Project Plan 2011-10

Project title

Plant species richness and endemism within the south-western Australian Floristic Region

Science and Conservation Division Program

Ecoinformatics

Parks and Wildlife Service

Service 2: Conserving Habitats, Species and Ecological Communities

Staff

Role	Person	Time allocation (FTE)
Supervising Scientist	Paul Gioia	0.2
Research Scientist	Prof Stephen D Hopper (The University of Western Australia)	0.0

Location

IBRA / **IMCRA regions** All IBRA Regions, All IMCRA Regions
NRM Regions All NRM Regions
DPaW Regions All DPaW Regions
DPaW Districts All DPaW Districts
Locations of field work have to be registered in the Scientific Sites Register. To make this project discoverable in the spatial search of the Departmental data catalogue, register and geo-locate data sets generated from this project.

Related Science Projects

Proposed period of the project

None – None

Parks and Wildlife Service

Service 2: Conserving Habitats, Species and Ecological Communities

Endorsements

Relevance and Outcomes

Background

This project was initiated in 2003 as a collaboration between Stephen Hopper, then CEO Kings Park, and Paul Gioia, then Senior Research Scientist at WA Herbarium, DEC. The intention was to investigate the use of Herbarium specimen data in exploring patterns of plant biodiversity within Western Australia. While some studies had investigated various aspects of plant biodiversity (Lesueur, Perth, Stirling Range, Fitzgerald

River, and western wheatbelt - see Brown, 1832; Diels, 1906; Speck, 1958; Hopper, 1979; Gibson et al., 1997; Hopper & Burbidge, 1990), none had used the Herbarium collection or employed the latest technology to analyse all available data across a broad scale. If resultant analyses could be demonstrated to closely approximate true biodiversity, outputs could be used to inform further research and conservation planning.

Aims

- To generate and explore patterns of plant species richness and endemism at a range of scales for the whole flora of the Southwest Australian Floristic Region (SWAFR) using locality records specimens in the Western Australian Herbarium.
- To test for the effect of bias on these patterns
- To develop a new phytogeographic map based on patterns of species richness and endemism

Expected outcome

- Improved understanding of plant biodiversity patterning within Western Australia
- An additional spatial layer to better inform conservation planning and resource prioritisation

Knowledge transfer

Researchers Conservation planners Community groups Outputs and findings will be distributed through both the traditional publication process as well as various digital and online mechanisms that will provide a permanent point of access.

Tasks and Milestones

- Initial analysis (January, 2003)
- Workshop to assess interim results and methodology (June, 2003)
- Refined analysis (December, 2003)
- Submit for publication (December, 2008)
- Revise sampling effort bias analysis methods (September, 2011)
- Revise methodology for determining floristic regionalisation (November, 2011)
- Resubmit Gioia & Hopper for publication (December, 2011)
- Resubmit Hopper & Gioia paper for publication (February, 2012)

References

Belbin, L. (1995) PATN User's Guide. CSIRO Sustainable Ecosystems. Available from: http://www.cse.csiro.au/client_serv/software/patn.htm.

Brown, R. (1832) General view of the botany of the vicinity of Swan River. Journal of the Royal Geographical Society, 1: 17-21.

Colwell, R.K. (2009) EstimateS: Statistical estimation of species richness and shared species from samples. Version 8.2. User's Guide. Department of Ecology & Evolutionary Biology, University of Connecticut. Available from: http://viceroy.eeb.uconn.edu/EstimateSPages/EstSUsersGuide/EstimateSUsersGuide.htm. Last accessed on 20th January, 2010.

Diels, L. (1906) Die Pflanzenwelt von West-Australien sudlich des Wendekreises. In Vegetation der Erde 7. Engelmann, Leipzig.

Gibson, N., Keighery, G.J. & Keighery, B.J. (1997) Contributions of N.H. Speck to the biogeography of Proteaceae in Western Australia. Journal of the Royal Society of Western Australia, 80(2): 73-77.

Gotelli, N.J. & Entsminger, G.L. (2010) EcoSim: Null models software for ecology Version 7. Acquired Intelligence Inc. & Kesey-Bear, Jericho, VT 05465. Available from: http://garyentsminger.com/ecosim.htm. Last accessed on 13th January, 2011.

Hopper, S.D. (1979) Biogeographical aspects of speciation in the southwest Australian flora. Annual Review of Ecological Systems, 10: 399-422.

Hopper, S.D. & Burbidge, A.A. (1990) Significance of the Lesueur Area, pp. 111-115. In Nature Conservation, Landscape and Recreation Values of the Lesueur Area: A Report to the Environmental Protection Authority from the Department of Conservation and Land Management, EPA Bulletin 424 (eds. A.A. Burbidge, S.D. Hopper & S.v. Leeuwen). Environmental Protection Authority, Perth.

Laffan, S.W. & Crisp, M.D. (2003) Assessing endemism at multiple spatial scales, with an example from the Australian vascular flora. Journal of Biogeography, 30(4): 511-520.

Speck, N.H. (1958) The vegetation of the Darling - Irwin botanical districts and an investigation of the family Proteaceae in south Western Australia. 2 vols. PhD Thesis. University of Western Australia, Perth.

Study design

Methodology

The initial study design was as follows:

- Calculate raw species richness and endemism with a 0.25 degree (approx) grid overlaying SWAFR
- Normalise for sample effort by randomly sub-sampling from points within each grid and averaging the results over 100 random subsamples
- Nominate nodes of localised richness using normalised dataset
- For each node generate a species list
- Classify each node by generating a of pairwise similarities using a dissimilarity matrix based on presence / inferred absence and the Czekanowski metric (Belbin, 1995).
- Repeat the process for each sub-sampled datasets to generate 100 dissimilarity matrices.
- Classify associations using standard agglomerative hierarchical fusion technique (flexible UPGMA)
- Average dissimilarity values for each node pair combination across all samples to produce a single average association matrix.
- Group sites by nodes and classify by similarities in species composition.

Re the normalisation methodology, subsequent reviewers' comments indicate a preference for the use of recently popular rarefaction methodologies such as those available from (Colwell, 2009). While the methodology described above is in fact rarefaction, methodology will be specifically revised to use the techniques described by (Colwell, 2009).

Additionally, nodes of richness will be analysed using null models (Gotelli & Entsminger, 2010; Laffan & Crisp, 2003) to determine if richness nodes are purely random.

The methodology for classifying richness nodes will be largely retained.

Biometrician's Endorsement

required

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

not required

Data management

Digital outputs will be archived in EcoBase and displayed in NatureMap.

Data Manager's Endorsement

None

Consolidated Funds

Source	Year 1	Year 2	Year 3
FTE Scientist FTE Technical Equipment Vehicle Travel Other Total			

External Funds

Source	Year 1	Year 2	Year 3
Salaries, Wages, OVer-time Overheads Equipment Vehicle Travel Other Total			

Endorsements

Endorsements and approvals as of June 12, 2015, 11:06 a.m.:

Project Team	granted
Program Leader	granted
Directorate	granted
Biometrician	required
Herbarium Curator	not required
Animal Ethics Committee	not required