Informing the development of the monitoring framework for native vegetation condition across the Adelaide and Mount Lofty Ranges NRM region: workshop summary report

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Summary

Native vegetation is an important and valued resource in the Adelaide and Mount Lofty Ranges (AMLR) NRM region because it provides habitat for native animals, places for recreation, and is culturally important for Aboriginal and non-Aboriginal people.

DEWNR staff from NR AMLR approached the Science, Monitoring and Knowledge (SMK) branch to assist in the development of a monitoring framework for native vegetation condition across the AMLR NRM region, the aim of which is to report on the state and trend of native vegetation condition across the region. The AMLR community is the target audience for these reports, including reporting against NRM plan targets.

A workshop was held in July 2015, and attended by staff from AMLR and other NRM regions,, , technical experts from DEWNR and the Nature Conservation Society of South Australia. The workshop aimed to inform the development of a monitoring framework for native vegetation condition. This document summarises the outcomes of the workshop, including:

- Outlining a framework for a monitoring plan and an implementation process
- Identification and prioritisation of vegetation groups for monitoring.
- The values of native vegetation for conservation, production and other reasons.
- The expected management outcomes for each vegetation group.
- Identification of pressures for each vegetation group.
- Potential indicators of vegetation condition.

The outcomes of the workshop will be used to develop and trial the monitoring framework. The framework will be trialled in the first year, and will be refined for monitoring in subsequent years.

1 Workshop outcomes

1.1 Background

DEWNR Staff from the Natural Resources Adelaide and Mount Lofty Ranges (AMLR) NRM region are working to improve the information that is available to report on the condition of native vegetation at the NRM regional scale. The target audience for the improved information on vegetation condition is the AMLR community. Information on vegetation condition will be reported to the community by the AMLR NRM board using report cards as well as other reports, including those required to report against targets in the regional NRM plan. Regional staff indicated that reporting to the community at sub-regional or regional scales is required because many native vegetation management programs in AMLR are funded by the NRM levy.

A workshop was used to bring technical experts together to inform the development of a framework to monitor vegetation condition across the AMLR NRM region. Workshop participants proposed a number of guiding principles for the framework, including that it should:

- aim to inform region-wide reporting to the community, but that an increasing number of management questions may be incorporated if the monitoring program is improved;
- not aim to evaluate the effectiveness of specific management actions, which were implemented within projects, at site or landscape scales. Indicators for these purposes could be incorporated into the framework when resources are available;
- be practical and achievable within the available budget;
- have practical reporting outcomes, which relate to the values underlying each vegetation group;
- incorporate the results of project specific monitoring programs where ever possible, and implement monitoring methods in addition to those implemented by existing monitoring programs, where this is not possible;
- be adaptable so that new and improved methods could be incorporated in the future.

A project plan was developed before the workshop, outlining the aims, deliverables, budget, timeframes and governance of the project. The schedule of the project plan reflected the first 2.5 years of the project, but the workshop aimed to provide direction for a long term (5 year) monitoring program. The workshop participants noted the alignment of the project plan with work being done for a separate project, which is modelling trends in the extent of native vegetation in South Australia.

1.2 Workshop overview

The workshop was held on 22 July 2015 in Adelaide at the Plant Biodiversity Centre, Botanic Gardens, between 9 am and 5 pm.

Participants included technical experts from DEWNR and NCSSA, Natural Resources AMLR and other NRM regions, as follows: Keith Smith, Kristian Peters, Andrew West, Randall Johnson, Jason Van Weenen and Damian Moroney (AMLR NRM region), Michelle Waycott, Glen Scholz, Daniel Rogers and Nigel Willoughby (DEWNR SMK branch), Tim Bond (SE NRM region), Jackie Watts (SAAL NRM region), Jody Gates, Mark Storry and Valerie Lawley (DEWNR C&LM branch), Adam Wood (AW NRM region), David McKenna and Kirstin Abley (DEWNR P&S), Renata Rix (SAMDB NRM region), Andrew Triggs (KI NRM region), Lee Heard (NY NRM region), and Jeff Foulkes and Peter Mahoney (Nature Conservation Society SA).

The workshop was facilitated by Annelise Wiebkin and notes were recorded by Jane McKenzie and Craig Meakin (DEWNR SMK branch).

The goals of the workshop were to identify:

- existing programs, data and management outcomes on vegetation in AMLR.
- priority vegetation groups in AMLR for monitoring, and a plan to monitor each group every 5 years. Note 'vegetation groups' refers to a range of fine and broad scale vegetation associations and landscapes that are valued for a range of social, ecological and economic purposes.
- the important pressures, including ecological, social and economic, on priority vegetation groups.
- indicators of vegetation condition for the priority vegetation groups.
- site selection rules, and the timing of monitoring.

1.3 Existing data

The information on vegetation condition that was reviewed before the workshop included:

- summaries of existing vegetation management programs, including data and expected management outcomes for vegetation in AMLR.
- data on native vegetation condition in the AMLR NRM region, including Bushland Condition Monitoring (BCM) data (e.g. woodland birds, coastal vegetation) provided by the Nature Conservation Society of South Australia.

In addition to reviewing the above information, AMLR provided copies of other data on native vegetation condition. The data were reviewed so that they could be considered in the planning stages of the framework, for example to find areas where there were data gaps. At the workshop, the existing programs, data and management outcomes on vegetation in AMLR were summarised and presented to the participants. The workshop participants identified the following data, which will be assessed in detail before sampling sites are finalised:

- BCM, held by NCSSA, including coastal vegetation sites.
- BCM data, held by Greening Australia.
- Vegetation condition data in the form of polygons, held by A. West (AMLR).
- Data from the Biological Surveys, held by DEWNR,
- Data from TERN Ausplots.
- Vegetation condition data on the condition of the Fleurieu swamps, held by the NCSSA.
- Data from surveys of fire-responses of grey box grassy woodland and stringybark communities, held by DEWNR.
- Data from surveys of threatened ecological communities, held by Commonwealth Department for the Environment.

Workshop participants indicated that these data may not be spread representatively across each vegetation group in the AMLR NRM region. It was noted at the workshop that the current project would be expected to fill those gaps.

1.4 Prioritising vegetation communities

Participants were asked to come to the workshop with a list of 5 high priority vegetation groups in the AMLR NRM region, and a list of management questions that were relevant to the high priority vegetation groups. Five groups were chosen to ensure that workshop participants considered the high priority vegetation groups before the workshop, and to provide a meaningful number of groups to start discussions. The synthesised list of vegetation groups included terrestrial, coastal and freshwater aquatic systems, but intentionally excluded marine systems, including seagrass.

The proposed vegetation groups for region-wide reporting to the community were as follows:

- *Allocasurina* woodland/forest (*Allocasurina verticillata*).
- Smooth-barked gum woodlands (*Eucalyptus leucoxylon*, *E. fasciculosa*, *E. camaldulensis*).
- Box gum woodland (*E. odorata*, *E. porosa*, *E. macrocarpa*).
- Forests and woodlands with open sclerophyll shrubby understory (SMLR 2). This was suggested by the representative from the SAMDB region. This community overlaps with AMLR.
- Stringybark woodlands.
- High rainfall gum woodlands (including riparian, *E. viminalis*, *E. camaldulensis*, swampgum).
- Ecotome transition zones (*E. goniocalyx*).
- Low rainfall grassy woodlands under production (northern and eastern hills).
- Grassy woodlands.
- Temperate tussock grassland.
- Heathlands and heathy woodlands (including pink gums and blue gums).
- Mallee on 'A' calcareous soils (*E. oleosa*, *E. gracilis*).
- Water dependent ecosystems.
- Coastal heath.
- Samphire (coastal/subcoastal shrublands) in low energy environment.
- Fleurieu Peninsula swamps.
- Estuaries.

For each vegetation group, the values (both biodiversity conservation and community), reasons for prioritising, existing monitoring programs, amount of investment in vegetation management, drivers (that cannot be managed) and pressures (that can be managed) and expected management outcomes were identified (summarised in Appendix A). If vegetation groups had similar values and expected outcomes they were grouped together, which resulted in 14 broad groups (Appendix A). Of these, 6 groups would be prioritised if the number of vegetation groups needed to be reduced to fit the budget.

1.5 Spatial scale, site selection and stratification of vegetation groups for monitoring

Workshop participants discussed the spatial scale for monitoring of vegetation condition. Some participants highlighted the need for monitoring to be undertaken at subregional or even smaller scales, to match the scale at which they implemented vegetation management and because different landscapes have been impacted in different ways. It was suggested at the workshop that this design would enable the monitoring information to be used to evaluate effectiveness of vegetation management at landscape scales. Workshop participants discussed the guiding principles of this framework, which included the need for landscape-specific management outcomes. The framework did not specifically address the evaluation of the effectiveness of management at project sites.

Several workshop participants indicated that vegetation sampling needed to be undertaken at the NRM regional scale. It was highlighted that this was in line with the guiding principles of this monitoring framework. The rationale for measuring trends in vegetation condition at the NRM regional scale was to inform the community about where and why NRM levy investments are required.

Workshop participants highlighted that some areas of some of the vegetation groups functioned or were valued differently, or were managed for different outcomes. For these reasons, workshop participants indicated that the vegetation monitoring

methods (such as benchmarks) needed to be spatially stratified to account for these differences. The workshop participants suggested that the following factors needed to be considered to stratify the sampling for the monitoring program, resulting in what are termed in this report as stratified vegetation groups:

1. Landscape type and state.
2. Climate resilience adaptation type.
3. Vegetation that has been modified by people versus vegetation that is pristine, or protected for conservation outcomes (if vegetation management targets are different).
4. Vegetation on sloped versus flat areas (if management outcomes are different).
5. Vegetation on the east versus west sides of the Mount Lofty ranges (if management outcomes are different).
6. Vegetation in open versus closed woodlands (if management outcomes are different).
7. Vegetation on nutrient poor soils versus vegetation groups on sandy soils (if management outcomes are different).
8. Vegetation in different types of wetlands (surface water or aquifer fed).
9. Managed versus unmanaged vegetation (if management outcomes are different, e.g. fire management vs non-fire management zones).
10. Vegetation in small versus large patches (if management outcomes are different).

The first 2 stratification factors in the list above are adapted from a landscape framework, which outlines the respective broad management and conservation outcomes for each factor. Andrew West (AMLR NRM region) provided the landscape framework for the AMLR NRM region as a map, which was based on historic landscape type, landscape states, and resilience to climate change (Appendix B). *Landscape types* include forest, grassland, mallee, shrubland and woodland. *Landscape states* are based on whether plant species diversity was higher, lower or typical of what was expected, based on trends in diversity over the past 40 years. *Climate change resilience* is based on whether system processes needed to undergo repair to adapt, whether both system processes and components needed to undergo some repair to adapt, or whether the system is not able to adapt (e.g. due to sea levels rising on samphires and mangroves) without new management interventions. Andrew West indicated that this spatial layer could be modified to reflect the requirements and scale of the proposed vegetation monitoring framework.

Workshop participants noted that not all of the stratification factors in the above list are relevant to all of the vegetation groups. For example "vegetation in different types of wetlands" is only relevant to wetland communities. Likewise, "vegetation on the east versus west sides of the hills" is only relevant to hill-side communities, which are influenced by the aspect of the hill slope. Some stratification factors are related to the expected management outcomes, such as "vegetation groups that have been modified by people versus vegetation that is pristine, or protected for conservation outcomes", because vegetation is expected to function differently in farmed versus undisturbed environments.

Workshop participants suggested that based on their knowledge of the expected variance between sites and the predicted change in vegetation condition, between 13 and 30 sites would need to be measured in each of the stratified vegetation groups. The total number of stratified vegetation groups for the monitoring program is 62. Based on the recommended sample sizes, the numbers of stratified vegetation groups that could be sampled are estimated in Appendix A (last column). If between 13 and 30 vegetation condition sites are measured, the total number of sites (including new and existing data) would be between 1,261 and 2,910, which would be monitored once over the 5 year program. These estimates incorporate the first 8 factors (out of 10) listed above to stratify the vegetation groups. The factors that relate to management areas and patch sizes (the last 2 factors in the list above), were not used to stratify the vegetation groups, with the exception of the fire management zones in the stringybark vegetation group. Before the monitoring plan is finalised, detailed maps will be need to be produced to determine how many management and patch size stratification groups would be needed within each vegetation group.

To map the stratified vegetation groups, vegetation extent maps will also be required. These may be sourced from DEWNR's corporate databases or from databases held by the AMLR NRM Board. Workshop participants noted that there is limited capacity to compile new maps for this new monitoring program and that DEWNR's native vegetation layer may not include some vegetation in highly modified landscapes. These issues would need to be addressed before the monitoring plan is finalised.

The number of sites to be assessed within each stratified vegetation group would also be influenced by the available budget for monitoring, the expected variance between samples, and statistical analyses. For example, if the number of sites required to detect change is more than can be resourced, fewer stratified vegetation groups may need to be sampled or several of them may need to be combined into broader groups. In addition, power analyses can be used to estimate the number of sampling sites to detect a given amount of change in vegetation condition within each stratified vegetation group. Such power analyses are best undertaken on data from each stratified vegetation groups that will be monitored in the AMLR NRM region. In the absence of such data (i.e. before the start of the monitoring program), other similar vegetation condition data could be used to inform the sampling design. Equivalent data include the BCM collected by the Nature Conservation Society of SA, and/or data collected on Eyre Peninsula (Wiebkin 2013) and South East NRM (McLeay et al. 2013). As new data are collected, power analyses can also be used to review and refine the sampling design.

The possibility of revisiting BCM sites to detect change was discussed by workshop participants, and will also need to be addressed before the monitoring plan is finalised. Workshop participants indicated that the coverage of the existing BCM sites, including the number of stratified vegetation groups, was not adequate to report on vegetation condition at the regional scale. The review of the BCM data indicated that these sites spanned about 25 per cent of the number of stratified vegetation groups in the AMLR NRM region. The review of the BCM data indicated that some of these sites are randomly distributed across broad areas, but some are focused on project sites, where management has been undertaken. Workshop participants noted that analyses of gaps will identify the spatial coverage of the existing information and new sampling that is required.

Workshop participants noted that randomly selecting the locations of sites (within stratified vegetation groups) would ensure that the vegetation condition surveys would not be biased toward vegetation in either good or poor condition. This would provide data that are representative of the condition of vegetation across the AMLR NRM region. Workshop participants noted that sites for monitoring can be randomly selected from within the mapped polygons for each stratified vegetation group using ArcGIS (e.g. Wiebkin 2013, McLeay et al. 2013). The locations of existing vegetation condition assessments can also be incorporated in these analyses, so that new sites fill the apparent gaps. Workshop participants discussed site selection rules that could be used to ensure that monitoring sites were:

- located in relatively large patches of vegetation
- independent of one another
- easy to access

These rules were not settled during the workshop. Workshop participants noted the importance of the rules that were used in studies in Eyre Peninsula and South East regions (Wiebkin 2013, McLeay et al. 2013), including that sites should be:

- within patches >6000 m^2 (or select a smaller area if most extant patches are <6000 m^2)
- >110 m from road centrelines and <210 m from road centrelines
- >100 m from the edge of areas of native vegetation (e.g. where vegetation meets paddock)
- at least 1,000 m apart if sampling the same vegetation community/stratification group.

The number of sites that are pre-selected should exceed the number of sites that will be monitored. If possible, 50 sites should be pre-selected within each stratified vegetation group because this would provide alternative sites if some are not accessible (due to remoteness of sites, impassable tracks, weather conditions or lack of approval from landowners), or where vegetation groups at chosen sites are different to those recorded in mapping data. The 50 randomly pre-selected sites should be labelled sequentially. Access and directions to each site should be checked and sought (i.e. approval from owners of private land) before the survey. Sites that are not accessible should be discarded and access to the next site on the list should be sought until access is confirmed for the required number of sites.

Metadata on the location of each site should include:

- unique identification number
- land owner surname
- land owner name
- land owner address
- landholder's contact detail
- section number
- hundred name
- stratified vegetation group

The locations of sites should be uploaded into field GPS units, and maps of the selected sites (together with cadastral or Forestry SA maps) should also be provided to field teams.

1.6 Indicators and benchmarks

Workshop participants agreed that indicators and benchmarks should be selected to reflect broad regional-scale values, pressures and expected management outcomes for each stratified vegetation group. Different stratified vegetation groups may have different indicators and benchmarks. Potential indicators for all stratified vegetation groups are included, as suggested by workshop participants, in Appendix C. Workshop participants did not allocate weights to each indicator. Similar work has been done by the NCSSA for the BCM method, Wiebkin (2013) and McLeay et al. 2013, and this is required before the program is finalised.

Benchmarks will be developed in consultation with technical experts, or analyses of existing data or they may be modelled once the data have been collected for this project. Workshop participants noted that there is no capacity to survey stratified vegetation groups to develop new benchmarks before the surveys are undertaken.

Where existing vegetation condition data are suitable for inclusion in this project, new benchmarks will be used to ensure that site assessments are standardised between existing and new data, and between sites and within different stratified vegetation groups. New benchmarks will be tailored to specific survey methods, which may differ between existing and new monitoring methods.

Workshop participants from SAMDB regional staff indicated that BCM assessment information is an effective tool to communicate the condition of vegetation to their community. They indicated that the number of indicators in the BCM method (13 in each vegetation community) is comprehensive and inclusive of several components of vegetation condition. They recommended that the AMLR monitoring program include a similarly comprehensive suite of indicators. Workshop participants noted that the number of indicators used by the AMLR monitoring program would need to be balanced against the amount of time required to assess each site, and the budget.

Several workshop participants suggested that an indicator of fuel load be considered for all flammable systems.

1.7 Methods

Detailed methods were not developed in the workshop, but the workshop participants agreed that the methods should be appropriate and efficient for measuring the chosen indicators. Guidelines for the development of the methods are provided in Appendix C.

Workshop participants from SAMDB indicated that there was some variation in vegetation condition assessments (using BCM methods) recorded by different observers. For this reason, the methods used in this monitoring program should be objective, quantitative and easy to understand.

Workshop participants indicated that the timing of sampling should be relevant to the timelines and schedules of expected management outcomes. It is likely that the resources for this project will allow for sites to be monitored once every 5 years.

1.8 Next steps

Subject to approval and resourcing being made available, the next steps for the project are listed below.

- Staff from the AMLR NRM region will decide which vegetation groups and stratification groups will be assessed.
- Staff from the AMLR NRM region will decide which indicators and benchmarks will be used (based on the suggestions in Appendix C). Indicators and benchmarks will reflect specific values of each system. For example woodland bird habitat features may reflect biodiversity value where woodland birds are declining.
- Analyses of existing information to assess where new monitoring sites are required.
- Methods will be developed for the new monitoring sites and the time required to complete field surveys will be estimated.
- The number of sites able to be resourced by this project will be calculated (based on selected methods) and the number of stratified vegetation groups to be monitored will be reduced, if required, to fit the budget (see vegetation groups prioritised by management investment in Appendix A)
- Field protocols, datasheets and monitoring sites will be prepared (considering results of gap analyses).
- Contractors will be engaged to trial the vegetation condition monitoring. Participants recommended (on the basis of management investment) that the trial focus on the samphire and grassy woodland systems.
- New field data and existing data will be analysed, and benchmarks will be applied to monitoring data to assess regional vegetation condition of the 2 trial vegetation groups.
- The monitoring design and protocols will be reviewed.
- An interim report will be produced to report on the trial.
- The remaining stratified vegetation groups will be monitored over the subsequent 3 years.
- Annual reports and report card content will be produced for all stratified vegetation groups.
- The AMLR NRM Board will lead the production of the report cards, which will be accessible to all members of the community.
- The remaining stratified vegetation groups will be monitored every 5 years.
- As resources become available, additional sites (such as those in project areas) and vegetation groups could be incorporated into the program to answer specific vegetation condition questions.

2 References

McLeay, L.J., Wiebkin, A.S., Page, B., Neagle, N. and Sharafi, S.M., (2013), Monitoring of Native Vegetation Condition and Extent in the South East Natural Resources Management Region. Report to the South East Natural Resources Management Board. Government of South Australia, Department of Environment, Water and Natural Resources, Adelaide.

Wiebkin, A. (2013). Monitoring Native Vegetation on Eyre Peninsula for the Wentworth Group's Regional Environmental Accounting Trial 2012. Report to the Eyre Peninsula Natural Resources Management Board. Government of South Australia, Department of Environment, Water and Natural Resources, Adelaide.

3 Appendix

A. Proposed vegetation groups for monitoring

Table of selected vegetation groups, outlining why they are valued for conservation, production and other reasons, whether they are priorities, existing monitoring programs, existing management investments, drivers and pressures that impact the vegetation groups, expected management outcomes for each vegetation group, and the proposed stratification of the vegetation groups. The extent of some vegetation groups only exists in a subset of available stratification types. For example, the extent of wetlands only exists in one landscape type and one climate resilience type (which overlaps completely with the landscape type). Within the single climate resilience type, there are two water-table swamp types, meaning that for wetlands only two stratification groups are relevant. These stratifications are approximate, and are based on the draft landscape map in Appendix B and extent maps of vegetation held by DEWNR. The number of stratification groups may change when all extent maps have been chosen. Vegetation groups labelled with * receive relatively more management investment, and these groups would be prioritised if the number of vegetation groups needed to be reduced to fit the budget.

The 'vegetation groups' refer to a range of fine and broad scale vegetation associations and landscapes that are valued for a range of social, ecological and economic purposes. The range of scales means that they do not all align with a single vegetation classification system, and that there is spatial overlap of some groups.

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*Wetlands	Biodiversity, Ecosystem Services: water quality and base flows	High level of pressure: close to development, impacted/modified by climate change. Fleurieu swamps are critically endangered	Some, but very site and type specific – mostly limited to Fleurieu swamps (15 years of data)	High	Hydrology Water use Change in disturbance regimes (fire and Grazing – some species need disturbance) Re-engineering of drains Groundwater extraction and use Weeds	May differ for different wetlands Overall maintain base ecological function Composition structure (presence of specific species, age-classes) Species diversity and composition varies depending on timing/level of disturbance. Diversity may not change but rare species or different age-classes may be lost Have to manage across swamp systems Two hydro types: surface or subsurface water driven systems and ground water driven (water table)	Landscape (1) Swamp type (based on water table) (2) Climate resilience strategies (1) **Total = 2 stratification groups** Top and bottom of swamp (tops will dry out earlier and become more terrestrial than the bottoms). This may require 2 additional levels of stratification.

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*Woodlands: high rainfall (gum woodlands) Rainfall ranges determine cut offs	Biodiversity Ecosystem services: pollination, soil protection, nutrient cycles, very productive system High species diversity	Vulnerable: highly modified, impacted by climate change	Some BCM and Biological surveys Sampling is biased towards healthy systems and sampling is limited in spatial distribution	High but focused	Modification (fragmentation and extent) due to clearance and land use Total grazing pressure (not major impact) Changes to disturbance regimes (change nutrient dynamics) Specific: koala browsing, tree dieback (tree health), fire (not major impact), weed invasion (woody weeds result in structural changes)	Regeneration Tree health of specific age-classes may be used to indicate management response Coarse woody debris Indicator species required: full list of species present not necessary and problematic due to variability (seasonal, rainfall responsive etc.)	Landscape (3) Climate resilience strategies (2) Modified for human use and protected for conservation (2) **Total = 9 stratification groups**
Woodlands: low rainfall (box, sheoak)	Biodiversity Ecosystem services: pollination, soil protection, nutrient cycles, very productive system High species diversity	Highly modified, vulnerable to climate change Lack of community recognition that it is important Peppermint box grassy woodlands are critically endangered Grey box grassy woodlands are threatened	Some BCM and Biological surveys Some focused stewardship program monitoring (10–15 years of data)	Very low, not specific to management outcomes, often misdirected due to lack of awareness of values of vegetation community	Total grazing pressure: problem as some level of grazing benefits some species but not others Kangaroos and deer	Different systems: 1) 'pristine - low modification': floristic composition important. 2) 'Modified' - habitat function important Structure Tree health (age-class specific) Recruitment/regeneration Coarse woody debris	Landscape (3) Modified for human use and protected for conservation (2) East and West (2) Climate resilience (1) **Total = 9 stratification groups**

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
Riparian woodlands	Biodiversity Ecosystem services: pollination, soil protection, nutrient cycles, very productive system High species diversity	Highly modified, vulnerable to climate change	Limited, extent poorly mapped, so spatial representation not well understood Northern Rivers project provides some additional BCM sites Light River (15 samples)	Little to moderate	Driven by channel flows, flood plains, flood out Hydrology Water use Land use Total grazing (specifically koala) for specific/dominant tree species Weeds	Maintain structure (especially understory) Composition (species specific) Canopy cover Tree health	Landscape (2) (possibly correlated with modification) Modified for human use, maintained for soil stability and protected for conservation (3) Climate resilience (1) **Total = 6 stratification groups** For further discussion: open and closed woodlands (2) Nutrient poor and sandy (2)

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*SMLR 2: forest and woodland with open sclerophyll shrubs understory, and some stringybark	Biodiversity (particularly birds)	Highly fragmented, concern over declining woodland birds	62 BCM sites, focused on areas where management activities occur	High, but focused	Disturbance dynamics (especially fire) Changes in structure due to changes in composition Nutrients Weeds (especially sandy sites) Total grazing pressure (kangaroos, rabbits, deer) *Phytophera* (difficult to measure)	Composition (for specific species) Structure Age-classes (surrogate for productivity) Rare/endemics	Landscape (1) Modified for human use and protected for conservation (2) Climate resilience (1) **Total = 2 stratification groups**
Sand scrub (sub-group of SMLR 2) e.g. McLaren Vale, Aldinga, Manning Reserve	Biodiversity	Fragmented, naturally limited in extent, recently modified, Threatened plants Bird species declining	Possibly some BCM sites from SMLR 2	Some, but focused	As above	As above	Landscape (1) Modified for human use a protected for conservation (2) Climate resilience (1) **Total = 2 stratification groups** Note: possibly combine this vegetation group with SMLR 2.

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*Coastal sand dunes: including low and high energy systems	Biodiversity Ecosystem services: coast protection, heritage values, community appreciation, recreation	Highly modified, impacted, close to development, vulnerable to climate change	BCM sites: well spread out (problematic due to linear nature of vegetation communities) BUSHRat: considered more adaptable, useful Methods capture different qualities/values 60 percent of BCM sites have been revisited	High	Weed abundance Disturbance: loss of ground cover Grazing: rabbits Sea level: shoreline hardening	Sand stabilisation (sand dune height) Increase ground cover Composition Structure (maintain dune zones, fore dunes) Two systems, but the maps may overlap	Landscape (3) Coastal heritage and community recreation (modified) (2) Climate resilience (1) **Total = 4 stratification groups**

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*Coastal samphire, mangroves, mudflats	Biodiversity	Rare species: overall biodiversity low but unique species assemblage Vulnerable to climate change, fragmented and linear nature are barriers to species migration	BCM limited sites Some transect data for biodiversity in samphire and coastal management projects	High	Disturbance: tracks, vehicles Nutrient inputs: sewerage discharge Development/land use, including salt ponds Infrastructure: levies influence tides Sea level rise Grazing by deer Weeds	Maintain diversity Evidence of seed-set Senescence of specific species Zone migration EPA sewerage discharge measures Stratify by 3 tidal zones	Landscape (2) Inter- and supra-tidal (2) Modified for human use, and protected for conservation (2) Climate resilience (1) **Total = 8 stratification groups** For further discussion: samphire, mudflats and mangroves (3 extra groups)
Estuaries: different hydrology from mangroves and samphire	Biodiversity	Rare species: overall biodiversity low but unique species assemblage Vulnerable to climate change, fragmented and linear nature are barriers to species migration	BCM limited sites Some transect data for biodiversity in samphire and coastal management projects	Low	As above	As above	Landscapes (1) Modified for human use, and protected for conservation (2) Climate resilience (1) **Total = 2 stratification groups**

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
Rocky cliffs (heath and edge vegetation): Fleurieu and some areas of Deep Creek	Biodiversity	Low priority for monitoring or investment because these groups are considered robust, little disturbance	Some BCM data	Low			Landscapes (1) Climate resilience (2) Modified for human use, and protected for conservation (2) **Total = 4 stratification groups**
Grasslands (plus/minus emergents)	Biodiversity	Highly modified, vulnerable to climate change Lack of community recognition that it is important Vegetation group is not clearly defined	A few BCM sites on properties where management is undertaken Sampling of biological survey sites is biased towards healthy systems Pygmy blue tongue monitoring Vegetation group is poorly mapped	Low, focused on property management (e.g. weeds), often detrimental to grassland function. Management can impact some values of the vegetation group.	Same as woodlands: low rainfall vegetation group Land use changes Grazing of specific species Weeds	Structure Recruitment Composition Stratify by 'modified' and 'pristine' systems	Landscapes (2) Climate resilience (1) Modified for human use and protected for conservation (2) **Total = 4 stratification groups**

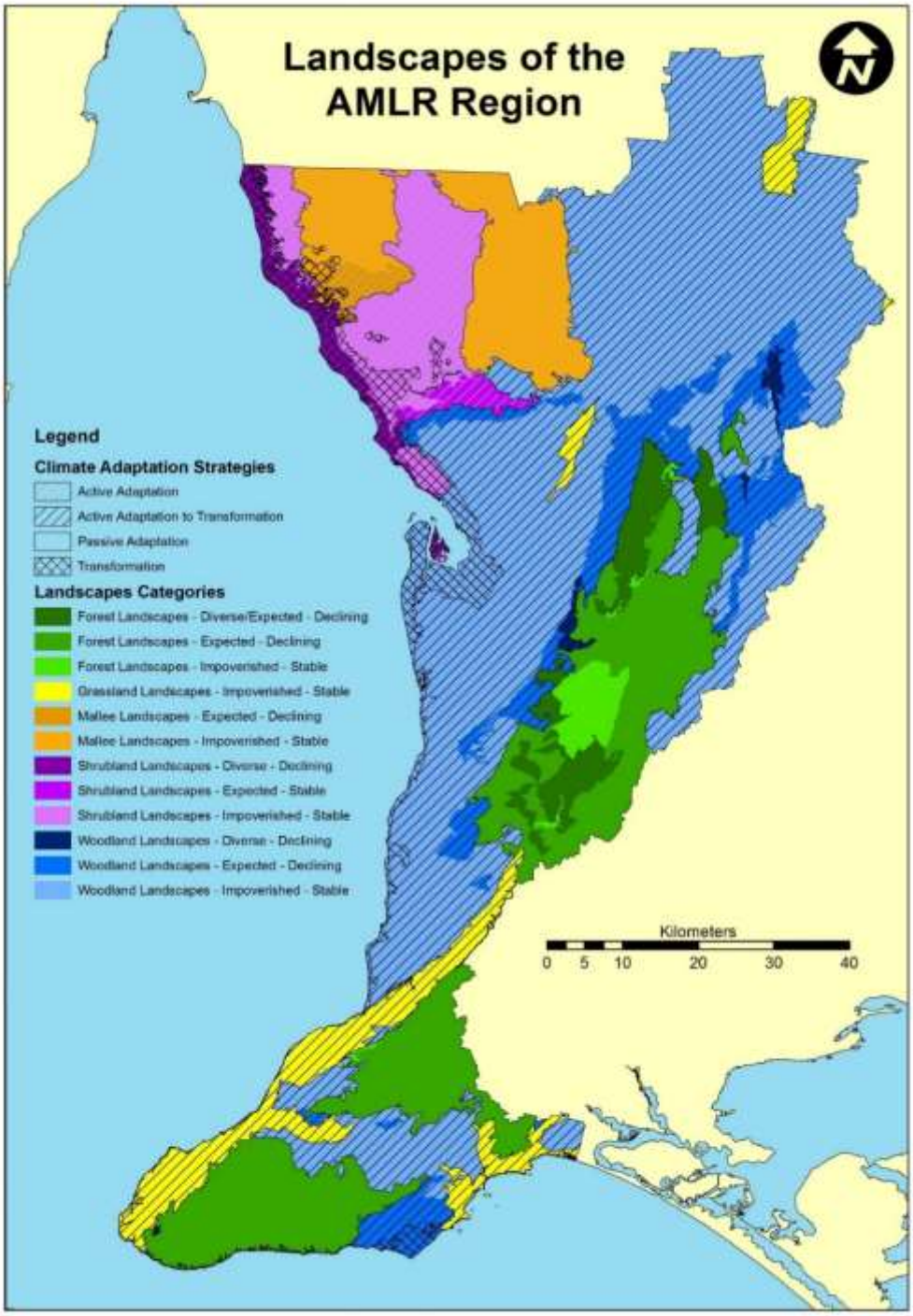
Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
*Spine of mountain range (Stringybark)	High biodiversity values People are most familiar with this type of vegetation group High recreational value	Mostly intact and relatively good extent Number of threatened species and generally high species diversity Focus for fire management	Yes, most data in region on this type	High, focused on areas of fire management	Changes to fire regime Weeds *Phytophera* Nutrients Water and drought impacts tree health, dieback	Maintain structure and composition (maintain x % of sites with xx structure and composition) Maintain specific species that are 'fire response' species Maintain large trees (including dead trees for habitat) Tree health	Landscapes (3) Climate resilience (1) Modified for human use and protected for conservation (2) **Total = 6 stratification groups** For further discussion: Fire management zones a, b, c (fine scale, small areas) (3)
Mallee (very little extent)	Biodiversity, unique species Small extent in AMLR	Highly fragmented Degrading remnants (especially on road sides) Pressure from sand mining, unique species	Unknown. Monitoring conducted by neighboring regions	Low	Grazing Weeds Climate change-vulnerable to rainfall Feral animals	Structure (habitat), very small patches Maintain composition A few endemics	Landscapes (2) Climate resilience (1) Modified for human use, (1) **Total = 2 stratification groups**

Vegetation group	Values	Reason it is a priority	Existing monitoring	Management investments	Drivers and pressures	Expected management outcomes	Stratification (# of types)
Inland chenopod shrublands	Biodiversity Small extent in AMLR	Highly modified, small proportion of total extent is in AMLR region Lack of community recognition that it is important Heavily impacted, vulnerable to climate change	Unknown	Low	Grazing Weeds Land use	Structure Composition	Landscapes (1) Climate resilience (2) Modified for human use (1) **Total = 2 stratification groups**

B. Landscapes of the AMLR Region.

Map of AMLR NRM region landscapes (A. West, unpublished data) including information on the:

- landscape categories (based on species turnover and historic vegetation patterns)
- states and trajectory (based on whether species diversity is higher, equal to, or lower than expected, and trends in diversity over the last 40 years)
- Climate change adaptation strategies



C. Potential indicators for monitoring vegetation condition

Tables of the 11 selected vegetation groups, outlining potential indicators, measures, benchmarks, monitoring methods, associated values or expected management outcomes and projects that have provided comparable data for each vegetation group. Indicators marked with "+" may be possible to incorporate in the current project, but they are not essential. Indicators marked with "*" are likely to be beyond the scope of the current project. The remaining indicators (not marked) are the potential indicators for the current project.

Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Wetlands	Condition	species composition	presence of 5 desirable/keystone perennial indicator species (as suggested by workshop participants)	all 5 spp. present	3 x 30 m transects, running 90˚ from swamp edge	maintain base ecological function, limit impact of grazing, limit effects of change in fire regime, reduce threats to TECs	Biol. survey
	Condition	composition age-class structure	presence of both age classes of each overstorey veg. species (juveniles and sub adult) as per BCM	both age classes for all overstorey spp. present	30 x 30m quadrat	maintain base ecological function, limit impact of grazing, limit effects of change in fire regime	BCM
	Condition	composition structure	cover of life forms as per BCM	most dense vegetation that could be expected for wetlands (model structural density)	3 x 30 m transects, running 90˚ from swamp edge	maintain base ecological function, limit impact of grazing, limit effects of change in fire regime, habitat quality	BCM
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds (model upper limit)	3 x 30 m transects, running 90˚ from swamp edge	limit weeds	BCM/Biol. survey
	Condition*	biodiversity	Not determined	Not determined	Not determined	species diversity	
	Condition*	water quality	Not determined	Not determined	Not determined	ecosystem services, pressure of agricultural practices such as too many nutrients	
	Condition*	water flow	Not determined	Not determined	Not determined	ecosystem services	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
High rainfall woodlands AND all grasslands (with or without emergents)	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain base ecological function	Biol. survey
	Condition	composition change	presence of 5 undesirable native species	5 spp. absent	3 x 30 m transect	maintain base ecological function	Biol. survey
	Condition	composition structure	cover of life forms as per BCM	model density range	3 x 30 m transect	maintain habitat function	BCM
	Condition	composition age-class structure	presence of 2 age classes of each overstory veg. species (juveniles and sub adult) as per BCM	both age classes for all over story spp. present	30 x 30 m quadrat	maintain/improve regeneration, limit grazing	BCM
	Condition	tree health of mature tree spp.	dieback score as per BCM	model dieback score range from best to worst	measure dieback on first 10 trees overhanging 30 m transect tape	maintain/improve tree health, limit koala browsing, limit impacts from change in fire regime	BCM
	Condition	coarse woody debris	woody ground cover as per BCM	model woody ground cover (split benchmarks for modified and protected areas)	3 x 30 m transect	maintain ground habitat	BCM
	Condition	ground cover	total ground cover	100 % ground cover (modified landscapes)	3 x 30 m transect	improve soil protection on modified landscapes only	BCM
	Pressure	weeds	presence/abundance of 5 most dominant weeds (e.g. olives) as per BCM	no weeds	3 x 30 m transect	limit weeds	BCM/Biol survey
	Condition	fragmentation	habitat hectares connectivity score	to be determined	GIS exercise across mapped vegetation group	limit further fragmentation	
	Condition	extent	extent (ha)	to be determined	GIS exercise across mapped vegetation group	limit further clearance	
	Socio-economic[+]	land use	Not determined	Not determined	Not determined	maintain ecosystem services	
	Condition*	pollination	Not determined	Not determined	Not determined	maintain ecosystem services	
	Condition*	nutrient cycles	Not determined	Not determined	Not determined	maintain ecosystem services	
	Condition*	biodiversity	Not determined	Not determined	Not determined	maintain/improve diversity	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Low rainfall woodlands (box, sheoak)	Condition (pristine systems only)	species composition	total diversity of perennial spp.	model maximum expected diversity	3 x 30 m transect	maintain ecological function	BCM/Biol. survey
	Condition (modified systems only)	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain habitat function	Biol. survey
	Condition	composition structure	cover of life forms as per BCM	model upper limit of density and preferred density range	3 x 30 m transect	maintain habitat function, limit impact of grazing (in modified habitats some grazing is good but not too much)	BCM
	Condition	composition, age-class structure	presence of 2 age classes of overstorey spp. (juveniles and sub adult) as per BCM	both age classes for all overstorey spp. present	30 x 30 m quadrat	maintain/improve regeneration	BCM
	Condition	tree health of mature tree spp.	dieback score as per BCM	model dieback score range from best to worst (split benchmarks for modified and protected areas, east and west)	measure dieback on first 10 trees touching transect tape	maintain/improve tree health, limit koala browsing, limit impacts from change in fire regime	BCM
	Condition	coarse woody debris	woody ground cover	model woody ground cover (split benchmarks for modified and protected areas, east and west)	3 x 30 m transect	maintain ground habitat	BCM
	Condition	ground cover	total ground cover as per BCM	100 % ground cover (just for modified landscapes)	3 x 30 m transect	improve soil protection	BCM
	Condition	fragmentation	habitat hectares connectivity score	to be determined	GIS exercise across mapped vegetation group	limit further fragmentation	
	Condition	extent	extent (ha)	to be determined	GIS exercise across mapped vegetation group (may use ARI model)	limit further clearance	
	Condition*	pollination	Not determined	Not determined	Not determined	ecosystem services	
	Condition*	biodiversity	Not determined	Not determined	Not determined	species diversity	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Riparian woodlands	Condition	composition structure	cover of life forms as per BCM	model density range	3 x 30 m transect	maintain habitat function	BCM
	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain ecological function	Biol. survey
	Condition	tree health of mature tree spp. (includes canopy cover)	dieback score as per BCM	model dieback score range from best to worst (split benchmarks for modified and protected areas)	measure dieback on first 10 trees touching transect tape	maintain/improve tree health, limit koala browsing, limit impacts from change in fire regime	BCM
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	3 x 30 m transect	limit weeds	BCM/Biol. survey
	Condition	ground cover (modified landscapes only)	total ground cover as per BCM	100 % ground cover (modified landscapes only)	3 x 30 m transect	improve soil protection on modified landscapes only	BCM
	Condition	fragmentation	habitat hectares connectivity score	to be determined	GIS exercise across mapped vegetation group	limit further fragmentation	
	Condition	extent	extent (ha)	to be determined	GIS exercise across mapped vegetation group (may use ARI model)	limit further clearance	
	Socio-economic status+	land use	Not determined	Not determined	Not determined	maintain ecosystem services	
	Condition*	water flow	Not determined	Not determined	Not determined	ecosystem services	
	Condition*	nutrient cycles	Not determined	Not determined	Not determined	ecosystem services	
	Condition*	pollination	Not determined	Not determined	Not determined	ecosystem services	
	Condition*	biodiversity	Not determined	Not determined	Not determined	species diversity	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
SMLR 2 (forest and woodland w open shrubs, some stringybark) **AND Sand scrub** (McLaren Vale/Aldinga/ Manning reserve)	Condition	composition age-class structure	presence of 2 age classes of overstorey spp. (juveniles and sub adult) as per BCM	both age classes for all overstorey spp. present	30 x 30 m quadrat	maintain/improve regeneration/productivity	BCM
	Condition	composition structure	cover of life forms as per BCM	model density range (need advice for modified areas, protected areas, east and west)	3 x 30 m transect	maintain habitat function, limit grazing	BCM
	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain/improve ecological function	Biol. survey
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	3 x 30 m transect	limit weeds	BCM/Biol. survey
	Condition	fragmentation	habitat hectares connectivity score	to be determined	GIS exercise across mapped vegetation group	limit further fragmentation	
	Condition	extent	extent (ha)	to be determined	GIS exercise across mapped vegetation group (may use ARI model)	limit further clearance	
	Condition[+]	rare/endemic spp.	presence of 3 rare/endemic species	all 3 spp. present	30 x 30m (or possibly larger)	conservation value/threatened flora	Biol. survey
	Condition*	nutrient cycles	Not determined	Not determined	Not determined	ecosystem services	
	Condition*	biodiversity	Not determined	Not determined	Not determined	maintain/improve species diversity (esp. birds)	
	Pressure*	Phytophthora	Not determined	Not determined	Not determined	limit disease	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Coastal samphire, mangroves, mudflats AND estuaries	Condition	composition age-class structure	presence of 2 age classes of overstorey spp. (seedlings and juveniles) as per BCM	both age classes for all overstorey spp. present	30 x30m quadrat	maintain/improve regeneration/productivity	BCM
	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	30 m transect (in 2-3 tidal zones)	maintain ecological function, maintain diversity	Biol. survey
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	30 m transect (in 2-3 tidal zones)	limit weeds	BCM/Biol. survey
	Condition	composition structure (mangroves only)	cover of life forms as per BCM	model structure	3 x 30 m transects (in 3 zones)	maintain habitat function	BCM
	Condition	Senescence (mangroves only)	dieback of mangrove spp. as per BCM	model dieback score range from best to worst	measure dieback on first 10 trees touching 30m transect tape	limit senescence	BCM
	Pressure	tracks	percentage of aerial quadrats with tracks present	no tracks other than gazetted roads	search area to be determined (desk top study)	limit disturbance by vehicles etc.	
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit loss of extent/ limit mangrove movement invading samphire, migration of competitors	
	Condition	fragmentation	patch size	to be determined	GIS based on aerial photo interpretation (i.e. presence of tracks in 5 aerial quadrats)	limit fragmentation from clearance	
	Condition[+]	rare/endemic spp.	presence of 3 rare/endemic species	all 3 spp. present	30 x 30m (or possibly larger)	maintain/improve conservation value/threatened flora	Biol. survey
	Pressure[+]	sewage discharge	sewage discharge (poss. use EPA discharge measures)	to be determined	see EPA methods	limit nutrient inputs	
	Pressure*	land use	area of salt ponds/presence of infrastructure e.g. levies			disturbance/development	
	Condition*	biodiversity	Not determined	Not determined	Not determined	species diversity	
	Condition*	water quality	Not determined	Not determined	Not determined	nutrient inputs	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Coastal sand dunes	Condition	composition structure	cover of life forms as per BCM	model structure density range (different for modified areas vs protected areas, high/low energy systems)	3 x 30 m transects (in 3 zones)	maintain/improve habitat function, limit grazing	BCM
	Condition	ground cover	total ground cover (as per BCM)	100 % ground cover (different for modified areas vs protected areas, high/low energy systems)	3 x 30 m transect (in 3 zones)	maintain/improve sand stabilisation	BCM
	Pressure	weeds (conservation areas)	presence/abundance of 5 most dominant weeds as per BCM	no weeds in conservation areas, model upper limit	3 x 30 m transect (in 3 zones)	limit weeds	BCM/Biol. survey
	Pressure	weeds (in modified areas for human use)	presence/abundance of 5 most dominant weeds as per BCM	Model upper limit, lower limit to be determined in modified dune areas	3 x 30 m transect (in 3 zones)	limit weed and maintain/improve sand stabilisation (in modified dunes)	BCM/Biol. survey
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit further clearance	
	Condition	fragmentation	patch size	to be determined	GIS mapping exercise (may use ARI model)	limit further fragmentation	
	Pressure indicator	shoreline hardening	extent of built landscapes	to be determined	to be determined	sea level rise	
	Condition[+]	dune zone width	dune zone width	no change in dune zone width	to be determined	changes to sand stabilisation and species composition/structure, disturbance	
	Condition[+]	sand dune height	height of dunes	to be determined	use stick and horizon and Pythagoras's theorem	sand stabilisation	
	Condition*	biodiversity	Not determined	Not determined	Not determined	species diversity	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Rocky cliffs (heath and edge veg, e.g. Fleurieu and Deep Creek)	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transects	maintain/improve ecological function, maintain diversity	Biol. survey
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	3 x 30 m transects	limit weeds	BCM/Biol. survey
	Condition	composition structure	cover of life forms as per BCM	model structure	3 x 30 m transects	maintain habitat function	BCM
	Condition	composition age-class structure	presence of 2 age classes of overstorey spp. (juveniles and sub adult) as per BCM	both age classes for all overstorey spp. present	30 x 30 m quadrat	maintain/improve regeneration/productivity	BCM
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit further clearance	
	Condition	fragmentation	patch size	to be determined	GIS mapping exercise (may use ARI model)	limit further fragmentation	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Stringybarks (in spine of the range)	Condition (modified systems only)	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain/improve habitat function	Biol. survey
	Condition	composition structure	cover of life forms as per BCM	model density range	3 x 30 m transect	maintain habitat function, limit grazing	BCM
	Condition	composition age-class structure	presence of 2 age classes of overstory spp. (seedlings and juveniles) as per BCM	both age classes for all overstory spp. present	30 x 30 m quadrat	maintain/improve regeneration	BCM
	Condition	presence of fire response spp.	presence of 3 (desirable/specific) fire response spp.	fire response spp. are present	quadrat size to be determined	limit disturbance by changes to fire regimes	Biol. survey
	Condition	large dead trees still standing	abundance of large dead standing trees	model abundance of dead trees	3 x 30 m transect	maintain/improve habitat for animals	
	Condition	tree health of mature tree spp. (includes canopy cover)	dieback score as per BCM	model dieback score range from best to worst (split benchmarks for modified and protected areas)	measure dieback on first 10 trees touching transect tape	maintain tree health, limit impacts from drought and changes to fire regimes	BCM
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit further clearance	
	Condition	fragmentation	patch size	to be determined	GIS mapping exercise (may use ARI model)	limit further fragmentation	
	Condition*	nutrient cycles	Not determined	Not determined	Not determined	ecosystem services	
	Pressure*	Phytophthora	Not determined	Not determined	Not determined	disease	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Mallee	Condition	composition structure	cover of life forms as per BCM	model density range	3 x 30 m transect	maintain habitat function, related to grazing impacts	BCM
	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain ecological function	Biol. survey
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	3 x 30 m transect	limit weeds	BCM/Biol. survey
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit further clearance	
	Condition	fragmentation	patch size	to be determined	GIS mapping exercise (may use ARI model)	limit further fragmentation	
	Pressure*	sand mining	Not determined	Not determined	Not determined	limit disturbance	

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Vegetation group	Type of indicator	Indicator	Measure	Benchmark description	Monitoring method	Outcome or value that indicator is related to	Projects with comparable data
Inland chenopod shrublands	Condition	composition structure	cover of life forms as per BCM	model density range	3 x 30 m transect	maintain habitat function, related to grazing impacts	BCM
	Condition	species composition	presence of 5 desirable/keystone perennial indicator species	all 5 spp. present	3 x 30 m transect	maintain ecological function	Biol. survey
	Pressure	weeds	presence/abundance of 5 most dominant weeds as per BCM	no weeds	3 x 30 m transect	limit weeds	BCM/Biol. survey
	Condition	extent	extent	to be determined	GIS mapping exercise (may use ARI model)	limit further clearance	
	Condition	fragmentation	patch size	to be determined	GIS mapping exercise (may use ARI model)	limit further fragmentation	
	Pressure*	land use	Not determined	Not determined	Not determined	limit disturbance/development	

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Department of Environment,
Water and Natural Resources