

# **5. Evaluation of environmental surrogates: III. Application of methodology to data from arid north west NSW**

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## **5.1 Introduction**

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The evaluation techniques applied to surrogates for forested north east NSW in Section 4, were also used to evaluate a completely different set of surrogates using biological survey data collected at Sturt National Park in arid north west NSW. This survey was conducted by NSW NPWS scientists R.L. Pressey and V.S. Logan and the data were kindly made available for use in this consultancy prior to the data, or any analyses of the data, being published elsewhere.

The original survey was conducted in 1991 and the dataset was later supplemented by a return survey in 1993. The purpose of Pressey and Logan's research project is to test the value of using mapped land descriptors as a basis for conservation planning. The surveys have collected floristic data at 160 sites stratified in relation to geology, landform, land system and land unit.

The data have been analysed in this consultancy simply to demonstrate the applicability of the evaluation techniques developed in Section 3 to an environment radically different from forested north east NSW. The evaluation is far less rigorous than that performed for north east NSW and is not intended to serve as a definitive test of surrogate performance in arid north west NSW.

Only the Species Accumulation Index was employed in this evaluation.

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## **5.2 Biological data utilised**

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Locations of flora survey sites were stratified according to the hierarchical design presented in Table 5.1. The distribution of sites in geographical space is depicted in Figure 5.1. A total of 160 sites were divided evenly between the two mapped geologies of Bedrock and Aeolian deposits. The 80 sites within Aeolian deposits were divided evenly between the two landforms of Dune Fields and Sand Plains while the 80 Bedrock sites were divided evenly between the landforms of Tablelands and Rolling Downs. Within each landform sites were further stratified against land systems and land units. The net result of this stratification was that 10 replicated survey sites were located within each combination of geology, landform, land system and land unit.

At each survey site all species of vascular plants were recorded, with a total of 312 species recorded at the 160 sites. Only data from the first survey, conducted in winter 1991 after a drought, were available for evaluation in this consultancy. Data from the second survey, conducted in autumn 1993 after rains, were not yet available for analysis.

**Table 5.1** Hierarchical relationship of mapped land descriptors used to stratify 160 flora survey sites in Sturt National Park.

Geology	Landform	Land System	Land Unit	Survey sites			
Aeolian deposits	Dune Field	Binerah	Dune	10			
			Swale	10			
		Corner	Dune	10			
			Swale	10			
	Sand Plain	Rodges	Rise	10			
			Flat	10			
		Nucha	Rise	10			
			Flat	10			
			Bedrock	Tablelands	Pulgamurtie	Drain	10
						Crest	10
Quarry View	Drain	10					
	Crest	10					
Rolling Downs	Onepah		Drain	10			
			Crest	10			
	Olive Downs		Drain	10			
			Crest	10			

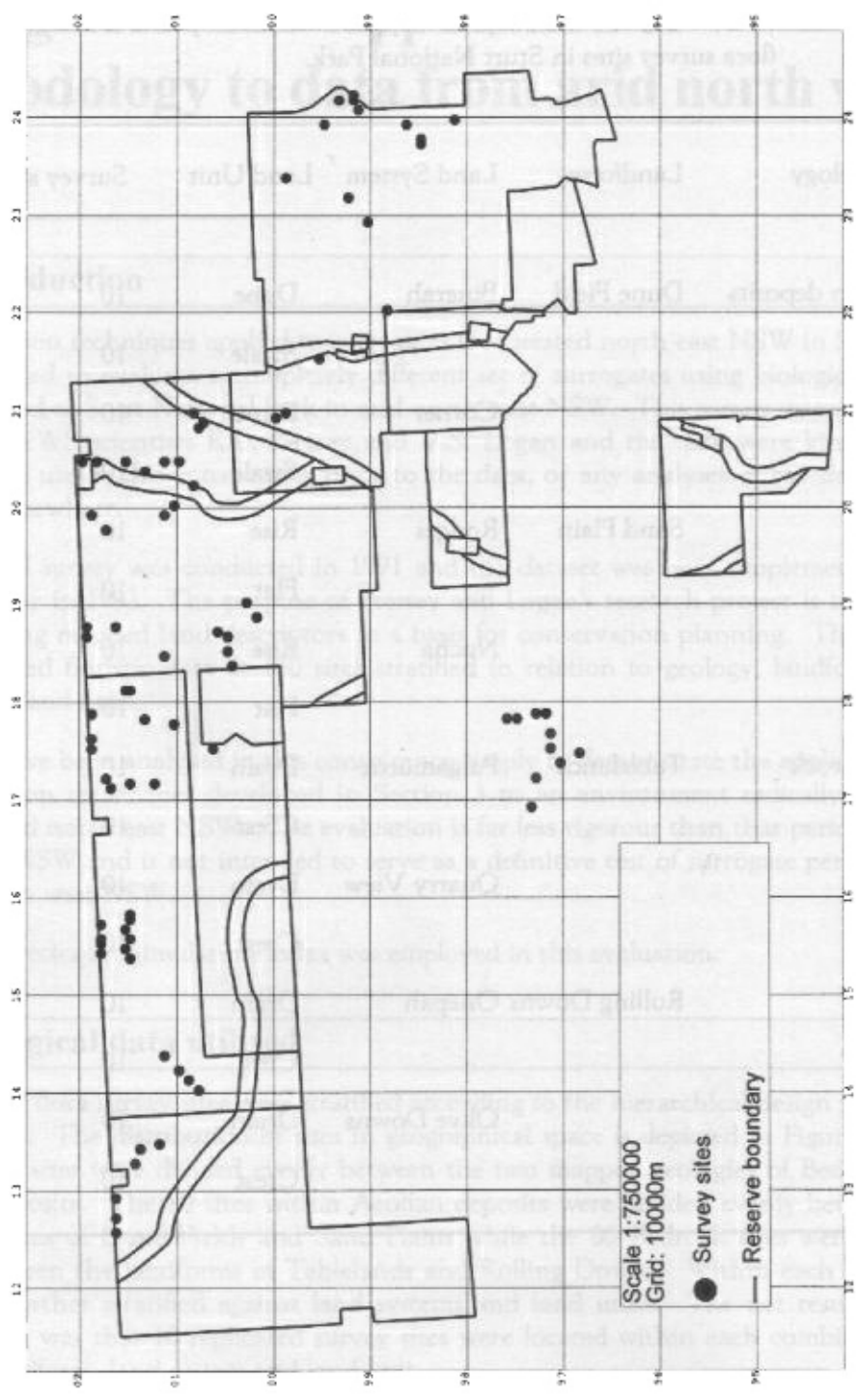


Figure 5.1 Survey sites used to evaluate surrogates in and near Sturt National Park.

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### 5.3 Environmental surrogates evaluated

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Five surrogates were derived directly from the mapped descriptors listed in Table 5.1. These descriptors are mapped on 1:250,000 Land Systems maps produced by the Soil Conservation Service of NSW. The five surrogates derived from this mapping were:

1. Geology (0/1 distance). A sites-by-sites surrogate distance matrix was generated in which a 0 indicated a pair of sites occurring within the same geological class and a 1 indicated a pair of sites occurring in different geological classes.
2. Landform (0/1 distance). This surrogate matrix contained 'distances' which were 0 for pairwise equality of mapped landform and 1 for pairwise inequality.
3. Land System (0/1 distance). This surrogate matrix contained 'distances' which were 0 for pairwise equality of mapped land system and 1 for pairwise inequality.
4. Land Unit (0/1 distance). This surrogate matrix contained 'distances' which were 0 for pairwise equality of mapped land unit and 1 for pairwise inequality.
5. Land System (land system distance). This surrogate matrix was designed to improve on the previous two by taking into account the hierarchical classification of land system elements into land systems (Stewart 1953). It contained 'distances' which were 0 for pairwise equality of mapped site land unit, 1 for different land units in the same land system, and 2 for land units in different land systems.

An additional surrogate was derived from species modelling. The modelling technique used was generalised linear modelling and models were constructed using the forward stepwise procedure described in Section 4.3.6. The 160 survey sites were divided randomly into two sets, each containing 80 sites. The first set was used to derive models while the second set was used to evaluate the performance of those models. Geology, landform, land system and land unit were used as predictors. Each of these variables was treated as a factor such that geology had two levels, landform had four levels, land system had eight levels and land unit had six levels (see Table 5.1). The surrogate performance of species modelling was evaluated by generating a species accumulation curve directly from the raw predicted probabilities of species occurrence, using the approach described in Sections 3.4.2 and 4.3.5.

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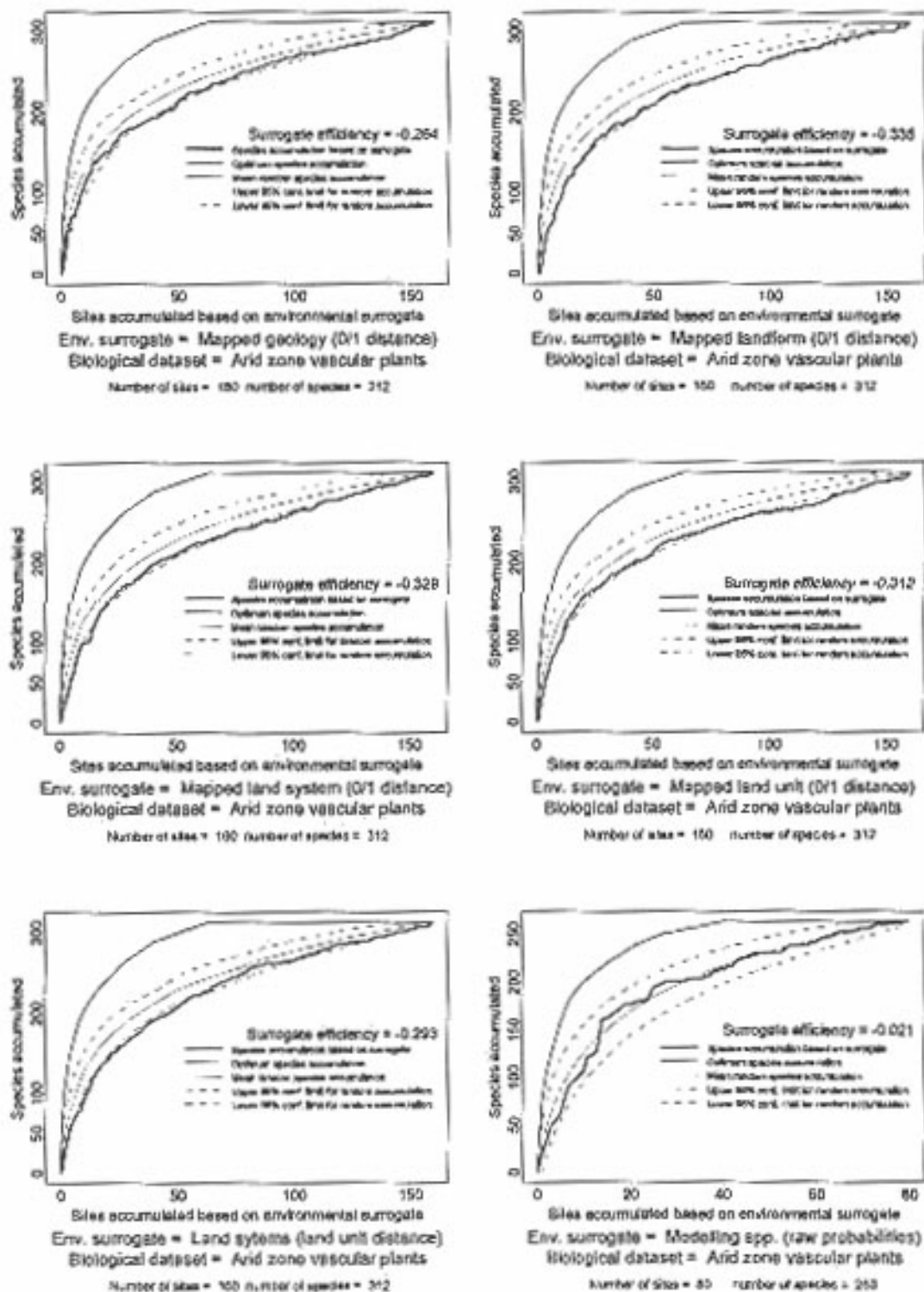
### 5.4 Results and discussion

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Species accumulation curves derived using each of the six surrogates are presented in Figure 5.2. None of these curves achieved significantly better performance than a curve derived by selecting sites in a random sequence. The poor performance of the six surrogates is reflected in the estimated values for the Species Accumulation Index, all of which are negative.

The results presented in Figure 5.2 are consistent with preliminary analyses conducted by Pressey and Logan using different analytical techniques. It appears that mapped geology, landform, land system and land unit descriptors explain little of the floristic variation within this region. The descriptors would not provide an effective basis for selecting conservation reserves.

These results are quite different to those obtained for forested north east NSW, where a number of surrogates performed significantly better than random. This reinforces the point made in Section 4.5 that caution should be exercised in extrapolating, or generalising, results obtained from testing of surrogates in one region to other regions, especially when these regions are in very different environments.



**Figure 5.2** Species accumulation curves for six of the seven surrogates evaluated for the arid zone. The derivation of these plots is described in Section 3. The Species Accumulation Index (surrogate efficiency) would normally be expected to be contained within the range 0 to 1. A value of 0 indicates that the accumulation of species achieved by selecting sites using the surrogate is no better than the accumulation achieved by a random selection of sites. Negative values, as shown here, indicate that the surrogates performed very poorly.

We again emphasise that this analysis of surrogates in arid north west NSW is preliminary, and is intended only to demonstrate the applicability of the analytical techniques developed in this consultancy to different regions and surrogates. Pressey and Logan are conducting a much more rigorous analysis of the data, including floristic data from the second survey and additional surrogates such as vegetation mapping. The results of these analyses will be published separately.