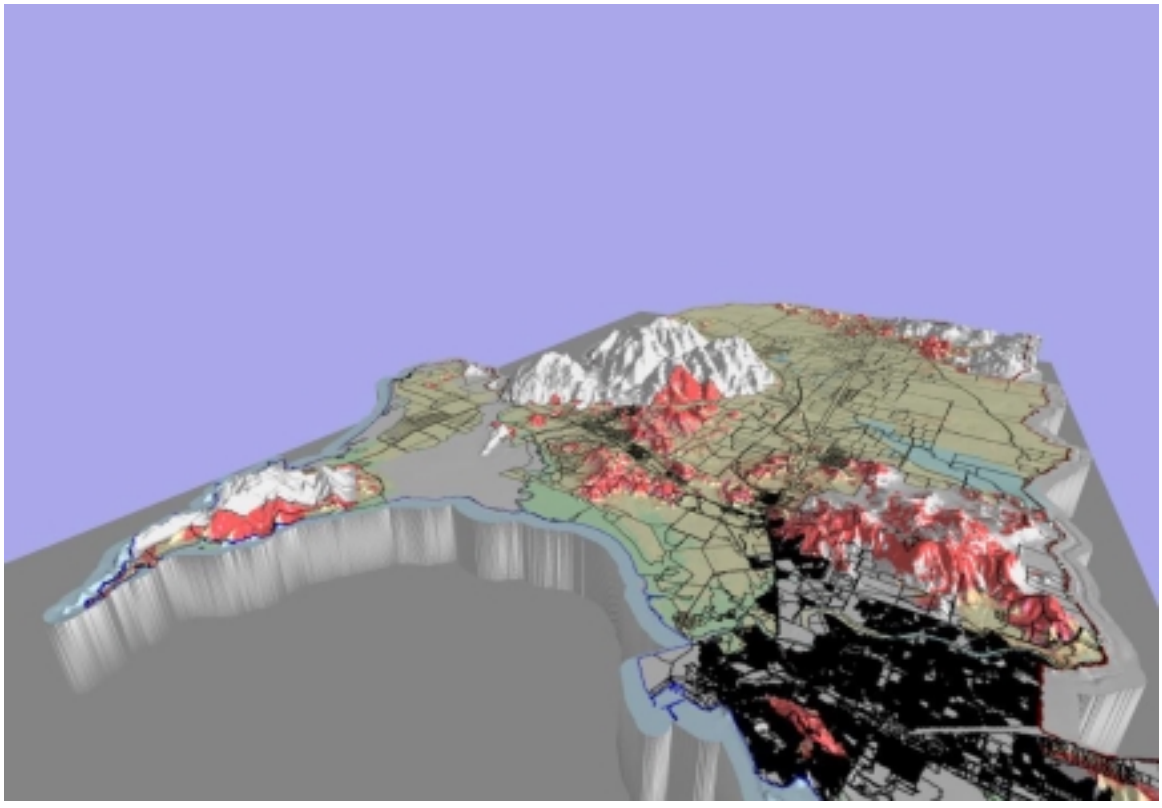
BUSH FIRE HAZARD MAPPING

Analysis of bushfire susceptibility based on vegetation type and slope

Trinity Software



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Introduction

Townsville City Council commissioned Trinity Software Australia P/L to incorporate updated vegetation data collated by the Australian Centre for Tropical Freshwater Research into a study done previously by Robert Crossley & Associates for bush fire susceptibility. This study is intended to provide base information required for Townsville City Council's planning scheme review.

As part of this study, a new digital terrain model (DTM) was created for the study area using advanced terrain modelling software (ANUDEM) produced by Australian National University. Slope and aspect were then derived from this DTM using MapInfo. A simple set of rules were then applied to estimate the fire risk associated with various vegetation and slope categories, and then these ratings were combined to produce an overall estimate of bushfire hazard. While aspect was used to determine bushfire susceptibility in the previous study, its influence was considered to be inconsequential to the overal susceptibility and thus was taken out of the analysis.

The categories and rules used in this analysis are described in this report, as well as maps showing the distribution of estimated risk.

Slope and Aspect

Slope and aspect are considered to affect bush fire hazard through their effect on burn characteristics, dryness and exposure to prevailing winds. The rules that estimated the hazard rating associated with either slope or aspect were developed in conjunction with rural fire officers and Townsville City Council in 1997. They were expressed as hazard levels associated with ranges of either slope or aspect.

Slope

Once started, fires will spread more quickly on steeper slopes than on flat terrain. The slope categories used and the slope hazard rating ascribed to each of these categories is shown in Table 2.1.

Table 2.1 Slope categories and bushfire hazard associated with various slope ranges.

SLOPE CATEGORY	SLOPE %	HAZARD RATING
1	0 to 3	1
2	3 to 10	2
3	10 to 20	3
4	20 to 30	4
5	>30	5

Aspect

In temperate areas of Australia, northern slopes and slopes facing the predomiant wind direction are considered to have a higher fire risk than the southern or lee slopes. This influence is not considered to be relevant for the Townsville area because:

1. In tropical areas the southern slopes are more or equally exposed to the sun during summer and

2. The dominant wind direction is thought to compensate for any influence of increased sun exposure in the Townsville area during the drier times of the year.

Aspect was thus not considered to have a predictable influence on fire susceptibility for the Townsville area and thus not considered in the analysis.

Derivation

Slope was derived from a terrain model generated for the Council area using a software product called ANUDEM. ANUDEM was produced by the Australian National University Centre for Resource and Environmental Studies. It was used to convert contour lines and spot heights to a Digital Terrain Model (a regular grid of elevation values) with a 25m grid spacing for areas covered by 1;25,000 and 1:50,000 topographic data (spot heights and contours).

Slope (rate of change of elevation) was derived using a product called Vertical Mapper, a raster analysis product for MapInfo. Bushfire hazard was then associated with each of the categories described in Tables 2.1. A map showing the distribution of these categories is provided (Figure 1).

Vegetation

Vegetation information for the area was derived from a number of sources. The majority of the area was covered by mapping done by the Australian Centre for Tropical Freshwater Research (communities described in ACTFR 1996). Additional data used included studies by supplied by the Environmental Protection Agency (Mt Elliot, Cape Cleveland and Cape Bowling Green) and the Department of Defense (Mt Stuart). This data was supplied in ArcView format by Townsville City Council and translated into MapInfo using MapInfo's standard translators.

Some data manipulation was required to eliminate where two studies from different sources overlapped. Where this occurred, the more detailed mapping done by ACTFR was used in preference. Obvious discrepancies between interpreted vegetation communities were noted along the margins of where two studies met, but were not dealt with in this study.

These vegetation communities for each study was categorised into hazard groups and fire hazard rating. The category and risk ascribed to each vegetation community in the study is shown in Appendix A. The categories and the hazard rating ascribed to those categories is summarised in Table 3.1, and shown in Figure 2.

Table 3.1 Vegetation categories and bushfire hazard risk for each of these categories.

VEGETATION GROUP		BUSHFIRE HAZARD RATING
NULL	Not Defined	NULL
1	Open Water	0
2	Low flammability vegetation	1
3	Flammable vegetation	3
4	Potential for very high intensity fires and spotting	5

Overall Bushfire Hazard Rating

Bushfire hazard was based on the logic developed in 1997 in conjunction with the local fire authorities. Overall hazard was calculated by the following steps:

1. The vegetation hazard and slope risk ratings were derived for the area as per Sections 2 and 3.

2. The overall rating was calculated as the product[1] of the hazard associated with slope and vegetation at any point (vegetation rating x slope rating).

3. The overall rating was modified for all areas where the slope was greater than 20% but not covered by vine forest (vine forest, Auricarian vine forest and semi-deciduous vine forest). A value of 23 was ascribed where these conditions existed.

4. Small (less than XX ha) areas of low susceptibility areas that are surrounded by areas of high susceptibility were upgraded to have the same susceptibility as the areas surrounding them. (NOT DONE YET).

The overall bushfire susceptibility was then ascribed into 5 categories using the following ranges to define each category (Table 4.1). The distribution of overall fire hazard was mapped at both A3 (in this document) and at A1 (attached to this document).

Table 4.1 Ranges of the product of slope, aspect and vegetation ratings that were used to define overall hazard rating.

HAZARD DESCRIPTION	OVERALL SUSCEPTIBILITY RATING	UPPER AND LOWER VALUES FOR PRODUCT USED TO DEFINE OVERALL BUSHFIRE HAZARD RATING	
Not Defined	Null		
Nil or very low fire risk	0		
Low	1		
Low to Moderate	2		
Moderate	3		

[1] The use of the product of the various ratings meant that the overall susceptibility rating was zero where the vegetation rating was zero (as in water areas for vegetation), or null where the vegetation rating was null and not over-ridden by another condition (as in areas where vegetation was not defined, but slopes were less than 20%).

Moderate to High	4		
High	5		

APPENDIX A - Vegetation groups used for the vegetation communities described in the various studies and the bushfire hazard rating used for those groups.

STUDY: Bowling Green (Environmental Protection Agency)

Group: Low flammability vegetation (Low Risk)

Code	Description in database
11	Mangroves
12	Beachfront

Group: Flammable vegetation (Medium Risk)

Code	Description in database
14	Salt Pan
16	Mid-High Woodland

Group: Potential for very high intensity fires and spotting (High Risk)

Code	Description in database
10	Old Dune Complex

STUDY: Cape Cleveland (Environmental Protection Agency)

Group: Low flammability vegetation (Low Risk)

Code	Description in database
1	Auricarian Vine Forest
11	Vine Thicket
12	Beach Front
7	Mangroves

Group: Flammable vegetation (Medium Risk)

Code	Description in database
10	Sod Grass
2	High Altitude Open Forest
3	Shrubland
4	Eucalypt Woodland
8	Freshwater Swamp
9	Salt Pans

Group: Potential for very high intensity fires and spotting (High Risk)

Code	Description in database
5	Swampy Palm Forest
6	Old Dune Complex

STUDY: Mt Elliot (Environmental Protection Agency)

Group: Not Defined (Unknown Risk)

Code	Description in database
0	

Group: Low flammability vegetation (Low Risk)

Code	Description in database
17	Vine Thicket
2	Araucaarian Vine Forest

Group: Flammable vegetation (Medium Risk)

Code	Description in database
1	High Altitude Rainforest
4	Riverine Open Forest
5	High Altitude Open Forest
6	Cliff Lines
7	Shrubland
8	Eucalypt Woodland

STUDY: Mt Stuart (Department of Defense)

Group: Low flammability vegetation (Low Risk)

Code	Description in database
SDV	Semi-deciduous Vine Forest

Group: Flammable vegetation (Medium Risk)

Code	Description in database
CL	Cleared
EPCM	Eucalypt Platyphylla/ Corymbia Marintina
EPEC	Eucalypt Platyphylla/ Eucalyptus Crebra
MW	Mixed Eucalypt Woodland on Lithosols
PPW	Petalostigma Pubescens Woodland
R	Riparian
Wet	Wetlands

Group: Potential for very high intensity fires and spotting (High Risk)

Code	Description in database
MVO	Melaleuca Viridflora Open Woodland

STUDY: TCC Vegetation Study (Australian Centre for Tropical Freshwater Research)

Group: Not Defined (Unknown Risk)

Code	Description in database
-99	

Group: Open water (Very Low Risk)

Code	Description in database
O	Open.water.associated.with.sedgeland
W	Water

Group: Low flammability vegetation (Low Risk)

Code	Description in database
AR	Araucaria.forest
BS	Beach.scrub
M	Mangroves
V	Vinethicket

Group: Flammable vegetation (Medium Risk)

Code	Description in database
AF	Alphitonia.footslope.woodland
AS	Acacia.scrub
BF	Beefwood.open.woodland
C	Cleared
CG	Coastal.Grassland
CM	Casuarina/Melaleuca.riparian.woodland
D	Dune.Forest
EB	Eucalyptus.brownii.open.woodland
EG	Exotic.grassland
EP	Eucalyptus.platyphylla.open.woodland
ET	Eucalyptus.tessellaris.open.woodland
ETW	Eucalyptus.tereticornis.woodland
EW	Eucalyptus.woodland.on.shallow.soils
FE	Foothill.mixed.Eucalypt.woodland
FLW	Footslope.Lophostemon.woodland
FS	Foredune.scrub
LF	Leucaena.forest
LRW	Lophostemon.riparian.woodland
MB	Melaleuca.bracteata.riparian.forest
MCR	Melaleuca/Castanospemum.riparian.forest
MEF	Melaleuca/Eucalyptus.riparian.forest
MEW	Mixed.Eucalypt.open.woodland
MM	Melaleuca.woodland/Mangroves
PG	Para-Grass
S	Sedgeland
SM	Salt-Marsh
TG	Triodia.grassland
Z	Ziziphus.mauritiana.forest
ZE	Ziziphus.mauritiana/Eucalypt.woodland

Group: Potential for very high intensity fires and spotting (High Risk)

Code	Description in database
ME	Melaleuca.viridiflora/Eucalypt.woodland

MS	Melaleuca.swamps
MV	Melaleuca.viridiflora.woodland
MW	Melaleuca/Eucalypt.woodland
SP	Swampy.palm.forest