HRU layer

Name: Homogenous response units
Resolution: 5’
Coverage: Global
Coordinate system: WGS84
Data type: ESRI grid
Date of release: 2008
Purpose: to support GEO-BENE (www.geo-bene.eu) Project
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Data description:

Concept of homogenous response units (HRU) used here was adopted after slight modification from earlier works (Schmid et al. 2006, Balkovič et al. 2006) as a general concept for delineation of basic spatial units. Only those characteristics of landscape, which are relatively stable over time (even under climate change) and hardly adjustable by farmers, were selected. HRU is a basic spatial frame for implementation of climate-change and land management alternative scenarios into global modeling and therefore it is basic input for delineation of landscape units. Moreover, HRU provides a possible interface for communication of bio-physical and optimization models (EPIC model derived and consecutively HRU level aggregated information on environmental indicators can input FASOM optimization modeling).

HRU is spatially delineated as a zone of 5‟ spatial resolution grid having the same class of altitude, slope and soil (HRU class definitions are listed in Tab. 1):

- Dominant altitude class was calculated by raster algebra as a zonal majority value of pre-classified GTOPO30 raster altitude class over a zone represented by one global grid pixel;
- Dominant slope class was calculated by raster algebra as a zonal majority value of pre-classified 30‟‟ spatial resolution temporary raster slope class over a zone represented by one global grid pixel. Temporary raster used for calculations was interpreted from original SRTM and GTOPO30 data by Georg Kindermann, IIASA as follows. Pre-classified SRTM raster derived slope in original 3‟‟spatial resolution was transformed to a 30‟‟ spatial resolution raster by zonal majority procedure to get the 60 N to 60 S extent raster of slope classes. For missing latitudes (60 N to 90 N) GTOPO30 slope classes were modified based on observed frequencies of SRTM slope classes over the 30‟‟ spatial resolution pixel of defined GTOPO slope class;
- Dominant soil class represents a most frequent soil class of DSMW soil mapping unit (as for its relative area) assigned to global grid pixel by intersection (spatial join) of global grid centroid lattice and original DSMW layer. Sum of the areas of all soil typological units classified to the same soil class or sum of areas of all non-soil bodies having dominant area portion of the total DSMW mapping unit area was applied as a criterion for dominant soil class assignment. Soil typological units of DSMW soil mapping unit were classified into five pre-defined soil classes based on soil profile data on aggregated soil texture classes (coarse, medium and heavy texture) coming from WISE and soil typological units classification for sandy, loamy or clay and stony or peat soil classes, respectively (an arbitrary value of 88 was assigned to all non-soil bodies).

Tab. 1: *Altitude, slope and soil class criteria for HRU delineation*

LAND CHAR.	UNIT	CLASS (CLASS INTERVALS)
altitude	meters	**1** (*0 – 300*), **2** (*300 – 600*), **3** (*600 – 1100*), **4** (*1100 – 2500*), **5** (*> 2500*),
slope inclination	degree	**1** (*0 – 3*), **2** (*3 – 6*), **3** (*6 – 10*), **4** (*10 – 15*), **5** (*15 – 30*), **6** (*30 – 50*), **7** (*> 50*)
soil	-	**1** (*sandy*), **2** (*loamy*), **3** (*clay*), **4** (*stony*), **5** (*peat*), **88** (*no-soil*)

HRU zone specific altitude, slope or soil class value which have been assigned to 5‟ spatial resolution pixel represents spatially most frequent class value (not average!) taken from input data of higher spatial (GTOPO30, SRTM) or attribute (DSMW) resolution than target dataset (i.e. idea of "the most likely" natural conditions is adopted here). This implies that not absolute information on landscape quality and variability over the 5‟ spatial resolution pixel area is transferred and resulting harmonized information on HRU is just a broad approximation to real variability of the global landscapes.

Totally, 150 unique combinations of altitude, slope and soil class resulted from HRU delineation process globally. Each delineated HRU zone is indexed by numerical code assembled from code of altitude, slope and soil on first, second and third position in string, respectively.

Input data identification:

SRTM

The high-resolution global Shuttle Radar Topography Mission digital elevation model (further referred as SRTM) derived by NASA (http://www2.jpl.nasa.gov/srtm/) was used as a source of global elevation data. SRTM digital elevation model is available in 3‟‟ horizontal resolution (approximately 90 m at the equator) for areas between the latitudes from 60 N to 60 S, altitude data are expressed in meters above a sea level.

GTOPO30

Global 30 Arc Second Elevation Data (further referred as GTOPO30) digital elevation model (http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html*)* was used as a source of global elevation data. GTOPO30 is a global digital elevation model available in 30‟‟ horizontal resolution (approximately 1 km at the equator); the units for altitude are meters above a sea level. It was derived from several raster and vector sources of topographic information. GTOPO30, completed in late 1996, was developed over a three year period through a collaborative effort led by staff at the U.S. Geological Survey's EROS Data Center.

DSMW

The digital version of the 1:5 000 000 scale Soil map of the world (further referred as DSMW) version 3.6 (http://www.fao.org/geonetwork/srv/en/metadata.show?id=14116 &currTab=simple) was used as a source of data on distribution of major soil units across the world. DSMW soil mapping units delineations (available both in vector or 5 arc minutes resolution raster) are attributed with information on soil mapping unit soil components (soil typological units and soil phases) and information on their area portion (in percent) within the soil mapping unit delineation. Totally, information on 106 soil typological units classified according to map legend (FAO-UNESCO 1974) and 5 miscellaneous non-soil units (glaciers, inland waters, dune and shifting sands, rock debris and outcrops, salt flats) is drawn on the map.

WISE

International Soil Reference and Information Centre (ISRIC) 5 by 5„ grid of soil properties estimation based on global soil distribution (DSMW) and soil profile data (WISE soil profile database, http://www.isric.org/UK/About+Soils/Soil+data/Geographic+data/Global/Global+soil+profile+data.htm) interpretation (further referred as WISE, http://www.isric.org/UK/About+Soils/Soil+data/Geographic+data/ Global/WISE5by5minutes.htm) was used as a source of DSMW soil typological unit specific data on soil analytical properties for 5 depth intervals of soil profile (20 cm intervals for total depth of 1m). Detailed interpretation methodology for WISE compilation is described in publication of Batjes (2006).

References:

Balkovič, J., Schmid, E., Bujnovský, R., Skalský, R., Poltárska, K., 2006. Biophysical modelling for evaluating soil carbon sequestration potentials on arable land in the pilot area Baden-Württemberg (Germany). Agriculture, Vol. 52, No. 4, pp. 169 – 176

Batjes, N., H., 2006. ISRIC-WISE derived soil properties on a 5 by 5 arc-minutes global grid (ver. 1.1). *Report 2006/2*, ISRIC - World Soil Information, Wageningen, 46 pp., Available on internet: http://www.isric.org/isric/webdocs/Docs/ISRIC_Report_2006_02.pdf, Accessed: February 8, 2008

FAO-UNESCO, 1974. Soil map of the world, Volume 1 - Legend. Unesco, Paris, 59 p.

Schmid, E., Balkovič, J., Moltchanova E., Skalský, R., Poltárska, K., Müller, B., Bujnovský, R., 2006: Biophysical process modeling for EU25: concept, data, methods, and results. Deliverable D3 (T30), Final Report, Appendix II., EU FP 6 Project INSEA – Integrated Sink Enhancement Assessment (SSPI-CT-2003/503614 with DG RTD), 2006, 76 p.