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# Climatic boundaries of modern vegetation zones as a key for paleozonation reconstructions

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The main purpose of our research is to compose the vegetation (landscape) zones world maps for 3 time periods (Last Glacial Maximum, Holocene Optimum, the present time); to reveal zonal structure of the plain landscapes of the continents and make contrastive analysis for specified time periods.

On the first stage the modern vegetation zones world map was produced at a scale of 1:65000000. In total 16 vegetation zones were marked and their diagnostic features were defined – the main vegetation and soil characteristics. During the map composition with account of collected information about vegetation, soils and climates in different regions of the world the updating of landscape zones boundaries was conducted.

Based on the world weather stations database the climatic database for each modern vegetation type was created, that includes climatic normals (1961-1990) of average monthly air temperature (mean, maximum, minimum) and precipitation from 629 weather stations of the world. The vegetation zones areas were estimated and corresponding diagrams, that show their proportion on different continents, were constructed. The quantitative evaluation of the similarity in vegetation zone structure on different continents was made.

For each vegetation zone in general around the globe the graphs showing possibility of the zone existence in special climatic condition diapason were constructed. As the main climatic characteristics that define vegetation zone extension on different continents were used: mean temperature and precipitation of the warmest (coldest) season, annual temperature range and annual precipitation, mean monthly temperature of the warmest (coldest) month and precipitation of the warmest (coldest) season. Upon that the selection and objectivation of the most relevant climatic characteristics that define vegetation zone extension on different continents were made. The analysis of proportion between modern climatic characteristics and vegetation zone boundaries was conducted and limiting factors of modern vegetation type extension were defined. For example, the limiting factor on the north boundary of broad-leaved forest is a coldest month temperature of -7°. The south boundary of broad-leaved forest in Eurasia coincides with the isotherm of +20,5° of the warmest month temperature, in North America this boundary corresponds to the isotherm of +26°. For the low latitudes vegetation zones (from forest-steppe and sclerophyllous forest to perhumid hylea) the limiting factor in most cases are moisture conditions their seasonal dynamics. The south boundary of forest-steppe in the northern hemisphere corresponds to summer precipitation of 150 mm. The most important factor, limiting steppe vegetation zone extension is a degree of climate continentality that can be estimated by annual precipitation and annual temperature range. The modal value of summer precipitation for steppe is an interval from 100 to 150 mm. Desert zone extension is limited by annual precipitation less than 250 mm, and semi-desert – maximum 450 mm.

Revealed interrelations between the characteristics of modern vegetation and climate are employed to reconstruct vegetation paleozonation. In addition to compose more accurate paleovegetation zone maps the reconstruction of the precipitation fields at the Holocene Climate Optimum and the Last Glacial Maximum is conducted. Upon that the method of climatic analogue, considering similarity in the atmospheric circulation restructuring during the transition from warm to cold paleoclimates and from warm to cold seasons, is used. At first the paleozonation maps for one of the continents – South America - is produced.