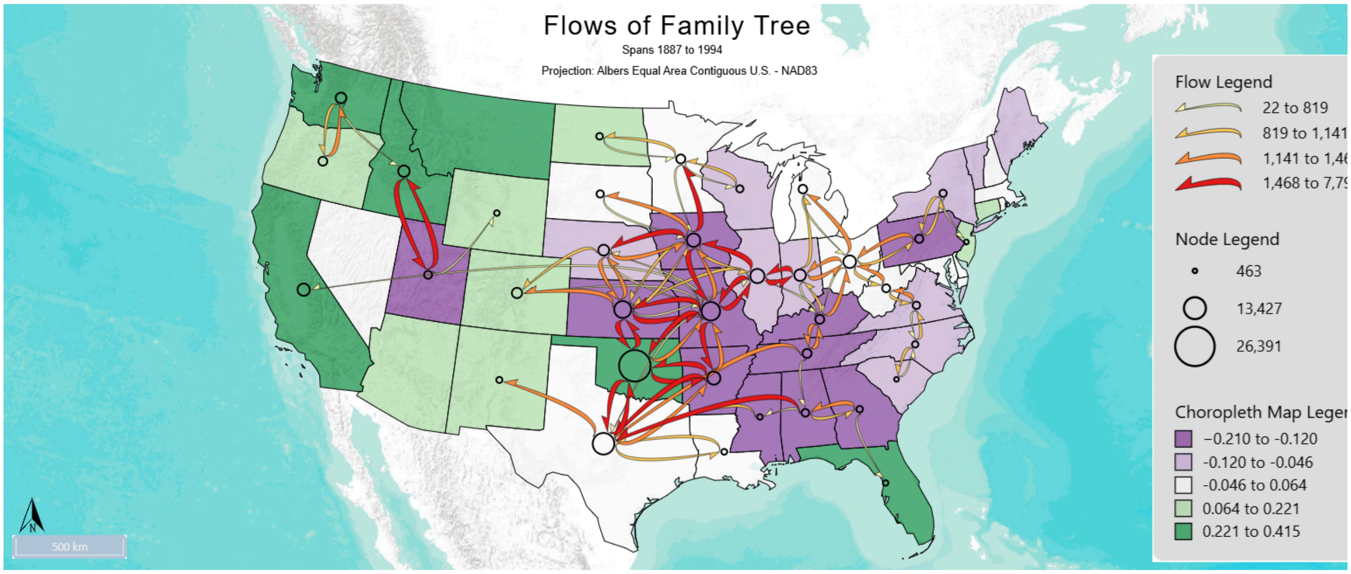

Justification of flow map design: The above map was designed the way it was based on cartography principles and following a set of guidelines to ensure interpretability. To begin, the heading of the map is clear in what it is trying to communicate, telling the reader it shows a flow of a family tree throughout the US. Under this title a description of the timeframe is provided; adding context to the years over which the domestic migration spans. As cited by Koylu et al., the software currently has limited options for map projections, so Albers Equal Area Contiguous U.S. -NAD83 was chosen for this report, and labeled on the map ("Flowmapper.org," 2021). In the case of the contiguous US, Albers Equal Area Conic projection can be made useful when ensuring area remains accurate and truthful. Minimizing distortion helps prevent confusion to the map interpreter and keeps the focus on the map information itself. A north arrow was added for orientation purposes, and a scale bar/legend is present as to not leave out crucial spatial details.

In Flowmapper.org, one can make edits to the base map, regions, nodes, and flows parameters. When editing the flow symbolization, the input data was the downloaded csv file of flows_1887_1924. OriginID was set to orgState and DestinationID was set to destState (both columns within the csv), as these show exactly where the family tree originated and where they resided after migrating. The quantiles classification method was used to classify flows, ensuring equal representation of large and smaller volume flows and allowing variability across regions to be emphasized (Slocum et al., 2009). Four classes were chosen, showing meaningful levels of flow from high to low volume, while keeping the color scheme free of confusion between colors. A yellow-orange-red color scheme was chosen so flows could be visualized in an intuitive way, with yellow representing small flows and red representing the largest volume flows. Dykes and Wood (2021), state that proper flow mapping relies on visual clarity balanced with thematic purpose. This is why I chose to reduce the top flows parameter to 87, as it minimizes visual clutter and reduces overlap of important flow lines. Additionally, fill opacity was kept at 100%, stroke width was kept at 0.5, and max width was reduced to 12. This keeps the arrows able to be seen while reducing the impact of their size on neighboring arrows.

Next, the nodes section was edited after the input nodes_states_1789_1924 csv file was input. The ID field was input with rootsid, X field with x, and Y field with y. Inflow_1887_1924 was set as the mapped node attribute. A proportional scaling was used for the nodes. The fill opacity was set to zero, in an attempt to not reduce visibility of the choropleth map below it. Max radius of the nodes was set to 18 so arrows in confined areas would not be overly compacted. Koylu et al. (2021), notes that reducing flows that pass through nodes and narrow angles within flows at shared nodes can reduce readability of the flow map information. This was taken into consideration when deciding how to edit the nodes tab, and through editing, it produces an output that is easy to interpret while not obscuring key flow data.

Lastly, the regions tab allowed for a choropleth map background to be generated, which allows for additional visualization of the data alongside the flows themselves. Using the inputs for polygon data as regions_states_lat/lon, this was joined with nodes_states_1789_1924. The ID used for JSON and CSV field were both rootsid, and this data was mapped to NetflowRatio_1887_1924. In the case of the lab data, NetflowRatio allows one to see the net migration measure in each state on the map. It shows (incoming-outgoing)/(incoming+outgoing), resulting in a measure of -1 to +1 in the legend. Positive values range from mid-white to green shaded states and represent net gain of migrants, while negative values range from mid-white to purple and represent a net loss of migrants. Natural Breaks was used as the classification for this dataset, as it is ideal for showing the actual distribution of net flow ratio across the states, allowing for the most clear interpretation of regional patterns and clusters (Slocum et al., 2009). A total of five classes were chosen to represent the data, allowing for balances between the number of negative and positive classes, with a middle ground in between representing little net migration. Since the data is skewed, this is the ideal choice for the choropleth mapping done here. Finally, in an attempt to make the map more visually appealing, a purple-green divergent color scheme was used to clearly see the transformation from states with a net loss and a net gain of migrants from the family tree.

Interpretation of Flow Patterns: As stated before, the provided map shows the migration (or origin-destination) flow of a family tree from 1887 to 1924. It appears that the top distributors of migrants throughout this map are from Missouri, Illinois, Oklahoma, and Texas. We can see a lot of people through time moving from a Southeast direction up to the Midwest and a Southern to more centralized direction. The majority of heavy flows (represented by red arrows) align closely with these observations. Nodes help to reinforce the idea of heavy flow patterns, with the largest seen in Texas, Missouri, Oklahoma, and Illinois. They represent inflows and outflows, combining the two into total migration. The net migration balance is shown from the background choropleth map and shading, with states in green showing high influx of migrants and purple showing high outward flux of migrants. From this, one can gain insights into which states are sending the most people away, such as Oklahoma, Missouri, and Iowa; and which are receiving the most migrants, such as Oklahoma, California, and Idaho. By using flow lines on top of the corpleth of net migration, Koylu & Guo (2017) argue that a multi-scale perspective can be applied to mobility, strengthening the interpretation of absolute movement as well as losses and gains on a relative scale. Overall, the map tells us that most of the family tree over time left the midwest. These migrants appear to have moved West over time where they settled after about 40 years.

References:

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Koylu, C. & Guo, D. (2017). Design and evaluation of line symbolizations for origin–destination flow maps. *Information Visualization, 16(4), 309-331.* DOI:https://doi.org/10.1177/1473871616681375