EEA geospatial data catalogue

Annual above ground vegetation productivity time-series, version 1, Aug. 2018

This raster data set corresponds to the above ground vegetation biomass productivity time-series for the period 2000-2016.

The data set addresses trends in land surface productivity derived from remote sensing observed time series of vegetation indices. The vegetation index used in the indicator is the Plant Phenology Index (PPI, Jin and Eklundh, 2014). PPI is based on the MODIS Nadir BRDF-Adjusted Reflectance product (MODIS MCD43 NBAR. The product provides reflectance data for the MODIS “land” bands (1 - 7) adjusted using a bi-directional reflectance distribution function. This function models values as if they were collected from a nadir-view to remove so called cross-track illumination effects. The Plant Phenology Index (PPI) is a new vegetation index optimized for efficient monitoring of vegetation phenology. It is derived from radiative transfer solution using reflectance in visible-red (RED) and near-infrared (NIR) spectral domains. PPI is defined to have a linear relationship to the canopy green leaf area index (LAI) and its temporal pattern is strongly similar to the temporal pattern of gross primary productivity (GPP) estimated by flux towers at ground reference stations. PPI is less affected by presence of snow compared to commonly used vegetation indices such as Normalized Difference Vegetation Index (NDVI) or Enhanced Vegetation Index (EVI).

The product is distributed with 500 m pixel size (MODIS Sinusoidal Grid) with 8-days compositing period.

Simple

Date (Publication)	2019-03-12
Date (Creation)	2018-08-30
Edition	01.00
Citation identifier	eea_r_3035_500_m_p-lint_p_2000-2016_v01_r00
Citation identifier	DAT-225-en

Point of contact

No information provided.

Point of contact

No information provided.

Maintenance and update frequency	As needed
EEA topics	• Land use • Biodiversity
GEMET - INSPIRE themes, version 1.0	• Environmental monitoring facilities • Habitats and biotopes
Keywords	
Keywords	
GEMET	• above-ground biomass growth • productivity • above-ground biomass • productivity trend • vegetation
Continents, countries, sea regions of the world.	• EEA39
Spatial scope	• European

Temporal resolution	• Annually
EEA Management Plan	• 2019 1.8.2
Access constraints	Other restrictions
Other constraints	no limitations to public access
Use constraints **Other constraints**	Other restrictions EEA standard re-use policy: unless otherwise indicated, re-use of content on the EEA website for commercial or non-commercial purposes is permitted free of charge, provided that the source is acknowledged (http://www.eea.europa.eu/legal/copyright). Copyright holder: European Environment Agency (EEA).
Aggregate Datasetindentifier	4635cd57-65d9-47b4-b18e-98a781ef27bb
Association Type	Cross reference
Aggregate Datasetindentifier	1be91ed4-2eb1-46d6-8453-5246c9e9d446
Association Type	Cross reference
Aggregate Datasetindentifier	f4b01c76-29f7-4075-b13f-5dc5a9c18ae2
Association Type	Cross reference
Aggregate Datasetindentifier	f5e0c7e9-7c44-477f-950b-7c092fa0f7a8
Association Type	Cross reference
Spatial representation type	Grid
Distance	500 500 m
Language of dataset	English
Topic category	• Environment

72.00	N	34.00	S	46.00	E	-26.00	W

Begin date	2000-01-01
End date	2016-12-31
Coordinate reference system identifier	EPSG:3035
Distribution format	• BIL (2016)

OnLine resource

Protocol	Linkage	Name
EEA:FILEPATH	https://sdi.eea.europa.eu/webdav/datastore/public/eea_r_3035_500_m_p-lint_p_2000-2016_v01_r00/	
WWW:URL	https://sdi.eea.europa.eu/data/29ae2d47-7af2-4c09-ba5f-e2fbb7c2b0d1	Direct download
ESRI:REST	https://land.discomap.eea.europa.eu/arcgis/rest/services/Phenology/Productivity_2000_2016_long_term_mean/ImageServer	
OGC:WMS	https://land.discomap.eea.europa.eu/arcgis/services/Phenology/Productivity_2000_2016_long_term_mean/ImageServer/WMSServer?request=GetCapabilities&service=WMS	

Hierarchy level	Dataset

Conformance result

Date (Publication)	2010-12-08
Explanation	See the referenced specification

Statement

The PPI time-series is affected by noise due to e.g. atmosphere and remaining cloud influence, resulting in some spikes and outlier values. Since large spikes and outliers might significantly affect the further function fitting, they first have to be removed from the data. This is done in an initial filtering process, further described in the TIMESAT software manual.

After the outlier removal the next step in the analysis is the determination of the number of growing seasons. This is based on a harmonic function fit (sine-cosine functions) to the data. The presence of a second season is established by evaluating the amplitudes of the first and second components of the harmonic fit. Presence of noise in the data complicates the decision on whether the given secondary maximum represents a true growing season or not. Therefore, an amplitude threshold is used to remove seasons that are smaller than the given threshold. A detailed description of the determination of the number of growing season is found in the TIMESAT software manual.

After the number of growing seasons have been determined double logistic functions are fitted to the data from each pixel. This is done to generate smooth continuous functions that well describe each individual growing season. It is assumed that most of the noise included in PPI (or any other vegetation index) results in negative bias of the values. Therefore, iterative adaptation of the logistic functions to the upper envelope of the data is applied in the following step. The function fit is performed on the PPI data. Values less than the first function fit are then considered as influenced by noise and thus less important, so their weights are decreased for the next iteration of the function fitting.

Phenological metrics (and other parameters describing character of the given growing season) are finally extracted from the fitted function data. The following parameters are extracted for each detected growing season to determine productivity:

Start-Of-Season (SOS): date of the start of the season defined as the date when the PPI has increased to the 20% level of the average annual PPI amplitude (Jin et al. 2017). The average annual PPI amplitude is the difference between the average peak level and the average base level for each pixel.

End-Of-Season (EOS): date of the end of the season defined as the date when the PPI drops under the 20 % level of the average annual PPI amplitude (Jin et al. 2017).

Large integral: integral of the fitted function between the start and end of the season.

Small integral: integral of the differences between the fitted function and the base level from start to end of the season.

Seasonal amplitude is calculated as a difference of the fitted curve maximum and the base level. The SOS and EOS points on the curve are then given as the fraction of the amplitude, i.e. the date when the fitted curve reaches/drops below the defined percent

fraction of the seasonal amplitude. For this indicator 20% of the seasonal PPI amplitude was used as the SOS and EOS detection threshold.

The output of the process is a productivity metrics for each year of the time series 2000-2016 (17 years) covering the EEA39 territory. The spatial resolution of the productivity dataset is 500mx500m pixel size.

Detailed description of the methodology for calculating the productivity metric can be found in the TIMESAT software manual (publically available)

References:

Jönsson P., Eklundh L., 2004. TIMESAT—a program for analyzing time-series of satellite sensor data. Computers & Geosciences 30 (2004) 833–845.

Eklundh L., Jönsson P., 2015. TIMESAT: A Software Package for Time-Series Processing and Assessment of Vegetation Dynamics. In: Kuenzer C., Dech S., Wagner W. (eds) Remote Sensing Time Series. Remote Sensing and Digital Image Processing, vol 22. Springer, Chambridge.

Jin, H., Eklundh, L. 2014. A physically based vegetation index for improved monitoring of plant phenology, Remote Sensing of Environment, 152, 512 – 525.

Karkauskaite, P., Tagesson, T., Fensholt, R., 2017. Evaluation of the Plant Phenology Index (PPI), NDVI and EVI for Start-of-Season Trend Analysis of the Northern Hemisphere Boreal Zone, Remote Sensing, 9 (485), 21 pp.

Jin, H.X.; Jönsson, A.M.; Bolmgren, K.; Langvall, O.; Eklundh, L., 2017. Disentangling remotely-sensed plant phenology and snow seasonality at northern Europe using MODIS and the plant phenology index. Remote Sensing of Environment 2017,198, 203-212.

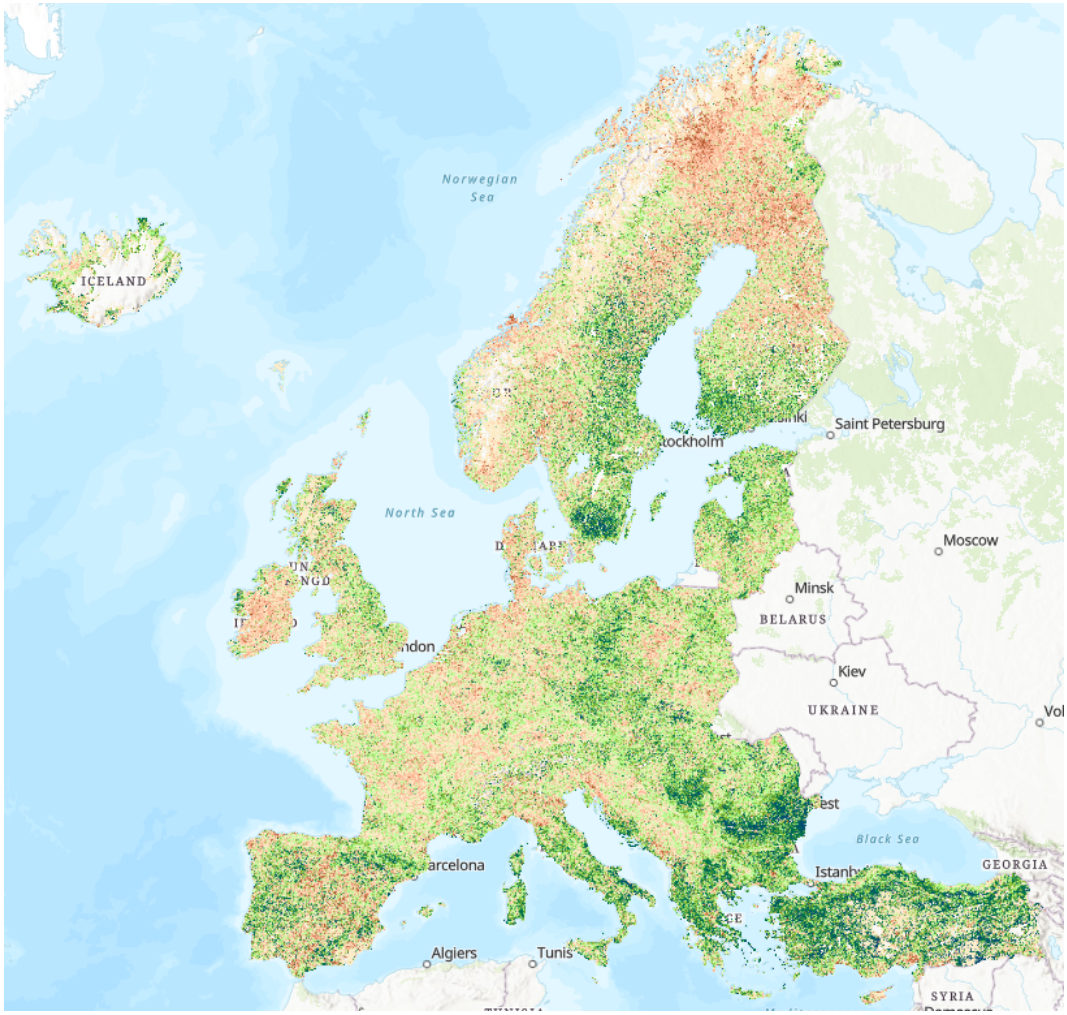
Abdi, A. M., N. Boke-Olén, H. Jin, L. Eklundh, T. Tagesson, V. Lehsten and J. Ardö (2019). First assessment of the plant phenology index (PPI) for estimating gross primary productivity in African semi-arid ecosystems. International Journal of Applied Earth Observation and Geoinformation 78: 249-260.

Jin, H., A. M. Jönsson, C. Olsson, J. Lindström, P. Jönsson and L. Eklundh (2019). New satellite-based estimates show significant trends in spring phenology and complex sensitivities to temperature and precipitation at northern European latitudes. International Journal of Biometeorology 63(6): 763-775.

Metadata

File identifier	29ae2d47-7af2-4c09-ba5f-e2fbb7c2b0d1 XML
Metadata language	English
Character set	UTF8
Hierarchy level	Dataset
Date stamp	2021-05-17T17:07:52.536Z
Metadata standard name	ISO 19115/19139
Metadata standard version	1.0
Metadata author	**Organisation name**: European Environment Agency; **Individual name**: ; **Electronic mail address**: sdi@eea.europa.eu; **Website**: ; **Role**: Point of contact

Overviews



Provided by

EEA