GLOBAL DISTRIBUTION OF ROOT PROFILES IN TERRESTRIAL ECOSYSTEMS

Summary:

A database of vertical root profiles for global terrestrial ecosystems was assembled from the primary literature in order to characterize the belowground structure of global vegetation types and to study relationships of belowground vegetation structure with climate, soil characteristics, and aboveground vegetation structure.

Variables used to characterize belowground vegetation structure include the depth above which 50% of all roots are located and the depth above which 95% of all roots are located in the profile. For each root profile, information recorded includes latitude and longitude, elevation, soil texture, depth of organic horizons, type of roots measured (e.g., fine or total, live or dead), sampling methods, units of measurements (root mass, length, number, surface area), and sampling depth. Some profiles lack information on one or more of these variables. Also recorded are presence and dominance of plant life forms (including succulents, forbs, grasses, semi-shrubs, shrubs, and four categories of trees: needle-leaved vs. broadleaved, evergreen vs. deciduous) and whether the vegetation was relatively natural or altered by humans (e.g., forest plantations and pastures). The database also includes data on mean annual precipitation and the seasonal distribution of precipitation.

The 50% and 95% rooting depths were calculated by fitting a non-linear smoothing function (a logistic dose-response curve) to each cumulative root profile and interpolating the 50% and 95% rooting depths. For details see Schenk and Jackson (2002) or the companion file, A Database of Root Profiles for Global Vegetation [ftp://daac.ornl.gov/data/global_vegetation/root_profiles/comp/root_profiles_methods.pdf]. Fewer than 10% of all profiles in the database were sampled to the maximum rooting depth, which means that more than 90% of these interpolated rooting depths are underestimates of the true 50% and 95% rooting depths at the respective sites. To correct for this sampling error, incompletely sampled profiles (those not sampled to the maximum rooting depth or to at least 3 m depth) were extrapolated by means of the same mathematical function used to interpolate completely measured profiles. To avoid excessive errors, extrapolations were restricted to a maximum sampling depth of either twice the sample depth or to 3 m depth, whichever was smaller. Profiles for tundra and wetlands were not extrapolated beyond the measured depth. For extrapolated profiles, both the 50% and 95% rooting depths based on interpolating to the maximum sampling depth and the 50% and 95% rooting depths based on extrapolating the profiles are included in the data file.

The Schenk and Jackson (2002) paper is available as a PDF file at http://www.biology.duke.edu/jackson/em02.pdf.

This data set builds on the initial root data compiled by R. B. Jackson in the mid-1990s (see Jackson et al. 1996; Jackson et al. 1997). The data set of 115 vertical root profiles (Jackson et al. 1996) was expanded to include 475 profiles from 209 geographic locations for the analyses

presented in Schenk and Jackson (2002). The current version of the data set (as of February 25, 2003) contains root profiles for approximately 298 sites with 565 profiles.

Data sets that are related to this root profile data set include root nutrient concentrations (for approximately 372 site-pit-depths from 56 papers in Gordon and Jackson 2000) and root turnover rates (data for approximately 188 sites from 152 papers that were used to estimate root turnover rates for 341 site-vegetation combinations in Gill and Jackson 2000). The three recent papers include most of the data contained in the initial root data set; however, some observations may have been excluded because of more stringent selection criteria. Many of the source papers provided data for all three of the rooting data sets and users are encouraged to review all three data sets.

Related Archived Data Sets:

- Global Distribution of Fine Root Biomass in Terrestrial Ecoystems
- Global Distribution of Root Nutrient Concentrations in Terrestrial Ecosystems
- Global Distribution of Root Turnover in Terrestrial Ecosystems

Data Citation:

Cite this data set as follows:

Schenk, H. J., and R. B. Jackson. 2003. Global Distribution of Root Profiles in Terrestrial Ecosystems. Data set. Available on-line [http://www.daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/660.

References:

Gill, R., and R. B. Jackson. 2000. Global Patterns of root turnover for terrestrial ecosystems. New Phytologist 81:275-280.

Gordon, W. S., and R. B. Jackson. 2000. Nutrient concentrations in fine roots. Ecology 81(1):275-280.

Jackson, R. B., H. A. Mooney, and E.-D. Schulze. 1997. A global budget for fine root biomass, surface area, and nutrient contents. Proceedings of the National Academy of Sciences, U.S.A. 94:7362-7366

Jackson, R. B., J. Canadell, J. R. Ehleringer, H. A. Mooney, O. E. Sala, and E.-D. Schulze. 1996. A global analysis of root distributions for terrestrial biomes. Oecologia 108:389-411.

Schenk, H. J., and R. B. Jackson. 2002. The global biogeography of roots. Ecological Monographs 72(3):311-328.

Data Format:

The Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) for Biogeochemistry Dynamics organized and formatted these data for long-term archive. The archived data are contained in two files: (1) The ecosystem root profiles file, containing estimated 50% rooting depths (D50) and 95% rooting depths (D95) plus information on sampling methods, vegetation, climate, and soil, and (2) a file containing the references to file (1). These files were obtained from H. Jochen Schenk, Department of Biological Science, California State University Fullerton, California, in February 2003. The data were placed into a spreadsheet format and stored as an ASCII comma-separated (.csv) file. Missing values are represented by -999.

Data File: Root_profiles_D50D95.csv (n=564)

Variables and Units
Profile Identification Profile ID (matches with ID in table below)
Reference (author and year, see companion reference file)
Location Geographic location
Latitude [decimal degrees]
Longitude [decimal degrees]
Elevation [m]
Sampling methods Maximum Diameter sampled [mm]
Measurement
Total mass [kg] [m^-2]
Sample depth
Sampled to max. rooting depth?
Soil characteristics Soil texture
Depth of organic horizon [cm]
Presence of plant growth forms Broadleaved trees
Needle-leaved trees
Shrubs
Semi-shrubs
Grasses
Forbs
Succulents
Tree phenology
Vegetation Anthropogenic
Wetland
Vegetation
Land Cover: U. of Maryland (UMD) code
Climate Potential Evapotransporation (PET) [mm]
Mean Annual Precipitation (MAP) [mm]
Rainfall seasonality, seasonal distribution of precipitation
Rooting depths D50, interpolated to sampled depth [m]

D95, interpolated to sampled depth [m]
D50, extrapolated [m]
D95, extrapolated [m]

Example Data Records:

ID,Schenk_Jackson_2002,Reference,location,Latitude,Longitude,Elevation,MaxDiameter,
Measurement,Totmass,Sampdepth,Sampmax,Texture,Depth_org_horizon,Broadleaved_trees,
Needleleaved_trees,Shrubs,Semi_shrubs,Grasses,Forbs,Succulents,Tree_phenology,
Anthropogenic,Wetland,Vegetation,UMD_cover,PET,MAP,Rainfall_season,D50,D95,
D50_extrapolated,D95_extrapolated
AC01a,YES,Webber & May 1977,"Colorado, U.S.A.",40.05,-
105.6,3650,Total,mass,2.46,0.9,no,medium,5,0,0,0,0,1,1,0,-999,N,N,alpine
herbaceous,10,304,993,winter maximum,0.12,0.7,0.15,1.25
AC01b,YES,Webber & May 1977,"Colorado, U.S.A.",40.05,-
105.6,3650,Total,mass,4.15,0.9,yes,medium,15,0,0,0,0,1,1,0,-999,N,N,alpine
herbaceous,10,304,993,winter maximum,0.06,0.5,0.06,0.69

Companion File: **root_profiles_references.txt** (also in .pdf and .rtf formats)

Example Data Records:

References cited in Appendix A of Schenk, H. J. and R. B. Jackson. 2002. The global biogeography of roots. Ecological Monographs. 72(3):311-328.

Abaimov, A. P., S. G. Prokushkin, O. A. Zyryanova, and L. N. Kaverzina. 1997. Osobennosti formirovanija i fynkcionirovanija listvennichnykh lesov na merzlotnykh pochvakh. (Peculiarities of forming and functioning larch forests on frozen soils. In Russian). Lesovedenie 1997(5):13-23.

Aerts, R. 1993. Biomass and nutrient dynamics of dominant plant species from heathlands. Pages 51-84 in R. Aerts, and G. W. Heil, editors. Heathlands: patterns and processes in a changing environment. Kluwer, Dordrecht, The Netherlands.

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