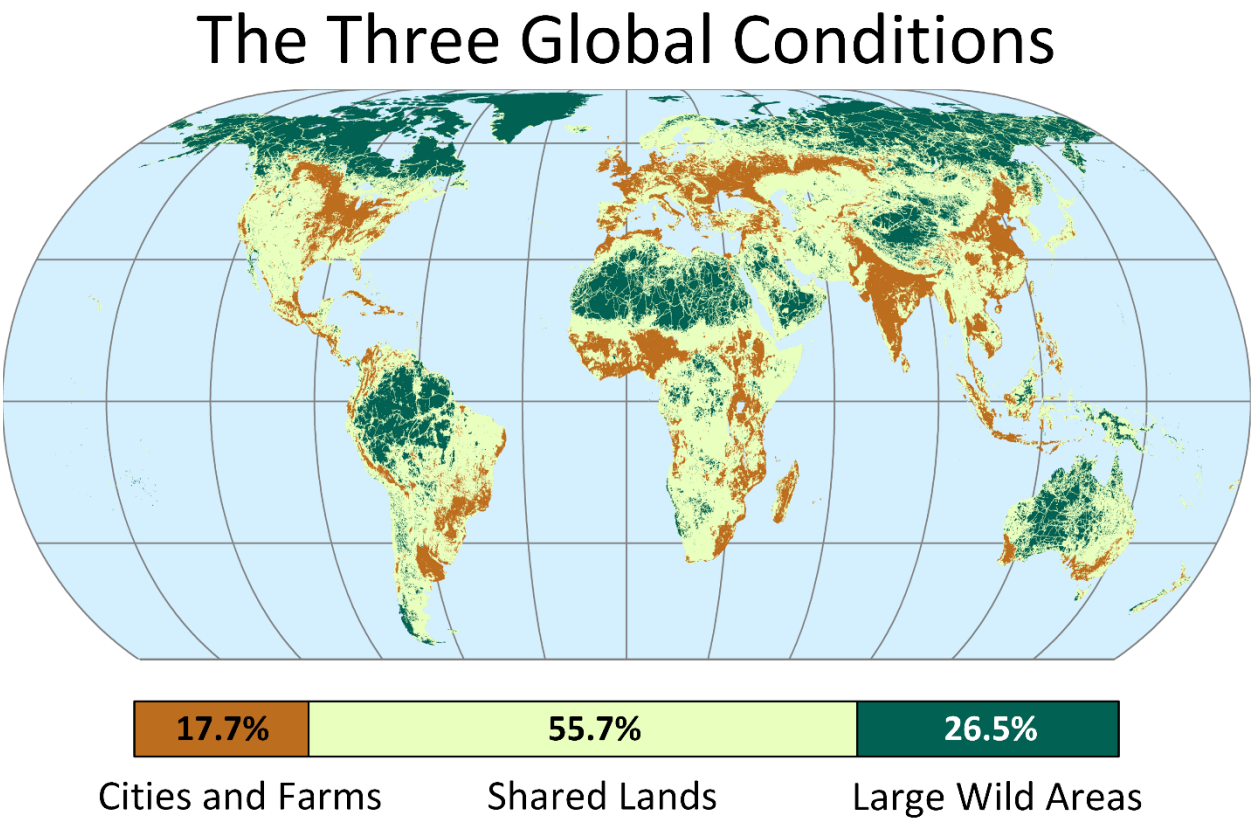
Three Global Conditions: Map Metadata Document
This document describes the Three Global Conditions map product.

Produced by Erle C. Ellis (ece@umbc.edu), June 12, 2019

Map Product:
Shapefile = three_conditions_v4_map_only.shp

Please Cite:
Locke, H., E. C. Ellis, O. Venter, R. Schuster, K. Ma, X. Shen, S. Woodley, N. Kingston, N. Bhola, B. B. N. Strassburg, A. Paulsch, B. Williams, and J. E. M. Watson. 2019. Three global conditions for biodiversity conservation and sustainable use: an implementation framework. *National Science Review* 6: DOI:10.1093/nsr/nwz1136.



Basic Classification and Mapping Rubric

Global patterns of human transformation of terrestrial ecology were classified into three categories (three global conditions) using global data on land use (Klein Goldewijk et al. 2017) and the human footprint (Venter et al. 2016) at regional landscape scale (Noss 1990), using hexagonal grid cells approximately 100 km^2 in area.

Classification Rubric

1: Cities and Farms: Intensive land use > 50%
2: Shared Landscapes: Human Footprint >= 4 AND intensive land use <= 50% AND >= 0.5%
3: Large Wild Areas: Human Footprint Index < 4 AND intensive land use < 0.5%

Basic Methods Description (full description in **Supplementary Methods**)

Regional landscapes across all continents except Antarctica were classified into three classes, the "three global conditions", using the rubric above, based on land use data for 2015 from HYDE 3.2.1 (Klein Goldewijk et al. 2017) and 2013 data for the Human Footprint (HFP;(Venter et al. 2016). Regional landscapes were mapped based on a set of 1,434,246 equal area hexagons of approximately 100 km^2 (96.19 km^2) based on a discrete global grid system ("DGG cells"; Level 12 ISEA Aperture 3 Projection (Sahr et al. 2003, Schmill et al. 2014). Percent land use areas, HFP, and other variables were computed for each DGG cell using zonal statistics in ArcGIS 10.6. Percent intensive land use area in each DGG cell was computed as the sum total of percent urban area, percent cultivated area, and percent intensively managed pasture area based on HYDE 3.2.1. HFP was computed as the maximum value within each DGG cell. DGG cells were then allocated to each of the three conditions classes using the Rubric above.

Map of Three Global Conditions

Shapefile: **three_conditions_v4_map_only.shp**

- Total of 1,434,246 classified DGG cells.
- A layer file (.lyr) with the color safe three conditions map symbology is included.
- **Field: 3cond_v4 = The Three Global Condition classes.**

Map Symbology

3cond_v4	R	G	B	Hex Code
1	189	109	30	#BD6D1E
2	233	255	190	#E9FFBE
3	1	97	83	#016153

Mapping Data Inputs

- HYDE 3.2.1 land use data for year 2015 as 5 arc minute geographic ASCII GRID format (5M grid cells) (Klein Goldewijk et al. 2017).
- Human Footprint (HFP) for year 2013 as 1 km^2 resolution raster in Mollweide projection GeoTiff format (Venter et al. 2016).
- Regional landscapes as hexagonal grid cells in shapefile format = L12 Discrete Global Grid cells ("DGG"; 96.19 km^2 hexagons (Sahr et al. 2003, Schmill et al. 2014)). Includes 1,434,246 DGG cells total. This is "**DGG shapefile**" in analysis below.

Three Conditions mapping methods, using ArcGIS 10.6

1. Acquire and process HYDE 3.2.1 dataset (Klein Goldewijk et al. 2017).

    a. Compute % of each 5M cell covered by urban, crops, pasture by dividing land use areas by total land areas of each cell (divide by land area in each 5M cell = maxln_cr.asc layer).
    b. p_past = % intensive pasture use.
    c. p_cult = % crop area.
    d. p_urbn = % urban area.
2. Compute % intensively used area within each DGG cell.
    a. Compute P_USED raster = p_past + p_cult + p_urbn
    b. Compute P_USED within each DGG cell using zonal statistics, after converting DGG shapefile into 30 arc second GRID aligned with HYDE GRIDs.
    c. Add Mean statistic for P_USED to DGG shapefile.
3. Acquire Human Footprint (HFP) for year 2013 (Venter et al. 2016).
4. Compute HFP within each DGG cell.
    a. Compute statistics for HFP within each DGG cell using zonal statistics, after converting DGG shapefile into 1 km2 GRID aligned with HFP GRID.
    b. Add Maximum statistic for HFP, = "HFP_MAX" to DGG shapefile.
5. Compute three conditions variable ("3_cond_v4" field in DGG shapefile), using Rubric, above, in Field Calculator.
    a. threecond = 2
    b. IF [P_USED] > 0.5 THEN
    c. threecond = 1
    d. End IF
    e. IF [HFP_MAX] < 4 AND [P_USED] < 0.005 THEN
    f. threecond = 3
    g. End IF
6. Remove all DGG cells where data for HYDE or HFP was absent.
    a. Total of 1,434,246 classified DGG cells in final shapefile.
7. Produce map output as shapefile.
    a. Filename = **three_conditions_v4_map_only.shp**.
    b. Three conditions variable = "**3_cond_v4"** field.
    c. Compress in zip file: three_conditions_map_2019_06_12.zip
    d. This zip file represents the **Supplemental Data** file in Locke et al. (2019)
    e. Produce map image as .png, in Eckert IV projection (above)

References

Klein Goldewijk, K., A. Beusen, J. Doelman, and E. Stehfest. 2017. Anthropogenic land use estimates for the Holocene – HYDE 3.2. Earth System Science Data **9**:927-953.

Noss, R. F. 1990. Indicators for Monitoring Biodiversity: A Hierarchical Approach. Conservation Biology **4**:355-364.

Sahr, K., D. White, and A. J. Kimerling. 2003. Geodesic discrete global grid systems. Cartography and Geographic Information Science **30**:121(114).

Schmill, M. D., L. M. Gordon, N. R. Magliocca, E. C. Ellis, and T. Oates. 2014. GLOBE: Analytics for Assessing Global Representativeness. Pages 25-32 *in* Computing for Geospatial Research and Application (COM.Geo), 2014 Fifth International Conference on.

Venter, O., E. W. Sanderson, A. Magrach, J. R. Allan, J. Beher, K. R. Jones, H. P. Possingham, W. F. Laurance, P. Wood, B. M. Fekete, M. A. Levy, and J. E. M. Watson. 2016. Sixteen years of change in the global terrestrial human footprint and implications for biodiversity conservation. Nat Commun **7**:12558.