SPECTRE: standardized SPECies ThREat spatial data for global terrestrial areas

Finnish: SPECTRE: Standardoidut, lajeja uhkaavia tekijöitä kuvaavat paikkatiedot maa-alueille globaalisti

- Short description:
  - English:
    - Spatial data on multiple threats to biodiversity at 1 km resolution for all global terrestrial areas. Available data covers threats such as mining density, road density, fire occurrence and climate change, with a current total of 24 layers to be increased in the future. These allow full comparability and ease of use under common statistical frameworks for global change studies, species distribution modelling, threat assessments, quantification of ecosystem services and disturbance, among multiple other uses. SPECTRE's layers are broadly separated into 5 categories: 1) Habitat loss, 2) Overexploitation, 3) Pollution, 4) Invasive species and 5) Climate change, with Invasive species being temporarily unavailable due to a lack of data that meet our criteria for inclusion.
  - Finnish:
    - Paikkatietoa useista biologiseen monimuotoisuuteen kohdistuvista uhista 1 km:n resoluutiolla kaikilta maa-alueilta globaalisti. Saatavilla olevat tiedot kattavat uhat kuten esimerkiksi kaivostoiminnan tiheyden, tieverkoston tiheyden, tulipalojen esiintyvyyden ja ilmastonmuutoksen nykyisellä 24 aineistolla, joiden määrän on tarkoitus kasvaa tulevaisuudessa. Nämä mahdollistavat vertailukelpoisuuden ja helppokäyttöisyyden yleisten tilastollisten viitekehysten mukaisesti maailmanlaajuisen muutostutkimuksen, lajien levinneisyysmallinnuksen, uhka-arvioinnin, ekosysteemipalvelujen sekä niiden häiriöiden kvantifioinnin, ja muiden käyttötarkoitusten osalta. SPECTRE:n aineistot on jaettu viiteen kategoriaan:
      1) elinympäristön häviäminen
      2) liiallinen hyödyntäminen
      3) saastuminen
      4) vieraslajit (tilapäisesti ei saatavilla, koska kriteereitämme täyttäviä lähdetietoja ei ole saatavilla)
      5) ilmastonmuutos

- Dataset producers:
  - Hesinki University, Finnish museum of natural history, Laboratory for Integrative Biodiversity Research, http://biodiversityresearch.org/
    - Vasco Veiga Branco, https://orcid.org/0000-0001-7797-3183
    - Pedro Cardoso, https://orcid.org/0000-0001-8119-9960
    - Luis Correia, https://orcid.org/0000-0003-2439-1168
- Scale / pixel size: 1 km x 1 km
- Coordinate system: WGS84. EPSG:4326
- License: CC-BY-4.0

SPECTRE datasets

1. **1_1 MINING_AREA**
    - **Mining density – Kaivostiheys**
    - Number of known mining areas in 50 km distance from the cell,
    - Year: 2020.
    - Data source: Sonter, L.J., Dade, M.C., Watson, J.E.M. & Valenta, R. K. (2020). Renewable energy production will exacerbate mining threats to biodiversity. Nature Communications 11, 4174.
        - DOI: https://doi.org/10.1038/s41467-020-17928-5
        - Original grid size: 1 km.
2. **1_2 HAZARD_POTENTIAL**
    - **Hazard potential – Vaarapotentiaali**
    - The number of significant hazards potentially affecting the cell. The hazards of interest include cyclones, droughts, earthquakes, floods, landslides, and volcanoes. This data set is further enriched by the inclusion of data pertaining to population, Gross Domestic Product (GDP), and transportation infrastructure.
    - Year: 2000
    - Data source: Center for Hazards and Risk Research - CHRR - Columbia University, Center for International Earth Science Information Network - CIESIN - Columbia University, and International Bank for Reconstruction and Development - The World Bank. 2005. Global Multihazard Frequency and Distribution. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC).
        - DOI: https://doi.org/10.7927/H45718Z5
        - Original grid size: 2.5 arc minutes, ~5 km at equator
3. **1_3 HUMAN_DENSITY**
    - **Population density – Väestötiheys**
    - Unit: persons/km2
    - Year: 2015
    - Data source: Schiavina, M., Freire, S., & MacManus, K. (2019). GHS-pop R2019A - GHS population grid multitemporal (1975-1990-2000-2015). *European Commission, Joint Research Centre (JRC)*.
        - DOI: http://doi.org/10.2905/2FF68A52-5B5B-4A22-8F40-C41DA8332CFE
        - Original grid size: 1 km (World Mollweide projection)
4. **1_4 BUILT_AREA** -
    - **Proportion of built-up area - Rakennetun ympäristön osuus**
    - Year: 2014
    - Unit: %
    - Data source: Corbane, C., Florczyk, A., Pesaresi, M., Politis, P. & Syrris, V. (2018). GHS built-up grid, derived from Landsat, multitemporal (1975-1990-2000-2014). European Commission, Joint Research Centre (JRC).
        - DOI: https://doi.org/10.2905/9F06F36F-4B11-47EC-ABB0-4F8B7B1D72EA
        - Original grid size: 1 km (World Mollweide projection)
5. **1_5 ROAD_DENSITY**

- **Road density – Tieverkoston tiheys**
- Years: 1997 to 2015
- Unit: meter of road / km2
- Data source: Meijer, J. R., Huijbregts, M. A. J., Schotten, K. C. G. J. & Schipper, A. M. (2018). Global patterns of current and future road infrastructure. *Environmental Research Letters*, 13(6), p.064006.
    - DOI: https://doi.org/10.1088/1748-9326/aabd42
    - Original grid size: 5 arc minutes, ~10 km at equator

6. **1_6 FOOTPRINT_PERC** -
    - **Human footprint – Ihmisen toiminnan ekologinen jalanjälki**
    - Anthropogenic impacts on the environment. The Global Human Footprint Dataset is the Human Influence Index (HII) normalized by biome and realm. The HII is a global dataset of 1-kilometer grid cells, created from nine global data layers covering human population pressure (population density), human land use and infrastructure (built-up areas, nighttime lights, land use/land cover), and human access (coastlines, roads, railroads, navigable rivers)..;
    - Year: 2009
    - Unit: %
    - Data source: 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. Watson. 2018. Last of the Wild Project, Version 3 (LWP-3): 2009 Human Footprint, 2018 Release. Palisades, New York: NASA Socioeconomic Data and Applications Center (SEDAC).
        - DOI: https://doi.org/10.7927/H46T0JQ4
        - Original grid size: 1 km (Mollweide projection)
7. **1_7 IMPACT_AREA** -
    - **Human impact – Ihmisen toiminnan vaikutus**
    - A classification of anthropogenic impacts on land into very low impact areas (1), low impact areas (2) and non-low impact areas (3), created by collating data on human population, livestock density, forest change, land cover and light pollution.
    - Years: 2000-2018
    - Data source: Jacobson, A. P., Riggio, J., Tait, A. M. & Baillie, J. E. M. (2019), Global areas of low human impact ('Low Impact Areas') and fragmentation of the natural world. *Dryad*.
        - DOI: https://doi.org/10.5061/dryad.z612jm67g
        - Original grid size: 1 km (World Eckert IV projection)
8. **1_8 MODIF_AREA**
    - **Modified landscape - Muokattu maisema**
    - The proportion of a landscape that has been modified, based on remote sensing imagery and ground inventory data on human settlement, agriculture, transportation, mining and electrical infrastructure,
    - Values: 0-1: 1 = fully modified, 0 unmodified.
    - Years: 1980 to 2016
    - Data source: Kennedy, C. M., Oakleaf, J. R., Theobald, D. M., Baruch-Mordo, S., & Kiesecker, J. (2019). Managing the middle: A shift in conservation priorities based on the global human modification gradient. *Global Change Biology*, *25*(3), 811–826.
        - DOI: https://doi.org/10.1111/gcb.14549
        - Original grid size: 1 km (Mollweide projection)

9. **1_9 HUMAN_BIOMES** -
    - **Anthropogenic biomes - Antropogeeniset biomit**
    - A classification of land cover into different anthropogenic biomes of differing pressure (0 to 5): wildlands (0), forested (1), rangeland (2), croplands (3), villages (4) and dense settlements (5) based on data from.
    - Years: 2001-2006
    - Data source: Ellis, E.C. & Ramankutty, N. (2008) Putting people in the map: anthropogenic biomes of the world. *Frontiers in Ecology and the Environment*, 6(8): 439–447.
        - DOI: https://doi.org/10.1890/070062
        - Original grid size: 5 arc minutes (Plate Carrée projection), , ~10 km at equator
10. **1_10 FIRE_OCCUR** -
    - **Mean fire occurrence – Tulipalojen keskimääräinen esiintymistiheys**
    - Calculated by overlaying ignition polygons built from known center and radius.
    - Unit: fires / year
    - Years: 2006-2016
    - Data source: Andela, N., Morton, D. C., Giglio, L., Paugam, R., Chen, Y., Hantson, S., … Randerson, J. T. (2019). The global fire atlas of individual fire size, duration, speed and direction. *Earth System Science Data*, *11*(2), 529–552.
        - DOI: https://doi.org/10.5194/essd-11-529-2019
        - Original data: vector data, calculated from 500 m MODIS data
11. **1_11 CROP_PERC_UNI** -
    - **The proportion of cropland (UNI) – Viljelymaan osuus (UNI)**
    - It similar to CROP_PERC_ IIASA, but data is from different sources.
    - Unit: %
    - Years: 1999-2014
    - Data source: Waldner, F., Fritz, S., Di Gregorio, A., Plotnikov, D., Bartalev, S., Kussul, N., … Defourny, P. (2016). A unified cropland layer at 250 m for Global Agriculture Monitoring. *Data*, *1*(1), 3.
        - DOI: https://doi.org/10.3390/data1010003
        - Original grid size: 250 m (in WGS84, EPSG:4326)
12. **1_12 CROP_PERC_IIASA**
    - **The proportion of cropland (IIASA) – Viljelymaan osuus (IIASA)**
    - It similar to CROP_PERC_UNI, but data is from different sources.
    - Unit: %.
    - Year: 2005
    - Data source: Fritz, S., See, L., McCallum, I., You, L., Bun, A., Moltchanova, E., … Obersteiner, M. (2015). Mapping global cropland and field size. *Global Change Biology*, 21(5), 1980–1992.
        - DOI: https://doi.org/10.1111/gcb.12838
        - Original grid size: 1 km
13. **1_13 LIVESTOCK_MASS**
    - **Livestock wet biomass - Karjan märkä biomassa**
    - The estimated total amount of livestock wet biomass based on global livestock head counts.
    - Unit: kg

- Year: 2005
- Data source: Robinson, T. P., Wint, G. R. W., Conchedda, G., Van Boeckel, T. P., Ercoli, V., Palamara, E., … Gilbert, M. (2014). Mapping the global distribution of Livestock. *PLoS ONE*, *9*(5).
    - DOI: https://doi.org/10.1371/journal.pone.0096084
    - Original grid size: 3 arc minutes, ~6 km at equator

14. **2_1 FOREST_LOSS_PERC**
    - **Forest tree cover loss between 2007 and 2017 – Metsäpeitteen häviäminen 2007 – 2017**
    - Unit: % from -100 to +100
    - Years: 2007-2017
    - Data source: Shimada, M., Itoh, T., Motooka, T., Watanabe, M., Shiraishi, T., Thapa, R., & Lucas, R. (2014). New Global Forest/non-forest maps from Alos Palsar data (2007–2010). *Remote Sensing of Environment*, *155*, 13–31.
        - DOI: https://doi.org/10.1016/j.rse.2014.04.014
        - Original grid size: 1 km
15. **2_2 FOREST_TREND** -
    - **Forest loss trend – Metsäpeitteen häviämisen trendi**
    - A classification metric of 0 (no loss) or a discrete value from 1 to a potential maximum of 19, representing loss (a stand-replacement disturbance or change from a forest to non-forest state) detected primarily in the year 2001–2019, respectively;
    - Years: 2001-2019
    - Data source: Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. High-Resolution Global Maps of 21st-Century Forest Cover Change. Science 342 (15 November): 850-53. Data available on-line from: https://glad.earthengine.app/view/global-forest-change. Global Forest Watch (2014). *Global Forest Watch*. World Resources Institute. http://www.globalforestwatch.org/
        - DOI: https://doi.org/10.1126/science.1244693
        - Data downloaded from: https://storage.googleapis.com/earthenginepartners-hansen/GFC-2022-v1.10/download.html
        - Original grid size: 1 arc second, ~ 30 m at equator
16. **2_3 NPPCARBON_GRAM** -
    - **Human appropriation of net primary productivity - Ihmisen käyttö primaarinettotuotannosta**
    - Global Patterns in Human Appropriation of Net Primary Productivity (HANPP) represents a digital map of human appropriation of net primary productivity measured in units of elemental carbon on a one-quarter degree global grid. Net primary productivity (NPP), the net amount of solar energy converted to plant organic matter through photosynthesis, can be measured in units of elemental carbon and represents the primary food energy source for the world's ecosystems. Humans appropriate net primary productivity through the consumption of food, paper, wood and fiber, which alters the composition of the atmosphere, levels of biodiversity, energy flows within food webs and the provision of important ecosystem services.
    - Year: 1995

- Unit: grams
- Data source: Imhoff, M. L., Bounoua, L., Ricketts, T., Loucks, C., Harriss, R. & Lawrence, W. T. (2004). Global Patterns of HANPP, v1 (1995). *NASA Socioeconomic Data and Applications Center*.
    - DOI: https://doi.org/10.7927/H44Q7RWV
    - Original grid size: 15 arc minutes, ~30 km at equator

17. **2_4 NPPCARBON_PERC** -
    - **Proportion of human appropriation of net primary productivity - Ihmisen käytön osuus primaarinettotuotannosta**
    - The quantity of carbon needed to derive food and fiber products (NNP - Net Primary Productivity) consumed by humans in each pixel compared to total carbon production.
    - Year: 1995
    - Unit: %
    - Data source: Imhoff, M. L., Bounoua, L., Ricketts, T., Loucks, C., Harriss, R. & Lawrence, W. T. (2004). HANPP as a Percentage of Net Primary Productivity, v1 (1995). *NASA Socioeconomic Data and Applications Center*.
        - DOI: https://doi.org/10.7927/H44Q7RWV
        - Original grid size: 15 arc minutes, ~30 km at equator
18. **3_1 LIGHT_MCDM2**
    - **Light pollution – Valosaaste**
    - Artificial sky luminance describing light pollution, simulated zenith radiance.
    - Year: ~2015
    - Unit: millicandelas / m2
    - Data source: Falchi, F., Cinzano, P., Duriscoe, D., Kyba, C. C. M., Elvidge, C. D., Baugh, K., … Furgoni, R. (2016). The new world atlas of artificial night sky brightness. *Science Advances, 2(6)*.
        - DOI: https://doi.org/10.1126/sciadv.1600377
        - Original grid size: 30 arc seconds, ~1 km at equator
19. **3_2 FERTILIZER_KGHA**
    - **Nitrogen fertilizer usage - Typpilannoitteiden käyttö**
    - The amount of nitrogen fertilizer nutrients applied to croplands.
    - Years: 1994-2001
    - Unit: kg/ha
    - Data source: Potter, P., Ramankutty, N., Bennett., E. M. & Donner, S. D. (2012). Global Fertilizer and Manure, Version 1: Nitrogen Fertilizer Application. *NASA Socioeconomic Data and Applications Center*.
        - DOI: https://doi.org/10.7927/H4Q81B0R
        - Original grid size: 30 arc minutes, ~60 km at equator
20. **5_1 TEMP_TRENDS**
    - **Temperature trends – Lämpötilan trendi**
    - Based on the linear regression coefficients of mean monthly temperature for the years of 1990 to 2019.
    - Years: 1990-2019
    - Data source: Harris, I. C., Jones, P. D. & Osborn, T. (2020). CRU TS4.04: Climatic Research Unit (CRU) Time-Series (TS) version 4.04 of high-resolution gridded data of

month-by-month variation in climate (Jan. 1901 - Dec. 2019). Centre for Environmental Data Analysis.
    - DOI: https://catalogue.ceda.ac.uk/uuid/89e1e34ec3554dc98594a5732622bce9
    - Original grid size: 30 arc minutes, ~60 km at equator

21. **5_2 TEMP_SIGNIF**
    - **Temperature trend significance – Lämpötilan trendin merkittävyys**
    - The temperature trends divided by its standard error, for years 1990 to 2019.
    - Years: 1990-2019
    - Data source: Harris, I. C., Jones, P. D. & Osborn, T. (2020). CRU TS4.04: Climatic Research Unit (CRU) Time-Series (TS) version 4.04 of high-resolution gridded data of month-by-month variation in climate (Jan. 1901 - Dec. 2019). Centre for Environmental Data Analysis.
        - Source: https://catalogue.ceda.ac.uk/uuid/89e1e34ec3554dc98594a5732622bce9
        - Original grid size: 30 arc minutes, ~60 km at equator
22. **5_3 CLIM_EXTREME** -
    - **Trend of climate extremes – Äärimmäisten sääilmiöiden trendi**
    - Calculated as whatever is the largest of the coefficients of two linear regressions, one of the months with the lowest mean temperatures, another of the months with the highest mean temperatures. For years 1990–2019.
    - Years: 1990-2019
    - Data source: Harris, I. C., Jones, P. D. & Osborn, T. (2020). CRU TS4.04: Climatic Research Unit (CRU) Time-Series (TS) version 4.04 of high-resolution gridded data of month-by-month variation in climate (Jan. 1901 - Dec. 2019). Centre for Environmental Data Analysis,
        - Source: https://catalogue.ceda.ac.uk/uuid/89e1e34ec3554dc98594a5732622bce9
        - Original grid size: 30 arc minutes, ~60 km at equator
23. **5_4 CLIM_VELOCITY**
    - **Velocity of climate change – Ilmastonmuutoksen nopeus**
    - The ratio between TEMP_TRENDS and a local spatial gradient in mean temperature calculated as the slope of a plane fitted to the values of a 3x3 cell neighbourhood centred on each cell. For years 2000 to 2020
    - Years: 2000-2020
    - Data source: Wan, Z., Hook, S. & Hulley, G. (2015). MOD11C3 MODIS/Terra Land Surface Temperature/Emissivity Monthly L3 Global 0.05Deg CMG V006. *NASA EOSDIS Land Processes DAAC.*
        - DOI: https://doi.org/10.5067/MODIS/MOD11C3.006
        - Original grid size: 3 arc minutes, ~6 km at equator
24. **5_5 ARIDITY_TREND**
    - **Aridity trends – Kuivuustrendit**

- Based on the linear regression coefficients of aridity for the years of 1990 to 2019, with aridity being the ratio between the monthly potential evapotranspiration and the monthly precipitation.
- Unit: mm/month
- Years: 1990-2019
- Data source: Harris, I. C., Jones, P. D. & Osborn, T. (2020). CRU TS4.04: Climatic Research Unit (CRU) Time-Series (TS) version 4.04 of high-resolution gridded data of month-by-month variation in climate (Jan. 1901 - Dec. 2019). Centre for Environmental Data Analysis.
    - Source: https://catalogue.ceda.ac.uk/uuid/89e1e34ec3554dc98594a5732622bce9
    - Original grid size: 30 arc minutes, ~60 km at equator