Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

Metadata Statement

Citation

Title: Spatial and temporal projections of modelled juvenile period for slow-maturing serotinous obligate-seeder plant species in the south-west of Australia.

Custodian: Western Australia Department of Biodiversity, Conservation and Attractions

Description:

Abstract (Purpose/Description of contents of dataset)**:**

By quantifying the length of time after fire for obligate-seeding plant species to become reproductively mature (the juvenile period), the risk of population decline under specific fire intervals can be delineated to inform local fire and conservation management. In this project, juvenile period data for serotinous obligate-seeder taxa across south-west Australia were collated from several studies. Linear models were then developed to estimate juvenile period based on measures of environmental productivity. These models were then spatially projected to the classic and drier Mediterranean agro-climatic class areas (Hutchinson et al. 2005) within south-west Australia. Full details of the modelling can be found in Gosper et al. (2022).

Data are spatial projections of modelled juvenile period based on two metrics: (a) the number of years until 50% of individuals in the population have flowered, and (b) two times (2×) the number of years until 50% of individuals in the population have flowered. Spatial projections of juvenile period under recent conditions and future climate scenarios (2050 and 2090) were produced and are outlined below.

1. <u>JP - recent</u>– Juvenile period as years until 50% of individuals in the population have flowered under recent conditions (30-year period centred on 1990) based on a model featuring the environmental variables mean annual precipitation, annual mean minimum temperature and gross primary productivity. (Fig 5 a in Gosper et al. 2022)

2. <u>JP 2× - recent</u>–Juvenile period as 2× years until 50% of individuals in the population have flowered under recent conditions (30-year period centred on 1990) based on a model featuring the environmental variables mean annual precipitation, annual mean minimum temperature and gross primary productivity. (Fig 5 a – 2× legend)

3. <u>JP - 2050 RCP 4.5</u> – Juvenile period as years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2050) with the RCP 4.5 emissions scenario based on a model featuring annual precipitation. (Fig 5 b)

4. JP - 2× 2050 RCP 4.5 - Juvenile period as 2× years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2050) with the RCP 4.5 emissions scenario based on a model featuring annual precipitation. (Fig 5 b –2× legend)

5. JP – 2090 RCP 4.5 – Juvenile period as years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2090) with the RCP 4.5 emissions scenario based on a model featuring annual precipitation. (Fig 5 e)

6. JP – 2× 2090 RCP 4.5 –Juvenile period as 2× years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2090) with the RCP 4.5 emissions scenario based on a model featuring annual precipitation. (Fig 5 e –2× legend)

7. JP change – Projected change (in years) in juvenile period between recent conditions (Product 1) and 2050 under RCP 4.5 (Product 3). Juvenile period metric is years to 50% of individuals in the population having flowered. (Fig 5 f)

8. JP – 2090 RCP 8.5 - Juvenile period as years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2090) with the RCP 8.5 emissions scenario based on a model featuring annual precipitation. (Fig. S1 in Supplementary Material to Gosper et al. 2022)

9. JP – 2× 2090 RCP 8.5 –Juvenile period as 2× years until 50% of individuals in the population have flowered under future conditions (30-year period centred on 2090) with the RCP 8.5 emissions scenario based on a model featuring annual precipitation. (Fig. S1 – 2× legend)

Search words/Subject:

Juvenile period, fire ecology, climate change, plant conservation, serotinous obligate-seeder

Geographical Location

Location (place names) or IBRA/IMCRA Region (code): Southwest Australian Floristic Region; IBRA Yalgoo, Geraldton Sandplains, Avon Wheatbelt, Swan Coastal Plain, Jarrah Forest, Warren, Coolgardie, Mallee, Esperance Plains.

All WA: no

Geographical Bounding Box

North: -26.485000
South: -35.132500
East: 124.352500
West: 113.800000

Data Currency and Status

Commencement Date: 1/6/2021

Completion Date: 31/10/2021

Status of data: Complete

Maintenance/Update frequency: none planned

Access

Stored Data Format: ESRI shapefile

Location/Directory address:

- RSSA cloud storage: Z:\DEC\SWAFR_ThreatenedFlora_ThreatVulnerability_SPP\PRODUCTS\JuvenilePeriod. Restricted access
- CDDP DBCA ArGIS/QGIS Tools. Menu item: Flora/Juvenile Period. Internal access only
- DBCA Data Catalogue. https://data.dbca.wa.gov.au/dataset/juvenile-period-in-slow-maturing-plants-south-west-of-western-australia. Internal access only.
- DataWA. Details TBA. External access.

Geographic Coordinate System: GDA 1994 (EPSG 4283)

Constraints (access/reliability): The following information provides a summary of the model limitations as noted in Gosper et al. (2022). Refer to these sources for more information.

- Scale - The climate and gross primary productivity mapping and thus the modelled environmental productivity layer is broad in scale and therefore may not take into consideration the extent of small-scale fire refugia, such as wetlands or rock outcrops, that may well enable fire interval-sensitive flora to persist in landscapes with short fire intervals relative to productivity. Similarly, stochastic refugia formed through the interaction of fuel loads, fire weather, fire severity and fire patchiness, can also facilitate persistence of fire interval-sensitive flora in landscapes with short fire intervals relative to productivity.
- Ranges in flora maturation rates - The models were parameterised with the sampled species which had the slowest maturation rate. Unsampled species may have slower rates of maturation which would influence the model outcomes, and species with faster maturation rates are likely to be present in all areas.
- Uncertainty in future climate predictions - For the models of future juvenile period there is greater uncertainty in rainfall predictions with time. Alternative climate models and emission scenarios to those used could also represent plausible futures and thus different forecasts.
- Interpretation - Minimum tolerable fire interval for slow-maturing species may not be same as the ideal interval between fires within a prescribed burning management unit taking other factors, such as previous fire severity and patchiness, post-fire weather and fuel loads, into account.

Data Quality

Lineage:

Data for the environmental productivity predictors were extracted for each juvenile period site location and linear models were constructed using R version 3.6.0. The gross primary productivity data was downscaled from a 0.05 degree to a 0.0025 degree raster grid to be equivalent to the climate data. The most parsimonious modelled relationships for current and future climates were spatially projected in ArcGIS at a scale of a 0.0025 degree (approximately 250m) raster grid. All spatial projections were then multiplied by two to produce rasters for the metric two times (2×)

years until 50% of individuals in the population have flowered. A raster of projected change in juvenile period was calculated by subtracting model 'JP – current' from model 'JP - 2050 RCP 4.5'. Final rasters were masked to the extent of classic and drier Mediterranean agro-climatic class areas (Hutchinson et al. 2005). The juvenile period rasters were classified using a 5-year defined interval and converted to vector format for publication. The projected change raster was classified in 3-year intervals and converted to vector format for publication.

Environmental productivity variables of the most parsimonious model relationships were sourced from the below datasets. Refer to Gosper et al. (2022) for full details.

Harwood, T, Donohue, R, Harman, I, McVicar, T, Ota, N, Perry, J, Williams, K (2016). 9s climatology for continental Australia 1976-2005: Summary variables with elevation and radiative adjustment. v3. CSIRO. Data Collection. https://doi.org/10.4225/08/5afa9f7d1a552

Harwood, T., Donohue, R., Harman, I., McVicar, T., Ota, N., Perry, J., Williams, K. (2014): A selection of 9s gridded climate change variables for continental Australia for biodiversity modelling: 1990, 2050, 2070, 2090; GFDL and ACCESS1.0; RCP 4.5, 8.5. v3. CSIRO. Data Collection. https://doi.org/10.25919/5b989f0b36bab

Zhang, Y., Xiao, X., Wu, X., Zhou, S., Zhang, G., Qin, Y., & Dong, J. (2017). A global moderate resolution dataset of gross primary production of vegetation for 2000–2016. Scientific data, 4(1), 1-13.

Positional Accuracy: Determined by the grid-resolution of the input environmental productivity variables of which the largest resolution was 0.05 degree (gross primary productivity).

Attribute Accuracy: Checked and consistent with published maps.

Logical Consistency: Checked and consistent

Completeness: Complete

Attribute List

Field name	Description
Juvenile period spatial products	
JP_yrs	Juvenile period (in years)
JPx2_yrs	2x Juvenile period (in years)
JP_Comb	Juvenile period and, in brackets, 2x juvenile period (both in years)
Projected change in juvenile period spatial product	
JP_Change	Change in juvenile period (in years)

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Metadata Information

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Additional Metadata

Related information:

Gosper CR, Miller BP, Gallagher RV, Kinloch J, van Dongen R, Adams E, Barrett S, Cochrane A, Comer S, McCaw L, Miller RG, Prober SM and Yates CJ (2022) Mapping risk to plant populations from short fire intervals via relationships between maturation period and environmental productivity. *Plant Ecology* 223, 769-787. https://link.springer.com/article/10.1007/s11258-022-01229-6
To request this paper, from the authors, please use this link on Research Gate and click on "Request full-text PDF".

Gosper C, Miller B, Kinloch J, van Dongen R, Adams E, Barrett S, Cochrane A, Comer S, McCaw L, Miller R, Yates C, Gallagher R and Prober S (2022) Estimation of juvenile period in slow-maturing plants over space and time. *Biodiversity and Conservation Science Information Sheet 109/2022. On-line:* https://www.dpaw.wa.gov.au/images/Estimation%20of%20juvenile%20period%20in%20slow-maturing%20plants%20-%20Science%20Information%20Sheet%20109.pdf

Hutchinson MF, McIntyre S, Hobbs RJ, Stein JL, Garnett S, Kinloch J (2005) Integrating a global agro-climatic classification with bioregional boundaries in Australia. Global Ecol. Biogeogr. 14:197-212.

SPP No.:

2000-015; 2010-011; 2018-073

Size of the datasets:

Total size of the five datasets in 14.2M

Location of documentation (internal):

Z:\DEC\SWAFR_ThreatenedFlora_ThreatVulnerability_SPP\PRODUCTS\JuvenilePeriod\Documentation\Calculation of juvenile period from climate predictors - documentation.docx

Where has the data been backed up/archived (internal)?

RSSA Cloud Storage

Retention and disposal assessments (internal):

Spatial Products – Retain in Agency

Spatial Intermediate files - Destroy 5-7 years