Environmental factors affecting the occurrence and abundance of the Pink-tailed Worm-lizard *(Aprasia parapulchella)* in the Australian Capital Territory

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Abstract

The effect of human-induced land use changes on biodiversity and ecosystem functioning is something that we will increasingly need to grapple with. The loss and decline of the habitat of species as a result of agricultural practices is one of the most pervasive threats to biodiversity and current conservation measures are not successfully offsetting the effects of this threat.

The Pink-tailed Worm-lizard *(Aprasia parapulchella)* is a disturbance sensitive species of legless lizard which is listed as threatened at national and state levels in Australia. The loss and decline of its habitat, as a result of agricultural practices, are thought to be the major causes of its decline across its distributional range. However, the relationship between the occurrence of this lizard and agricultural disturbance has not been examined in detail and previous researchers have identified this gap in the knowledge about this species. Currently, there is no synthesis of existing knowledge about *A. parapulchella* and the information is not contained in the published scientific literature. Such a synthesis, combined with a more detailed investigation of the environmental correlates of occurrence and predicted distribution of the species, is likely to aid conservation efforts directed towards the species.

I aimed to address these gaps in the knowledge of the species at both the patch and landscape/regional scales. In this thesis I provide a synthesis of the existing knowledge on the life-history and ecology of *A. parapulchella*. In addition, I investigate the factors driving occurrence and abundance of *A. parapulchella* in the ACT at the regional and patch scale.

Species distribution models are increasingly common tools being used for predicting and explaining the distribution of species in space. These models are often used over a broad spatial scale. I used MaxEnt to examine the relationship between environmental factors and the occurrence of *A. parapulchella* at the regional scale using a fine grained analysis (30m resolution). I also applied the novel use of a remotely-sensed classification discriminating between C3 and C4 grasses within the model as a way of incorporating agricultural modification as a variable. The results confirmed previously described relationships and add to the existing knowledge. Soil type and geology made the highest contributions to the model (29.4% and 20.3% respectively) followed by slope (15.5%), average minimum temperature in October (13.2%), average rainfall in October (12.1%) and agricultural modification (9.5%). New associations between likelihood of occurrence of *A. parapulchella* and climatic variables were described. In addition an association between *A. parapulchella* and a Devonian-age geological unit was identified for the first time in the Australian Capital Territory.

As I found that agricultural modification contributed to a species distribution model for the occurrence of *A. parapulchella* in the Australian Capital Territory, the question of the importance of this variable arose. Comparing models with and without agricultural modification may also be a useful method to quantify habitat loss and degradation. I compared models with and without the agricultural modification variable in order to assess the extent to which incorporating agricultural modification improved the model. Including agricultural modification led to a lower likelihood of predicting false positives ($t = 2.32$; $p = 0.021$), whilst the likelihood of correctly predicting presence was not significantly different between models with and without agricultural modification. The model with agricultural modification predicted more native grassy vegetation, whilst the model without the variable predicted more exotic/degraded native grassy vegetation. The results of the modelling suggest that at least approximately 40% of optimal habitat has declined in condition or been lost in the

evaluation area used in the study and at least approximately one-quarter of optimal habitat has been lost or degraded in the Australian Capital Territory.

In order to investigate the factors influencing occurrence and abundance of *A. parapulchella* at the patch scale, the abundance of *A. parapulchella* were recorded at sites of varying levels of disturbance. Vegetation indicators of disturbance were derived and a range of habitat attributes measured. The data were analysed using boosted regression trees. Vegetation indices associated with disturbance were the best predictors in the model. The percentage cover of large tussock grasses was identified as particularly influential in the model. Other habitat variables made minor contributions to the model.

Taken together, the results suggest that loss and degradation of the ground layer habitat of *A. parapulchella*, as a result of agricultural modification, has historically been the major driver of decline of the species across its range. Whilst forestry and urbanisation remain significant threats that need to be addressed simultaneously, their direct impact is often more immediately obvious compared to those associated with agricultural modification. The findings of my research suggest that, on private land, management that maintains rocky habitat with a substantial cover of grasses from the large tussock functional group (as well as suitable native grassy connections between rocky areas) will provide the best chance for maintaining viable populations of *A. parapulchella*

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