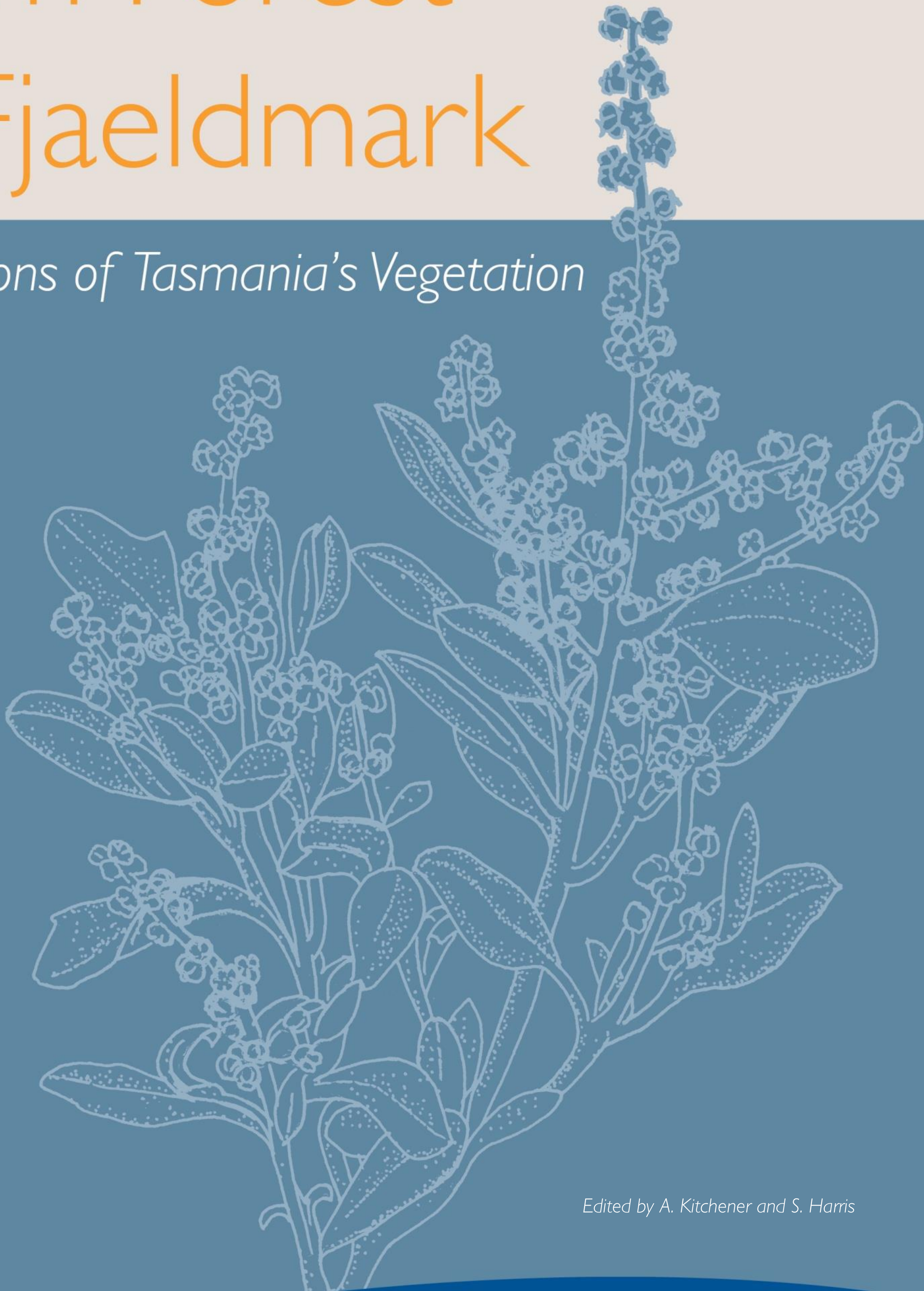
EDITION 2

From Forest to Fjaeldmark

Descriptions of Tasmania's Vegetation



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Preface and acknowledgements for the second edition

The original edition of this publication coincided with the first release of an integrated vegetation map of Tasmania, TASVEG 1.0.

This second edition has been prepared for release with TASVEG 3.0 and reflects the substantial revision of some unit descriptions and TASVEG mapping since the first edition.

Improvements to distributional data within this edition are attributable to the ongoing mapping work of the Tasmanian Vegetation Monitoring and Mapping Program (TVMMP). Staff contributing substantially to the review of vegetation mapping since 2005 have included Mrs Sib Corbett, Ms Felicity Hargraves, Mr Anthony Hunn, Ms Jayne Balmer and Dr Anne Kitchener. The mapping program is supported by dedicated governance groups - TVMMP Scientific Reference Group (SRG) and TVMMP Technical Reference Group (TRG). The contribution of quality mapping and information from a variety of external providers is also acknowledged. This includes the regular contribution of the Forest Group Plantation dataset (jointly provided by Forestry Tasmania and Private Forests Tasmania) and ad hoc contributions by staff within the Resource Management and Conservation Division of the Department of Primary Industries, Parks, Water and Environment (DPIPWE), private consultants, local councils and NGOs.

A significant addition is the inclusion of descriptions of the vegetation of Macquarie Island. These have been provided by Mr Micah Visoiu and Dr Jennie Whinam based upon their invaluable experience of this sub-Antarctic region of Tasmania and on the *Map of structural vegetation types and drainage on subantarctic Macquarie Island* (Australian Antarctic Data Centre, 1998). The original map is the product of a joint project between Dr Patricia Selkirk and the late Dr Don Adamson of the School of Biological Sciences, Macquarie University and the Australian Antarctic Division (AAD).

A major review of the mapping unit descriptions for *Scrub, heathland and coastal complexes* was managed by Ms Felicity Hargraves with the support of the TVMMP team, TVMMP SRG and aided by advice from other experts. We thank those who provided constructive comments and advice through an initial workshop facilitated by NRM South (Dr Magali Wright with assistance from Mrs Jill Jones) and through comments on manuscript drafts. Those who have made a substantial contribution the revision of the *Scrub, heathland and coastal complexes* section are listed separately below. In particular we thank Mr Micah Visoiu, Dr Richard Schahinger, Ms Jayne Balmer and Mrs Sib Corbett for their substantial efforts in support of this revision. We thank Mr Nicholas Fitzgerald for scientific proofing of revised text in the *Scrub, heathland and coastal complexes* section.

For integration of new mapping and maintenance of the TASVEG data set, upon which the community distribution information in the revised manuscript depends, we thank our current expert GIS team of Mr Lindsay Mitchell and Mr Paul Fazackerley, and recognise the following for provision of substantial GIS support in developing the post-TASVEG 1.0 data set: Mr Julian Ward, Mr Murray Stebbing, Mr Winston Smith, Mr Chris Collins, Mrs Bronwyn Tilyard, Mr Peter von Minden and Mr Lindsay Millard. We acknowledge Mr John Corbett's early programming work to develop an application to ortho-rectify and mosaic hard copy aerial photographs for efficient desk-top vegetation mapping.

Ms Gina Donnelly is acknowledged for her considerable expertise in the provision of an updated design template and design layout for the revised manuscript.

Thanks are also due to Ms Lee Buchanan, Ms Sha-Sha Kwa and Mr David Rayner for their assistance with publication of this document on the DPIPWE web site.

Dr Anne Kitchener is credited with the project management of the revised publication and TASVEG data set and for their coordinated release, and Mrs Kristy Franken is thanked for her guidance and support in achieving this major milestone.

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Vegetation Communities: Wet eucalypt forest and woodland
Eucalyptus viminalis subsp. *viminalis*: © Richard Hale. Tasmanian Parks and Wildlife Service collection.

Vegetation Communities: Macquarie Island vegetation
Pleurophyllum hookeri: © Richard Hale.

Glossary, Abbreviations and Appendices
Alyxia buxifolia: © Georgina Davis; DPIPWE collection.

Acknowledgements to the first edition

The beginning of TASVEG (an integrated vegetation map for Tasmania) coincided with the first round of funding from the Australian Government's Natural Heritage Trust. It originated as a proposal developed by DPIWE and the then Environment Australia. Mr Mike Askey-Doran, Mr Peter Bosworth, Dr Mick Brown, Mr Steve Casey, Mr Fred Duncan, Ms Louise Gilfedder, Dr Gintaras Kantvilas, Prof. Jamie Kirkpatrick, Mr Andy North, Dr Richard Barnes, Ms Penny Wells, Mr David Peters, Mr Colin Reed and Ms Karen Ziegler provided technical advice in the early stages of the project.

TASVEG mapping incorporated two sets of vegetation mapping. Tasmanian World Heritage Area (WHA) mapping was initiated and supervised by Ms Jayne Balmer and Dr Jennie Whinam from the end of 1989. Mrs Sib Corbett completed much of this, with contributions by Ms Rachel Mackie, Ms Melinda Lambourne and Prof. Jamie Kirkpatrick. The forest communities mapped during the studies (Comprehensive Regional Assessment), leading to Tasmania's Regional Forest Agreement, provided the basis for another major component of the mapping and the contributions to that mapping are acknowledged separately in Environment and Heritage Report Volume II. Background Report Part C (1996).

The vegetation scientists within DPIWE on whom the new Tasmanian vegetation mapping program fundamentally depended included: Dr Matthew Appleby, Mr Paul Black, Mrs Sib Corbett, Mrs Helen Crawford (nee McKenny), Ms Joanna Edwards, Mr Robbie Gaffney, Ms Felicity Hargraves, Ms Anne McEntee, Dr David Rankin, Mrs Liz Quinn, Dr Richard Schahinger and Mr David Storey. Others have contributed mapping through other sources such as the Private Forest Reserve Program, consultant's reports and local government vegetation planning reports.

The vegetation descriptions that form the bulk of this book have involved many contributors over a long period and it is difficult to attribute most of these clearly to one or two or even a few individuals. Those who have made a substantial contribution to the text are listed separately.
Dr Anne Kitchener began the major task of documenting descriptions of mapping categories, blending the field observations of the mappers with information from current literature and expert advice.

Members of the TASVEG Scientific Advisory Committee and the Mapping Users Reference Group are thanked for their considerable input and advice. In particular, for the original edition the work by the Scientific Advisory Committee, through a series of workshops chaired by Dr Stephen Harris supported by Mrs Liz Quinn, was invaluable in improving our documentation of the mapping unit descriptions and keys. Constructive comments were also received from Ms Penny Wells, Ms Fiona Wells, Mr Stephen Waight, Mrs Naomi Lawrence, Dr Phil Bell, Dr Richard Barnes, Mr Chris Grose and Mr Ian Household.

Mr Martin Stone, Ms Anita Wild and Dr Mick Brown refereed an earlier draft of this work and provided detailed and constructive comments that profoundly influenced the current book.

Ms Gina Donnelly in the Information Land Services Division, DPIWE, cheerfully shouldered responsibility for the huge task of layout and design of this book.

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Foreword

The release of this second edition of From Forest to Fjaeldmark flags the substantial progress that has been made in revising the State's 1:25,000 scale vegetation map, TASVEG, and the vegetation classification underpinning it.

From Forest to Fjaeldmark Edition 2 has been developed primarily as a companion manual to guide the use and interpretation of TASVEG 3.0 and future versions of the data set. However the comprehensive nature of the descriptions, which document the state's extensive and diverse native vegetation, ensure it will continue to be an essential reference for anyone interested in Tasmania's natural history.

The TASVEG data set and the From Forest to Fjaeldmark manual are essential tools for everyone in the business of biodiversity research, land management or monitoring. These tools are vital for continued improvement in managing Tasmania's unique biodiversity which, although better reserved than ever before, continues to be impacted by weeds, pathogens, changing climate and fire frequency.

The maintenance and public accessibility of up-to-date state-wide vegetation mapping remains a priority of the Tasmanian government. For this reason, TASVEG is available on-line through the LISTmap viewer (http://maps.thelist.tas.gov.au/listmap) and via the Natural Values Atlas (https://www.naturalvaluesatlas.tas.gov.au).

It is appropriate that this latest version of Forest to Fjaeldmark, presented as a series of print and screen-friendly documents and now attractively formatted to include full colour images, is also easily accessible as an on-line electronic resource at http://www.dpipwe.tas.gov.au/f2f.

The electronic format will enable more frequent updating to ensure the information maintains currency with the TASVEG data set.

Complemented by the suite of other electronic data resources made available by DPIPWE, the mapping and manual are more accessible than ever before, ensuring their value as key tools for resource management and development for the foreseeable future.

Kim Evans

Secretary, Department of Primary Industries, Parks, Water and Environment

Introduction and Context

Ammobium calyceroides

Overview

The principal aim of this publication is to describe the classification of mapping units used in the TASVEG map.

The description of each of the current 162 mapping units, most of them ecological vegetation communities, form the bulk of this book and are an essential reference for those seeking to interpret the mapping.

The Vegetation Communities are presented in twelve sections that reflect broad vegetation or landscape types. An *Intersectional key* is provided for determining which broad grouping will contain the description being sought. The key and the format of information presented within each vegetation description are explained in the section *The Vegetation Communities: Guide to descriptions and Intersectional key*.

Historic and environmental context information relevant to understanding TASVEG mapping is provided under a number of headings within the *Introduction and Context.*

The information in *Development of Tasmanian Vegetation Mapping* briefly describes the history, methods and constraints in producing the TASVEG data set. This information is essential to an understanding of the accuracy and precision of TASVEG, its limitations and appropriate uses.

The paragraphs under *Geographical and Environmental Context* briefly describe Tasmania's biophysical environment. For more detailed accounts of vegetation ecology more serious users of vegetation mapping are referred to other publications, such as Vegetation of Tasmania (Reid et al. 1999) and Subantarctic Macquarie Island: environment and biology (Selkirk et al. 1990).

Major changes in the classification of several vegetation communities have occurred between the first and second editions of this publication. Details of these changes are provided in *Changes since the first edition*.

Changes to TASVEG mapping since the release of TASVEG 1.0 are captured within the metadata documents for each release version of the TASVEG data set. For access to this information contact the Coordinator of the TVMMP in DPIPWE:

TVMMPSupport@dpipwe.tas.gov.au.

This publication is a fundamental resource for those practitioners working on Tasmania's vegetation and using TASVEG, the state-wide vegetation map. It is a technical document designed for vegetation workers in government and private industry, including NRM land management specialists, and conservation planners. It does not pretend to be accessible in understanding for those without some scientific or technical background. If you are doubtful about interpretation of vegetation communities, you should seek expert advice. If final arbitration is required, the user should contact the TVMMP.

This publication provides information about Tasmania's natural vegetation resource. The documentation of the technical procedures underpinning the vegetation mapping process (including GIS procedures) and the protocols for maintaining, revising and providing access to the TASVEG map are outside the scope of this publication.

Edition 2 - changes since the first edition

Changes to the TASVEG catalogue

Since the release of TASVEG 1.0 which mapped 158 distinct units, there have been 21 new units added and 17 units discontinued from the TASVEG classification catalogue to reach a total of 162 mapping units in TASVEG 3.0. The major revision of the *Scrub, healthland and coastal complexes* (described below) was a significant contributing factor, as was the addition of Macquarie Island to the TASVEG 3.0 release with the addition of seven new sub-Antarctic units. One of the discontinued units remains in the TASVEG mapping but will be remapped into other units over time. Likewise, the six units that map generalised vegetation are expected to be reassigned over time and removed from the TASVEG catalogue. Conversely, the distribution of new units recently added will be expanded with future revision mapping.

As a general principle it is the intention of TVMMP that the TASVEG classification remains stable. However from time to time, changes designed to better describe the vegetation may be undertaken. All revisions to the TASVEG mapping classification are considered by the TVMMP SRG and amendments made only where appropriate.

Scrub, heathland and coastal complexes

Prompted by a lack of adequate differentiation between the vegetation communities in the section *Scrub, heathland and coastal complexes*, it became the subject of a major review in 2012. The mapping unit descriptions, the key for the section and the intersectional key have been substantially revised to describe more accurately the vegetation that is included in each unit and how they are distinguished in the classification. Several units were discontinued. For descriptions to discontinued units consult the first edition of this book. Several new units have been erected and will map at least part of the extent of these communities for the first time in TASVEG version 3.0. A comprehensive description of the changes to the *Scrub, heathland and coastal complexes* is located in the introduction to that section. Additionally, a diagrammatic representation of changes to the vegetation classification in TASVEG 3.0, largely as a result of this review but also resulting from more general improvements to the mapping, is found in the section *The Vegetation Communities: TASVEG 3.0 – Summary of changes to the classification of vegetation communities.*

Changes to units in other vegetation groups

The review of the *Scrub, heathland and coastal complexes* section also resulted in changes to other sections. The reclassification of *Leptospermum* with rainforest scrub (RLS) to a new scrub unit SRF and the inclusion of *Notelaea-Pomaderris-Beyeria* forest (NNP) within Broad-leaf scrub (SBR) have warranted review of the descriptions for both and changes to the relevant section keys.

Within the *Dry eucalypt forest and woodland* section the unit *Eucalyptus viminalis* shrubby/heathy woodland (DVS) and *Eucalyptus amygdalina* inland forest (DAI) have both been discontinued and absorbed into other *E. amygdalina* dry forest mapping units.

A new unit *Unverified plantations for silviculture* (FPU) has been included. This unit maps vegetation artificially planted with trees (but not recognised formally as plantations for official accounting purposes) as well as the buffers, easements and roadway infrastructure associated with these assets.

The previously named *Agricultural, urban and exotic vegetation* section has been renamed as *Modified land*. A minor review of this section has clarified the intention of the mapping unit Permanent easements (FPE) to restrict its application to native vegetation. Ramifications of this change required minor updates to many units within the section, especially to Extra-urban miscellaneous (FUM).

The introduction to the Modified land section has also been updated to support the Intersectional key by describing a number of exceptions that are more appropriately attributed as Modified land and to exclude those that are not. Some of these are identified in the following paragraphs.

Intersectional key

The Intersectional key has been updated to reflect changes to the TASVEG catalogue, reduce ambiguity and to better direct the user to the most appropriate sectional key. The intention of 2a has been clarified in relation to the presence of exotic species in the dominant stratum (defined as the tallest native structural layer with a solid crown cover of >5%), to prevent the situation where an essentially native community (e.g. native grassland) could be automatically directed to the Modified land section where an exotic species (e.g. gorse) forms a sparse (>5% solid crown cover) canopy, or where exotic species may temporarily dominate a community due to a spring flush of exotic annuals. An additional step has been introduced at 2b to direct users to the Modified land section, where a native tree canopy persists but the understory has been cleared and/or replaced with exotic species and is not expected to return a native understorey in the medium term (approximately 50 years). This is to ensure that trees (regardless of cover) occurring as isolated individuals or small copses over, for example, improved pasture are not automatically keyed out to a native vegetation community. The Intersectional key should not be used in isolation, but as a general guide to direct the user to the most appropriate section within this manual. The introductory information provided for each of the broad vegetation groups, and the unit vegetation descriptions should also be consulted prior to assigning unit categories to vegetation. Field validation is normally required for a definitive allocation of vegetation code.

Glossary

The glossary has been reviewed and definitions for a number of terms added, largely to support the interpretation of the Intersectional key and the keys to broad vegetation groups.

Updated distributional information

The thumbnail distribution maps have been revised for all mapping units. Revised bioregional information has been provided in line with the most recent Interim Biogeographic Regionalisation for Australia (IBRA 7.0) which now includes the Subantarctic Islands Bioregion (SEWPaC, 2012). Where better mapping has significantly altered the distribution of a TASVEG mapping unit, the text describing the pattern of distribution has been revised to align with the mapping.

Vegetation of Macquarie Island

For the first time the seven vegetation communities that occur on Macquarie Island are described and presented, in conjunction with introductory information and a key to this group, within the new *Macquarie Island vegetation* section.

Successional pathways in unit descriptions

As unit descriptions are revised, relevant information on the likely successional pathway for the vegetation community will be added. This has been provided only for units within the sections *Scrub, heathland and coastal complexes* and *Macquarie Island vegetation* sections but will be extended to all units in future editions.

Undifferentiated units

The treatment of units used to map 'undifferentiated' vegetation has changed. In this edition, to discourage the use of these units, we have significantly reduced their descriptions. These units were primarily established as temporary categories to assigned vegetation not as yet discriminated into the more specific mapping units available for this purpose. It is intended that, over time, the existing mapping of such generalised vegetation will be replaced, and the use of 'undifferentiated' categories will be abolished, or retained for limited use where field access is not possible and remote allocation to a more specific unit is not advised, or where the vegetation forms a tight mosaic, unable to be mapped at 1:25 000 scale.

These changes have been applied to undifferentiated saltmarsh and wetlands (AUS and AWU, respectively), undifferentiated wet forest communities dominated by *Eucalyptus delegatensis, E. nitida* or *E. obliqua* (WDU, WNU and WOU, respectively) and undifferentiated *Nothofagus* rainforest (RMU).

Summary

While the principal changes in Edition 2 have been the revision of the *Scrub, heathland and coastal complexes* section and addition of the new *Macquarie Island vegetation* section, other information has been updated throughout the manuscript to reflect the revised and improved information in TASVEG 3.0.

The mapping unit descriptions provided in this manual reflect the current mapping and provide a guide to continued mapping. There is still scope for further improvement in the definitions of mapping units and this is part of the ongoing business of the TVMMP.

References and further reading

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Development of Tasmanian vegetation mapping

Introduction

In this section the historical context of vegetation mapping in Tasmania is described. This is important because the composite TASVEG map has its origin in several mapping sources produced at different scales and using different mapping processes. This account of TASVEG mapping will only briefly cover the methods relating to the different mapping processes.

Vegetation mapping – general constraints

While the theory and practise of vegetation mapping has been treated extensively elsewhere (Kuchler 1967, Kirkpatrick and Dickinson 1986), some important considerations are outlined here.

Vegetation often exists as a complex continuum and, while it can be classified to produce a vegetation map, the delimitation of ecological vegetation communities is a largely artificial process. Where there is not a clear demarcation in the vegetation, drawing a line between communities is necessarily subjective, particularly where vegetation forms a successional series or where there is a gradual transition from one vegetation community to another over an environmental gradient.

The scale of the mapping has important implications for its use. While TASVEG mapping, notionally at 1:25,000 scale, is considered very detailed for most purposes and is a useful guide to the spatial distribution of vegetation communities, maps are generalisations and must be used in conjunction with adequate field validation.

The terms ‘mosaic’ and ‘complex’ are often used to describe mapping units that may be made up of small patches of different ecological vegetation communities that fall below the threshold to easily map at a nominated scale. TASVEG includes several mapping units used to describe vegetation landscapes in which several distinctive vegetation types typically occur in a mosaic or complex. Such a complex or a mosaic can be due to rapid changes in topography, drainage and exposure over short distances (e.g. Coastal slope complex, QCS; Coastal terrace mosaic, QCT) or a complicated fire history leading to intricate fire patterning (Scrub complex on King Island, SSK).

The TASVEG catalogue provides only a few units specifically designed for the mapping of mosaic and complex vegetation. In general areas are circumscribed into polygons of relatively homogenous vegetation. Where constraints of scale prevent this, larger polygons containing mosaics of vegetation are attributed to the most abundant vegetation community within the mosaic.

A number of constraints and issues specific to TASVEG 3.0 are discussed further below (*TASVEG 3.0 – specific constraints and issues*).

Pre-TASVEG vegetation mapping in Tasmania

The earliest vegetation maps known for Tasmania are simple sketches of particular regions. In 1962, a German phytogeographer published a vegetation map based on a brief reconnaissance of the State (Schweinfurth 1962). Following this Davies (1964) published a vegetation map. These preparations had not been used to guide conservation planning in the current sense, but indicated broad patterns that may have been applied to very general economic and agricultural uses.

Detailed conservation planning based on vegetation communities commenced with publication of Jackson (In Specht et al. 1974). This included what was then a monumental assessment of the vegetation types in all the national parks of each state. Jackson carried out the estimate of vegetation types and their areas in Tasmania’s national parks for this work. By the mid 1970’s, with the appointment of a phytogeographer in the University of Tasmania, detailed vegetation maps began to be published with accompanying ecological process analysis (e.g. Kirkpatrick 1977, Harris and Kirkpatrick 1982).

The first detailed compilation for a State vegetation map based on air photo interpretation (PI) was carried out by Kirkpatrick and Dickinson and published ay 1:500, 000 scale by the Forestry Commission (now Forestry Tasmania) in 1984. This contained 49 vegetation mapping communities. It was used as the basis for conservation planning at a critical phase in the expansion of the Tasmanian reserve system. For example, it was a key information source in the report of the Commission of Enquiry into the Lemonthyme and Southern Forests (Department of the Arts, Sport, the Environment, Tourism and Territories 1988), which led to an expansion of the WHA. Many other examples can be cited (Kirkpatrick and Brown 1994, Pannell 1992, Williams 1989, and Wells 1989).

Concurrent with conventional vegetation mapping, the Forestry Commission had, since 1947, been carrying out detailed forest structural mapping (often referred to simply as forest PI type mapping) providing reliable information about tree heights, growth stage, condition and crown densities of eucalypt stand components as a basis for commercial forest planning. Whilst forest PI type maps generally do not attempt to identify species or vegetation types, broad formation-level categories distinguish eucalypts from acacias, rainforest, scrub and agricultural land cover (Stone 1998). Some information critical to vegetation mapping arose from this data source. For example, rainforest dominated by myrtle was accurately typed and could be used in calculations of the area of rainforest in Tasmania (Hickey and Davis 1993) and rainforest reserve planning (Hickey et al.1988).

The Recommended Areas for Protection (RAPs) process (Hickey and Brown 1989) aimed to capture representative areas of forest types in reserves on public land. The vegetation mapping of Dickinson and Kirkpatrick (1984), supplemented by the more detailed mapping cited above and forest PI type mapping was its basis.

Origins of TASVEG mapping

TASVEG is a product originating from the integration of three principal streams of mapping; that deriving from the State's Regional Forest Agreement (RFA) process, WHA mapping and early TVMMP mapping of primarily non-forest (including non-native) vegetation (TASVEG2000).

Each of these three maps were produced using different methods, classifications and mapping scale, described in more detail below together with the issues associated with their integration into the single state-wide mapping layer, TASVEG.

The integration has led to varying precision and accuracy of the mapping within TASVEG. Over time review mapping using a single method and classification system will remove these inconsistencies.

In 1997, an RFA was signed for Tasmania. The recommendations were based on detailed scientific studies carried out in a Comprehensive Regional Assessment for Tasmania. An important part of the process was mapping of ecological forest communities.

The classification used for the RFA Forest Communities Map (1996) was based on expert advice as to mappable ecological forest communities that could be a sensible basis for forest conservation planning. Once established, these communities remained stable. The 1:550,000 scale Resource Assessment Commission (RAC) vegetation map (Kirkpatrick and Brown 1991) and detailed forest PI type mapping were used to model the distribution of the most common forest communities. More detailed vegetation maps and expert based knowledge were used to determine the mapped extent of a number of less common communities, which were integrated into the final map. The RFA map was notionally produced for use at 1:100,000 scale and was subject to rapid field verification by a team of vegetation scientists. The process is described in more detail in Tasmanian-Commonwealth Regional Forest Agreement Background Report Part C Environment and Heritage Report Volume 2 (1996) together with the rule-sets used to model distributions. The Forest Communities map (1996) formed the original source for most of the forested areas beyond the WHA in TASVEG.

WHA 1:25,000 mapping using photo-interpretation of 1988 colour aerial photography began in 1989 using a synusia-based classification that recorded both the vertical and horizontal elements present in the vegetation within mapped polygons. Hence for example where small forest copses occurred through an area of moorland this information would be captured in a single large polygon by coding it to show the presence of a mix of these two vegetation types while also documenting both the understorey and dominant strata of multi-strata communities. The mapping of both forest and treeless vegetation, while based principally on aerial photo-interpretation, was thoroughly field checked.

The classification of vegetation elements, described by Kirkpatrick (1990), was later modified to accommodate new elements encountered as the project expanded into new areas. Some 60 highly detailed vegetation synusia maps of the eastern half of the WHA, as well as some adjacent areas outside the WHA, including Mount Field National Park, the upper Mersey River, the State Forest section of the Warra LTERM site and the areas immediately north and west of Cradle Mt. are the product of this 'WHA Complex' mapping (Corbett 1996). This mapping method has also been applied in some smaller areas peripheral to the WHA (part of the Styx Valley, Cockle Creek) and elsewhere. Due to the high level of resources required for this method (Kirkpatrick 1997), the WHA mapping project was completed using a simplified approach that allowed faster mapping of the remaining (western) WHA as well as the Cape Sorell Peninsula and State Forest around Lake Gordon. The 'Post2000 WHA' mapping used a conventional vegetation community based classification system, and did not attempt to capture the variation in vegetation within polygons. The Post2000 WHA mapping began with only a small preliminary catalogue of vegetation categories which was expanded during the course of the mapping. Equal attention was given to forest and treeless communities.

Areas mapped by the WHA mapping program were incorporated into TASVEG 1.0 using computer scripts to automatically convert WHA mapping codes into the most closely matching TASVEG unit. In instances where the original mapping polygons contained mosaics of vegetation the conversion process led to polygons generally being allocated to the most abundant of these.

TVMMP non-forest mapping originated in the first round of the Natural Heritage Trust (NHT) in 1998. From 1998-2001, Department of Primary Industries, Water and Environment received Natural Heritage Trust funds to produce a State-wide vegetation map at 1:100 000 scale focussing on Tasmania's treeless vegetation to complement mapping completed during the State's RFA process. A decision was made at the State level to begin mapping at 1:25 000 scale, which was considered to be the ideal scale for Tasmania's purposes. This mapping is from hereon referred to as TASVEG2000, to distinguish it from more recent TASVEG review mapping.

TASVEG2000 maps were community-based vegetation maps using a classification based on structural dominance in the style of Specht et al. (1974). Vegetation communities were commonly defined by the dominant species, but often incorporated aspects of the understorey.

TASVEG2000 non-forest mapping is largely based on aerial PI typing of the nature, location and extent of vegetation communities. An expert panel of vegetation scientists, the Scientific Reference Group (SRG) and later the TASVEG Scientific Advisory Committee (SAC), was consulted on an appropriate vegetation classification that would provide mapping units for non-forest vegetation that could be consistently identified using remote sensing and aerial PI techniques. A field-based pilot study tested the reliability of the remote-sensing methods in identifying a sample of vegetation communities and refinement of the catalogue of TASVEG2000 vegetation communities ensued. Aerial PI typing was assisted by strategic field verification.

During the earlier stages of TASVEG mapping leading up to TASVEG 1.0, the absence of completed descriptions and definitive keys meant that the delimitation of vegetation communities relied on individual perceptions of the vegetation mappers. Whilst moderation exercises were held through joint field trips, there were inevitably some differences in interpretation. The understanding of how open woodlands, woodlands and forests are defined has also varied since the mapping began.

In the earlier phase of the TVMMP the focus of TASVEG2000 mapping was on assigning the gaps in the RFA map to non-forest vegetation categories, with very little modification to RFA polygon boundaries. During this phase large sections of RFA mapping were imported with limited or no alterations.

In later phases of TASVEG2000, the principal changes to RFA forest map polygons were aerial PI-instructed changes to polygon boundaries and reclassification of polygon attributes on the basis of vegetation density. Reclassification of RFA forest polygons to other forest or woodland community types and sometimes to TASVEG2000 treeless community types also occurred, where field work permitted better access, or where other accredited information was available.

The exception to these generalisations is the TASVEG2000 mapping of the West Coast Range and parts of the eastern Central Plateau, which followed methods similar to that used in Post2000 WHA mapping, and whose forest mapping is reinterpreted from aerial photography rather than being based on the RFA map.

In addition to the RFA Forest Communities Map and forest PI typing, a range of other data sources was used, where available, to increase reliability of polygon attribute information. Other quality vegetation maps and point data were included under guidance by the SRG and SAC. The Geo-Temporal Species Point Observations Tasmania (GTSpot) database (Peters & Thackway 1998) was used in a limited capacity to assist validation of vegetation communities identified from aerial PI. Landsat-5 MSS images for the north coast, southwest and southeast of the State were used in a limited capacity to assist in differentiation of improved pasture from native grassland. Vegetation experts were consulted where their experience could be drawn upon to increase the reliability of a polygon's attributes.

The catalogue of TASVEG2000 vegetation communities, once agreed upon, remained relatively stable, especially for south-eastern Tasmania. Some additional vegetation communities were added as the mapping program proceeded, particularly where less well surveyed vegetation types were encountered.

TASVEG 3.0 – specific constraints and issues

The latest state-wide vegetation map, TASVEG 3.0, has been notionally produced for use at 1:25 000 spatial coverage, albeit with some areas of coarser scaled RFA forest mapping still remaining in some areas of the layer.

The data set does not completely reflect vegetation extent and distribution at a single date. The nature of the mapping technique, which is based primarily on interpretation of aerial photographs (but which increasingly uses high quality satellite imagery), has required that areas of the State are revised at different times. Therefore the mapping reflects the vegetation at a range of dates. The most recent imagery used for review mapping is from 2013, but most of the imagery used for the current map is now more than 10 years old. Perhaps the most out of date is the mapping within the WHA, which was based on 1988 imagery. Polygons derived from the RFA forest community map are also likely to have been mainly derived from imagery predating 1991.

The minimum patch size for a viable vegetation community has not previously been defined in this manual. In relation to cartographic standards, advice from other jurisdictions and review of relevant publications (e.g. Neldner et al, 2012) suggests that for 1:25,000 scale mapping, a minimum polygon size of about 0.25 ha (or 25 m width for linear polygons) is appropriate. This includes features smaller than 0.25 ha where these are contiguous (i.e. their perimeters are separated by a distance of no greater than 12.5 m) and their combined area is 0.25 ha or greater.

The TASVEG, minimum resolution of homogenous vegetation patches within continuous native vegetation is generally larger than 1 ha, however this varies depending on context. TASVEG also maps native vegetation in patches of smaller than 1 ha, though these have not been consistently mapped by the methods employed. Analysis of TASVEG shows that these smaller patches are both forest/woodland and non-forest vegetation.

Regardless of whether they have been captured by TASVEG mapping, it is recognised that native vegetation communities can occur naturally or as remnants in a cleared or disturbed landscape in patches smaller than 1 ha. Patches (or contiguous patches) of vegetation as small as 0.1 ha may be valid for forest and woodland communities of high conservation significance where they are assessed as viable. For example, the threatened community *Eucalyptus ovata* forest and woodland (Schedule 3A *Nature Conservation Act* 2002) commonly occurs as small but viable patches in an undisturbed matrix of other forest types (e.g. *Eucalyptus amygdalina* forests on gravels and on sands in the midlands and north of Beaconsfield (North and Barker, 2002)). Important non-forest vegetation communities can be viable as patches of less than 0.1 ha in area. Appropriate mapping to 0.1ha includes communities occupying clearly defined but localised environments distinct from the surrounding vegetation. Likely examples are wetland and saltmarsh communities, Alkaline pans, Rockplate grasslands, Cushion moorland and Lichen lithosere.

Changes in the TASVEG classification arising out of the merger of different mapping sources have resulted in inconsistent mapping of some vegetation units in TASVEG mapping. In the first process of integrating RFA forest mapping into TASVEG2000, the complete suite of forest communities inherited from the RFA process were adopted in the TASVEG classification system unaltered. The integration of the WHA mapping involved the conversion of WHA mapping codes into the best matching classes available within the RFA and TASVEG2000 mapping unit classification. In some cases the match was only approximate and has led to some unit descriptions being generalised to account for the regional variation covered by the unit.

While the legacy of the mapping's origins is still evident in TASVEG 3.0, post TASVEG 1.0 revision mapping has significantly reduced these issues.

TASVEG 3.0 – what has been improved?

There have been many improvements in the processes (principally in the GIS processes) used to create the current TASVEG map. While the technical processes employed in creating and maintaining the digital information is outside the scope of this document, some key changes to the data set since TASVEG 1.0, as they relate to the information provided in this revised edition and how this may be used, are noted. Users interested in more detailed technical information are encouraged to contact the TVMMP:

TVMMPSupport@dpipwe.tas.gov.au.

TASVEG spatial information is now managed within a corporate scale relational database management system. This environment facilitates data integrity checking, database versioning and automated data archiving, such that the standard of data and its management are greatly improved and our capacity to integrate external data sets is more streamlined.

The attribute structure for TASVEG 3.0 has been cleaned and simplified to reduce redundancy and ambiguity and to improve reliability of data capture. The main changes are simplification of data source attributes, changes to the way in which confidence in the attribution and delineation of polygons is described, and adjustments to how field checking is captured. An understanding of these changes is important for those mapping practitioners intending to collect revision mapping for the purpose of updating the TASVEG map.

Since the release of the first state-wide coverage of TASVEG in 2005 our program of revision mapping, supplemented with the integration of quality mapping form external providers, has appreciably improved the currency and accuracy of the vegetation mapping.

TASVEG 3.0 includes, amongst other refinements, a reduction in the number of logical consistency and topological errors, significantly improved knowledge of the distribution of important lowland native grasslands and other vulnerable communities, reduced mapping of 'undifferentiated' vegetation and more finely resolved mapping of forest communities, improved currency and accuracy of mapped vegetation in a number of areas including the Ben Lomond Bioregion and on the Tasman Peninsular and better mapping of scrub, heathland and coastal complex vegetation communities.

The key changes to TASVEG mapping since the release of TASVEG 1.0 are captured within the metadata documents for each release version of the TASVEG data set since that time. For access to this information contact the TVMMP.

Summary

TASVEG Version 3.0 is the current state-wide map of Tasmania's vegetation. Although originally derived from the integration of three streams of mapping TASVEG has been continually revised since that time. This version of the map is a significant update of the 2005 version (TASVEG 1.0) in terms of the currency and accuracy of its information, the greater resolution of vegetation communities and the significant improvement of technical aspects of mapping through advances in GIS techniques.

TASVEG mapping is a live process that allows incorporation of new mapping, including that by experienced botanists outside the Department of Primary Industries, Parks, Water and Environment.

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Geographical and environmental context

Introduction

Edition 2 of this manual deals with the terrestrial vegetation throughout Tasmania, including its offshore islands, between 39°12' S and 43° 30' S., and including the subantarctic Macquarie Island not dealt with in the original publication. For the purpose of this publication, 'Tasmania' refers to the Tasmanian mainland and its offshore islands, although the following descriptions of landform, cover and climate relate mainly to the main land mass. A comprehensive description of the environment and biology of Macquarie Island can be found in Selkirk et al. (1990).

Tasmania's landmass (including offshore islands) comprises approximately 6.8 million ha and is mountainous and heavily forested. The area of lakes is 110 000 ha, of which 91 600 ha result from artificial impoundment. The length of the mainland coastline is 4 790 km, with the south eastern part of the State being the most highly indented. An extensive network of rivers drains Tasmania, the longest stretching 214 km.

Although the Tasmanian mainland is separated from continental Australia by the shallow waters of the 250 km wide Bass Strait there are islands in Tasmanian waters that are 10 km from Wilsons Promontory in Victoria. Bass Strait has been both a barrier and a bridge for migration of humans and other animals and plants, as successive glacial periods and interglacials have caused sea level fluctuations.

Tasmania's climate is conducive to forest vegetation over most of the island. However, other factors controlling vegetation distribution create a complex and variable pattern of mainly disclimax vegetation types. These factors include geology, palaeoenvironmental history (especially during the Quaternary Period), current climate and the interactions of humans, fire, and site characteristics. Readers are especially referred to Jackson (1999) for a more detailed description of Tasmania's environment than is given here.

Climate

The moderating influence of the oceans on temperature extremes gives Tasmania a temperate maritime climate. Tasmania's climate is characterised by mild winters, cool summers, and rainfall in all the seasons. Consequently, plant growth is possible everywhere.

Tasmania's climate owes much to its position in the Roaring Forties and the consequent westerly airstreams that deliver heavy rain and strong winds, particularly to the southern and western mountain regions. There is a strong west to east environmental gradient with the west being more mountainous, wetter, cloudier and cooler and supporting blanket moorlands, rainforest and wet eucalypt forest. The central highlands have a slightly continental climate due to elevation and distance from the sea. The alpine environments are on the mountain tops of the west, Central Plateau and to a smaller extent the north-east and south-east; conditions on some are harsh enough to result in fjaeldmark vegetation (Kirkpatrick and Harwood 1980). In the east of Tasmania are more subdued fertile landscapes, with lower rainfall, higher temperatures and extensive areas supporting grassy woodlands, dry forests and heathland communities.

The westerly airstream is strongest and most persistent in winter, hence there is a distinct rainfall peak during winter and early spring in the west. The eastern half of the island falls in a broad rain-shadow, where rainfall tends to be lower and less reliable than in the west. However, it is more evenly distributed over the seasons (Bureau of Meteorology 1993). Average annual rainfall over the western half of the island exceeds 1 000 mm, which is more than the minimum rainfall required (approximately 800 mm) to support rainforest (Jackson 1983). Most of western Tasmania receives an average of more than 1 500 mm rainfall, while in many of the mountainous regions rainfall of over 3 500 mm per year is typical, making it one of the wettest parts of Australia. This region supports many vegetation communities and plant species unique to Tasmania. The highest rates of plant species endemism in Tasmania occur in the west and south-west (Kirkpatrick and Brown 1984).

Rainfall is only a predictor of vegetation type since in many areas, when evaporation is taken into account, the effective rainfall is much less than the actual rainfall. This is further accentuated by the effects of aspect and soil properties. For example, north-facing slopes and shallow or well–drained soils tend to dry out quickly and therefore often have much lower moisture availability than south-facing slopes or gullies. Consequently, there are often distinct changes in the vegetation at the local scale due to differences in slope, aspect and geology.

The heaviest snowfalls are in July and August and commonly result in snow lying above 900 m, although extensive snowfalls can occur down to 600 m and occasionally down to below 150 m. No permanent snow occurs. Shallow highland lakes freeze over in winter. Glazing storms affect the high parts of the western mountains. Frosts are common in winter, and occasional in other seasons, even in most lowland areas of Tasmania. In highland and inland regions, cold- air drainage can create frost hollows and inverted treelines.

The temperature range is greater inland than it is at the coast. The mean maximum summer temperatures are in the range of 18 °C to 23 °C, and during winter between 9 °C and 14 °C. These are modified by altitude (cooler), proximity to the coast (warmer) or high frequency of cloud cover in the west (cooler). The highest temperature recorded is 42.2 °C at Scamander in 2009; the lowest recorded temperature is –13 °C at Shannon, Tarraleah and Butlers Gorge in 1983.

The Bass Strait islands tend to have a milder climate than mainland Tasmania, owing to their lower latitude, maritime influence and low elevation. The far north east and the eastern Bass Strait islands experience the characteristics of a Mediterranean climate with mild wet winters and a summer dry season.

Extraordinary and catastrophic climatically- induced events occur periodically. Severe thunderstorms accompanied by lightning are capable of starting bushfires. Tornados are extremely rare but one near Smithton in 1992 cut a swathe several kilometres long through a suburb and some forest (Fox-Hughes 2004). Landslides in western Tasmania affect the distribution and structure of King Billy pine forests (Cullen 1991). A severe frost in the mid 1800s resulted in a large area of tree dieback in the Central Highlands (Calder 1850).

Geology, geomorphology and soils

Much of the Tasmanian landscape is steep and rugged, owing to the extensive history of mountain-building, folding and faulting upon the results of which glacial, periglacial and fluvial processes have left their mark.

In the western half of the State, termed the 'fold structure province' (Davies 1965), the basement rocks comprise Cambro-Ordovician and Precambrian metamorphic rocks. These have been extensively folded and eroded resulting in a series of mountain ranges composed of very resistant rock and separated by broad valleys, often floored by younger limestone or dolomite and mostly mantled in siliceous gravels and other unconsolidated sediments.

Although most of western Tasmania is climatically suited for rainforest, much of the landscape is vegetated with buttongrass moorland, due to the effects of soil and fire. The siliceous rocks of western Tasmania are highly resistant to weathering and are naturally low in plant nutrients. Consequently, soil formation is slow. High rainfall exacerbates this situation by increasing soil erosion and nutrient leaching. Much of the mineral nutrient influx is from cyclic salts in rainwater (Macphail et al. 1999). Relatively frequent fires in the Holocene have contributed to erosion and nutrient loss in a feedback cycle that tends to promote moorland and scrub vegetation (Jackson 1968).

Geographical and Environmental Context

Extensive areas of rolling hills and deep, fertile soils where basalt or limestone occurs are found in north-west Tasmania. Basalt weathers readily to produce deep red soils that are generally considered the best in the State for agricultural purposes. The deepest, most fertile soils are on north-west metasediments and those overlying Cambrian Mt Read volcanics. These soils naturally support tall closed forest, but many areas have been cleared for agriculture.

In the south-eastern half of the island, Permian and Triassic sediments and Jurassic dolerite overlie the ancient basement rocks. The landscape of this 'fault structure province' (Davies 1965) is shaped by faulting and subsequent dissection by fluvial erosion. Dolerite– chemically similar to basalt – can give rise to deep, relatively fertile soils. Sedimentary rocks and Recent sediments generally produce infertile soils. The fault structure landscape extends from submerged grabens of the Derwent and Tamar estuaries and Great Oyster Bay, to the highest plateaus and peaks.

The Central Plateau is the highest part of Tasmania, with elevation generally over 900 m and several peaks exceeding 1 400 m in altitude. The dolerite bedrock produces podsolic soils that are deeper and more nutrient rich than those on the west coast; however, glacial and periglacial erosion has removed much soil leaving a rocky landscape. Glaciation has created many lakes on the extensive flat areas of the plateau.

A major graben forms the Northern Midlands, which are bordered to the west by the Central Plateau and to the east by the Eastern Tiers. The Northern Midlands, lying in the rain shadow of the Central Highlands and western mountains, is the driest region of Tasmania (less than 600 mm annual rainfall). Low effective rainfall and periods of drought are major limiting factors on the vegetation, particularly on the basalt hills. Soils formed on Quaternary deposits and sand dunes are common throughout the Midlands. The relatively dry climate and high soil fertility is conducive to grass growth and grasslands and grassy woodlands occur naturally in the Midlands.

The Eastern Tiers are a continuous range of hills forming the drainage divide of the East Coast and composed almost entirely of dolerite, with podsolic soils supporting eucalypt forest. The north-east highlands are very similar to the Central Plateau in terms of elevation (with extensive areas over 1 200 m altitude and peaks exceeding 1 500 m), dolerite geology, glacial and periglacial landscapes. The climatic treeline is highest in the north-eastern highlands at just over 1 400 m and declines in altitude in a south- westerly direction across the Central Plateau to a minimum of around 700 m in the south-west (Kirkpatrick and Brown 1987).

Extensive sequences of metamorphosed sandstone and siltstone, known as Mathinna Beds, occur in the north-eastern lowlands. Typically steep and highly dissected granite landscapes are common in the north-east and Flinders Island, with deeply weathered soils. Mild, dry summers, combined with generally nutrient–poor sandy soils, support sclerophyllous vegetation including heathland.

Coastal environments are diverse, and the nature of the vegetation is variable. Low lying coastal areas in the south-east and the north-west are sufficiently sheltered and gently graded in profile to support extensive estuarine and saltmarsh habitat

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Humans and fire

Humans have been present in Tasmania for at least 35,000 years and recent evidence from a site on the Jordon River suggests they may have arrived more than 40,000 years ago. The interaction of humans, climate, vegetation and soils has been profound, with the frequency and intensity of fires changing throughout the period since human colonisation. The current broad vegetation pattern is attributed largely to a pattern of fire use maintained throughout the period of Aboriginal occupation of the island (Jackson 1986).

Fire is central to an understanding of Tasmania's vegetation ecology. There are complex successional pathways that are manifested by various floristic and structural changes in vegetation, even over short distances. The frequency and intensity of fires may have changed due to the transition from predominantly indigenous management to European management of the landscape. Prior to human occupation, it is likely that lightning strikes generated some fires, as they have been observed to do since European settlement.

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