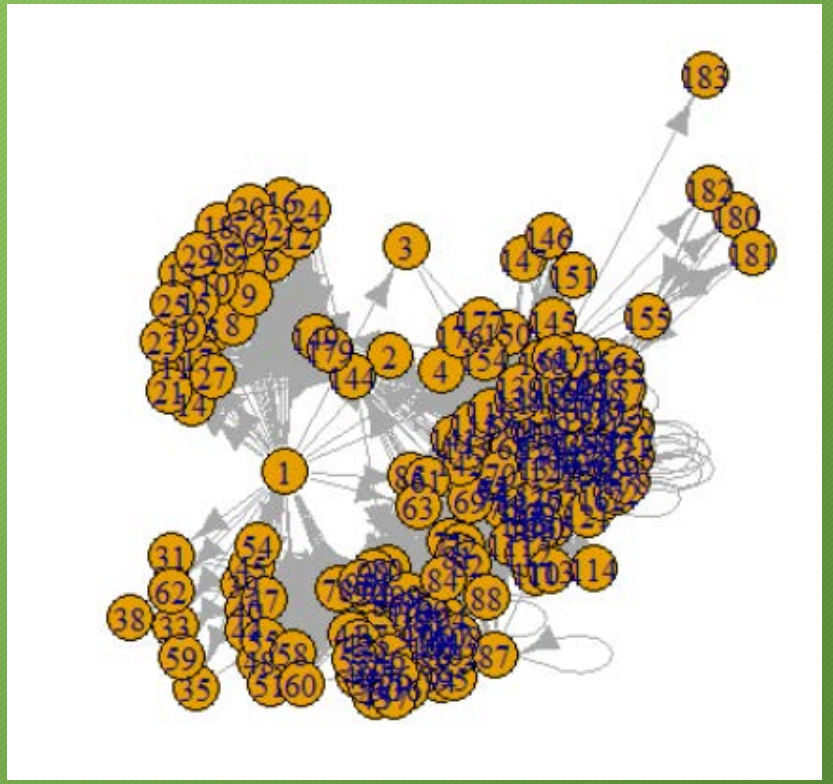
Removal of Highest Eigenvector Centrality Vertex

- Eigenvector Centrality = not about the degree of the node measured, but about the degree of its neighbors
- Mainly with Undirected or Strongly Connected Graphs
- Each Subsequent Removal – Max Degree Decreases by 1
- Other Values Remain the same



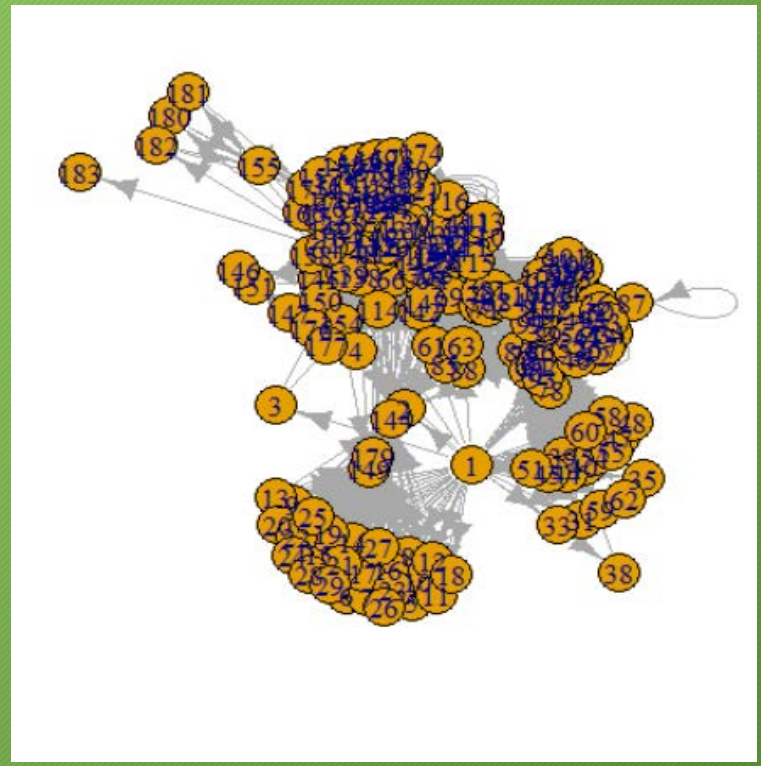
Removal of Highest Katz Centrality Vertex

- Katz Centrality – Improvement for Eigenvector Centrality for Digraphs
- Introduces Attenuation Factor – the longer the path, the higher the score
- Dampen the spider trap effect
- Diameter reduced to 5 (from 6)
- Max Degree – Reduced Again
- Other Attributes Remain the Same



Removal of Highest Page Rank Centrality Vertex

- Page Rank Centrality – Upgrade to Katz Centrality
- Considers the Out-Degree of the Neighbors of a Vertex
- Results – Similar as with Katz Centrality
  - Diameter down to 5
  - Max Degree Decreases Slightly
  - Other Properties Remain Unchanged



Summary

- Most Noticeable Influence – Degree and Closeness Centrality Removal
- Strongly Connected Network
- Without Spider Traps
- No big difference between Eigenvector, Katz and Page Rank
- Probably when more edges are removed, we can observe the changes better

Thank You!