Mind the gap: navigating baseline data needs and uncertainty in compliance-based restoration

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Acknowledgement of Country

We acknowledge the traditional custodians throughout Western Australia and their continuing connection to, and deep knowledge of, the land and waters. We pay our respects to Elders both past and present.

Makuru*: Season of fertility. 'Makuru' is represented by the colour dark blue as it symbolises rain and cold weather.* Many animals are be pairing up in preparation for breeding in the coming season. If you look carefully, you might see pairs of 'wardongs' (ravens) flying together. Blues and purple flowers of the blueberry lily *(Dianella revoluta)* and the purple flags *(Patersonia occidentalis) start to emerge.*

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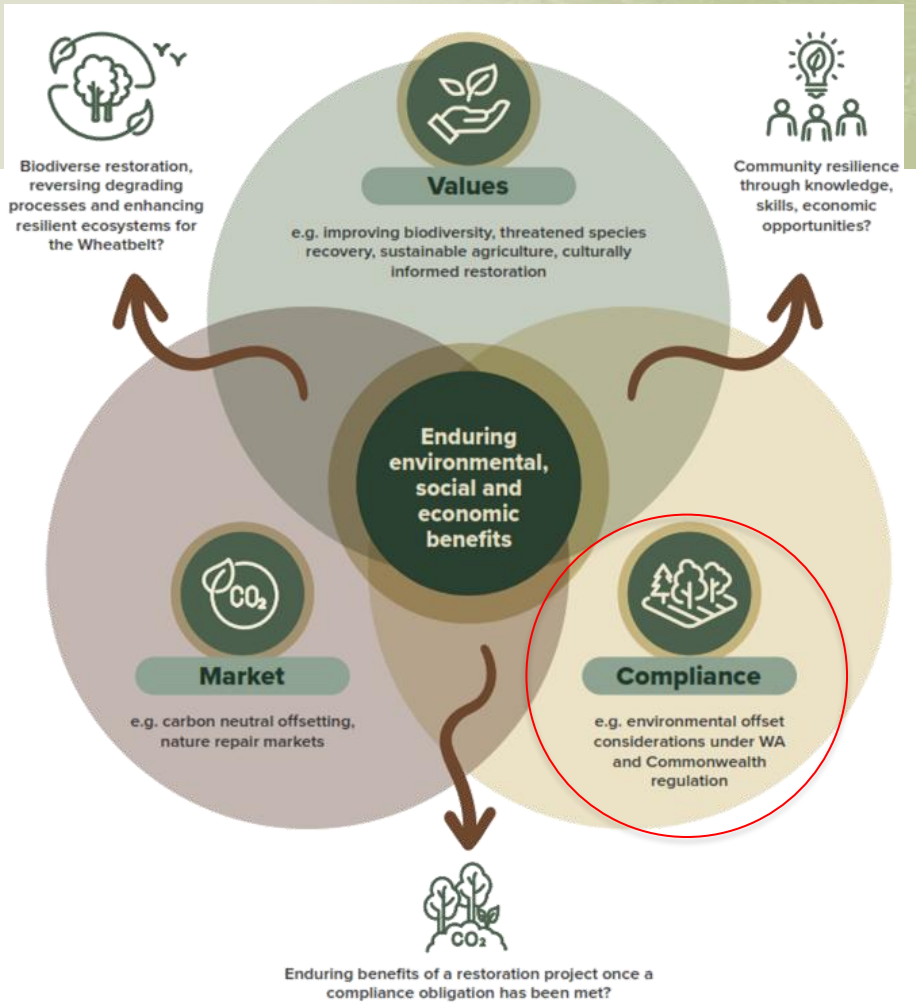
Restoration in Western Australia

- Ecological restoration in Western Australia is undergoing a rapid evolution.
- There are many drivers for restoration e.g. voluntary, market, compliance.
- Increasing in scale, increasing level of recovery.
- Compliance-led restoration plays a critical role in restoring endangered ecological communities and their associated values.
    - Restoration post impact
    - Restoration for offset



Restoration in EIA and beyond…

While Western Australia applies a consistent approach for Environmental Impact Assessment pre-disturbance, we do not have the same rigor for assessing post-disturbance restoration.

- Inconsistent data collection (what, when and where)
- Incompatibility of datasets, lack of shared learning
- Poorly performing sites often due (but not limited) to:
  - Not having the right data
  - Not monitoring at appropriate intervals
  - Lack of adaptive management

Physical conditions of the soil

Species tolerance to altered cond.

Supply chain

Seasonal & long-term climate

Recovery trajectories

Level of recovery

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What data do we / do we not collect for EIA?

- Baseline data collection is informed by formal technical guidance e.g.
  - Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020).
  - Flora and vegetation surveys for environmental impact assessment (EPA 2016a).
  - Sampling of short-range endemic invertebrate fauna (EPA 2016b).
  - A guide to managing and restoring wetlands in Western Australia (DEC 2012).
- But this does not capture all information needed to inform restoration projects.
- We need baseline data for impact and reference sites.
- No WA Gov or federal technical guidance for restoration (currently).
  - Noting SERA engagement with DCCEEW National Standards
  - WA EPA recognises the critical role for Restoration in offsetting (EPA 2024)

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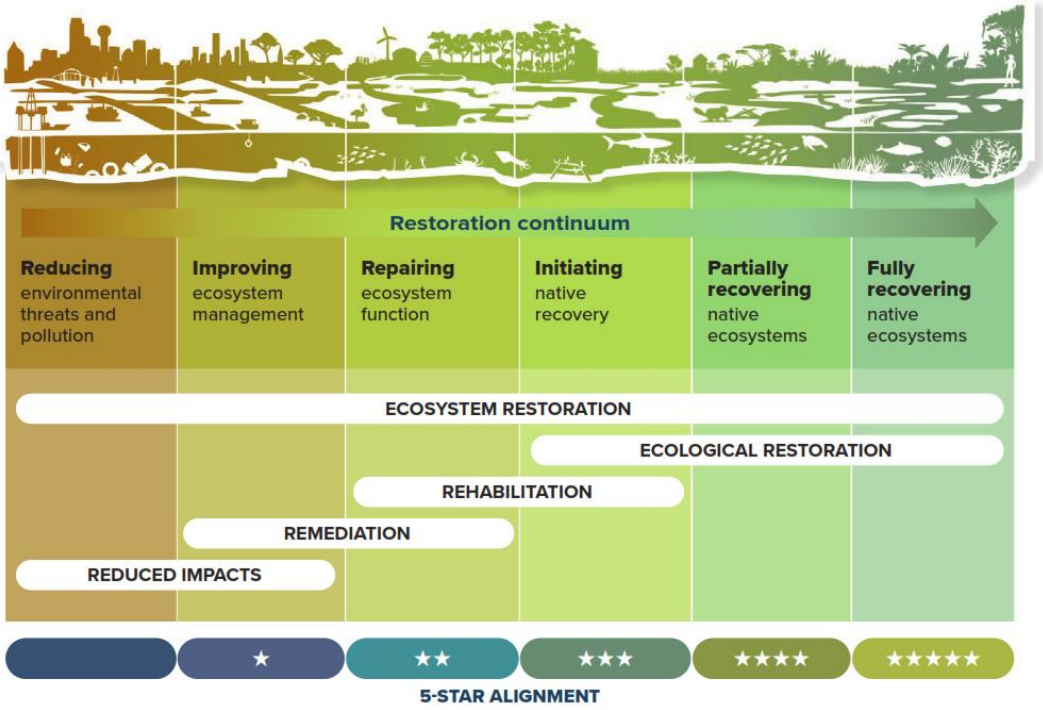
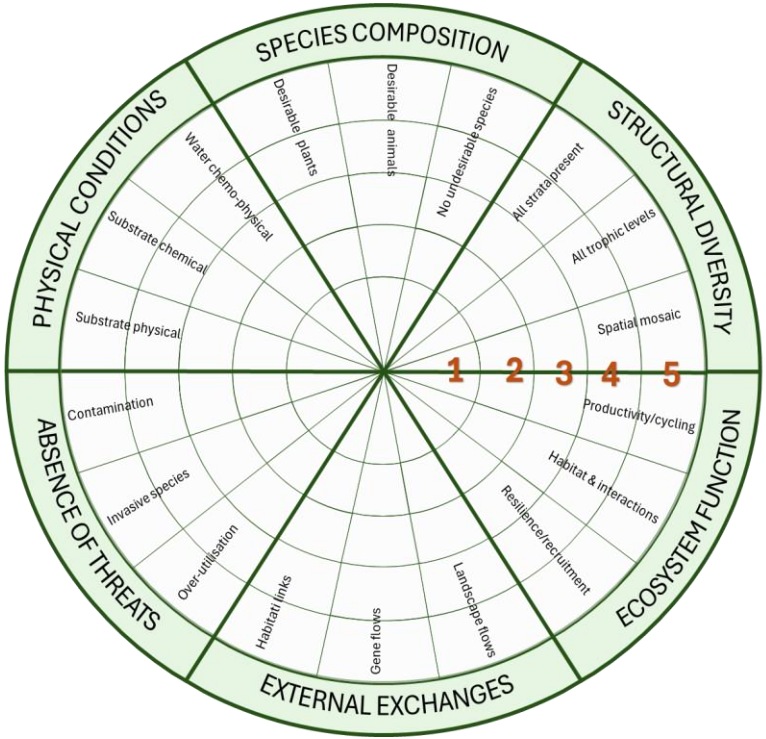
Standards-based restoration

- Approach informed by SERA (Standards Reference Group 2021) & SER (Gann et al. 2019)
- Consistent, repeatable and scalable approaches, using a restorative continuum and 5-star recovery system

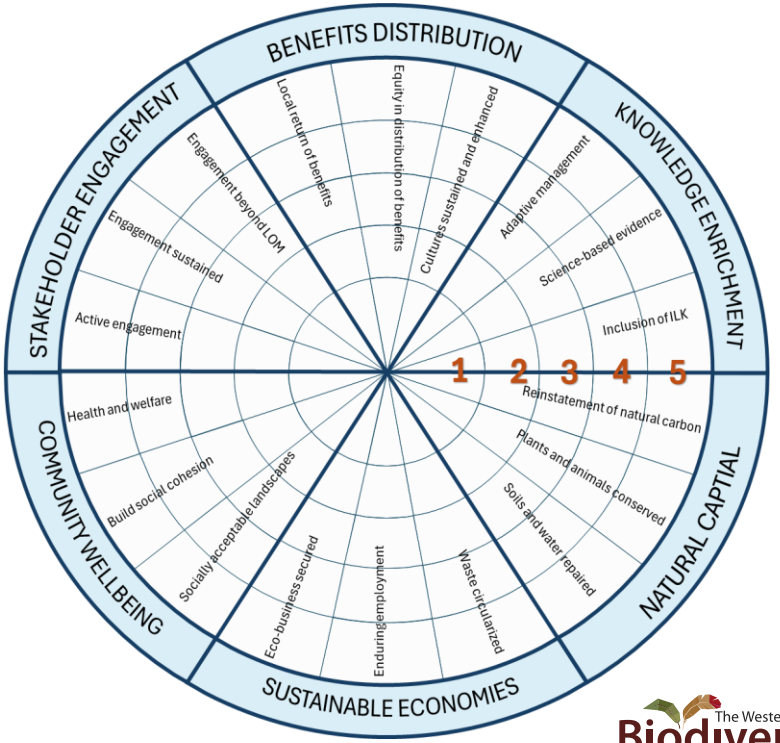


A monitoring framework for restoration

Ecological Recovery



Social Benefits



From Gann et al. 2019 - see Young et al. 2022 for mining-specific wheels

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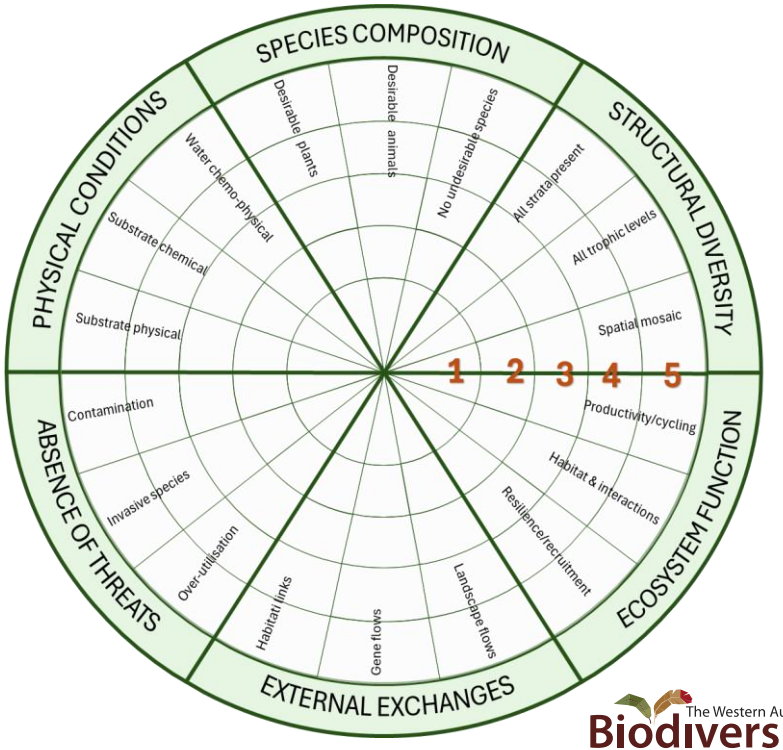
Why so much data?

- As a restored ecosystem matures the most important / informative attributes are in flux e.g.
  - Implementation → Absence of threats, Physical conditions
  - Establishment → Species composition, Structural diversity
  - Maturation → Ecosystem function, External exchanges

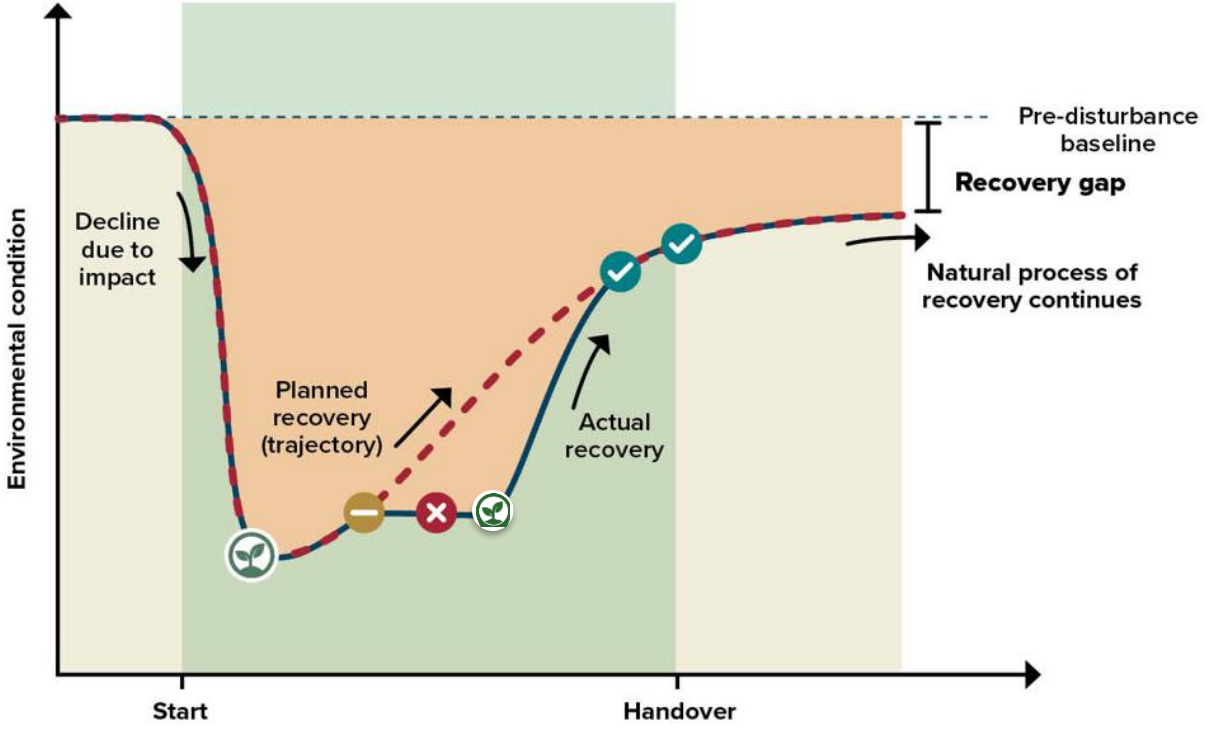
Ecological Recovery



Baselining for monitoring

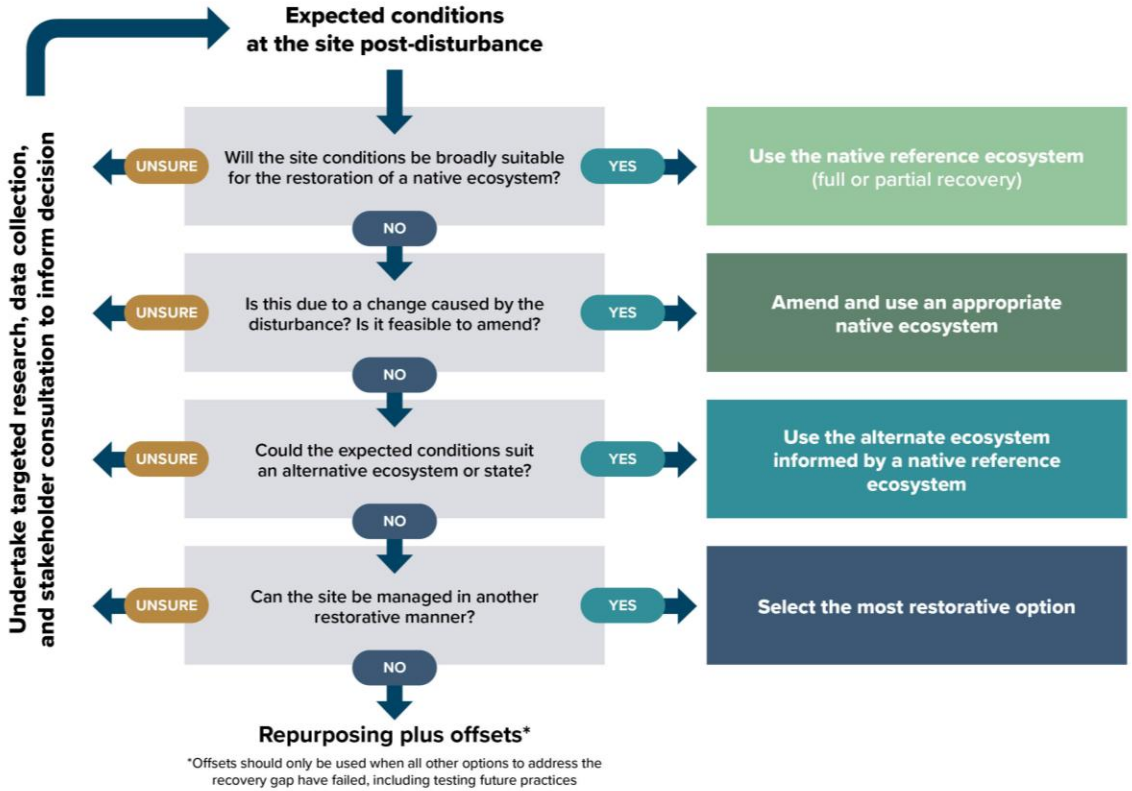
Baseline data for all attributes is needed to monitor trajectory

- Objective **is** being met. Low risk of not meeting goal
- Objectives **are not** being met. Medium risk of not meeting goal
- Objectives **are not** being met. High risk of not meeting goal
- Restoration activity



Selecting references for restoration

- Multiple references may be needed.
- Ideally represent an intact natural system.
- Historic reference state may not be possible.
- Ecosystem dynamics within sites coupled with climate change can limit the suitability of local reference.
- Need to agree on the reference at EIA.



What baseline data do we already collect? Is it sufficient to inform restoration?

SER Ecological Benefits Recovery Wheel		Typically collected in baseline EIA (desktop or detailed survey with examples)
Ecological Attribute	Sub-attribute	
Absence of threats	Contamination	
	Invasive species	Abundance and level of risk
	Over-utilisation	
	Other degradation drivers	Level of disturbance
Physical Conditions	Water chemo-physical conditions	
	Substrate chemical conditions	
	Substrate physical conditions	
Species Composition	Desirable plants	Richness and abundance
	Desirable animals	Richness and abundance
	Rare and threatened species	Presence/ abundance
	No undesirable species	Presence/ abundance
	Provenance, genetic diversity and genetic resilience	
Structural diversity	All vegetation strata	Vegetation structure
	All trophic levels	Trophic levels (e.g. producers, consumers)
	Spatial mosaic	Vegetation structure and composition
Ecosystem Function	Productivity/cycling	Course woody debris
	Habitat & interactions	Nesting/denning
	Resilience/recruitment	
External Exchanges	Landscape flows	Movement of matter/ organisms
	Intraspecific gene flow	
	Habitat links	Habitat corridors

Example indicators, purpose and associated data points for monitoring attributes

(see Appendix 10 Bishop & Young in press for more!)

SER Ecological Benefits Recovery Wheel		Example indicators
Ecological Attribute	Sub-attribute	
Absence of threats	Contamination	Concentration of pollutants or harmful substances Area of exposure/existing contaminant
	Over-utilisation	Species composition Tree damage Richness and abundance of undesirable species Vegetation % cover
Physical Conditions	Water chemo-physical conditions	Chemical condition Physical condition
	Substrate chemical conditions	Soil chemical properties
	Substrate physical conditions	Soil parameters Biological indicators Hydrological conditions
Species Composition	Provenance, genetic diversity and genetic resilience	Seed source location and corresponding characteristics Seed quantity Plant species provenance Genetic composition
Ecosystem Function	Resilience/recruitment	Seedling recruitment Food web interactions Resilience to disturbance
External Exchanges	Intraspecific gene flow	Observed pollinators (e.g. insects, birds) and travel distance Genomic data

Integrating standards-based restoration information into EIA

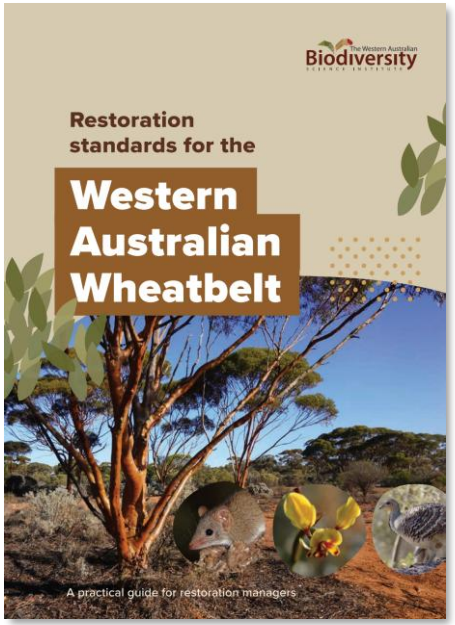
- Much of the data for standards-based restoration is already being collected.
- With appropriate planning, missing data could be incorporated into baseline assessments.
- Combination of field and remote sensing data can be used to maximise efficiencies.

Integrating standards-based restoration information into EIA

We need to be thinking about:

- Understanding the system, not just the flora and fauna.
- Understanding the properties of the post-impact or advanced offset site.
- Determining the most appropriate reference.
- Building a data collection and monitoring framework that can remain consistent for the project entirety.
- Incorporating research trials to begin to fill knowledge gaps.
- Recognising compliance-based restoration requires monitoring and adaptive management.

Coming soon



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References

- Bishop and Young (in pub) Restoration Standards for the Wheatbelt. WABSI
- DEC (2012) A guide to managing and restoring wetlands in Western Australia. Department of Environment and Conservation, Perth, Western Australia.
- EPA (2020) Terrestrial vertebrate fauna surveys for environmental impact assessment. Technical Guidance. Environmental Protection Authority, Western Australia.
- EPA (2016a) Flora and vegetation surveys for environmental impact assessment. Technical Guidance. Environmental Protection Authority, Western Australia.
- EPA (2016b) Sampling of short range endemic invertebrate fauna. Technical Guidance. Environmental Protection Authority, Western Australia.
- EPA (2024) Public Advice: Considering Environmental Offsets at a Regional Scale. Environmental Protection Authority, Western Australia.
- Gann, G.D., McDonald, T., Walder, B., Aronson, J., Nelson, C.R., Jonson. J., et al. (2019) International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology 27: S1–S46
- Standards Reference Group (2021) National Standards for the Practice of Ecological Restoration in Australia. 2.2 ed. Society for Ecological Restoration Australasia. https://www.seraustralasia.org
- Young, R.E., Gann, G.D., Walder, B., Liu, J., Cui, W., Newton, V., Nelson, C.R., Tashe, N., Jasper, D., Silveira, F.A.O., Carrick, P.J., Hägglund, T., Carlsén, S. and Dixon, K. (2022) International principles and standards for the ecological restoration and recovery of mine sites. Restoration Ecology, 30: e13771. https://doi.org/10.1111/rec.13771

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