IUGS/IAGC Task Group on GLOBAL GEOCHEMICAL BASELINES

Geology and climate are the two main factors governing the spatial distribution of chemical elements.

The observed geochemical and mineralogical patterns for many elements in soil of the conterminous United States of America (USA) are controlled, in large part, by the interplay of climate (in particular, average annual precipitation) with the soil parent material (*geology*). A broad, rather uniform, gradient in average annual precipitation extends across nearly two thirds of the USA from relatively low precipitation east of about 110° W longitude to the Atlantic coast (Fig. 1). One of the most fundamental changes in soil composition across the USA is the weathering of feldspar (i.e., decreasing feldspar concentration) in soil from west to east and south-east along this gradient of increasing precipitation (Fig. 2). These changes are also expressed as lower concentrations of feldspar-related elements, such as K (Fig. 3) and Na (Fig. 4), which are leached from the soil profile during weathering in these humid environments.

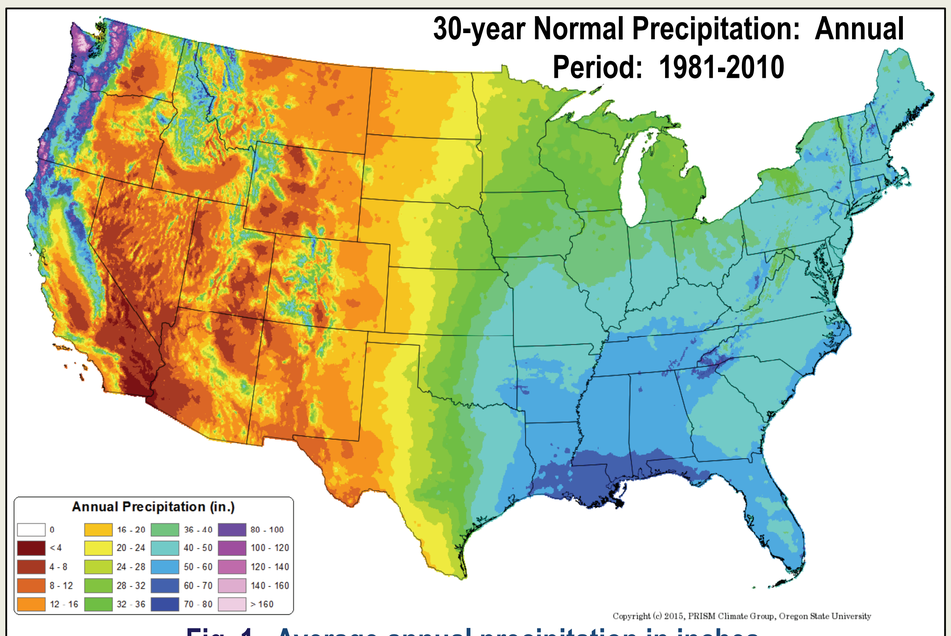


Fig. 1. Average annual precipitation in inches.

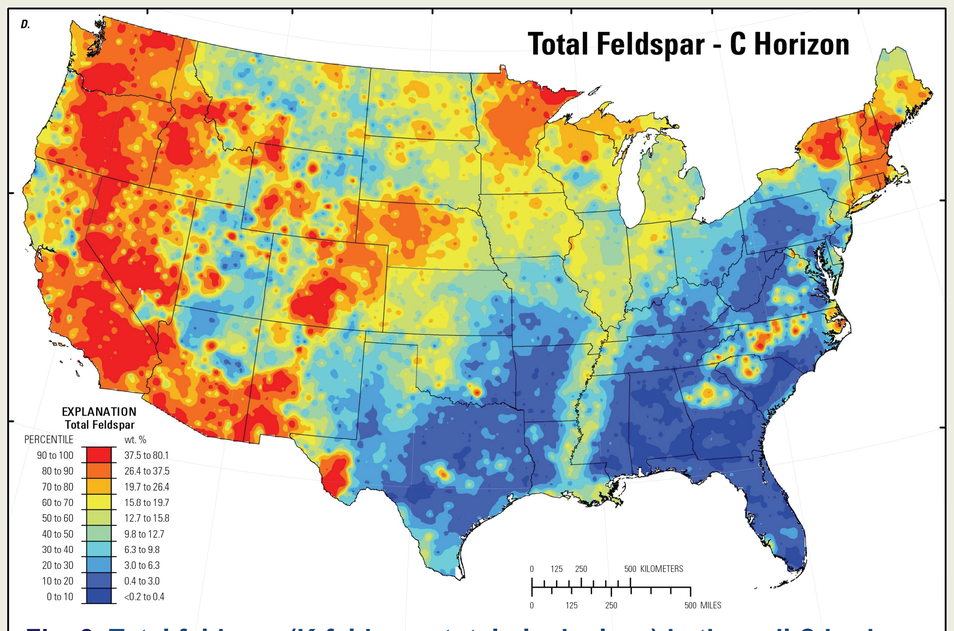


Fig. 2. Total feldspar (K-feldspar+total plagioclase) in the soil C horizon.

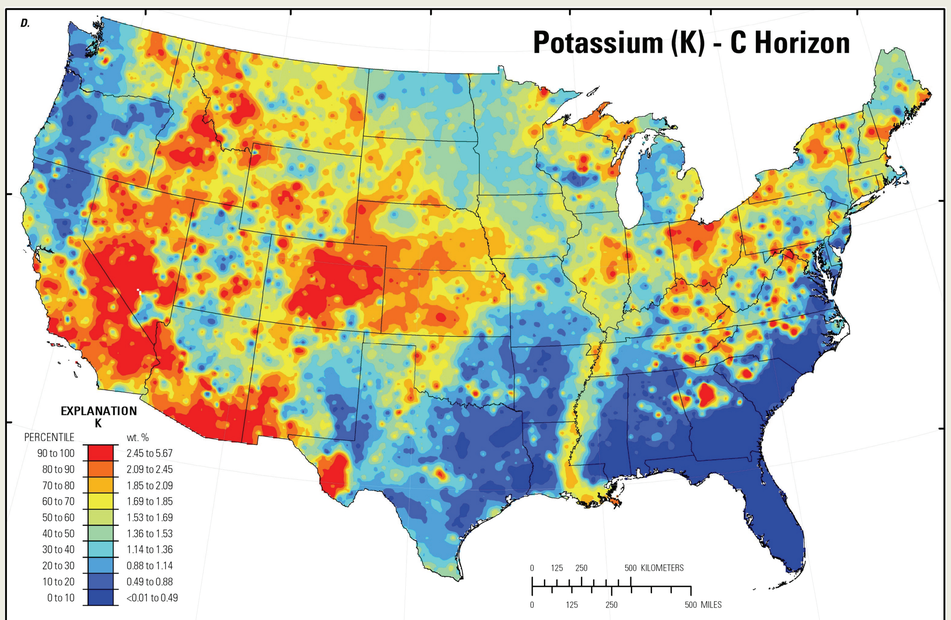


Fig. 3. Potassium concentration (wt. %) in the soil C horizon.

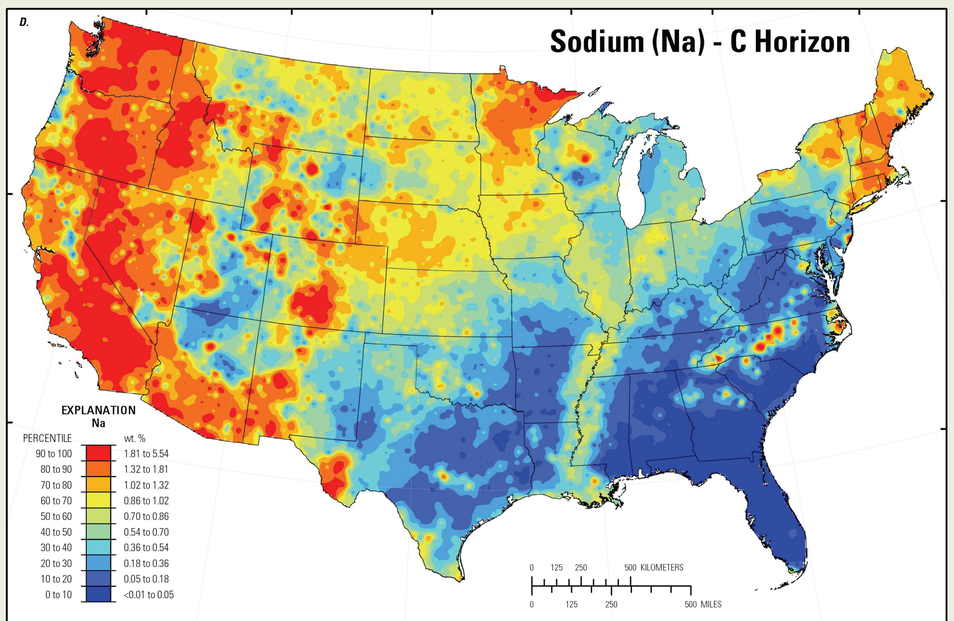
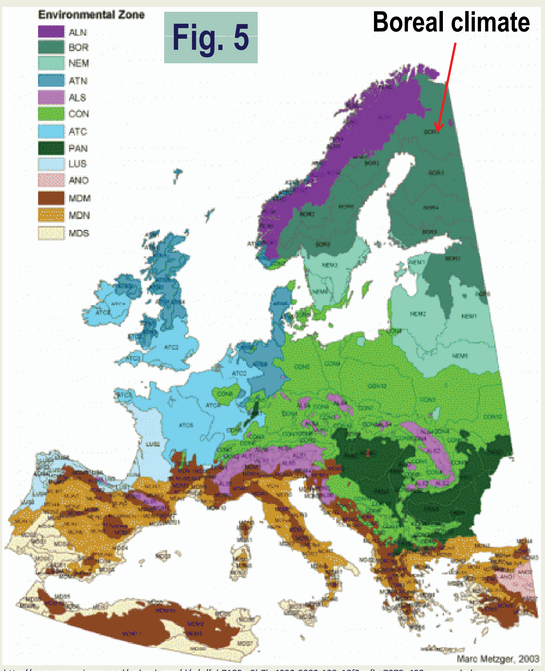


Fig. 4. Sodium concentration (weight %) in the soil C horizon.

Stream water is more acid in Fennoscandian countries, due to the low base cation capacity of metamorphic basement rocks (*geology*) and high concentration of humic and fulvic acids, which are typical of Boreal climate (Fig. 5). Low pH values (Fig. 6) result in higher solubility of aluminium (Fig. 7) and some other metals, especially rare earth elements (Fig. 8). In Europe, Fennoscandia and Scotland with younger less weathered soil, developed on glacial till that contains fine-grained unweathered plagioclase, show elevated concentrations in residual subsoil and alluvial soil (floodplain sediment) with respect to Na_2O (Figs. 9 & 10) and K_2O (Fig. 11) compared to other European countries.



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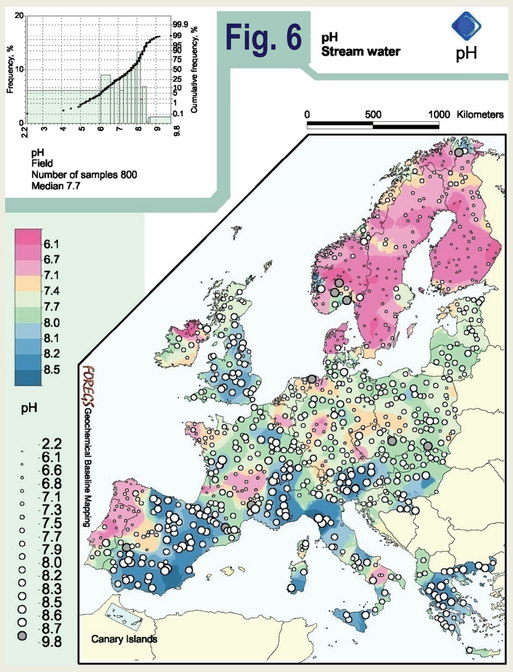

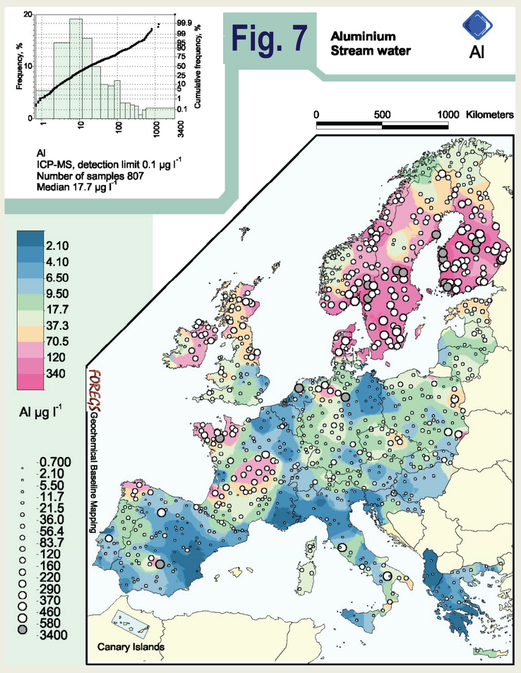

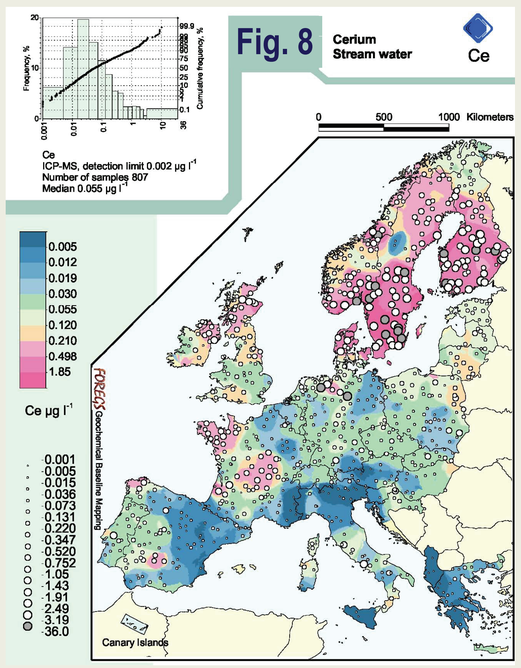

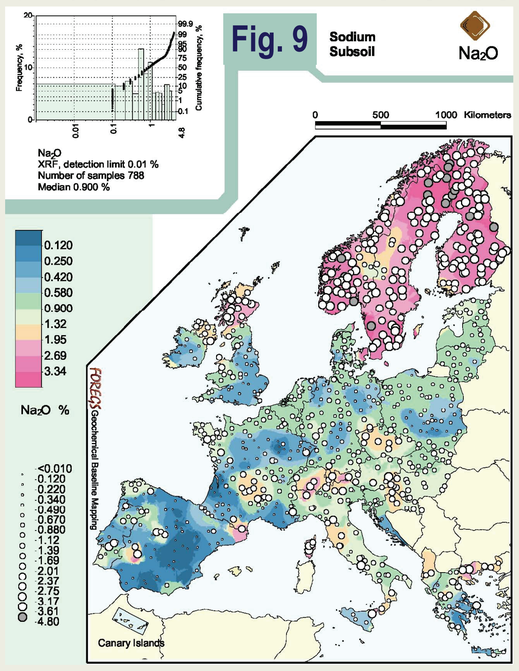

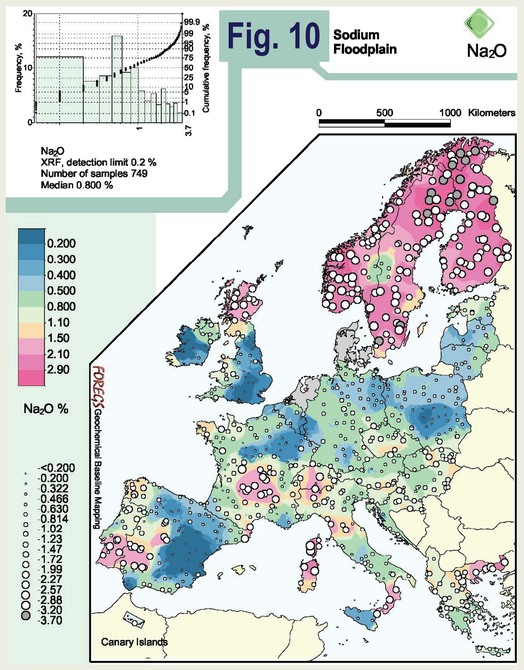

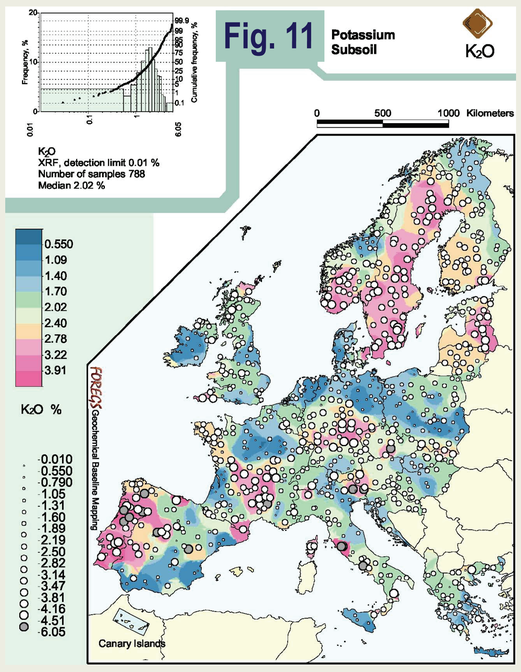

In Europe, high K_2O values are also found in Estonia and Latvia (Devonian clay & basal Quaternary till rich in mica), northern Scotland, SW England, Massif Central, central Germany (two-mica granite enriched in K, Rb, Cs), and to a lesser extent Brittany, the Alps (near the Austrian-Italian border), and western Iberia peninsula (central system of the Iberian Massif with granitic and metamorphic lithologies, especially the crystalline areas of northern Portugal and the eastern Pyrenees granitic intrusives).

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Mapping the Geochemistry of the Earth's Land Surface