GISERA
Gas Industry Social and Environmental Research Alliance

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BIODIVERSITY FACTSHEET

Guidelines for plant population offsetting

Science-based recommendations for four different plant groups from the Brigalow area

Biodiversity offsetting is a policy tool used to compensate for impacts on biodiversity from development activities. Current biodiversity offsetting guidelines frequently lack scientific support when choosing appropriate plant population sizes needed to consistently maximise long-term population viability.

KEY POINTS

- Estimated offset ratios (this ratio varies between plant groups), specific recommendations and associated management actions for each plant group to maximise long-term population viability and reduce the possibility of over-or underestimating offset sizes.
- Mitigating mortality factors (e.g. fire, inbreeding depression, weed competition) is as important as choosing appropriate offset sizes to increase offset success.
- For all plant groups, maintaining population connectivity and gene flow is essential to decrease extinction risk.
- Combined management actions to increase spatial availability and genetic diversity increases population viability and population persistence up to 50%. This is particularly important in short-lived species with self-incompatibility mating systems.

Importance of science-based guidelines

Currently determining a population size for the purpose of biodiversity offsetting is generally based on the 'precautionary principle', so the larger the population the better to ensure population survival. However, this principle can inflate (or underestimate) the required number of individual plants to ensure population viability and this widespread use is not underpinned by rigorous evaluation of plant biology, ecology and genetics. In general this practice decreases the effectiveness and success of offsets.

In this study, researchers have developed science-based population offsetting guidelines for four different plant groups (eucalypts, *Acacia*, forbs and grasses) from the Brigalow area based on their life-history and ecology. Guidelines taking biological differences into account can help to improve current population offsetting practices by making them more cost-effective as well as increasing the chances of success of plant population offsetting.

A simulation model was developed for each plant group. The simulation modelling analysis was specifically done to:

1. Identify key biological traits essential for reproduction and survival for each plant group.
2. Estimate offset sizes that maximise population viability under different scenarios.

***Acacia*, commonly known as wattles, in front of a stand of eucalypts**

Everlasting daisy (*Xerochrysum bracteatum*)

Recommendations for population offsetting for each plant group studied

Plant group	Key vital rates	Main threats	Offset ratio	Main recommendation
Eucalypts	Mortality of early age classes	Fire, leaves and twigs being eaten, inbreeding if fragmentation is severe	≥ 10:1	Mitigation and control of external mortality factors on offset sites with pre-existing populations more important than propagation. This is particularly important for young age classes.
Acacia	Adult and seed mortality	High intensity fire	≥ 4:1	Fire regime controls are important for viability of this group. Offsets preferably close to other populations.
Forbs	Adult mortality	Habitat fragmentation, fire, weeds	≥ 7:1	Multiple offset sites with high connectivity are recommended as well as control for external mortality factors affecting reproductive individuals. Mixing provenance and removing weeds is highly recommended. Propagation can be effective.
Grasses	Seed germination rates and adult mortality	Weeds, fire	10:1	More research needed, high uncertainty. Weed and fire control and mitigation necessary to ensure population viability. Propagation could be effective, however uncertainty is large.

Recommendations

Biological differences are important considerations for biodiversity offsetting. Guidelines taking such differences into account can help to improve current population offsetting practices by making them more cost-effective as well as increasing the chances of success of plant population offsetting. More generally, science-based policies will help managers and government and state agencies to generate more effective and efficient regulations.

Before planning a plant population offset program, consider the following:

- Apply offset ratio and management actions tailored to each plant group.
- Use modelling and population viability analysis as complementary tools to predict extinction risk.
- Report demographic data and success rate from offset monitoring to inform future plant population offset planning.
- Implement research project offsets when levels of uncertainty, such as lack of biological knowledge of the targeted species, are high to maximise the success of the offset plan.
- Offset sites should be closely connected to other populations allowing gene flow between them. This is essential to avoid the negative effects of inbreeding.

Bush tomato (*Solanum sp.*)

ABOUT GISERA

The Gas Industry Social and Environmental Research Alliance (GISERA) is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research. Visit gisera.csiro.au for more information about GISERA's governance structure, projects and research findings.

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