Title NSW Aridity Index - High resolution (30 meter)

Abstract

The aridity index, also known as the Budyko radiative index of dryness, is a dimensionless parameter that represents the long-term balance between net radiation and precipitation. The method used to generate the high-resolution aridity index layer across New South Wales was developed by Nyman et al., 2014. To create the high-resolution (30 m) aridity index layer for New South Wales, the following parameters were used: 1 arc second monthly net radiation and shortwave radiation ratio, 30 years of historical data encompassing precipitation and surface temperature from the period 1992 to 2021, 30-meter Shuttle Radar Topography Mission digital elevation model, and 30-meter Leaf Area Index layer which provides insights into the density and distribution of vegetation across the region. The aridity index layer is a high-resolution dataset that allows identification of finer-scale variations in local moisture balance related to aspect unlike existing aridity index layers. This dataset serves as a valuable tool for understanding and managing water resources, assessing environmental conditions, and informing decision-making in a wide range of applications related to water management, land use, and climate change adaptation. The Lineage section of the metadata provides more information about the method.

Resource locator

Show on SEED Web Map Name: Show on SEED Web Map

Protocol: WWW:DOWNLOAD-1.0-http--download

Description:

Display dataset on SEED map viewer

Function: download

Data Quality Statement Name: Data Quality Statement

Protocol: WWW:DOWNLOAD-1.0-http--download

Description:

Data quality statement for NSW Aridity Index - High resolution (30 meter)

Function: download

<u>Download</u> <u>Package</u> Name: Download Package

Protocol: WWW:DOWNLOAD-1.0-http--download

Description:

Data (GeoTIFF)

Function: download

ArcGIS REST
Services
Directory - NSW
Aridity Index High resolution
(30 meter)

Name: ArcGIS REST Services Directory - NSW Aridity Index - High resolution (30

neter)

Protocol: WWW: DOWNLOAD-1.0-http--download

Description:

An ArcGIS Server web service represents a GIS resource such as a map, locator, or image that is located on an ArcGIS Server site and is made available to client applications. Depending on the layers enabled, this web service allows a user to query its features and/or visualise the dataset. This service is aimed at advanced geographical information users, and will require access to geographical information system (GIS) software such as ArcGIS/ArcMap.

Function: download

Unique resource identifier

Code 1ee4c0a1-d576-44ae-8b6f-b5215e6325ba

Presentation form

Map digital

Edition	1	
Dataset language	English	
Metadata standard		
Name	ISO 19115	
Edition	2016	
Dataset URI	https://www.planningportal.nsw.gov.au/opendata/dataset/lee4c0a1-d576-44ae-8b6f-b5215e6325ba	
Purpose	Fire management planning	
Status	Completed	
Spatial representation type	grid	
Spatial reference system		
Code identifying the spatial reference system	4283	
Spatial resolution	30 m	
Topic category	climatologyMeteorologyAtmosphere	
	environment	

Keyword set	
keyword value	HAZARDS-Fire
Originating controlled vocabulary	
Title	ANZLIC Search Words
Reference date	2008-05-16
Geographic location	
Vertical extent information	
Minimum value	-100
Maximum value	2228
Coordinate reference system	
Authority code	urn:ogc:def:cs:EPSG::
Code identifying the coordinate reference system	5711
Temporal extent	
Begin position	1992-01-01
End position	N/A
Dataset reference date	
Resource maintenance	
Maintenance and update frequency	Unknown
Contact info	
Contact position	Data Broker
Organisation name	NSW Department of Climate Change, Energy, the Environment and Water
Full postal address	NSW
	Australia
	data.broker@environment.nsw.gov.au
Telephone number	131555
Email address	data.broker@environment.nsw.gov.au
Web address	https://www.nsw.gov.au/departments-and-agencies/dcceew
Responsible party role	pointOfContact

1 Introduction Aridity index or radiative index of dryness (AIB) is a non-dimensional measure of the long-term balance between rainfall and net radiation. Landscape aridity can be calculated from the annual sum of net radiation, Rn (MJ/m2/day) and precipitation, P through the following ratio Equation 1 AIB = Rn / λ P where P is the average daily rainfall (m/day) and λ is the latent heat of vaporisation (MJ/m3) which is a function of topographic adjusted surface temperature, TD (°K): Equation 2 λ = (3.146 – 0.002361TD) x 1000 And TD is a function of air temperature Ta (°C), the change of temperature with elevation Tlapse , The topographic downscaling factor STD, Z is the elevation of each 30 m cell, Zb is the average elevation of 5 km tile, and the leaf area index, LAI by the following equation: Equation 3 TD (°C) = Ta – ((Tlapse*(z-zb)) / 1000) + k (STD –

1/STD) x (1 - LAI / LAImax) Equation 4 TD (°K) = TD (°C) + 273

Where k = 1 and the standard lapse rate will typically decrease at a rate of roughly 9.8 degrees Celsius per thousand meter, Tlapse = 9.8.

2 Layers implemented in the model 2.1 Net Radiation (Rn) Mean monthly solar radiation was modelled across Australia using topography from the 1 arcsecond resolution SRTM-derived DEM-S and climatic and land surface data. The twelve SRAD modelled net radiation layers (MJ/m2/day) were used to calculate the net radiation layer. The 1 arcsecond tiled SRAD net radiation .tif files can be found here: https://data.csiro.au/collection/csiro:18670?g=net%20radiation&st=keyword&str=47&si=1

.tif files were opened in ArcGIS Pro, projected, extracted to the area of interest, and averaged over the twelve months.

- 2.2 Average daily rainfall (P) Annual daily rainfall NetCDF files for thirty years from 1992 to 2021 were downloaded from Australian climate data SILO website. The NetCDF files can be found in here: https://www.longpaddock.qld.gov.au/silo/gridded-data/ By using Python code in each individual year, the mean rainfall in each year was calculated, consecutively the mean rainfall over the 30 years were calculated. After exporting the final .tif file and opening it into ArcGIS Pro, projected and extracting the area of interest, the pixel values divided by 1000 to convert the rainfall unit from mm to m. Finally, the layer was resampled to 30 m to have the same pixel size as net radiation layer.
- 2.3 Surface temperature (Ta) The maximum and minimum surface temperature NetCDF files for thirty years from 1992 to 2021 were also downloaded from Australian climate data SILO website. The NetCDF files can be found in here: https://www.longpaddock.gld.gov.au/silo/gridded-data/

In ArcGIS Pro, the average surface temperate for each year was calculated by the following equation: Equation 5 (Tmax + Tmin) / 2 The exported .tif file were projected and extracted to the area of interest and resampled to 30 m.

- 2.4 Digital elevation model (DEM) from SRTM The SRTM .tif files were downloaded from the SEED website: https://datasets.seed.nsw.gov.au/dataset/srtm18 The raster file was projected and extracted to the area of interest and snapped to the surface temperature layer.
- 2.5 Lapse rate temperature (Tlapse) Lapse rate standard was mentioned in the introduction section.
- 2.6 Topographic downscaling factor (STD) Topographic downscaling factor was calculated based on the modelled mean monthly shortwave radiation ratio. Mean monthly shortwave radiation ratio was modelled across Australia using topography from the 1 arcsecond resolution SRTM-derived DEM-S and climatic and land surface data. The twelve SRAD modelled short wave ratio layers were used to calculate the mean short ware ratio layer. The 1 arcsecond mosaic SRAD short wave ratio .tif files can be found here: https://data.csiro.au/collection/18731v002

Tif files were opened in ArcGIS Pro, projected and snapped to surface temperature (Ta), extracted to the area of interest, and averaged over the twelve months.

- 2.7 Leaf area index (LAI) Bands 4, 5 and 6 of the Landsat 8 scenes to cover the area of interest were downloaded and mosaiced. By the equation 6, leaf area index was calculated. Equation 6 Band 5 / (Band 4 + Band 6) The Landsat 8 scenes can be found here: https://earthexplorer.usgs.gov/ The final mosaic raster file was projected and snapped to surface temperature (Ta) and extracted to the area of interest.
- 2.8 Maximum leaf area index (LAImax) The leaf area index layer with 30 m pixel size In ArcGIS Pro was aggregated with max aggregation technique to 5000 m. By applying this step, we will have the maximum LAI value in each 5 km which is required in Equation 3.
- 2.9 Topographic adjusted surface temperature (TD) In Python by using equation 3, topographic adjusted surface temperature (TD) can be calculated.
- 2.10 Latent heat of vaporisation (λ) In Python by using Equation 2, latent heat of vaporisation (λ) can be calculated.

References: Nyman et al., 2014. Aust. Met. and Ocean. Journal 64 109-122.

Constraint set

Use constraints

This data is provided under a Creative Commons Attribution 4.0 licence http://creativecommons.org/licenses/by/4.0. Attribute 'NSW Department of Climate Change, Energy, the Environment and Water' in publications using this data.

Limitations on public access

Responsible party

Contact position Data Broker

Organisation name NSW Department of Climate Change, Energy, the Environment and Water

Full postal address NSW

Australia

data.broker@environment.nsw.gov.au

Telephone number 131555

Email address <u>data.broker@environment.nsw.gov.au</u>

Web address https://www.nsw.gov.au/departments-and-agencies/dcceew

Responsible party role pointOfContact

Metadata point of contact

Contact position Data Broker

Organisation name NSW Department of Climate Change, Energy, the Environment and Water

Full postal address NSW

Australia

data.broker@environment.nsw.gov.au

Telephone number 131555

Email address <u>data.broker@environment.nsw.gov.au</u>

Web address https://www.nsw.gov.au/departments-and-agencies/dcceew

Responsible party role pointOfContact

Metadata date 2024-03-25T03:48:00.826879

Metadata language