Mapping native vegetation in the Painkalac Creek Estuary, Aireys Inlet.

A report to the Surf Coast Shire, December 2005.

Steve J. Sinclair & Matt D. White

Arthur Rylah Institute for Environmental Research (ARI)

Department of Sustainability and Environment (DSE)

Arthur Rylah Institute

Flora, Fauna & Freshwater Research

Summary

The Arthur Rylah Institute (ARI) was contracted by the Surf Coast Shire to produce a map (accurate at a scale of 1:10,000) of vegetation in the Painkalac Creek estuary at Aireys inlet, assigning each patch of native vegetation to an Ecological Vegetation Class (EVC).

This report provides details of previous studies which have examined the ecology of the Painkalac Creek estuary, and presents the results of mapping carried out during December 2005, using aerial photograph interpretation and on-site examinations. A map is provided, along with a series of GIS files (on the associated CD) showing the extent and type of native vegetation in the study area. The maps accompanying this report (Appendix 1) should be considered accurate at a scale of 1:2,000.

Vegetation in the estuary was described according to the following EVCs:

- Saline Aquatic Meadow (EVC 842)
- Coastal Saltmarsh (EVC 9) (mapped as two variants)
- Estuarine Wetland (EVC 10)
- Estuarine Reed Bed (EVC 952)
- Brackish Sedgeland (EVC 13) (mapped as two variants)
- Estuarine Flats Grassland (EVC 914)
- Brackish Grassland (EVC 934)

Largely freshwater wetlands on the margins of the estuary were described according to the following EVCs:

- Sedge Wetland (EVC 136)
- Tall Marsh (EVC 821)
- Spike-sedge Wetland (EVC 819)

Vegetation on the coastal dune at the creek mouth was described using the following EVCs:

- Coastal Alkaline Scrub (EVC 858)
- Coastal Dune Scrub (EVC 160)

Another area which has been radically modified since settlement, and was difficult to assign to an EVC was identified. This area was tentatively assigned to Grassy Woodland (EVC 175), which probably best represents its original vegetation. Native vegetation on the hills surrounding the Estuary was not included as part of this study.

Each of the EVCs is described, in terms of its ecological place in the landscape, and its floristics. Comments are provided on the Bioregional conservation status, and any notable threats to the persistence of each EVC.

INTRODUCTION and LITERATURE REVIEW

Estuarine environments occur in many places around the Victorian coast, where rivers enter the sea, and fresh and salty water meet. These environments are highly valued for their biodiversity, as well as for their aesthetic and recreational values.

The composition and structure of natural vegetation occurring on the floodplains of estuaries is strongly controlled by its height above mean tide level. Distinct zonation of vegetation type is typically observed. The layout of these zones is largely determined at a fine scale by the local patterns of interaction between elevation and inundation by fresh and salt water, as tides rise and fall, and river flows vary with rainfall and coastal processes that may periodically block the mouth of the estuary. In these environments, a small change in elevation (several cms) can produce a marked change in the growing conditions for plants, and hence a relatively sharp boundary between vegetation types. Estuarine vegetation is thus highly susceptible to alteration and potentially to degradation as a result of hydrological changes, including changes in river flow, groundwater chemistry/elevation, river-mouth dredging, alterations to water seepage patterns, and sea-level changes. Due to their sensitivity to environmental change, and the comparative ease with which their boundaries can be observed and accurately mapped, estuarine vegetation patterns may offer a useful means of monitoring local environments (General accounts of the ecology of Australian Estuaries are provided in many sources, including Anon. 2002).

This project involves the fine-scale mapping of vegetation patterns in the Painkalac Creek Estuary, on Victoria's southern coast, near the western end of the Otway Plain Bioregion[1]. The area receives moderate rainfall (729mm annually at Eastern View), with the winter months being the wettest (Forsyth and Ransome, 1978). Painkalac Creek rises in the foothills of the Otways Ranges, draining a catchment of approximately 40 km^2. Its upper reaches flow through relatively steep valleys, cut through sedimentary rocks of the Otway Group (Mesozoic), then through more gently-sloping country, of more erodable sedimentary rocks such as the Eastern View Formation (Cainozoic) (Forsyth and Ransome, 1978; Manning *et al*., 1979). As it nears the Coast, the creek flows slowly across flatter country, which has encouraged the deposition of sediment and the formation of a relatively large floodplain (approx. 3.5km long), across which the creek meanders. At the coast, the creek mouth is partially blocked by a long (800m) sand dune, which holds stabilising layers of calcrete. This dune has promoted the formation of a sheltered saline lagoon just back from the river mouth (Manning *et al*., 1979). The lower floodplain/lagoon area is typical of estuarine environments, and supports a complex mosaic of vegetation types.

The Painkalac Creek area was settled relatively early in Victoria's history (1842, by J. Airey). Photographs from the early 1900s (reproduced in Manning *et al*., 1979) show that the floodplain and most of the nearby hills were at that time completely cleared of woody vegetation and used for stock grazing. The creek is now dammed, and the mouth is rarely open to the sea. Thus, the native vegetation of the floodplain has been greatly modified since colonisation. The creek now flows across a floodplain that has been partially converted to non-native pasture, and surrounded at its lower end by

[1] See www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/biodiversity_bioregions_vic

the town of Aireys Inlet. The tenure of land supporting native vegetation is as follows (Moulton, 1999):

? Land upstream of the Great Ocean Road bridge and east of the Creek is freehold.
? Downstream of the bridge, land is owned by the Crown with Surf Coast Shire as Committee of Management (Mellors Swamp);
? Upstream of the bridge and west of the Creek most of the land is owned by the Shire. It is managed as a Conservation Reserve (Painkalac Creek Reserve), and is the subject of a Trust for Nature Covenant.

The Painkalac Creek Reserve is the subject of a Fire Management Plan (Moulton, 2003). For many years, portions of the Floodplain have been separated by slashed breaks, and burnt in rotation.

Two previous studies have closely examined and mapped the vegetation of the Painkalac Creek estuary. Both have been helpful in the present project:

✍ In 1979, Manning and co-workers from Monash University produced a detailed report to the Aireys Inlet and District Association, which described the geology, geomorphology, vegetation, fauna and history of the area. Its production was prompted by the need to understand the impacts of growing housing development, and the building of a new dam and water reticulation system. This report included a fairly simple map of vegetation units in the estuary, presented at a scale of ~1:5,000. Six vegetation units were described in the area covered by this report, some of which are equivalent to the presently accepted Ecological Vegetation Classes (EVCs), while others encompass several EVCs. Plant species lists were produced for the Painkalac Creek area, however these focussed on the upper catchment and surrounding hills, and the floodplain and estuary were not surveyed in detail.
✍ In 1990, Carr and co-workers (from a consortium of environmental consultancies) produced another report for the Painkalac Valley Steering Committee. This report collected a great deal of valuable information including 25 vegetation quadrats in the area covered by the present study, accessible via the Flora Information System (FIS, curated by DSE). This report (Carr *et al*., 1990) provided a relatively detailed map of vegetation units in the estuary, presented at a scale of ~1:5,000. The vegetation units were defined in this study on the basis of floristic analysis of quadrat data. These units closely relate to the presently accepted mapping units (EVCs), and the relationships between them are briefly discussed for each EVC in the body of this report.

Several other valuable studies have considered the vegetation of the Aireys Inlet area in detail (Carr and Robinson, 1985; White, 1990), however they consist largely of plant species lists, and do not provide any information on plant communities or their extent. The Department of Sustainability and Environment (DSE) has also mapped remnant native vegetation across Victoria, at a resolution suitable for interpretation at about 1:100,000. While highly valuable at a regional level, this mapping is unable to capture fine scale patterns at a local level. In this dataset, the entire Painkalac Creek estuary is mapped as Coast Tussock Grassland (EVC 163). This EVC determination does not accurately reflect the vegetation patterns on-site.

The present study builds on the previous detailed mapping work (Manning *et al*., 1979; Carr *et al*., 1990), and makes important improvements. Firstly, the maps are accurate when interpreted at a far finer-scale (~1:2,000). Secondly, the representation

of vegetation patterns is achieved using the latest and most comprehensive vegetation typology available: DSE's state-wide EVCs, along with the presently un-published wetland vegetation typology of Frood (in prep.) which is soon to be integrated with DSE's EVC typology. It is anticipated that the present study will form the basis for future monitoring work in the Painkalac Creek estuary, and will inform on-ground vegetation management decisions.

METHODS

All areas of native vegetation in the Painkalac Creek Estuary study area were assigned to an Ecological Vegetation Class (EVC), according to the current EVC descriptions maintained by DSE (Anon. 2000, Oates and Taranto, 2001), and with reference to the proposed amendments to wetland EVCs yet to be integrated into the departmental EVC typology (Frood unpublished, Oates pers. comm., Frood pers. comm.). The study area was bounded by the river mouth, the roads on each side of the floodplain, and the large river bend level with Beach Rd, beyond which the floodplain is covered by modified pasture, predominantly *Phalaris aquatica*. Thus, both Mellors Swamp and Painkalac Creek Reserve were covered by this study.

Areas supporting distinct EVCs were represented as polygons in a GIS (Arcview 3.2), using recent digital aerial photographs (supplied by the Surf Coast Shire) as templates. All polygons were visited on foot to ensure that the identity and extent of each EVC was accurately mapped. The map produced should be considered accurate at a scale of 1:2,000. Metadata describing the properties and fields of the GIS data is attached as Appendix 2.

Brief descriptions of each EVC are provided below. Detailed floristic investigation of each EVC was not undertaken, given the number of pre-existing FIS quadrats in the study area (Carr *et al.*, 1990), with the exception of Brackish Grassland (EVC 934), which was not adequately represented by existing quadrats. A quadrat (FIS, D09500) was taken in this EVC, and the data is appended as Appendix 3.

RESULTS

Numerous EVCs were mapped in the study area. These are discussed below, with reference to their basic ecology, floristic composition, their extent within the study area and their Bioregional conservation status (DSE, unpub., Oates pers. comm.). The EVCs are discussed in three main groups:

- Estuarine/Floodplain EVCs that are influenced by salinity,
- Freshwater wetland EVCs on the floodplain, and
- Coastal dune EVCs.

Unless otherwise noted, the EVC information is compiled with reference to field observations (Decmber 2005), along with several core reports describing EVCs across Victoria (Anon. 2000, Oates and Taranto, 2001; Frood, unpub.). The final map (see Appendices 1 and 2) also shows areas of non-native pasture and areas of 'modified/mixed' vegetation where some scattered native plants persist among gardens, lawns, roadways etc.

Estuarnie/Floodplain EVCs

- **Saline Aquatic Meadow (EVC 842)**

Figure 1: Saline Aquatic Meadow (EVC 842).

Local extent: 3.29 ha
Bioregional Conservation status: Rare.

This EVC is usually submerged in salt water (Figure 1). It occurs mostly in slow flowing reaches of the estuary, away from the main stream channel and is subject to tidal fluctuations in water level (particularly when the creek mouth is open). It also occurs in semi-permanent pools in depressions within Coastal Saltmarsh (EVC 9, see below), which dry out over summer and become very saline. As the focus of this report was on terrestrial vegetation, the submerged Saline Aquatic Meadow was not investigated in great detail. Brief observations and the quadrat data of Carr *et al*., 1990 suggest that this EVC is locally dominated by floating strands and matts of Many-fruit Tassel (*Ruppia polycarpa*), Fennel Pondweed (*Potamogeton pectinatus*) and Long-fruit Water-mat (*Lepilaena cylindrocarpa*). This EVC is unlikely to be affected by vascular plant weed species. Carr *et al*. (1990) mapped this EVC as 'Submerged Saline Herbfield'.

✍ Estuarine Reed Bed (EVC 952)

Local extent: 0.22 ha
Bioregional Conservation status: None assigned, not previously mapped.

Estuarine Reed Bed occurs mostly in permanently inundated areas, with moderate salinity. It consists of dense growth of Common Reed (*Phragmites australis*), with very few other species. This EVC was mapped as '*Phragmites australis* (Common Reed) grassland' by Carr *et al*., (1990).

✍ Coastal Saltmarsh (EVC 9)

Local extent: 3.24 ha (Upper floodplain 0.06 ha, Lower floodplain 3.18 ha).
Bioregional Conservation Status: Vulnerable.

Coastal Saltmarsh typically occurs on anaerobic/waterlogged clays and silts, and would be inundated by tidal flows (when the creek mouth is open). Across Victoria, Coastal Saltmarsh includes a range of floristic associations forming herbfields, shrublands, sedgelands and/or grasslands. All are characterised floristically by the presence of succulent halophytic chenopods of the genera *Sarcocornia, Halosarcia* and *Sclerostegia* which often comprise most of the perennial biomass. Saltmarsh is diverse and extensive on the central Victorian Coast, but rare and floristically depauperate in the west, including the Painkalac Creek estuary. Here, the vegetation is strongly dominated by Beaded Glasswort (*Sarcocornis quinqueflora* subsp. *quinqueflora*). Creeping Brookweed (*Samolus repens*), Australian Salt-grass (*Distichlis distichophylla*) and Sea-rush (*Juncus krausii*) are moderately common. Even when undisturbed, this EVC would never have supported a very diverse range of plants. Carr *et al*. (1990) broadly mapped the corresponding area as 'Saltmarsh Complex'.

On the accompanying map (Appendix 1), we have distinguished two areas of saltmarsh:

- The lower saltmarsh (figure 2) consists of dense mats of Beaded Glasswort and Creeping Brookweed. It occurs on the edges of the lagoon, and the plants clearly have access to regular water. Weed invasion of this area is currently minimal (the spring annual weeds *Parapholis incurva* and *Critesion marinum* were common although dead) however Coastal Saltmarsh elsewhere in the state may be invaded by a variety of weeds.
- The upper saltmarsh occurs in small depressions on the upper floodplain. It is only sparsely vegetated, with occasional plants such as Beaded Glasswort, and the weed Buck's horn Plantain (*Plantago coronopus*). This area is discussed in more detail below (Conclusions).

Figure 2: Coastal Saltmarsh (EVC 9) (Foreground); Coastal Alkaline Scrub (EVC 858) (Background on lower dune)

✍ Estuarine Wetland (EVC 10)

Figure 3: Estuarine Wetland (EVC 10).

Local extent: 7.69 ha
Bioregional Conservation Status: Endangered

Estuarine Wetland generally occurs on the landward side of Coastal Saltmarsh (EVC 9, described above) on anaerobic/waterlogged clays and silts , in areas slightly more elevated, and thus less deeply and regularly inundated by sea water. This EVC consists of a dense sward of Sea-rush, with occasional patches of low-growing Common Reed, Knobby Club-sedge (*Ficinia nodosa*), Coast Tussock-grass (*Poa poiformis* var. *poiformis*), Beaded Glasswort, Creeping Brookweed and Australian Salt-grass. Even when undisturbed, this EVC would never have supported a very diverse range of plants. Weed invasion of this EVC is minimal. This community was mapped by Carr *et al*. (1990) as '*Juncus krausii* (Sea Rush) Herbfield', along with parts of Brackish Sedgeland (EVC 13, described below).

✍ **Brackish Sedgeland (EVC 13)**

Figuure 4: Brackish Sedgeland (EVC 13) (Foreground).

Local extent: 1.00 ha (EVC 13.1: 0.32 ha, EVC 13.2: 0.68 ha)
Bioregional Conservation Status: Vulnerable.

This EVC occurs very slightly higher than Estuarine Wetland (EVC 10, described above), and is probably influenced by occasional, extreme tidal events and or its proximity to saline groundwaters. Floristically, it is composed of salt-tolerant sedges, and a few herbs and grasses. Weed invasion in this EVC is currently minimal.Two fairly distinct floristic communities of this EVC occur in Painkalac Creek, which are informally described below:

- The first community (mapped as EVC 13.1) occurs on slight rises within Estuarine Wetland, and is dominated by large tussocks of Chaffy Saw-sedge (*Gahnia filum*), among Sea-rush, and Australian Salt-grass (Figure 4). Carr *et al*. (1990) considered this community to be part of the more widespread '*Juncus krausii* (Sea Rush) Herbfield'.
- The second community (mapped as EVC 13.2) occurs in a single patch, in an area transitional between Estuarine Wetland (EVC 10, described above) and Estuarine Flats Grassland (EVC 914, described below). It is strongly dominated by Bare Twig-rush (*Baumea juncea*), Australian Salt-grass, and Coast Tussock-grass. This community was described and mapped by Carr *et al*. (1990) as '*Baumea juncea* (Bare Twig-rush) Herbfield'. A picture of this community appears on the front cover of this report.

✍ Estuarine Flats Grassland (EVC 914)

Figure 5: Estuarine Flats Grassland (EVC 914) (Foreground).

Local extent: 4.55 ha
Bioregional Conservation Status: None assigned, not previously mapped. Likely to be vulnerable or endangered and naturally rare.

Estuarine Flats Grassland occurs in areas slightly higher than Estuarine Wetland or Brackish Sedgeland (EVCs 10 & 13, described above) (Figure 5). It is not subject to regular inundation from salt water, however the soil is salty and seasonally wet. Under natural flow regimes, Estuarine Flats Grassland would occasionally be inundated by river floodwaters. Floristically, Estuarine Flats Grassland is strongly dominated by native Tussock-grasses (*Poa* species). Both Coast Tussock-grass and Common Tussock-grass (*Poa labillardierei*) are present in this EVC, however many specimens examined could not be confidently assigned to one of these taxa, and it seems that they intergrade in this environment. This phenomenon has been noted by others (Walsh, 1994). Coast Tussock-grass is probably the more common in this EVC (cf Brackish Grassland EVC 934, described below). Sparse patches of Sea rush and relatively sparse, low-growing stands of Common Reed are spread throughout the grassland. Other plant species are less common, and include occasional plants of Creeping Brookweed, Australian Salt-grass, Knobby Club-sedge, Bidgee-widgee (*Aceaena novae-zealandiae*) and Sea Celery (*Apium prostratum* subsp. *prostratum* var. *prostratum*). Even when undisturbed, this EVC would never have supported a very diverse range of plants. Weed invasion of this EVC is minimal, with only scattered individuals of minor weed species being observed. This EVC was described

and mapped by Carr *et al.* (1990) as part of a more extensive plant community that these authors called '*Poa labillardierei* (Common Tussock-grass) Grassland'.

✍ Brackish Grassland (EVC 934)

Figure 6: Brackish Grassland (EVC 934).

Local extent: 6.57 ha
Bioregional Conservation Status: None assigned, not previously mapped. Likely to be endangered in the Bioregion and the state.

Brackish Grassland (Figure 6) occurs adjacent to Estuarine Flats Grassland (EVC 914, described above), in areas which are never inundated by tides, and only very rarely inundated by freshwater floods. It occurs on heavy, naturally saline/subsaline soils, and shares many ecological and floristic similarities with Plains Grassland (EVC 132) on the western plains of Victoria. It is strongly dominated by Common Tussock-grass, and includes a larger diversity of sub-dominant grasses than Estuarine Flats Grassland, including Smooth Wallaby-grass (*Austrodanthonia laevis*), Bristly Wallaby-grass (*Austrodanthonia setacea*), Wetland Wallaby-grass (*Notodanthonia semiannularis*), Long-hair Plume-grass (*Dichelachne crinata*), Australian Salt-grass and Common Wheat-grass (*Elymus scaber*). It also has a conspicuous herb component which is strongly dominated by Milky Beauty-heads (*Calocephalus lacteus*), and also includes Bidgee-widgee, Sheeps' Burr (*Acaena ovina*), Slender Speedwell (*Veronica gracilis*), and Creeping Cotula (*Leptinella reptans* s.l.). Appendix 3 shows the composition of a 10x10m quadrat taken in this EVC, because it was otherwise poorly represented in the FIS. The threatened Salt Blown-grass (*Lachnagrostis robusta*) was found in this EVC (as discussed below, Conclusions).

This EVC has probably suffered from some reduction in plant diversity through past grazing. It is currently threatened by weed invasion. Several very serious weed species were observed, most of which are only beginning to invade, and may still be controlled (discussed below). Other locally indigenous shrub species, including Common Boobialla (*Myoporum insulare*) may have occurred in this EVC pre-colonisation, but may be increasing in abundance due to a lack of inundation and/or altered fire regimes. Perhaps the most potentially damaging weed species include grasses such as Sweet Vernal-grass (*Anthonxanthum oderatum*) and invasive ornamentals of the iris-family (including *Watsonia meriana* and *Gladiolus undulatus*). This EVC was described and mapped by Carr *et al.* (1990) as part of a more extensive plant community that these authors called '*Poa labillardierei* (Common Tussock-grass) Grassland'.

✍ Modified Woodland (tentatively assigned to Grassy Woodland EVC 175)

Local extent: 5.04 ha
Bioregional conservation status: Grassy Woodland is endangered.

This mapping unit comprises a small number of plant species growing together, which are probably the few remaining relics of a now-cleared woodland. Interpreting the original structure and assigning an EVC to this area is difficult, given the degree of modification and the extent of clearing on these fertile creek flats since the earliest settlement. This area occurs on the higher floodplain which would almost never be inundated, on raised areas of coarser material. This coarser material has presumably been deposited on the riverbank during past floods. In areas on the edge of the estuarine flat, some material may have been washed from the surrounding hills onto the flat.

Several observations suggest that this area once supported a woodland of Swamp Gum (*Eucalyptus ovata*), with an understorey of shrubs, Austral Bracken (*Pteridium esculentum*) and grasses. Firstly, young Swamp Gums are presently (re-)colonising this area, demonstrating that there is no physical impediment to the growth of trees (in contrast to the lower areas of the estuary). Similarly, other existing species such as Austral Bracken almost always occur in areas capable of supporting tree growth. The small tree and shrub species still present include Blackwood (*Acacia melanoxylon*), Sweet Bursaria (*Bursaria spinosa*) and Prickly Tea-tree (*Leptospermum continentale*). Several grass species remain, including Common Tussock-grass, Grey Tussock-grass (*Poa* ?*seiberiana*), Kangaroo grass (*Themeda triandra*), and several Wallaby-grasses (*Austrodanthonia* spp.). At the southern end of this raised zone, closer to the creek mouth, the raised ground is apparently sandier due to the deposition of wind-blown sand, and species characteristic of coastal areas also occur, such as Coast Beard-heath (*Leucopogon parviflorus*).

Taken together, these observations suggest that a narrow band of woodland occurred on the river bank, adjacent to the Brackish Grassland. Closer to the coast this woodland may have given way to a shrubland with some coastal elements. We have chosen to map this entire area as Grassy Woodland (EVC 175), a broadly defined EVC which encompasses lowland woodlands with a grassy and shrubby understorey.

This area of vegetation was mapped as '*Pteridium esculentum* (Common Bracken) Herbfield' by Carr *et al*. (1990).

Freshwater Wetland EVCs

✍ Tall Marsh (EVC 821)

Figure 7: Tall Marsh (EVC 821).

Local extent: 0.14 ha
Bioregional Conservation Status: None assigned, previously mapped as Reed Swamp (EVC 300), which is vulnerable.

Like Sedge Wetland (EVC 136, described below), Tall Marsh (Figure 7) occupies a small area away from the influence of saline tidal flows, behind the barrier dune. This EVC consists of a tall, dense stand of Cumbungi (*Typha domingenisis*). It was mapped as part of "*Typha* (Cumbungi) Herbfield" by Carr *et al*. (1990), along with Sedge Wetland (EVC 136).

✍ **Spike-sedge Wetland (EVC 819)**

Figure 8: Spike-sedge Wetland (EVC 819) (Foreground).

Local extent: 0.40 ha
Bioregional Conservation Status: None assigned, not previously mapped.

This EVC occurs in several small depressions on the upper edge of the floodplain, largely away from the influence of saline water. These would periodically hold water, and dry out in summer. Several such depressions occur within the study area, while another which was visible in the agricultural land over the river was also mapped (but not inspected in detail). The vegetation is dominated by Common Spike-sedge (*Elaocharis acuta*), along with herbs such as Small Loose-strife (*Lythrum hyssopifolia*), Grass Brachyscome (*Brachyscome ?graminea*) and White purslane (*Neopaxia australasica*). This EVC also contains several conspicuous weeds, most notably Water Buttons (*Cotula coronopifolia*) and Buck's-horn Plantain (*Plantago coronopus*). The site in the adjacent paddock is slightly 'grassier', containing Common Swamp Wallaby-grass (*Amphibromus ?nervosus*), and Leafy Blown-grass (*Lachnagrostis aemula*). This site may approach Plains Grassy Wetland (EVC 125), but was beyond the study area boundary, and (although mapped) was not closely investigated. Spike-sedge Wetland was mapped by Carr *et al*. (1990) as "*Elaocharis acuta* (Common Spike-rush) Herbfield".

✍ Sedge Wetland (EVC 136)

Local extent: 0.03 ha
Bioregional Conservation Status: None assigned, not previously mapped.

Sedge wetland occupies only a tiny area within the Painkalac Creek estuary. It occurs away from the influence of saline tidal flows, behind the barrier dune. It is characterised by the dominance of Tall sedge (*Carex appressa*). This EVC was mapped as part of "*Typha* (Cumbungi) Herbfield" by Carr *et al*. (1990), along with Tall Marsh (EVC 821).

Dune EVCs

✍ Coastal Dune Scrub (EVC 160)

Local extent: 4.61 ha
Bioregional Conservation Status: None assigned, not previously mapped.

This EVC occurs on the deep sand of the dune at the river mouth, on the side of the dune exposed to the ocean. Early photographs and the descriptions in Manning *et al*., (1979) demonstrate that the dune was once less vegetated than it is now, and some of the scrub now present is regrowth, possibly resulting from the reintroduction of some species. The dominant species include Coast Tea-tree (*Leptospermum laevigatum*, possibly locally (re-)introduced, Manning *et al*., 1979), Coast Sword-sedge *(Lepidosperma gladiatum*) and Coast Daisy-bush (*Olearia axilaris*). This EVC was mapped as part of 'Coastal Dune Shrubland' by Carr *et al*. (1990), along with Coastal Alkaline Scrub (EVC 858).

✍ Coastal Alkaline Scrub (EVC 858)

Local extent: 1.83 ha
Bioregional Conservation Status: None assigned, not previously mapped.

This EVC occurs on the sheltered side of the dune (Figure 2), and is taller and denser than the Coastal Dune Scrub (EVC 160, described above) growing on the exposed dune face. Across southern Victoria, this EVC is tightly linked to sheltered, near-coastal areas, on soils which contain limestone/calcrete. The overstorey is dominated by Moonah (*Melaleuca lanceolata*), while the mid-storey contains numerous shrub, herb and sedge species, including Thyme Rice-flower (*Pimelea serpyllifolia* subsp. *serpyllifolia*). This EVC is impacted by weed invasion, most notably Parrot Bush (*Polygala myrtifolia*). This EVC was mapped as part of 'Coastal Dune Shrubland' by Carr *et al*. (1990), along with Coastal Dune Scrub.

DISCUSSION and CONCLUSIONS

Significance of the vegetation

The vegetation of the Painkalac Creek estuary is clearly of significance. Its aesthetic and recreational contributions to the Aireys Inlet area are obvious (Moulton, 2003). The work presented here shows that the estuary/floodplain also retains a good representation of EVCs which are otherwise endangered, rare or vulnerable, along with some EVCs which have not previously been mapped in the Bioregion. The area of Brackish Grassland may prove to be of particular significance. A recent advisory report (Anon. unpub.) made the following comments on Brackish Grassland:

Most communities are critically endangered. Extremely depleted in estuarine situations, remnants few and generally highly modified. Highly endangered by weed invasion, soil disturbance, urbanisation and lack of awareness by managing agencies.

This EVC is not currently afforded a Bioregional Conservation status, but is likely to be endangered. The Painkalac Creek floodplain may, after more extensive mapping work throughout the state, prove to be a highly important area for this EVC.

Significant Plant species

Assessment of the occurrence of significant plant species was not part of this project. However, two significant species known to occur in the Painkalac Creek Estuary are noteworthy:

Salt Lawrencia (*Lawrencia spicata*) Rare in Victoria.

This herb was recorded in a single quadrat by Carr *et al*., (1990) (D19025, 144°05'38" E, 38°28'02' S), probably in an area transitional between Brackish Sedgeland (EVC 13) and Brackish Grassland (EVC 934). This species was not noted in the present study, although no targeted searches were made.

Salt Blown-grass (*Lachnagrostis robusta*) Rare in Victoria.

Several plants of this grass were noted scattered in Brackish Grassland (EVC 934). An incidental record of this species (I 11208) was entered into the FIS for the Painkalac Creek estuary. This species is inconspicuous, and may also be difficult to distinguish from other *Lachnagrostis* species in the field (*Lachnagrostis aemula* was observed nearby).

.

Weed invasion

In general, the lower, wetter and more saline zones of estuaries are relatively resilient to weed invasion. Few weeds are (currently) present Australia which are able to invade EVCs such as Estuarine Reed Bed (EVC 952), Saline Aquatic Meadow (EVC 842), Estuarine Flats Grassland (EVC 914) or Estuarine Wetland (EVC 10). In

contrast, the grassy areas at higher elevations, and the coastal sands are very vulnerable to invasion by a large range of weed species.

The Grassy areas of the floodplain (Brackish Grassland (EVC 934) and the former woodland mapped as Grassy Woodland (EVC 175)) are presently being invaded by native and non-native shrub species (notably Flax–leaf Broom (*Genista linifolia*), Boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*), Coast Wattle (*Acacia longifolia*) and Blackberry (*Rubus* sp.)). Many shrub species are stimulated to germinate by fire, and will spread further each time an area is burnt. As already noted by Moulton (2003), it is essential to undertake weed control work following fires. It must also be noted that the area of raised ground mapped as former woodland would have always contained shrubs. These species are unlikely to need controlling, and include Blackwood (*Acacia melanoxylon*) and Sweet Bursaria (*Bursaria spinosa*). The dune vegetation also suffers from some weed invasion, particularly from Parrot Bush (*Polygala myrtifolia*), however this species has not reached such densities that it cannot still be controlled. The adjacent hillsides (here unmapped or mapped as 'mixed/modified' vegetation also harbour numerous weeds which may pose a threat to the floodplain. These include several native species which have 'escaped' from gardens (Including Red Honey-myrtle (*Melaleuca hypericifolia*), Green Honey-myrtle (*Melaleuca diosmifolia*)). Most of these weed species noted above are already recognised as major problems in the Surf Coast Shire (Carr *et al*., 1998)

The present study was <u>not</u> intended as a study of weed invasion- it is advisable that further survey work be carried out in order to direct weed eradication work.

Ecological changes

As noted in the introduction, patterns of zonation in estuarine vegetation are readily perturbed by changes in hydrology. There is some evidence that the vegetation on the Painkalac Creek floodplain is undergoing gradual change.

The upper areas of Coastal Saltmarsh (see Appendix 1) have large areas of exposed, bare ground, which in this context suggests that these areas are unstable/ in transition. On the basis of field observations alone, it is difficult to determine whether these areas represent incipient saltmarsh or senescent saltmarsh. Both situations occur elsewhere: In areas that are becoming increasingly saline, pre-existing vegetation may die off, allowing saltmarsh specialists to colonise. In other areas, conditions may become unfavourable for the persistence of saltmarsh vegetation and it may die. Given that Carr *et al*., (1990) mapped the upper saltmarsh area as 'Saltmarsh Complex' 15 years ago, it is most probable that this area represents senescent saltmarsh. There are several factors which operate locally that <u>may</u> be leading to a reduction in the cover of saltmarsh, including:

- ✍ Drought, either climatic or due to increased water off-take upstream. Painkalac creek is dammed, and Victoria has just experienced a drought of many years.
- ✍ Fire. Moulton (2003) shows that much of the area in question was burnt in 1996.
- ✍ (Over-)grazing by native marsupials.

It is possible that these factors have acted in concert to reduce the vigour and extent of saltmarsh on the upper floodplain over many years.

In 1990, a relatively small area of '*Phragmites australis* (Common Reed) grassland' (Now Estuarine Reed Bed, EVC 952) was mapped on the floodplain (Carr *et al*., 1990). This area now supports little native vegetation, with occasional plants of Beaded Glasswort and Sea-rush being present among pools supporting elements of Saline Aquatic Meadow (EVC 842). This change may be caused by localised, increased salinity.

The comments provided here on vegetation change are, at best, speculative. A firmer idea of the hydrological basis for these changes will come only from specific hydrological studies and/or from long-term, detailed monitoring of vegetation patterns. The present study provides the ground-work for such monitoring

References

Anon (unpub.) Estuary entrance management decision framework. Draft workshop report and additonal questions. Technical Advisory Group- Flora.

Anon (2000) West Victoria comprehensive regional assessment. Commonwealth/ Victorian RFA steering committee, Department of Natural Resources and Environment and Environment Australia.

Anon (2002) Australian catchment, river and estuary assessment 2002: Assessing the aggregate impacts of resource use on key natural ecosystems. National land and resources audit, Natural Heritage Trust. Vol 1, p111-188.

Carr GW, Bedgood SE, Jaremovic R, Goss HM, Johnston CAN, Seymour SB, Clarke A, Leirs L, Greenhill B (1990) Painkalac Creek Wetlands and Floodplain Environmental Study. Prepared for the Painkalac Creek Valley Study Steering Committee. Ecological Horticulture PL, Biosis Research PL, Context PL, SCAT Environmental and Waste Treatment Consultants.

Carr GW, Morgan M, MacDonald M (1998) Environmental weeds- Invaders of our Surf Coast. Anglesea and Aireys Inlet Society for the Protection of Native Flora and Fauna (ANGAIR) and Surf Coast Shire. Adams Printing, Geelong.

DSE (unpub.) Catchment Management Authorities - EVC Bioregional Conservation Status, Depletion & Tenure Area Statement, Full EVC Victorian Bioregion Statement - CMA Breakdown.

Forsyth DA, Ransome SW (1978) A report on the Painkalac Creek (Aireys Inlet) catchment- a proposal for proclamation prepared for consideration by the Land Conservation Council. Soil Conservation Authority, Kew, Victoria.

Frood D (unpub.) Typology for Wetlands and related vegetation in Victoria. EVC Descriptions: Existing, proposed amendments and new descriptions.

Moulton P (2003) Painkalac Creek fire management plan 1999 (revised 2003). Prepared for Surf Coast Shire.

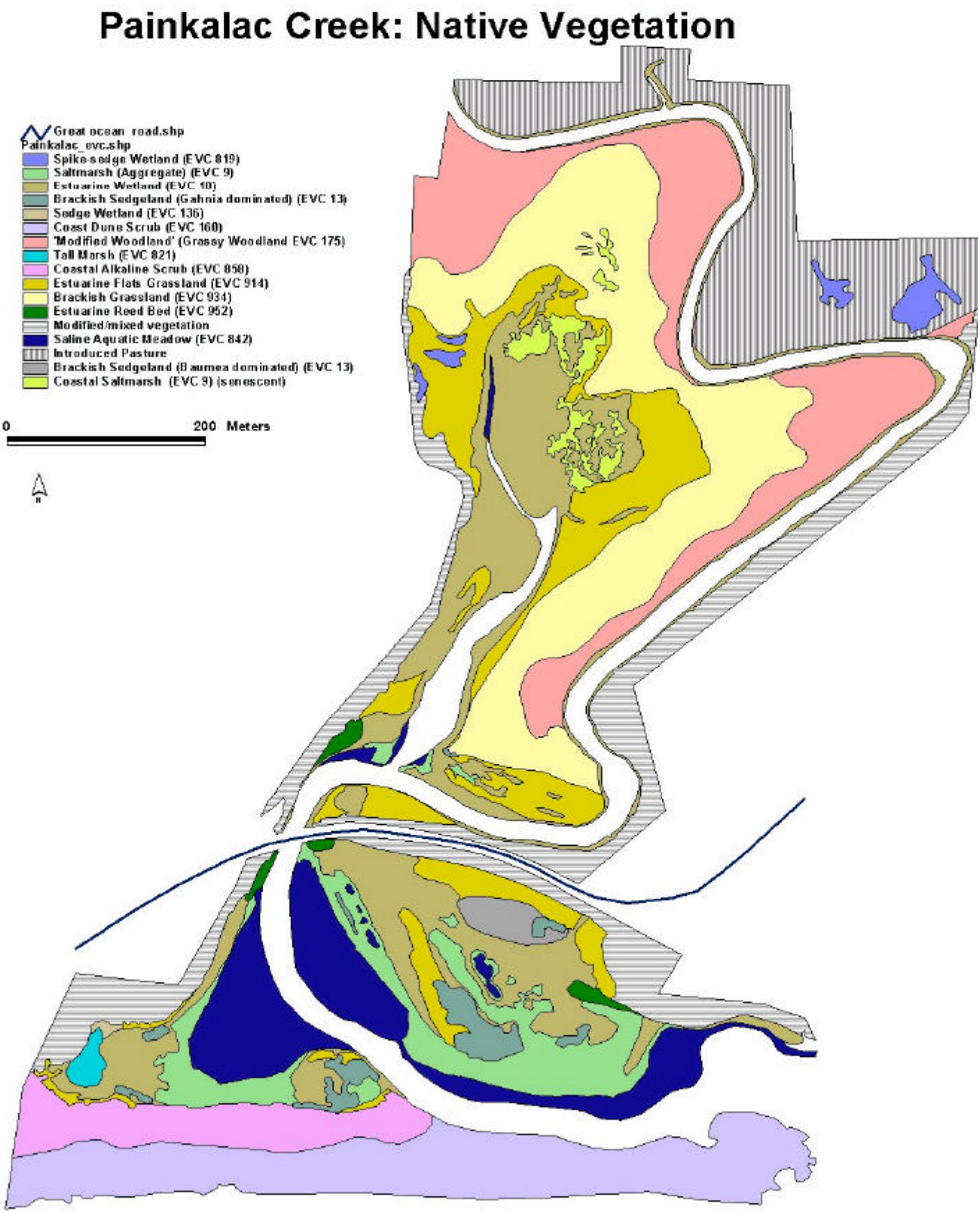
Oates A, Taranto M (2001) Vegetation mapping of the Port Phillip and Westernport region. Arthur Rylah Institue of Environmental Research.

Walsh NG (1994) Poaceae. In: Walsh N.G., Entwisle T.J. (Eds.) (1994) Flora of Victoria. Vol II p 356-629. Inkata Press, Melbourne.

Acknowledgments

We thank Doug Frood (Pathways Bushland and Environment) and Alison Oates (DSE) for their valuable advice on EVC typology/ identification, and David Cameron (DSE) for assistance with plant identification.

Appendix 1


Painkalac Creek: Native Vegetation
Great ocean road.shp
Painkalac_evc.shp
Spike-sedge Wetland (EVC 819)
Saltmarsh (Aggregate) (EVC 9)
Estuarine Wetland (EVC 10)
Brackish Sedgeland (Gahnia dominated) (EVC 13)
Sedge Wetland (EVC 136)
Coast Dune Scrub (EVC 160)
'Modified Woodland' (Grassy Woodland EVC 175)
Tall Marsh (EVC 821)
Coastal Alkaline Scrub (EVC 858)
Estuarine Flats Grassland (EVC 914)
Brackish Grassland (EVC 934)
Estuarine Reed Bed (EVC 952)
Modified/mixed vegetation
Saline Aquatic Meadow (EVC 842)
Introduced Pasture
Brackish Sedgeland (Baumea dominated) (EVC 13)
Coastal Saltmarsh (EVC 9) (senescent)
0
200 Meters
N

Appendix 2

GIS files: metadata

The following GIS (Arcview 3.3) files have been created during the completion of this project:

Painkalac_veg_area.shp

This layer represents the study area boundary as a line theme.

- Arcview 3.3 shapefile
- AMG zone 55
- MGA94

Painkalac_EVC.shp

This layer represents all of the vegetation mapping data.

- Arcview 3.3 shapefile
- AMG zone 55
- MGA94

Fields

- EVC: shows the EVC assigned to each polygon of native vegetation. EVC numbers are consistent with all other DSE publications (eg Anon. 2000, Oates and Taranto, 2001; Frood, unpub.), however a decimal place has been added to allow some EVCs to be differentiated. Several 'non-EVC' labels also represent non-native vegetation. The values are used as follows:

842.0	Saline Aquatic Meadow
9.1	Coastal Saltmarsh
9.2	Coastal Saltmarsh (senescent areas)
10.0	Estuarine Wetland
952.0	Estuarine Reedbed
13.1	Brackish Sedgeland (*Gahnia* dominated)

13.2	Brackish Sedgeland (*Baumea* dominated)
941.0	Estuarine Flats Grassland
934.0	Brackish Grassland
136.0	Sedge Wetland
821.0	Tall Marsh
819.0	Spike-sedge Wetland
858.0	Coastal Alkaline Scrub
160.0	Coastal Dune Scrub
175.0	Modified Woodland (once Grassy Woodland)
997.0	Non-native Pasture
998.0	Modified/Mixed Vegetation

- Area: area of each vegetation polygon in m^2
- Hectares: area of each polygon in hectares
- Date: the date of data completion (in all cases 14122005, 14th December 2005)
- Poly_id: a unique numerical identifier for each polygon

Painkalac_EVC_leg

This file is an Arcview Legend which is designed to be applied to the field 'EVC' of the layer **Painkalac_EVCs.shp.**

Appendix 3

Quadrat Data taken from Brackish Grassland (EVC 934)

Data Source: Flora Information System: Biodiversity and Natural Resources: DSE - 2004

D09500 Recs: 34
Date: 14 Dec 2005
Lon-Lat: 144°05'50" 38°27'46"
AMG : 55 246726 5738817
Altitude: 1
Collector: SJSIN; MDW
***** denotes introduced species

+	0107		***Acaena ovina*** - Australian Sheep's Burr
+	0166	*	***Aira elegantissima*** - Delicate Hair-grass
+	0961		***Austrodanthonia caespitosa*** - Common Wallaby-grass
+	0967		***Austrodanthonia laevis*** - Smooth Wallaby-grass
+	0980		***Austrodanthonia setacea*** - Bristly Wallaby-grass
+	0496	*	***Briza minor*** - Lesser Quaking-grass
+	0501	*	***Bromus hordeaceus subsp. hordeaceus*** - Soft Brome
2	0583		***Calocephalus lacteus*** - Milky Beauty-heads
+	0702	*	***Centaurium erythraea*** - Common Centaury
+	1033		***Dichelachne crinita*** - Long-hair Plume-grass
+	1036		***Dichondra repens*** - Kidney-weed
1	1076		***Distichlis distichophylla*** - Australian Salt-grass
+	0146		***Elymus scaber var. scaber*** - Common Wheat-grass
+	4447		***Epilobium billardierianum subsp. intermedium*** - Variable Willow-herb
+	1466		***Euchiton collinus s.s.*** - Creeping Cudweed
+	1748	*	***Hypochoeris radicata*** - Cat's Ear
+	1830		***Juncus pallidus*** - Pale Rush
+	1843		***Juncus subsecundus*** - Finger Rush
1	0850		***Leptinella reptans s.l.*** - Creeping Cotula
+	2056	*	***Lotus angustissimus*** - Slender Bird's-foot Trefoil
+	8739		***Microtis spp.*** - Onion Orchid
+	0979		***Notodanthonia semiannularis*** - Wetland Wallaby-grass
+	2386		***Oxalis perennans*** - Grassland Wood-sorrel
+	2553	*	***Plantago coronopus*** - Buck's-horn Plantain
1	2561	*	***Plantago lanceolata*** - Ribwort
4	2600		***Poa labillardierei*** - Common Tussock-grass
1	2605		***Poa poiformis*** - Coast Tussock-grass
+	2942	*	***Romulea rosea*** - Onion Grass
+	3100		***Selliera radicans*** - Shiny Swamp-mat
+	3163	*	***Sisyrinchium iridifolium*** - Blue Pigroot
+	3427	*	***Trifolium dubium*** - Suckling Clover
1	3506		***Veronica gracilis*** - Slender Speedwell
+	3516	*	***Vicia hirsuta*** - Tiny Vetch
+	3548	*	***Vulpia muralis*** - Wall Fescue