

# The problem of the use of ambiguous terms in Tasmanian coastal planning policy documents for defining appropriate coastal development zones

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## Introduction

Coastal planning and policy in Tasmania has been hindered by a use of ambiguous and undefined terminology in relevant coastal planning policy documents, notably the Tasmanian Coastal Policy (1996) and in some Local Government Planning schemes. The use of such terminology to define appropriate and inappropriate areas for coastal development has previously and will continue to result in vexatious planning disputes and poor coastal planning outcomes until it is corrected. This document identifies several of these deficiencies.

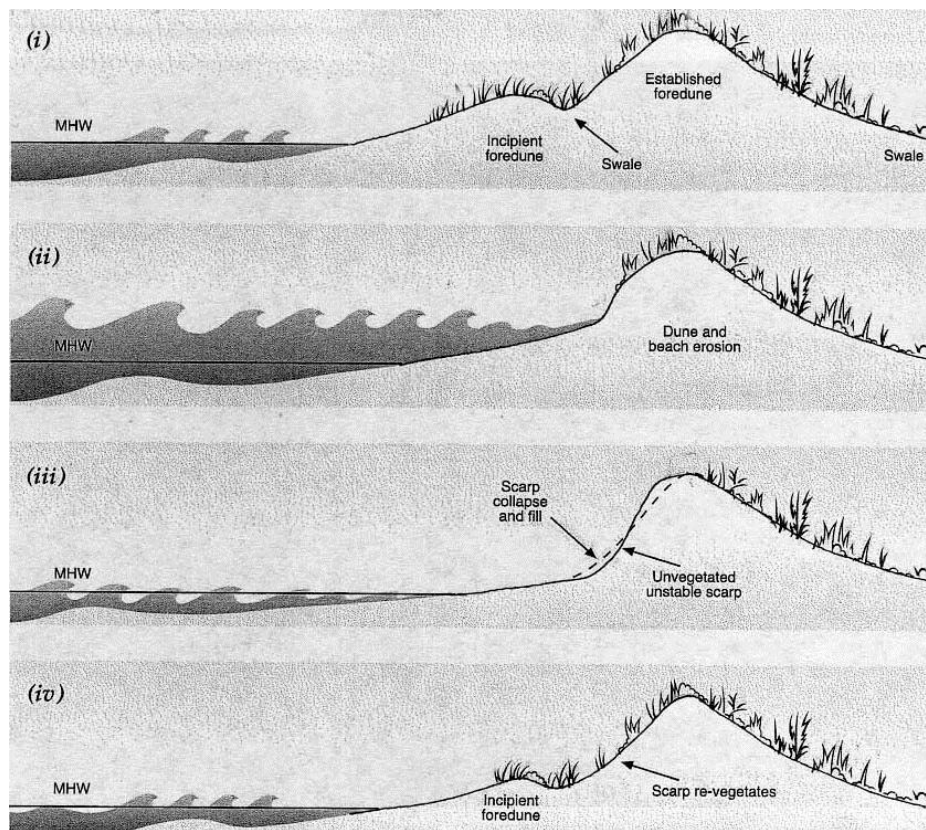
## Contemporary Coastal Dune Terminology

One of the few sources of guidance to appropriate coastal development zones in current Tasmanian coastal planning policy documents (particularly the Tasmanian Coastal Policy 1996 and various Local Government Planning schemes) is to specify 'frontal dunes' or 'primary dunes' as places where coastal development should be restricted. However these are ambiguous terms which are not defined in the relevant policy documents, and moreover are essentially colloquial terms that are rarely used in the current scientific and professional literature on coastal landforms.

Shore-parallel sand dunes backing sandy beaches, and formed by accumulation of sand blown off beaches by onshore winds, are a common feature backing most Australian beaches. These features are normally referred to in the contemporary coastal geomorphic literature as 'foredunes', and have widely accepted characteristics and an accepted definition which are summarised in a review paper by the internationally recognised coastal dune authority Patrick Hesp (Hesp 2002).

Two main types of foredunes are widely recognised, namely "established foredunes" and "incipient foredunes", and are described below in accordance with Hesp (2002) and other contemporary coastal geomorphic texts. See Figure 1.

Established foredunes vary in size but may reach tens of metres in height and width, and typically extend parallel to the back of most of a beach. They form by accumulation of sand blown landwards from the beach and trapped by backshore vegetation above the limit of all but the largest storms. These dunes may take decades to centuries to form. Because the position at which they can form is determined by the landwards reach of the largest storms, the dune front will occasionally be reached and eroded by storm waves during infrequent large storms. Any infrastructure placed too far forward on the dune may be damaged or destroyed by such events. If average sea-level is stable, the erosion scarp will eventually be repaired by sand blown back onto the dune front from the beach in-between major storms (see Figure 1). However note that if sea level is rising, successive large storms may erode the dune further back than it has been previously eroded and may ultimately destroy the entire foredune. A new foredune may subsequently form further to landwards if sea-level later stabilises again at a higher level.



**Figure 1:** Incipient and established foredunes, illustrating the cyclic coastal processes which give rise to these two varieties of foredune. Reproduced from Hesp (2000).

An incipient dune is an ephemeral feature which accumulates to seawards of the main established foredune during intervals between large storms when the upper beach is above the limit of normal wave action so that vegetation can begin to establish and a foredune can begin to accumulate from sand blown off the beach by onshore winds. However because incipient foredunes occur within the range of large infrequent storm waves, they will occasionally (perhaps every decade or several decades) be destroyed by large storms whose waves reach the established foredune. However in cases where average sea level is dropping, or where there is an excess supply of sand to the beach from some other source, the beach itself may accrete or 'prograde' to seawards and the incipient dune may continue to accumulate into a fully-fledged established foredune. In this case the former established foredune becomes a 'hind dune' with a new established foredune in front of it, and a new incipient foredune may begin to form to seawards of the original one which has become an established foredune.

A range of other dune types may also occur behind beaches. These are usually found to landwards of the established foredune and represent either earlier phases of coastal landform development (e.g., parallel dunes representing older foredunes that have become hind dunes, or beach ridges) or dunes formed of sand blown landwards from eroding foredunes (e.g., blowouts, transgressive and parabolic dunes). A range of widely accepted terms for such dunes is also available in the contemporary coastal geomorphic literature (including Hesp 2002).

In contrast to the terms described above, terms such as 'Primary Dune', 'Secondary Dune' or 'Frontal Dune' are older terms for which no widely agreed definition was ever achieved in the coastal literature, and the usage of which (largely as a result of this) has generally been replaced in the

contemporary coastal geomorphic literature by the term 'foredune'. These older terms were generally used in a broadly equivalent way to 'foredune' but due to the lack of clear definition were frequently used in ambiguous and contradictory ways to refer variously to features that are more correctly described as 'established foredunes', 'incipient foredunes', or sometimes to other types of dune. Because of this ambiguity these terms are now rarely used by contemporary coastal scientists.

Another ambiguous term also used in Tasmanian coastal policy documents (including the Tasmanian State Coastal Policy and the Tasmanian Shack Sites Act) is the term 'actively mobile landforms'. Whilst the coastal policy cites the equally ambiguous term 'frontal dune' as an example of such a landform, 'mobile landforms' might also arguably refer to beaches, transgressive dunes, and eroding or slumping shorelines of any sort. However as discussed further below there are significant problems in trying to determine what is or is not an 'actively mobile landform' in the sense of the Tasmanian State Coastal Policy.

Further discussion of all these ambiguities is provided below.

### **"Frontal Dunes"**

The currently in-force Tasmanian State Coastal Policy (1996) refers to 'actively mobile landforms such as frontal dunes' (clause 1.4.2) as locations where development will generally not be permitted, however the policy provides no definition of the term 'frontal dune'. The same term is also used in some other policy documents which refer to the Coastal Policy. As Hesp (2002) notes, the term 'frontal dune' is sometimes used as a loose equivalent to 'foredune', but it is important to note that the term does not specifically refer to either incipient or established foredunes and could apply to either. In principle it seems logical to assume that the term 'frontal dune' would refer to the most seawards dune on a shore, but due to the dynamic nature of sandy coasts this in itself is an ambiguous definition as shown below.

The ambiguity is regularly exploited by developers wishing to build on an established foredune since they can assert that the small incipient foredune in front of the established foredune is the 'frontal dune', making the established foredune a 'back dune' or 'hind dune' and therefore putatively not subject to the State Coastal Policy clause (1.4.2). However in cases where an incipient foredune is not present (typically as a result of recent storm waves having removed it or prevented one from forming), then the established foredune is in that case arguably the 'frontal dune' since it is the most seawards dune present. The difficulty with this ambiguous term becomes most apparent in considering the dynamic nature of sandy shores, as illustrated in Figure 1 above. On the day preceding a large storm, an incipient dune backing a given beach might arguably be the 'frontal dune'. However if the storm then completely destroys the incipient foredune (as may occur), then on the day following the storm the remaining established foredune would have arguably become the 'frontal dune'. However if no further large storms occur for several years then a new incipient dune will eventually form and will again become the 'frontal dune'.

For these reasons, the undefined term 'frontal dune' is in my view too ambiguous and in fact unstable in meaning to serve as a useful criterion for identifying locations where coastal development should or should not be permitted.

## **“Primary” and “Secondary” Dunes**

Many Tasmanian policy documents refer to ‘primary’ and ‘secondary’ dunes. As an example, the Circular Head Planning Scheme Clause (6.5.1) states that “any development on a primary sand dune shall be prohibited, and any development on a secondary or back sand dune shall only be granted a permit at the discretion of Council...”. However the scheme provides no definition of these terms (e.g., in Part 13: “Definitions”).

Although the terms ‘primary dune’ and ‘secondary dune’ can be found in some older coastal literature (see further below), they are rarely used in recent coastal geomorphic textbooks. Considering the major recent Australian texts (which are consistent with international literature), Eric Bird’s ‘Coastal Geomorphology – An Introduction’ (Bird 2000) uses the term ‘foredune’ but does not refer to primary or secondary dunes. The same is true for Colin Woodroffe’s major text ‘Coasts – Form, Process and Evolution’ (Woodroffe 2003). Similarly Short & Woodroffe’s recent textbook ‘The Coast of Australia’ (Short & Woodroffe 2009) distinguishes between and describes ‘incipient foredunes’, ‘established foredunes’ and ‘hind dunes’ (as older foredunes landwards of a current established foredune on an accreted shoreline), but does not use the terms ‘primary dune’ or ‘secondary dune’. Finally, the standard reference work on practical coastal management works in Tasmania, the ‘Tasmanian Coastal Works Manual’ (Page & Thorp 2010) published in December 2010 by the Department of Primary Industries, Parks, Water and Environment, uses the terms ‘foredune’, ‘established foredune’, ‘incipient foredune’ and ‘hind-dune’ to refer to coastal dunes (e.g., Section 6.2 Coastal Dune Systems), but does not use the terms ‘primary’ or ‘secondary’ dunes (except that the term ‘secondary dune’ appears in a figure reproduced from an older text on vegetation).

In contrast, the terms ‘primary’ and ‘secondary’ dune occur mainly in older and/or non-geomorphic literature and have no generally agreed definition:

In one of the few clear definitions in the older scientific coastal geomorphic literature, Davies<sup>1</sup> (1980, p.157; see also Tinley 1985) defined ‘Primary Dunes’ to be dunes accumulated directly from sand blown landwards from a beach, and ‘Secondary Dunes’ to be dunes formed of sand derived from subsequent erosion of a primary dune. Under this definition Davies cited ‘frontal dunes’ parallel to the rear of the beach as an example of ‘primary dunes’, and his definition of a primary dune would clearly include incipient foredunes, established foredunes, and also older hind dunes which were once foredunes and have not yet been reworked by further erosion. Under Davies definition ‘secondary dunes’ include blowouts, parabolic and transgressive dunes formed of sand blown further landwards from an eroding primary dune. This distinction between primary and secondary dunes has been used in Tasmania, for example in a public service context by Pemberton (1994) who described foredunes at Clifton Beach as ‘primary dunes’ and transgressive dunes inland of the foredunes as ‘secondary dunes’ in accordance with Davies definition.

However Davies (1980) early distinction between primary and secondary dunes was not consistently adopted and other usages inconsistent with his are common. One such usage which is found quite frequently on a range of coast-related websites and in some consultant reports is the notion that the incipient foredune is the “Primary Dune” and the established foredune is the “Secondary Dune”.

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<sup>1</sup> Jack Davies was a former Professor of Geography at the University of Tasmania in the 1960s who wrote several texts on coastal geomorphology and is recognised internationally as a major early coastal landform researcher.

Examples of this usage can be found on The Smithsonian Marine Station at Fort Pierce 'Dune Habitats' web page (<http://www.sms.si.edu/irlspec/dunes.htm>) and the Capricorn Coast Flora 'Foreshore dunes' web-page (<http://www.mycapricorncoast.com/plants/foreshore1.html>) amongst many others. However it is notable that in these and many other cases there is no reference cited as an authority for the meaning of the terms 'primary dune' and 'secondary dune' that is used; moreover these terms are commonly used in association with descriptions of coastal flora and appear to be more a result of botanists trying to describe coastal vegetation succession sequences in terms of primary, secondary and tertiary species than an effort to accurately define coastal landform types (e.g., see Page & Thorp 2010, section 7.3.3). This usage is inconsistent with the better-defined geomorphic usage of Davies (1980) since the established foredune is also a dune formed of sand blown from a beach and would thus be a 'primary dune' according to Davies but is a 'secondary dune' according to some other (unreferenced) usages such as those websites noted above.

In summary, at least two inconsistent uses of these terms exist and have been widely used, albeit it is noticeable that many usages of the terms do not cite a source or reference for the meaning they adopt. Since such unreferenced usages are not supported or defined in contemporary coastal geomorphic texts, they can only be regarded as colloquial terms that are of little value in defining particular types of features for policy, planning and legal purposes.

### **Other Dune Types**

At many Tasmanian beaches, of which a good example is Clifton Beach in southeast Tasmania, many of the dunes on which housing and other development currently exists or is proposed are partly or wholly blown-out (wind-eroded) foredunes which in some cases might still be correctly described as 'blown-out foredunes' but in many cases are more properly described as 're-vegetated transgressive dunes' that are neither primary dunes, frontal dunes nor foredunes under any definition of those terms (Hesp (2002) also provides a useful scientific discussion of some of these additional dune types). These are nonetheless formerly eroded and mobile dunes with a significant risk of renewed erosion and mobility and thus arguably are unsuited for development. Not only does the terminology used in existing planning policy instruments fail to identify these dunes as potentially hazardous for development, but in fact they do not properly fit into any of the dune types specified (albeit ambiguously) in those documents. Thus the policy instruments are wholly inadequate to define appropriate and inappropriate areas for coastal development at places such as Clifton Beach.

### **"Actively Mobile" Dunes**

The currently in-force Tasmanian State Coastal Policy (1996) refers to 'actively mobile landforms such as frontal dunes' (clause 1.4.2) as locations where development will generally not be permitted, however the policy provides no definition of the term 'actively mobile landform' other than to cite the equally ambiguous undefined term 'frontal dune' as an example of such a thing.

Given the lack of definition, it is not possible to be certain what the authors of the coastal policy intended; however it seems likely that the term 'actively mobile landform' is intended to refer to a landform which is actively moving in whole or in part. Movement of a coastal landform will generally involve the processes of erosion and/or accretion – which both amount to changes of landform shape or morphology – since there are few other natural processes by which a coastal landform might be said to 'move' (albeit some movement due to subsidence or tectonics may occur

in some cases, however these will be much rarer (in Australia at least) than normal sources of wind and wave erosion).

Granted this, the problem is that if an 'actively mobile landform' is one which is changing shape through processes of erosion or accretion, then *all* landforms are arguably 'mobile' because they will all erode or accrete and thereby change shape to some noticeable extent over some time frame (which may be of the order of centuries to millennia for some hard rock features, or as little as seconds to minutes in the case of some soft sand landforms exposed to wind or waves).

The problem of defining an 'actively mobile landform' in a planning or policy context is therefore one of defining what amount of movement (or shape change) over what duration or time frame is required. The coastal policy gives no guidance or definition on this matter at all. I have previously argued (in tribunal hearings involving proponents who wished to build or use dunes which are arguably 'actively mobile') that the relevant degree and timing of 'active mobility' should be a degree of movement (shape change by erosion and or accretion) sufficient to create a significant hazard for buildings or other relevant uses within a normal planning time frame of 50 or 100 years. Defined in this way an established foredune would be an 'actively mobile landform' since it is highly likely to be subject to one or more episodes of storm wave erosion in such a period, as well as a high likelihood of significant blowout erosion. However this was not a definition the proponents preferred, and they hired their own advocates to argue that the landform must be visibly moving (changing shape) on timeframes of minutes to days in order for it to be classified as 'actively mobile'.

Although it seems clear to me that the latter definition was not the intent of the coastal policy, I could not demonstrate this intent because the policy provided no clear definition. Hence the term remains an ambiguous one whose continued undefined use will continue to result in arguably inappropriate planning outcomes.

## **Conclusion**

It is implicit – and in some cases explicitly stated in the relevant policy documents – that the purpose of restricting development on 'frontal' or 'primary' dunes, or on 'actively mobile landforms', is one or more of the following:

- Access: to allow public access to and use of the coastal strip, especially beaches;
- Conservation: to maintain coastal scenic amenity, to allow natural coastal processes to operate and to conserve habitat for coastal species;
- Hazards: to avoid development in coastal areas subject to hazards such as erosion, dune mobility, flooding and slumping that may result from coastal storm surges, wave erosion, human interference or other causes.

The third purpose is of particular relevance to present and future coastal development in view of the fact that ongoing sea-level rise is expected to cause progressively more erosion and flooding to greater distances inland than has occurred in the past.

The use of the terms 'frontal dune', 'primary dune' or 'actively mobile landform' to identify coastal areas on which development should be restricted for any of the above reasons is inadequate for two reasons, namely:

1. These terms are subject to multiple interpretations amongst which a 'correct' usage cannot be identified due to a lack of any clear unambiguous definition in the policy documents in which they are used, or elsewhere; and because:
2. The landforms to which the terms may putatively refer to do not in any case provide a useful delineation of the full extent of coastal areas which might be best reserved for public access, amenity or conservation purposes, nor do they usefully delineate the full extent of coastal areas that may be subject to flooding, erosion, dune mobility or other hazards.

In my view, for the reasons discussed above, the use of the terms 'primary dune', 'secondary dune', 'frontal dune' and 'actively mobile landform' in Tasmanian coastal planning policy documents is fundamentally flawed. Moreover the ambiguity of these terms is such that I consider it is not possible to provide an unambiguous determination of whether a proposed development is or is not located on a landform referred to by any of these terms. Although such determinations have been made in the past, I believe the basis on which they were made to be flawed, and I consider that it would be incorrect to make any further such determinations. I consider that Tasmania's present coastal planning system is fundamentally flawed for reasons including those discussed above, and urgently requires revision and improvement to provide an unambiguous basis for making coastal planning decisions based on a proper assessment of actual risks and values rather than on arguable determinations based on ambiguous and largely irrelevant terminology.

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