Results

*Distance measures*

A comparison of pairwise distances between populations using Nei’s distance and Reynolds’s distance formulas suggest several similarities and some differences. Both distance measures indicate that the populations with the largest pairwise distances are Bearpaw Lake Intersection, Lozier Road, and Buffalo Fork (Figure heatmap). Kendall’s coefficient of concordance indicates that the ranking of sites based on average pairwise distances is more concordant than would be expected by random chance (W stat = 0.092, p-value = 0.0001 on 9,999 permutations). While the two distance measures rank the sites similarly, the difference between the largest distances and the smallest distances is larger for the Nei’s distance calculations than for the Reynolds’. We expect trees based on the Nei’s distance matrix, therefore, to differentiate between sites more clearly.

*Tree algorithms*

Cophenetic plots depict the population distance as calculated in the distance matrix against the tree distance produced by the final dendrogram. Cophenetic plots for the neighbor-joining tree and the UPGMA tree for both Nei’s distance and Reynolds’ distance indicate that the neighbor-joining trees better capture the distances in the population distance matrices (Figure cophenetics). The variability in the spread of the plots is slightly larger in the Nei’s NJ tree versus the Reynolds’ NJ tree, but both UPGMA trees assign similar tree distances to very different population distances. The inability of the UPGMA trees to capture population distances increases as the population distances increase.

This result is not surprising, for two reasons. The UPGMA tree is a rooted tree, and the algorithm is therefore more constrained than the neighbor-joining algorithm that doesn’t assume a particular root. The UPGMA procedure also produces a tree in which every leaf is equidistant from the root. Because the NJ tree is not constrained in these ways, the resulting tree is better able to capture the distances in the original distance matrix.