We developed global maps of N, P, K concentrations and ratios in leaves for woody plants by modeling with Neural Networks at 1km resolution. We gathered georeferenced data from published data bases (like TRY and ICP) and a total of 206 peer-published papers (ISI WEB) achieving 28736 records of N, P and K leaf concentrations that we split in 6 morphoclimatic groups (tropical evergreen, tropical deciduous broadleaves, temperate coniferous, temperate evergreen broadleaves, temperate deciduous broadleaves and boreal). We trained Neural Networks with climatic, soil and atmospheric deposition data and morphoclimatic groups to model the foliar elemental composition and project it at global scale according to a Land Cover map. The models provide maps with information of the foliar concentrations of each element at pixel level, their uncertainty and goodness of fit, and relative importance of the independent variables. Linear models were also created to show the relationship between dependent and independent variables. These maps and these relationships will improve the understanding of the biogeochemical processes and provide better input nutritional data for the global models of carbon cycle and climate change.