Planning for Use of Fire on Conservation Lands in SW of WA

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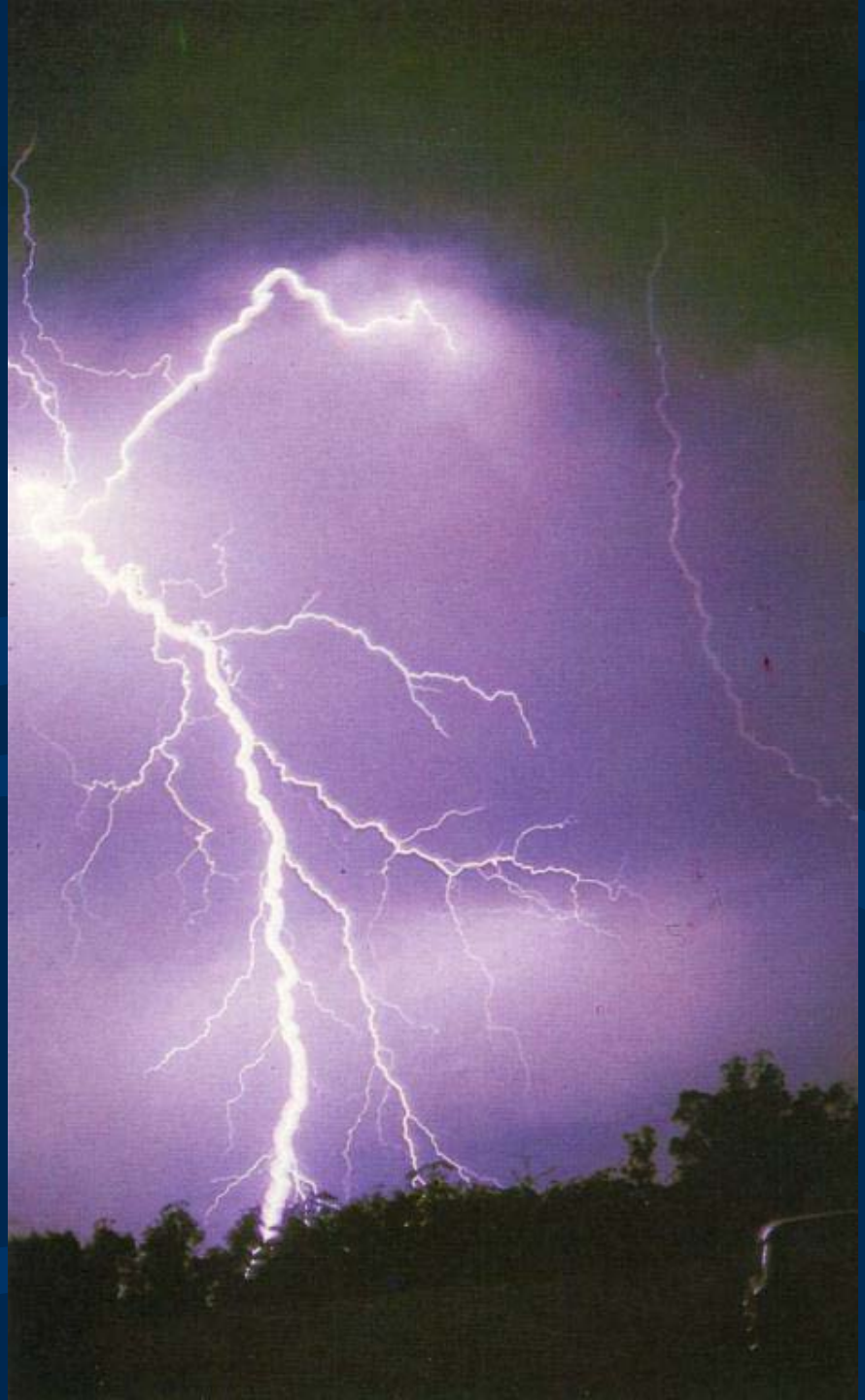
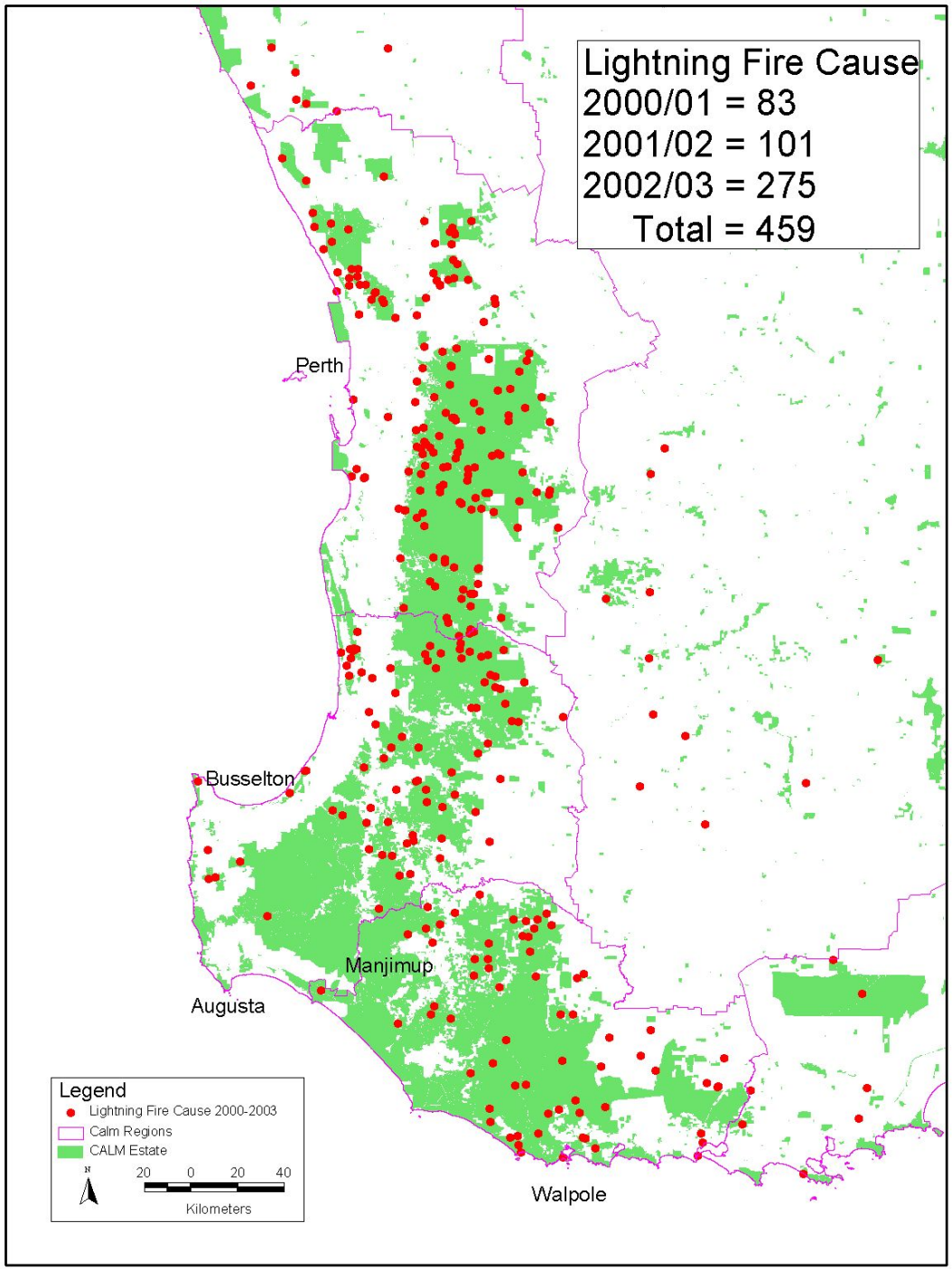
Manager Fire Services DCLM

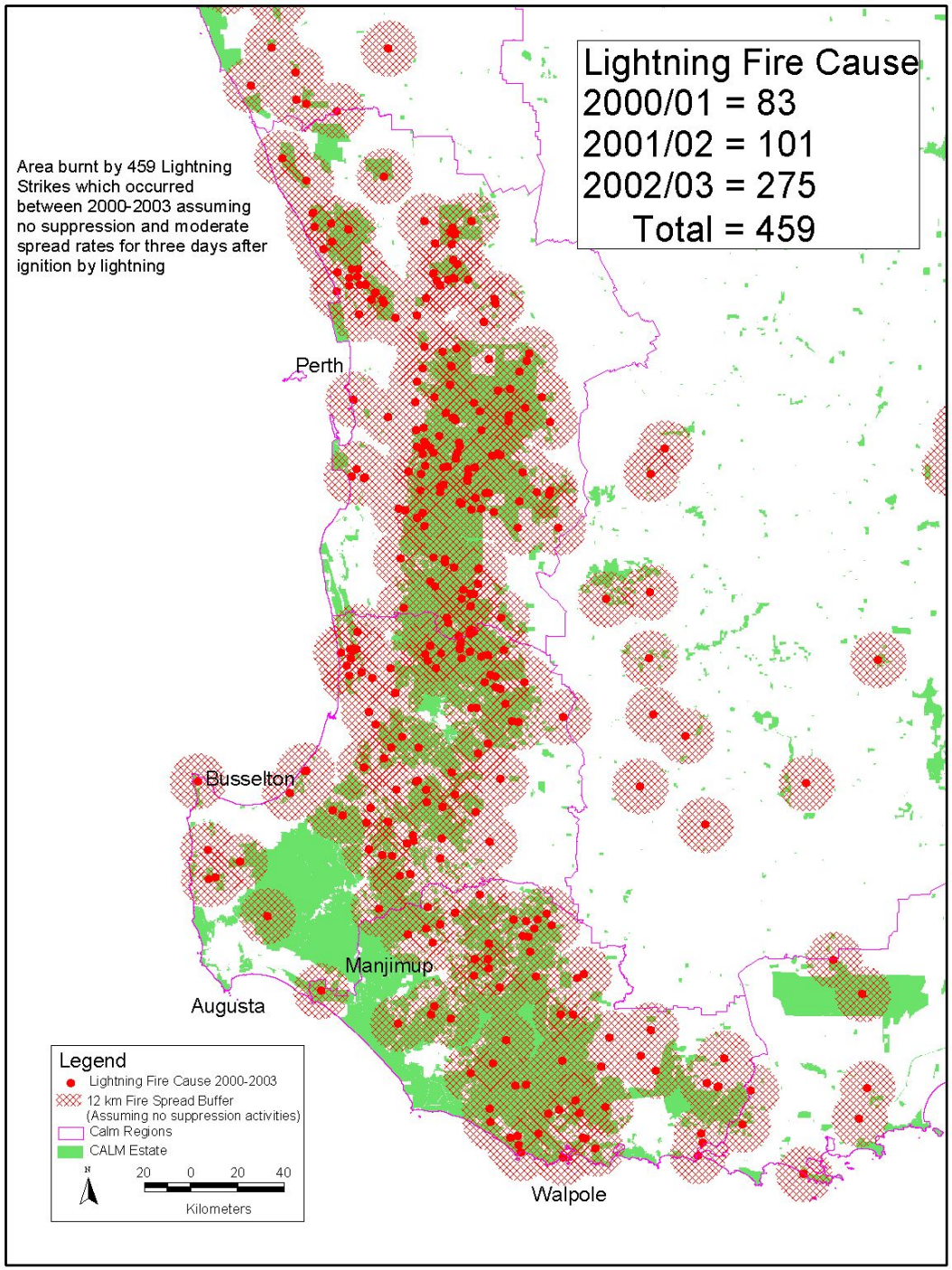
Climatic Indicators – Jarrah Forests

- Mediterranean Type
- 140-160 dry fuel days annually
- Annual summer drought
- Up to 200 lightning-caused wildfires annually
- Region characterised as “fire prone”





Lightning-caused Fires (2001-2003)

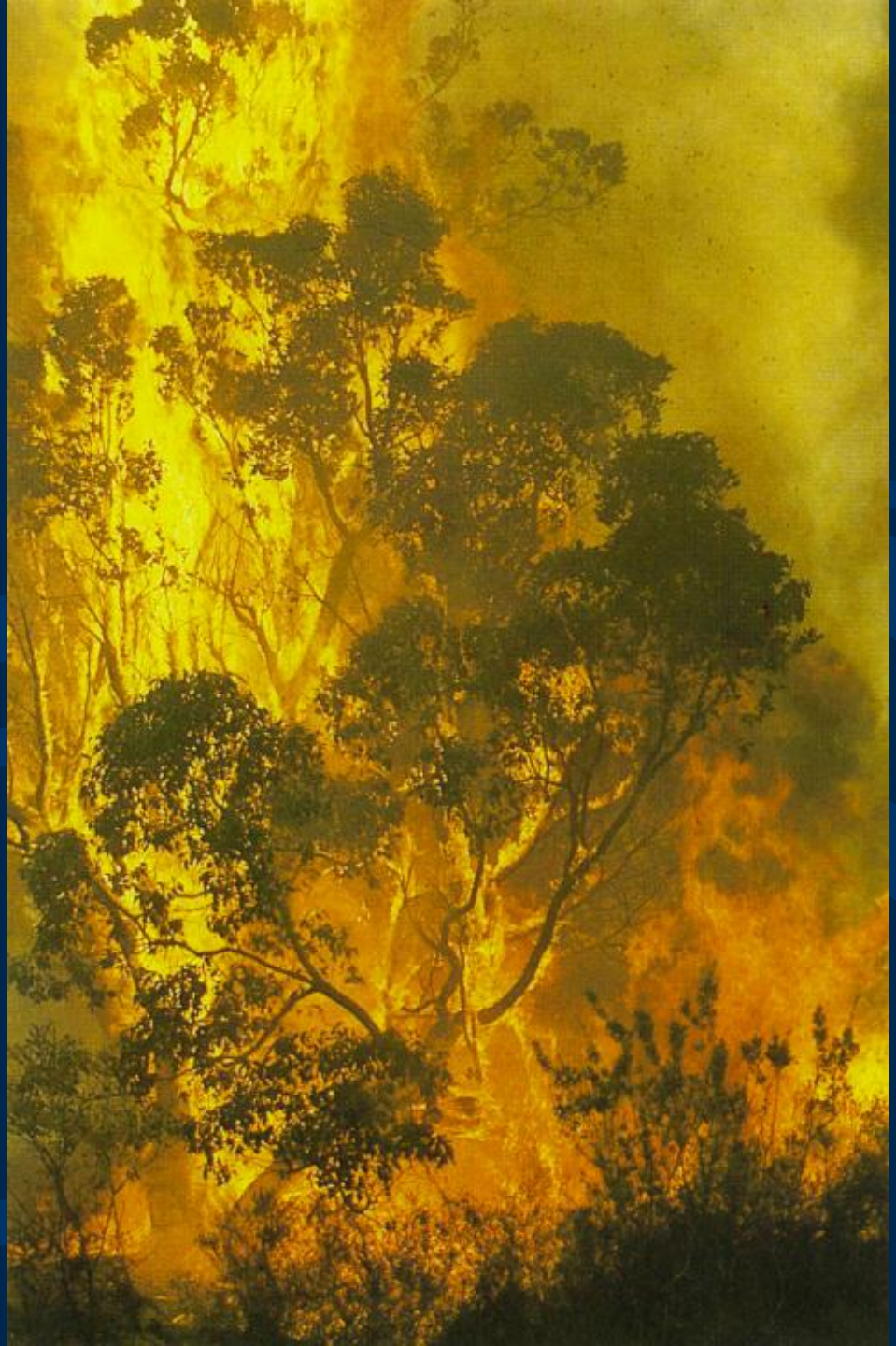


Unrestrained Lightning Fires (2000–2003)

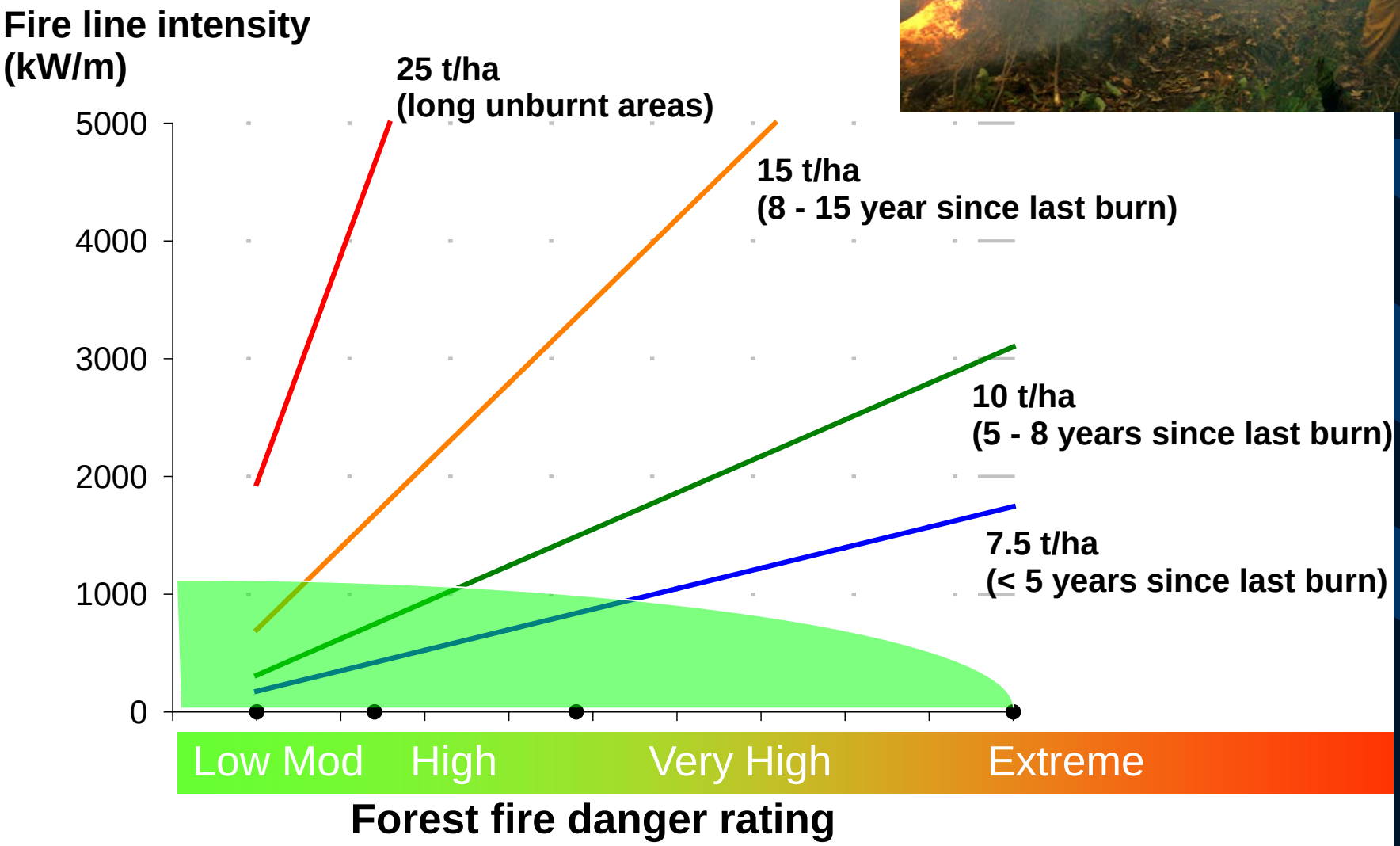
- 459 Fires
- Spread for 50 hours over 3 to 4 days
- ROS 200 m/hr
- ~85% of forest burnt
- Ultra conservative

Historic Indicators – Jarrah Forests

- Extensive, frequent use of fire by Nyungars
- Fires in spring/summer/autumn
- Mostly low intensity, occasionally high intensity
- Balga trees 3-4 fire intervals in drier parts of the forest
- Riparian areas and low fuel habitats burnt less frequently

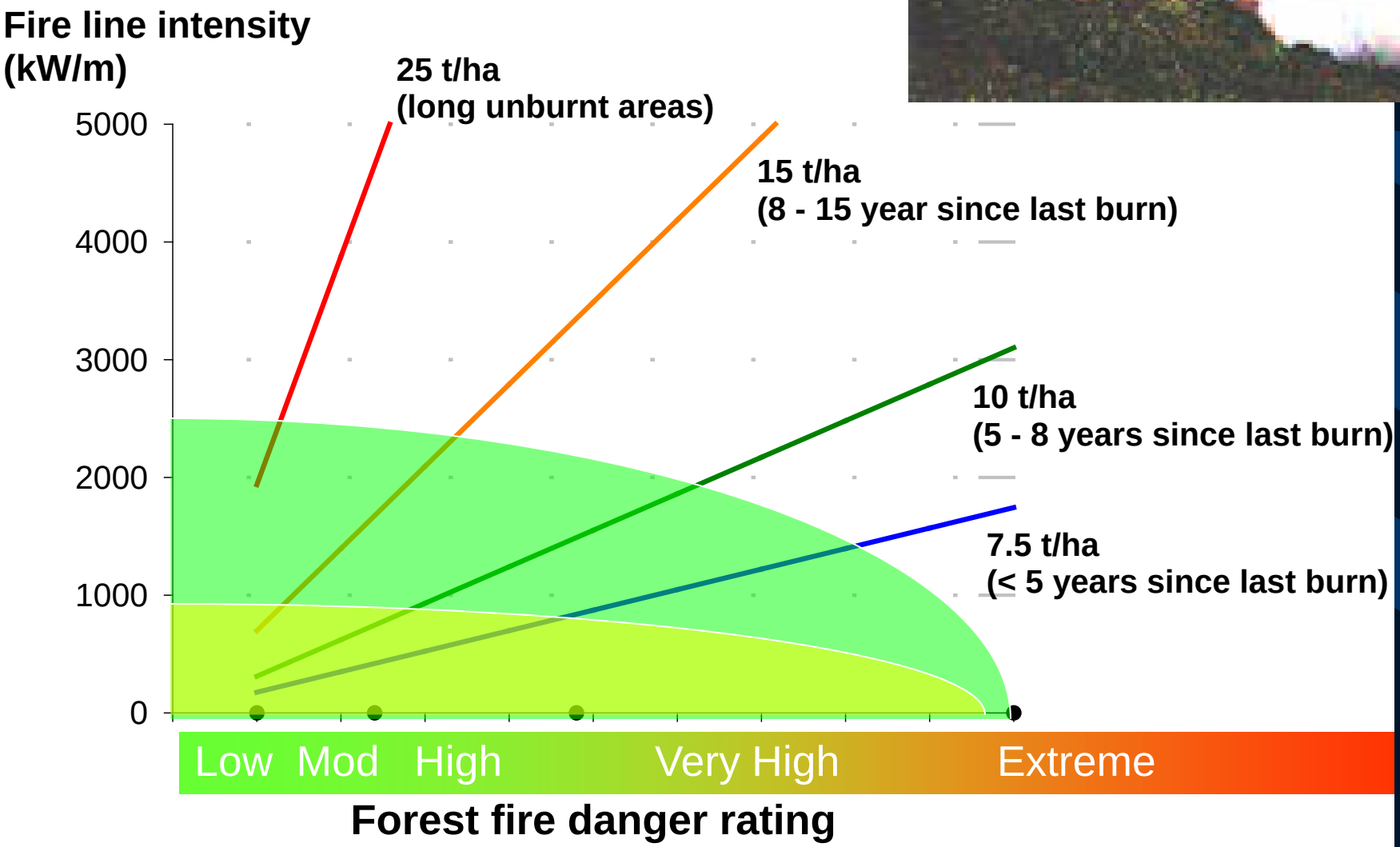


Direct Suppression
Hand crew



Direct Suppression

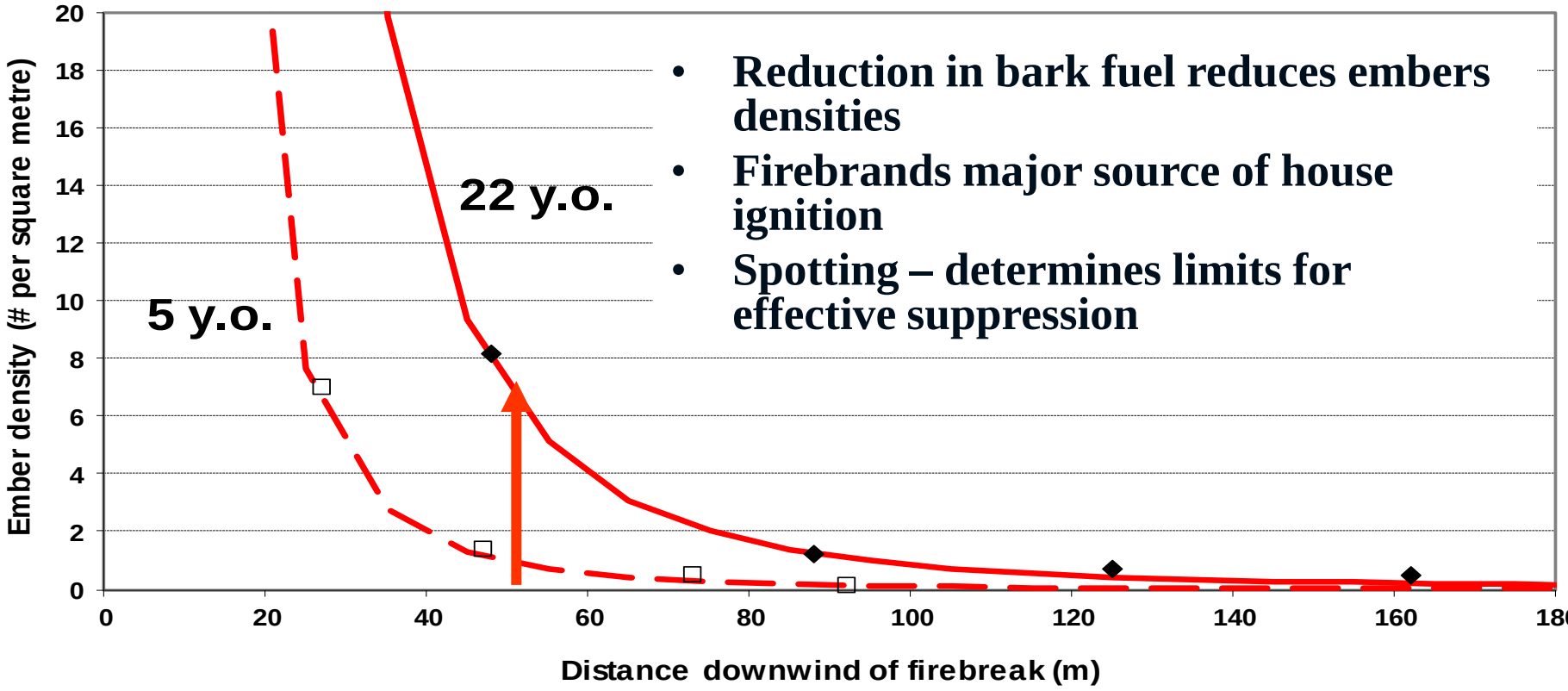
Air tanker - dozer



Prescribed Burning

Only practical means to reduce spotting

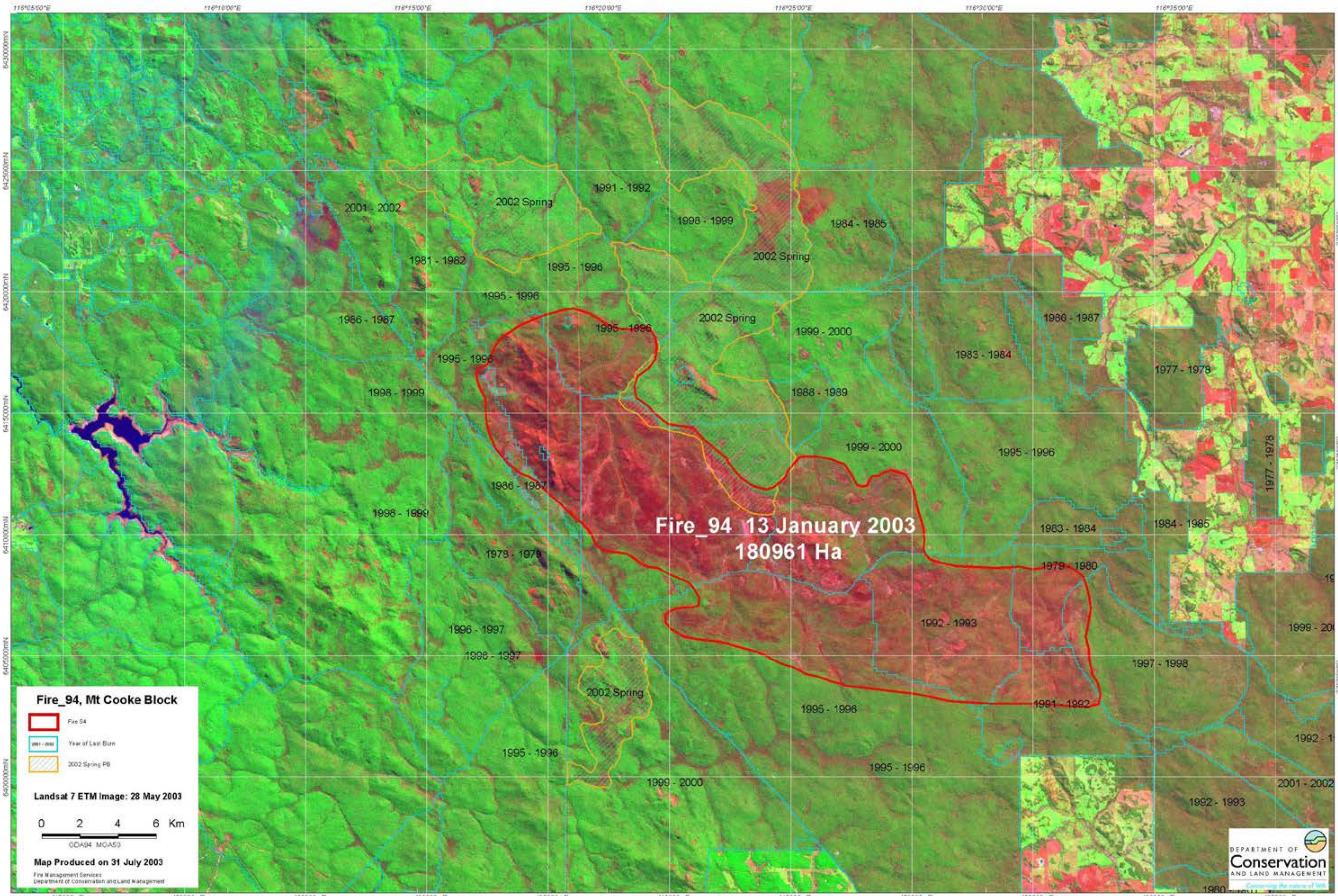
Comparison of peak ember densities downwind of fire F (22 year old fuel) and fire D (5 year old fuel) , burnt simultaneously on 14/02/02.



- **Reduction in bark fuel reduces embers densities**
- **Firebrands major source of house ignition**
- **Spotting – determines limits for effective suppression**

Mount Cooke Fire 10th–11th January 2003

Mount Cooke Fire 10th–11th January 2003



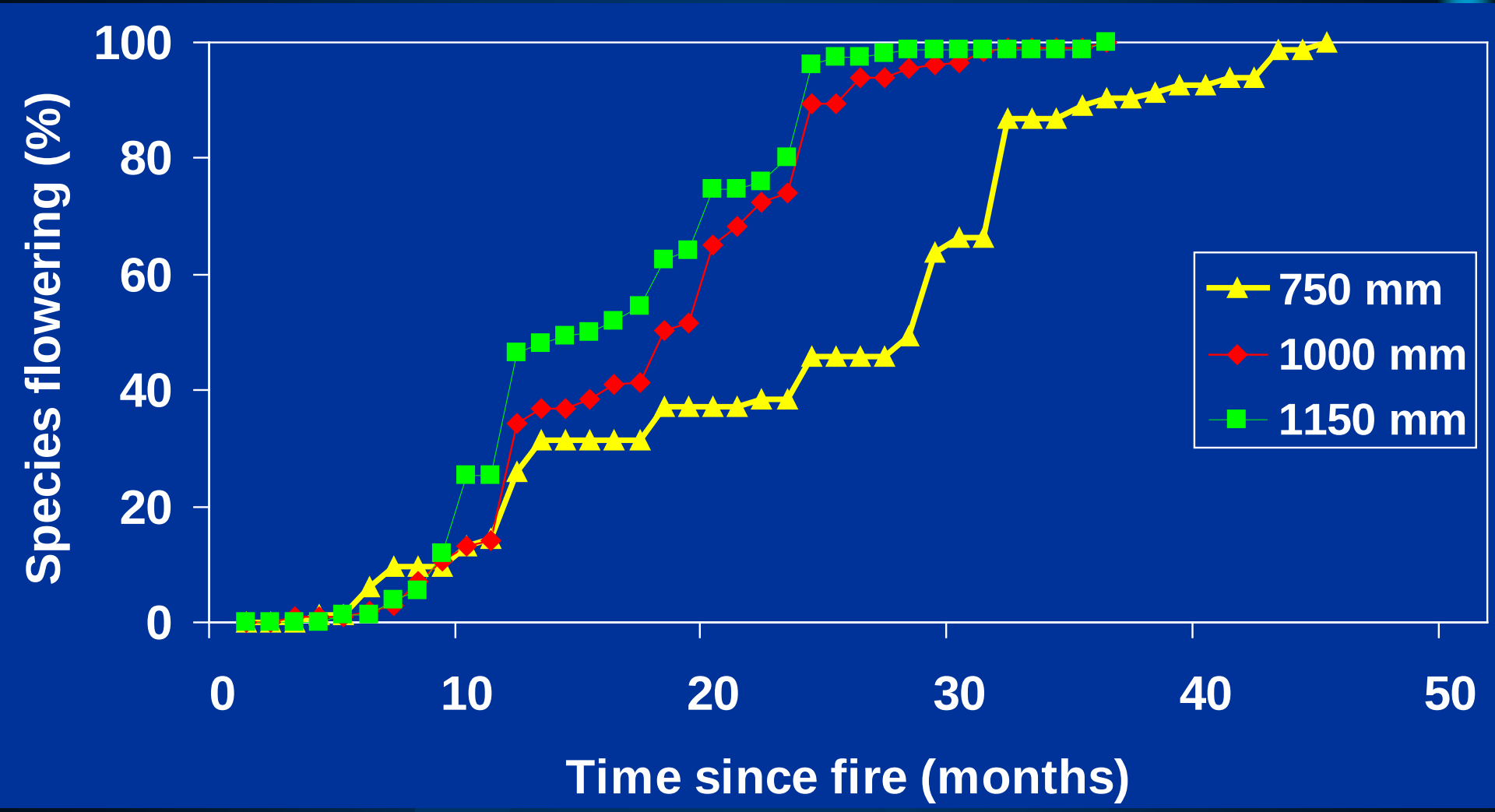
Fire_94 13 January 2003
180961 Ha
Fire_94, Mt Cooke Block
Fire 94
Year of Last Burn
2002 Spring PB
Landsat 7 ETM Image: 28 May 2003
0 2 4 6 Km
GDA94 MGA53
Map Produced on 31 July 2003
Fire Management Services
Department of Conservation and Land Management
DEPARTMENT OF Conservation AND LAND MANAGEMENT
2001 - 2002
2002 Spring
1991 - 1992
1998 - 1999
1984 - 1985
1981 - 1982
1995 - 1996
1986 - 1987
1999 - 2000
1983 - 1984
1977 - 1978
1988 - 1989
1978 - 1979
1979 - 1980
1996 - 1997
1992 - 1993
1997 - 1998

Biodiversity Considerations

Biological Indicators (*flora*) – Jarrah Forests

- Some obligate seeders on moist sites flower 6-8 years after fire.
- Thicket-forming species in broad valley floors are obligate seeders and depend on dry fires for regeneration.
- Seedling regeneration and survival is most prolific after summer/autumn fire.

Time to first flowering after fire for 300 upland forest understorey species



Biological Indicators (*fauna*) – Jarrah Forest

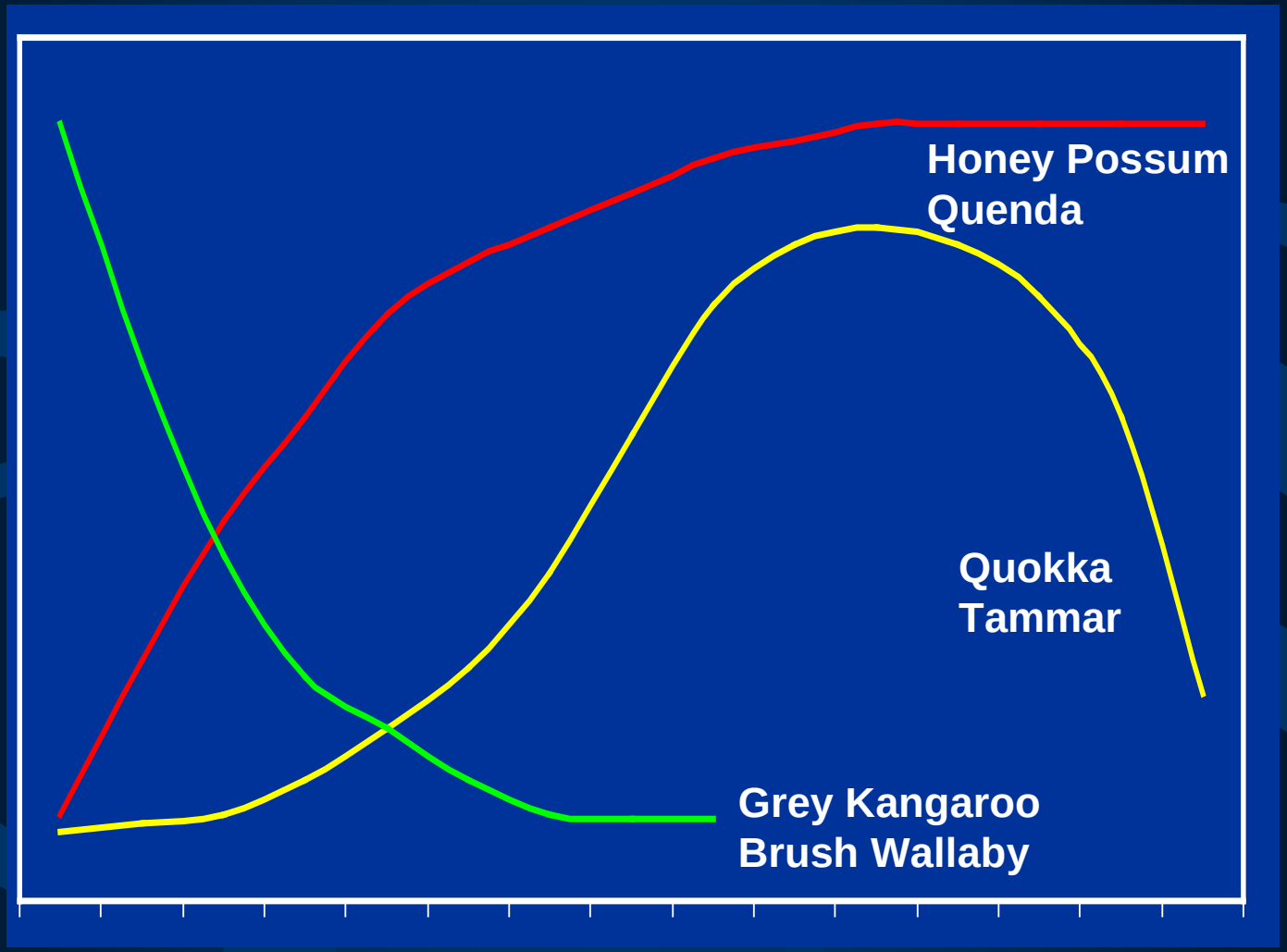
•Black Gloved Wallaby


•Tammar Wallaby

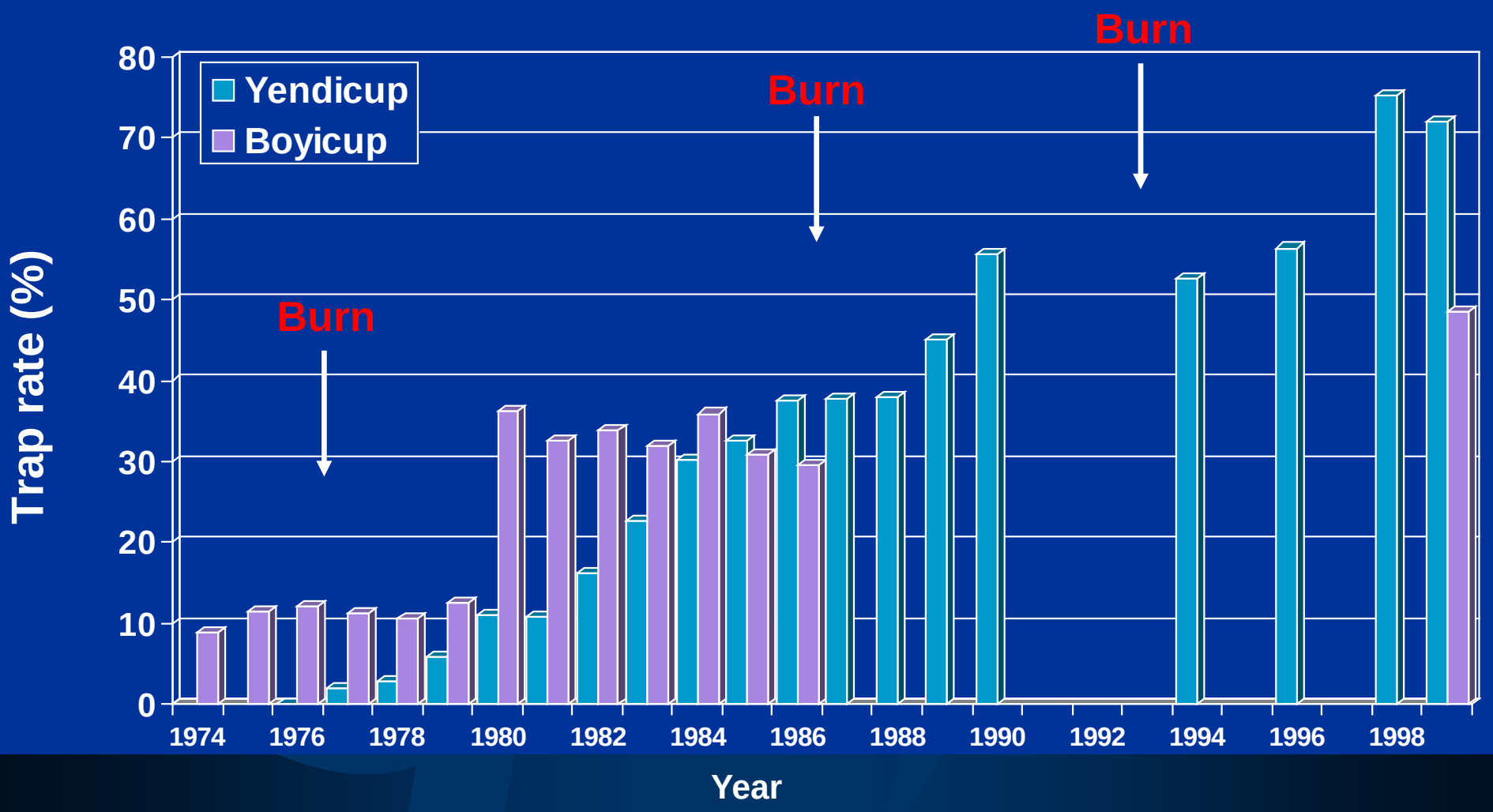
•Quenda Bandicoot

•Quokka

Generalised post-fire population trends for some Jarrah forest mammals



Mammal Trap Rates in Perup Forest



Biological Indicators (*mammals*) – Jarrah Forests

- Behavioural and biological adaptations to fire.
- No single fire interval is optimal for all species.
- Severity of fire impact proportional to fire size and intensity.

Fire Management Objectives

- To protect environmental and community values on lands managed by the Department from damage or destruction from wildfire.

Fire Management Objectives

- To use fire as a management tool to achieve biodiversity conservation and other land management objectives, in accordance with designated land use priorities.

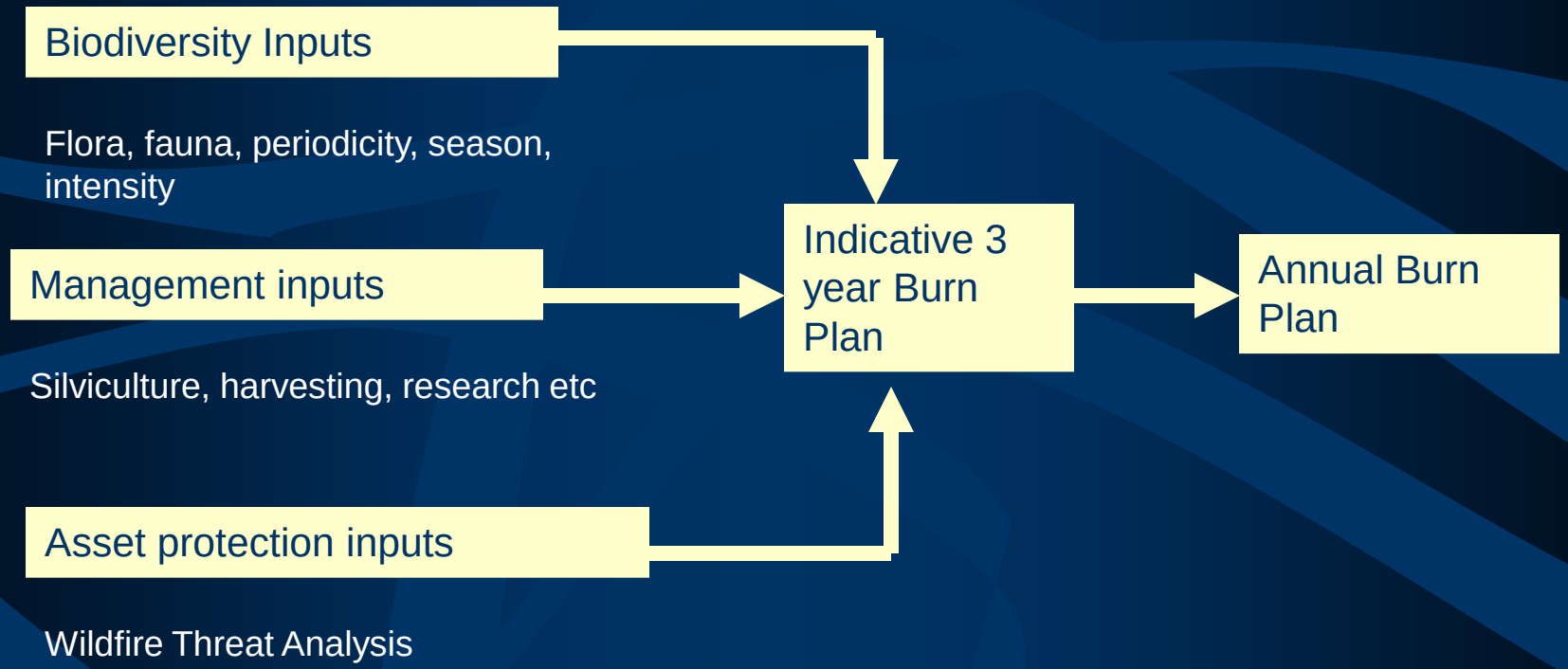
Use of Fire

- Use prescribed fire or other methods to reduce hazards on appropriate areas of CALM lands, where it can be demonstrated that this is the most effective means of wildfire control, and where undesirable ecological effects do not result.

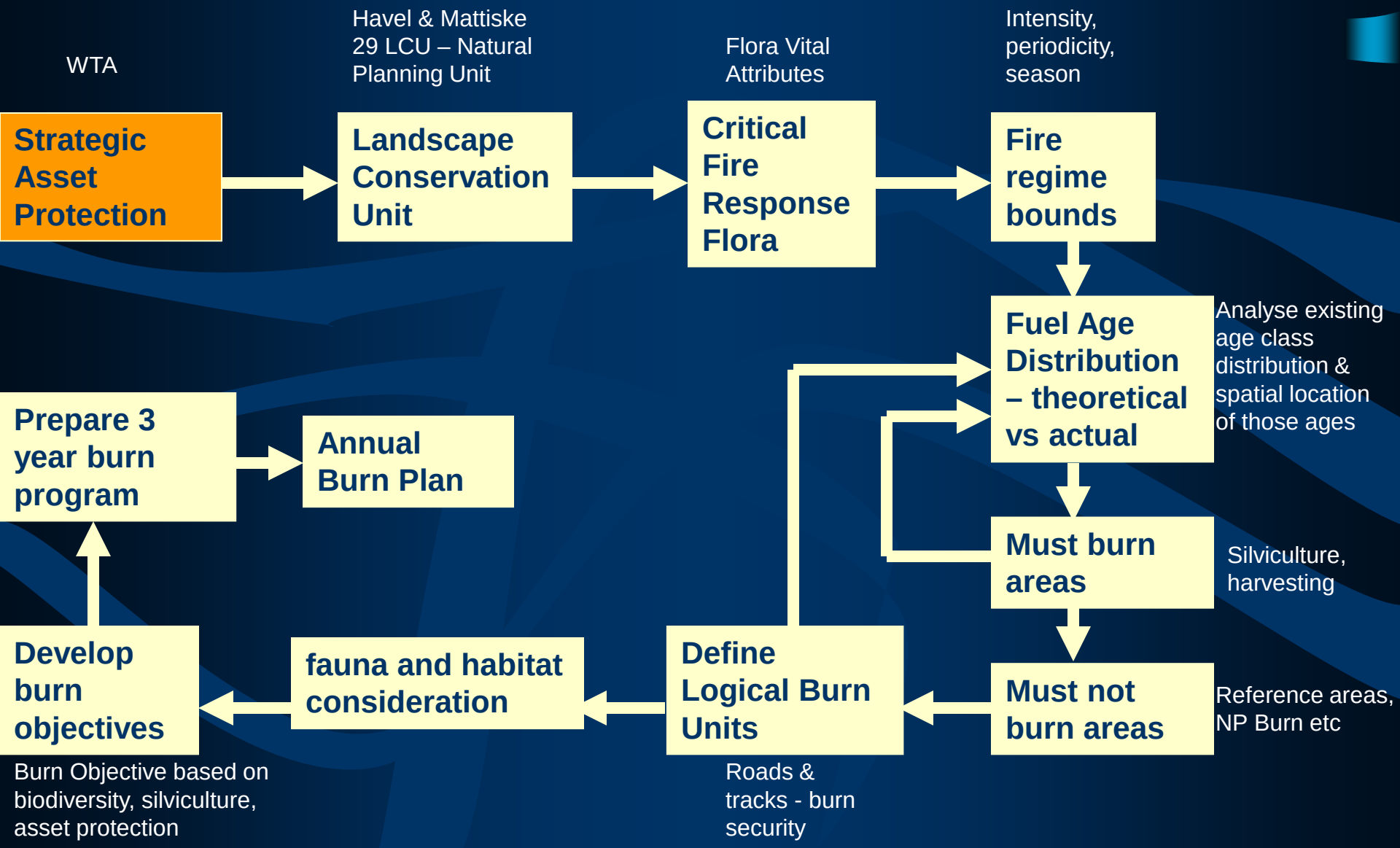
Fire Diversity Promotes Biodiversity

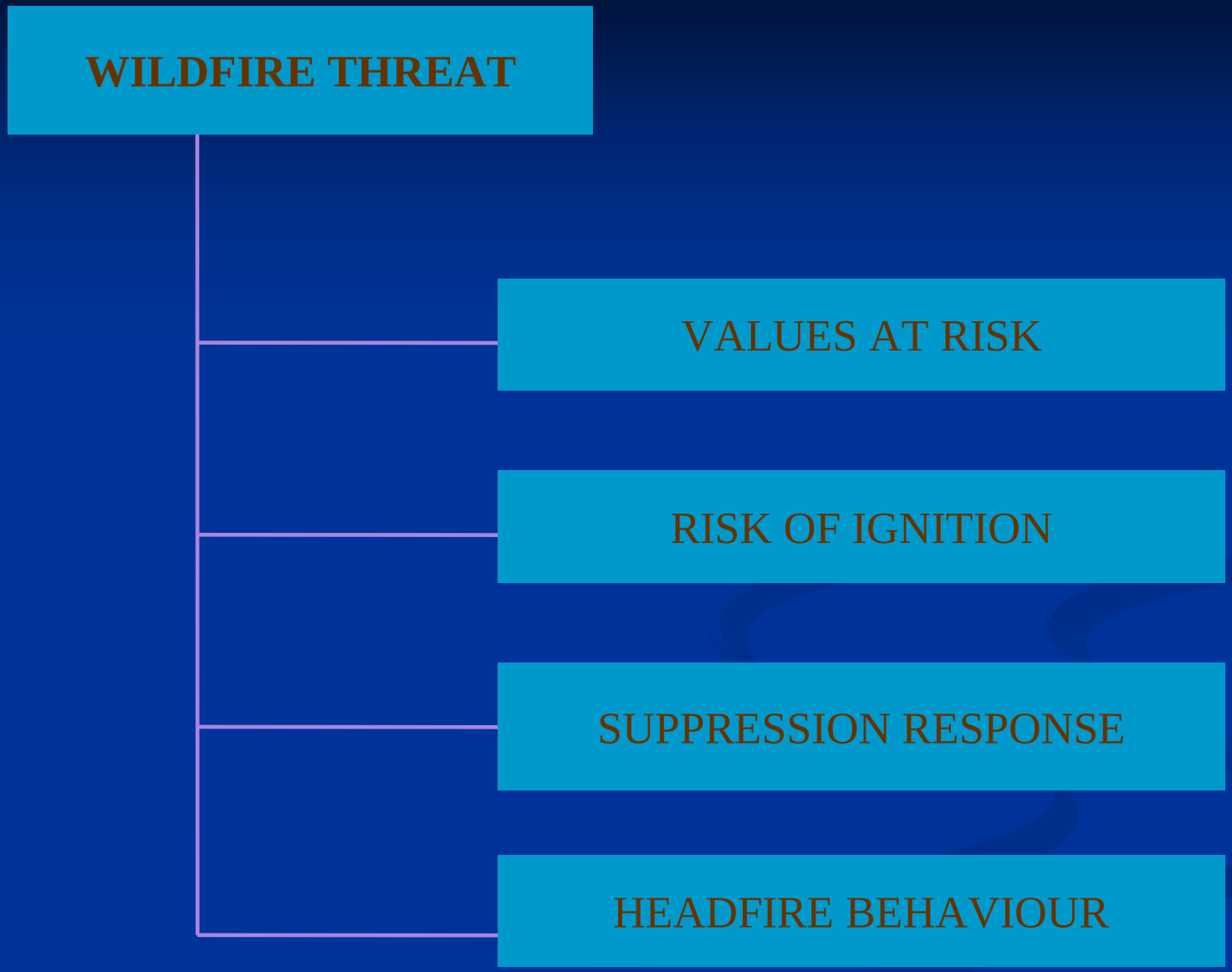
- An interlocking mosaic of patches of vegetation representing a range of fire frequencies, intervals, seasons, intensities and scales need to be incorporated into ecologically-based fire regimes if they are to optimise the conservation of biodiversity.

Integrated Fire Management



Fire Management for Biodiversity




WILDFIRE THREAT
VALUES AT RISK
RISK OF IGNITION
SUPPRESSION RESPONSE
HEADFIRE BEHAVIOUR

VALUES

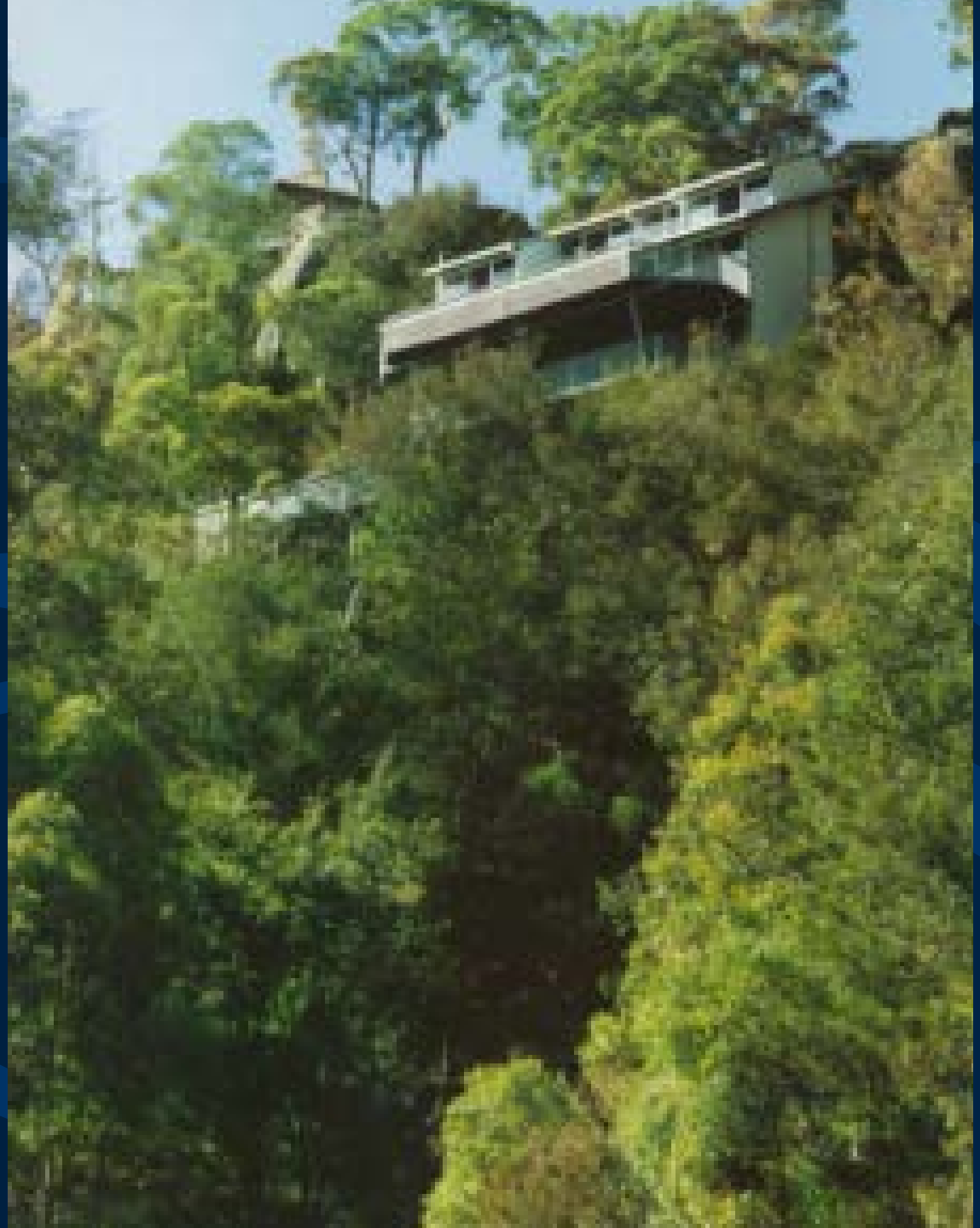
Four Broad Categories

- Community Protection
  - (settlements, hospitals, schools, essential utilities)
- Visitor Values
  - (Camping areas, recreation sites, cultural/heritage)
- Biodiversity conservation
  - (fire vulnerable threatened species and ecological communities , monitoring plots, research sites)
- Forest Production
  - (pine plantations, young regrowth, large or small)

VALUES

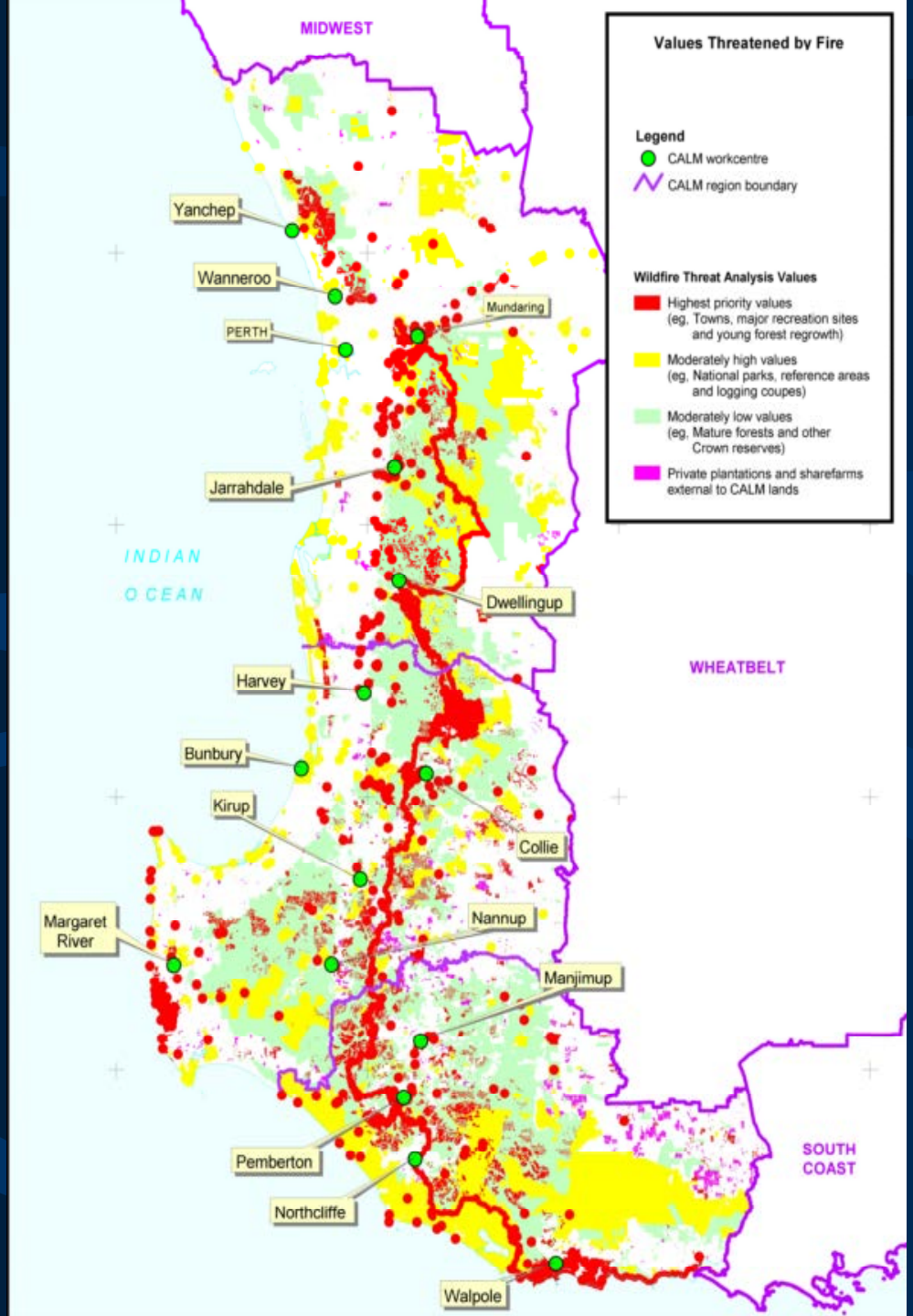
Grouped from 1 to 6

- **Group 1**
  - Threat to Multiple lives and irreplaceable biological values.
- **Group 2**
  - Few Lives at Risk, Very High Property / Community Fire Vulnerable Critically Endangered.Species,
  - Essential Utilities, Major recreation site.
- **Group 3**
  - High Biological, property values. Low risk to Life
- etc



Rare Frogs

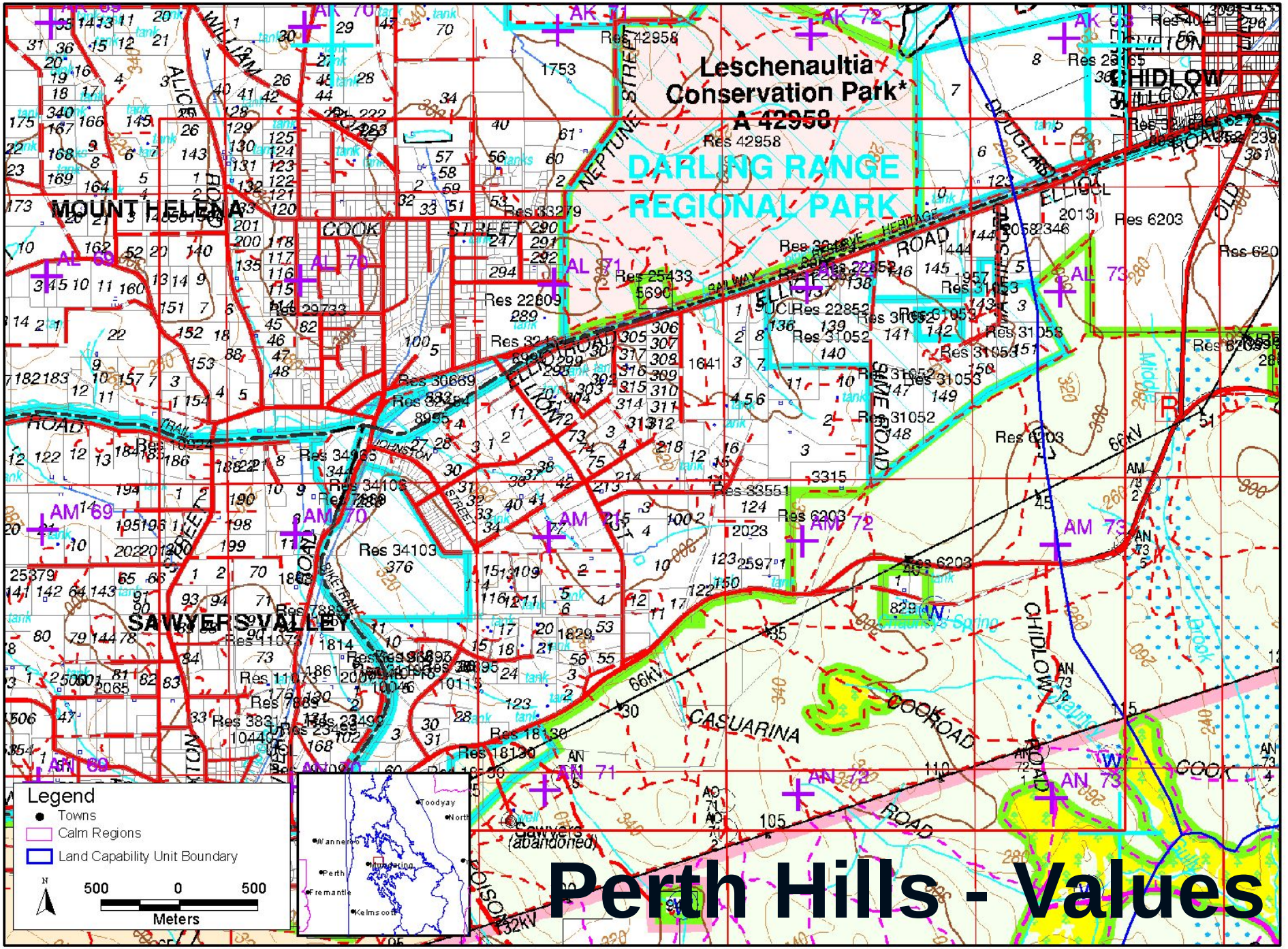
Noisy Scrub Bird



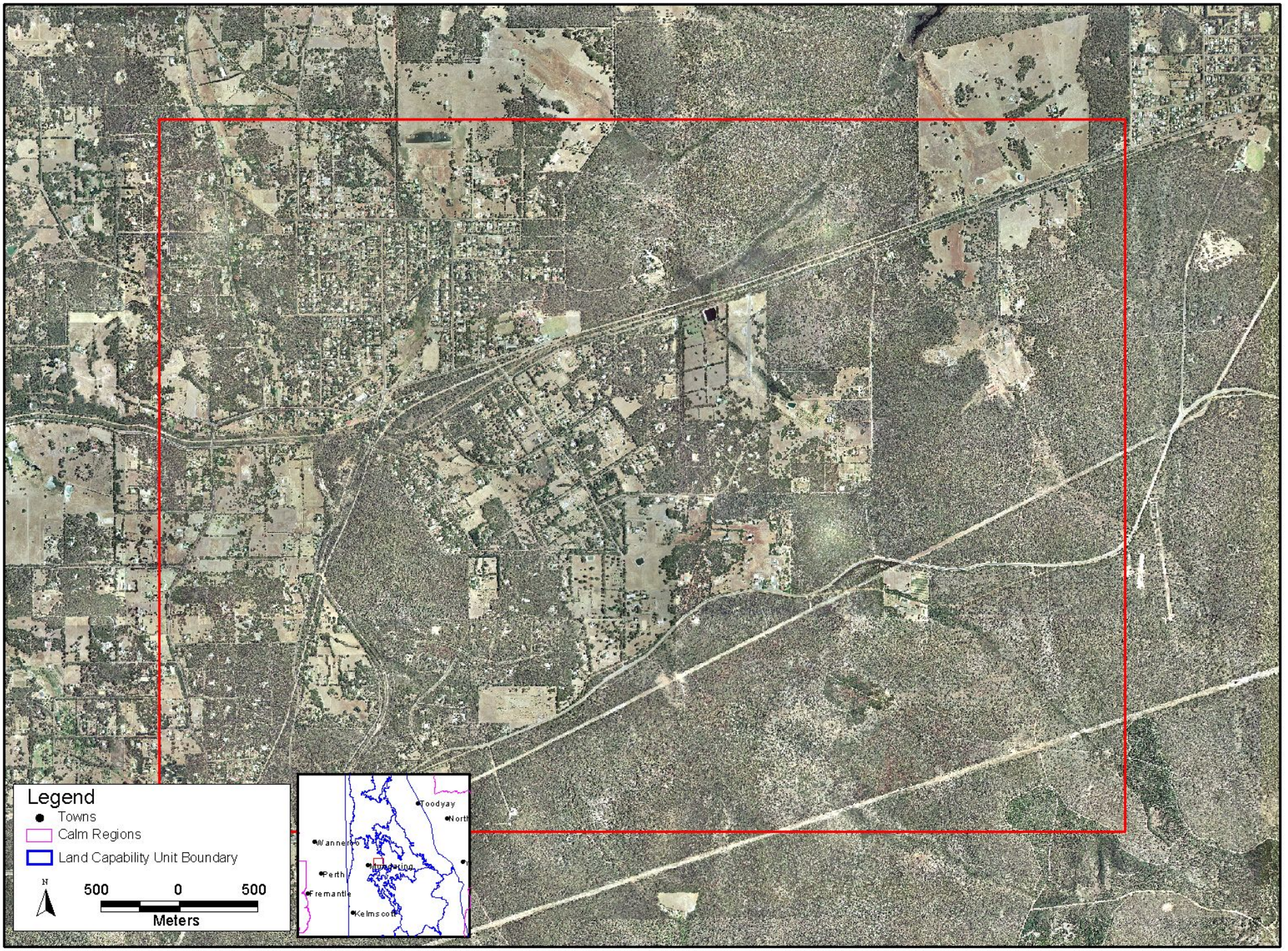
Values Threatened by Fire

Legend
CALM workcentre
CALM region boundary

Wildfire Threat Analysis Values
Highest priority values
(eg, Towns, major recreation sites and young forest regrowth)
Moderately high values
(eg, National parks, reference areas and logging coupes)
Moderately low values
(eg, Mature forests and other Crown reserves)
Private plantations and sharefarms external to CALM lands



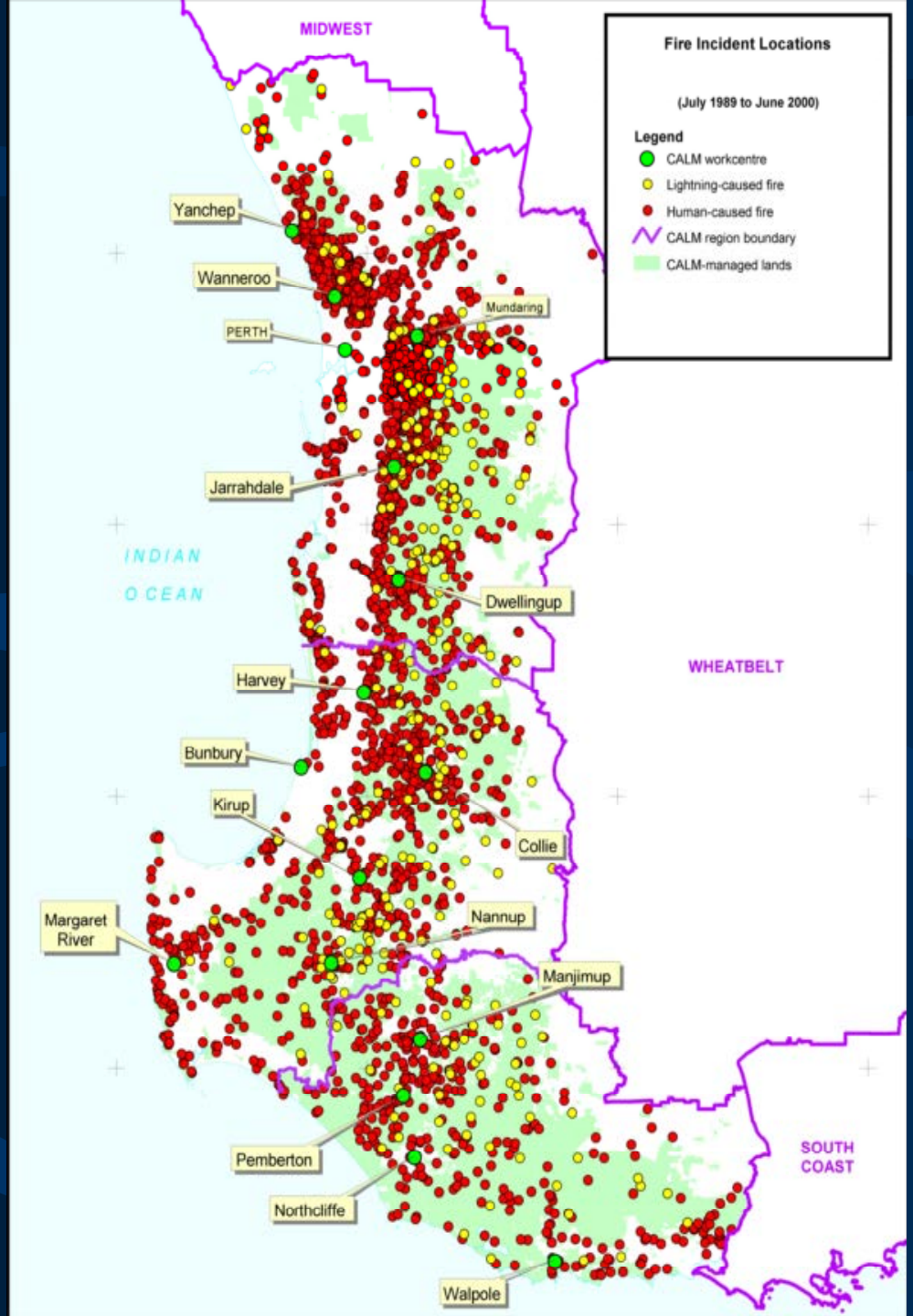
Perth Hills - Values


Legend
Towns
Calm Regions
Land Capability Unit Boundary
N
500
0
500
Meters
Toodyay
Wanneroo
Perth
Fremantle
Kelmscott

Risk of Ignition

Causes of Fires

- Lightning (varies from 4 to 60%)
- Deliberate/Arson (40 to 60%)
- Accidental Escapes from Burns (2 to 8%)
- Recreationists
- Timber and Other industries
- Unknown



Fire Incident Locations

(July 1989 to June 2000)

Legend

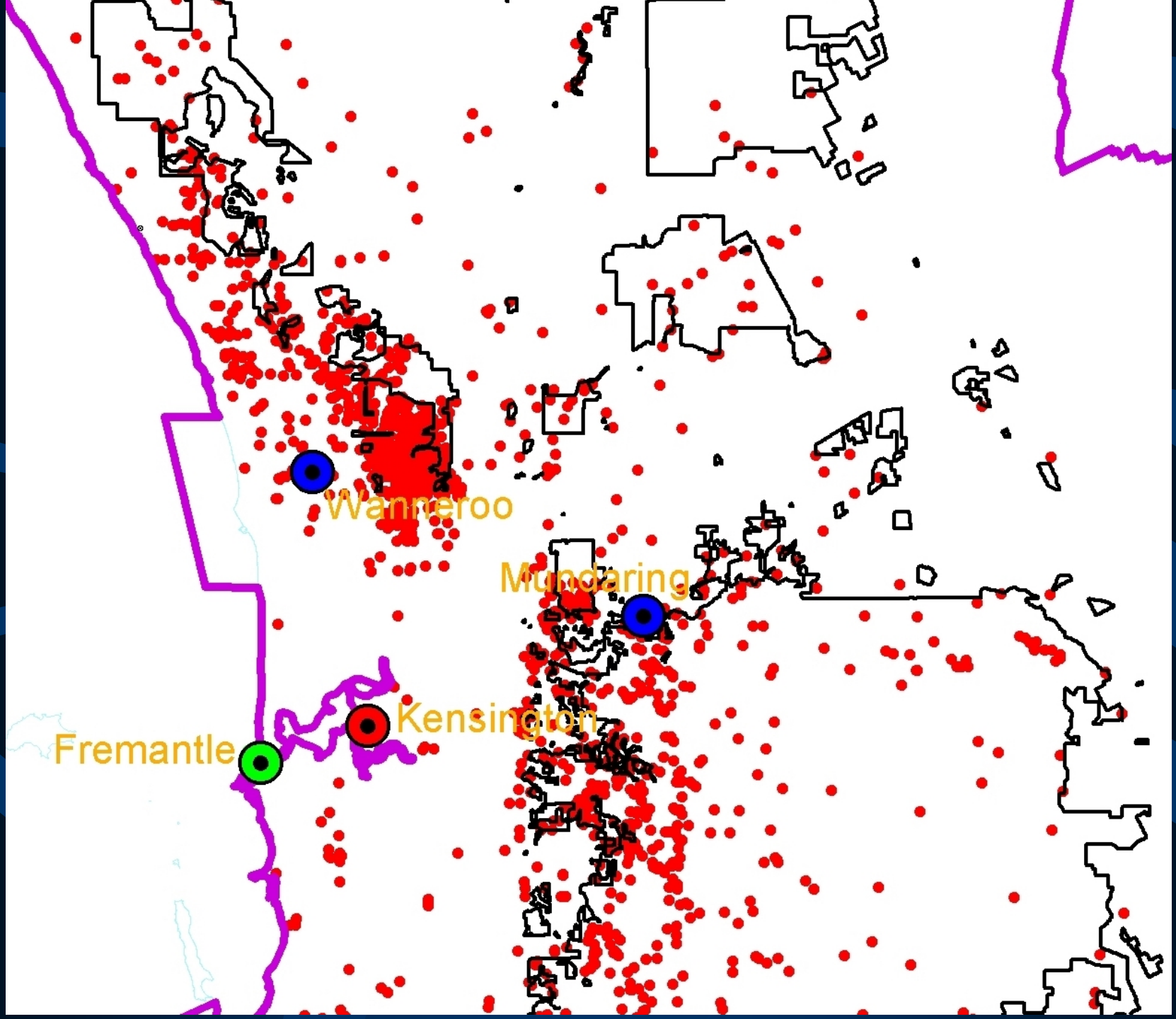
CALM workcentre

Lightning-caused fire

Human-caused fire

CALM region boundary

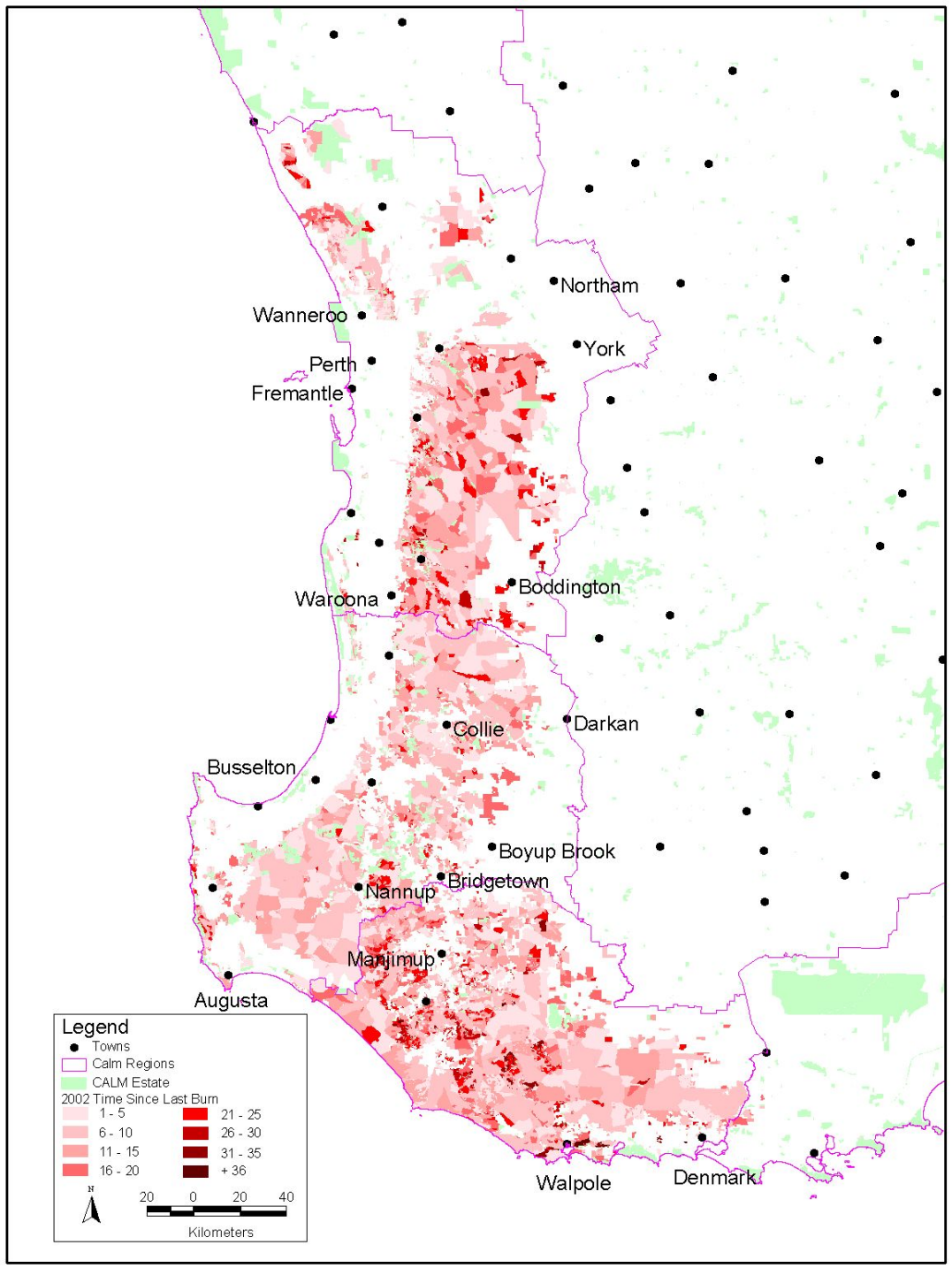
CALM-managed lands


Wanneroo
Mundaring
Kensington
Fremantle

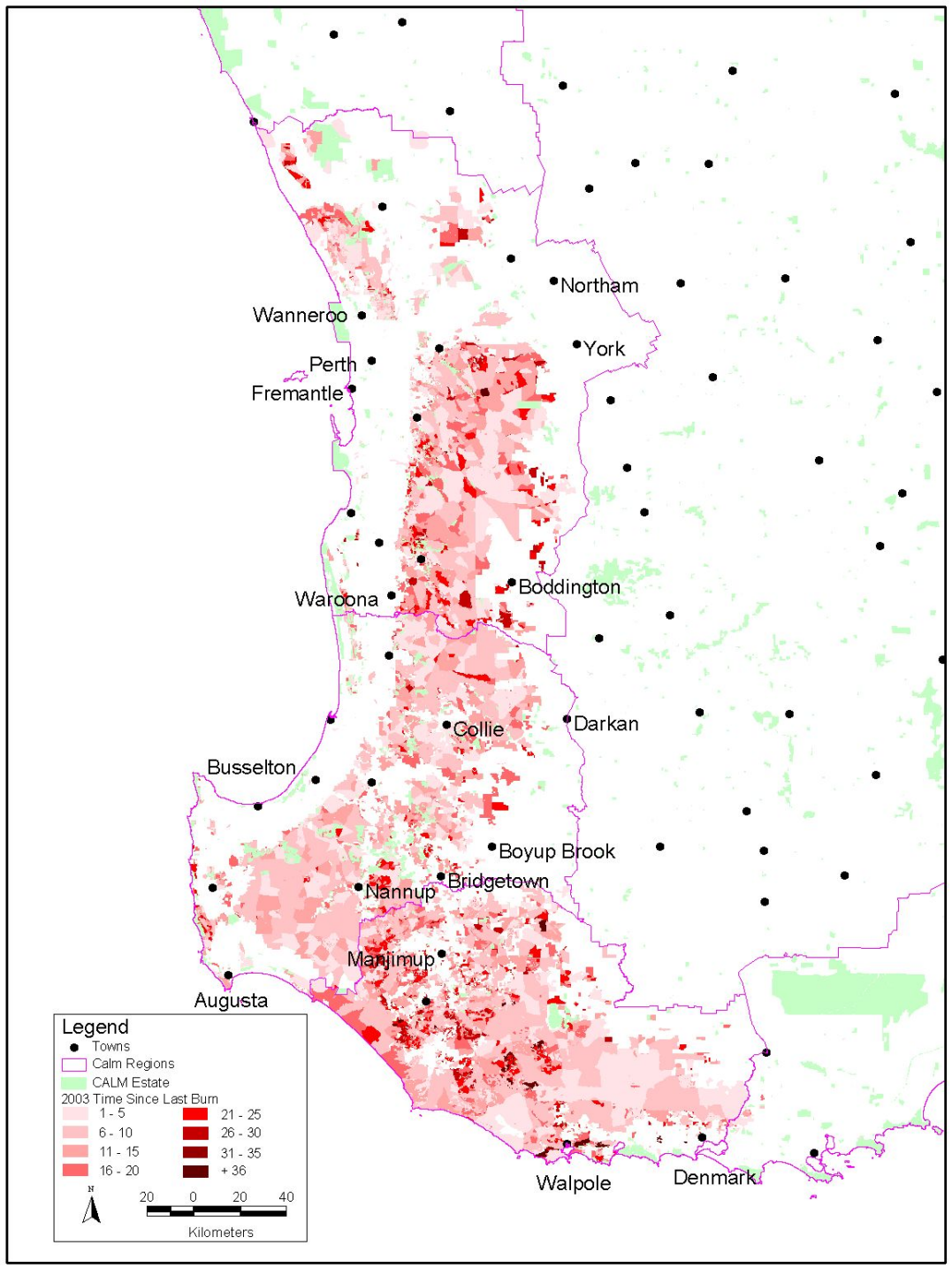
Fire Behaviour

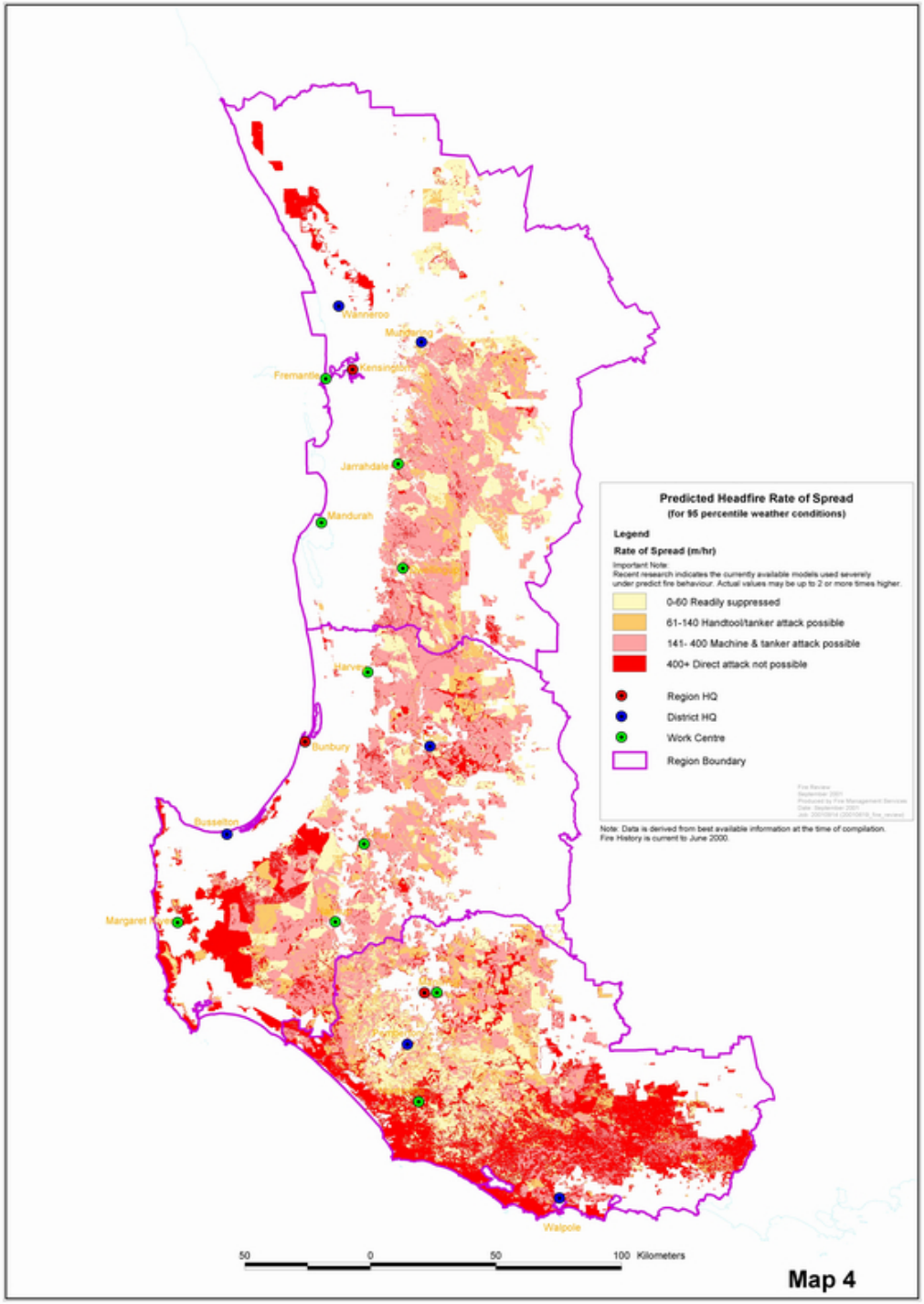
- Headfire Behaviour (Rate of Spread meter/hour)
- Head Fireline Intensity (kW/meter)
- Based on Fuel Type, Time since last Fire/Burn, Terrain, Weather (95% conditions).
- Grouped into “Ease of Suppression” categories

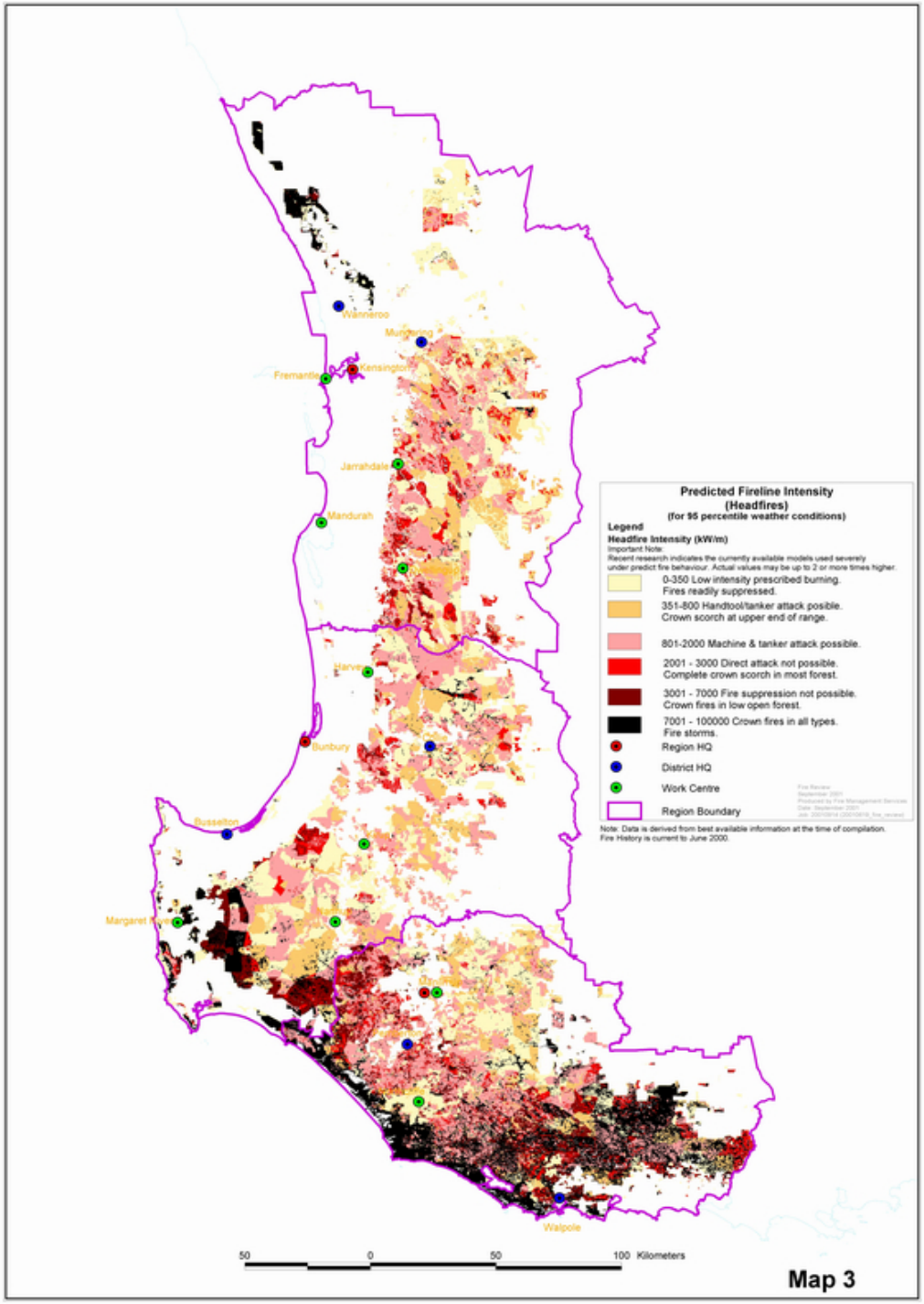
Time Since Last Fire – June 2002



Time Since Last Fire – June 2003

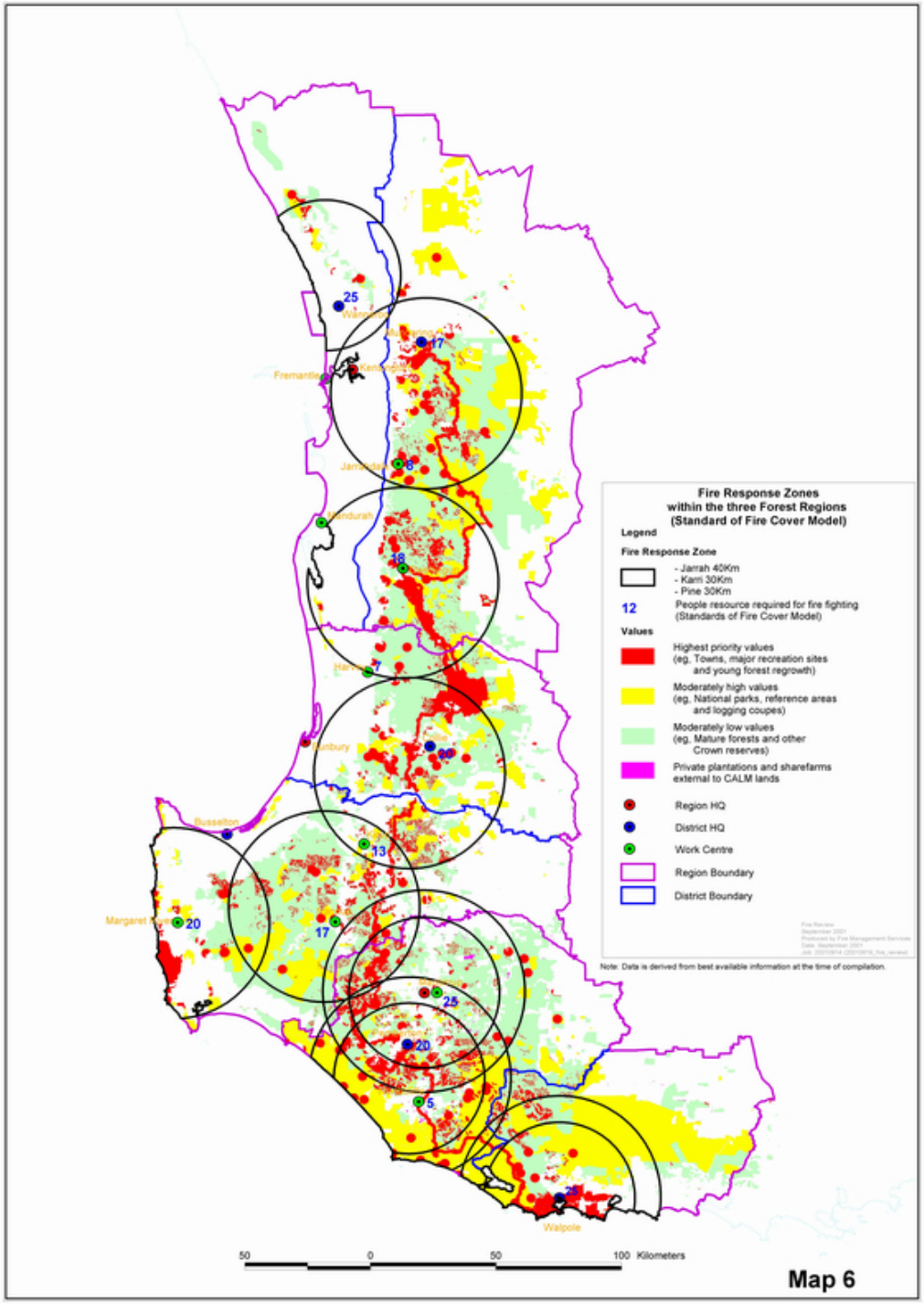



Wanneroo
Fremantle
Kensington
Jarrahdale
Mandurah
Harvey
Bunbury
Busselton
Margaret River
Walpole
Predicted Headfire Rate of Spread
(for 95 percentile weather conditions)
Legend
Rate of Spread (m/hr)
Important Note:
Recent research indicates the currently available models used severely under predict fire behaviour. Actual values may be up to 2 or more times higher.
0-60 Readily suppressed
61-140 Handtool/tanker attack possible
141- 400 Machine & tanker attack possible
400+ Direct attack not possible
Region HQ
District HQ
Work Centre
Region Boundary
Note: Data is derived from best available information at the time of compilation.
Fire History is current to June 2000.
50
0
50
100 Kilometers
Map 4

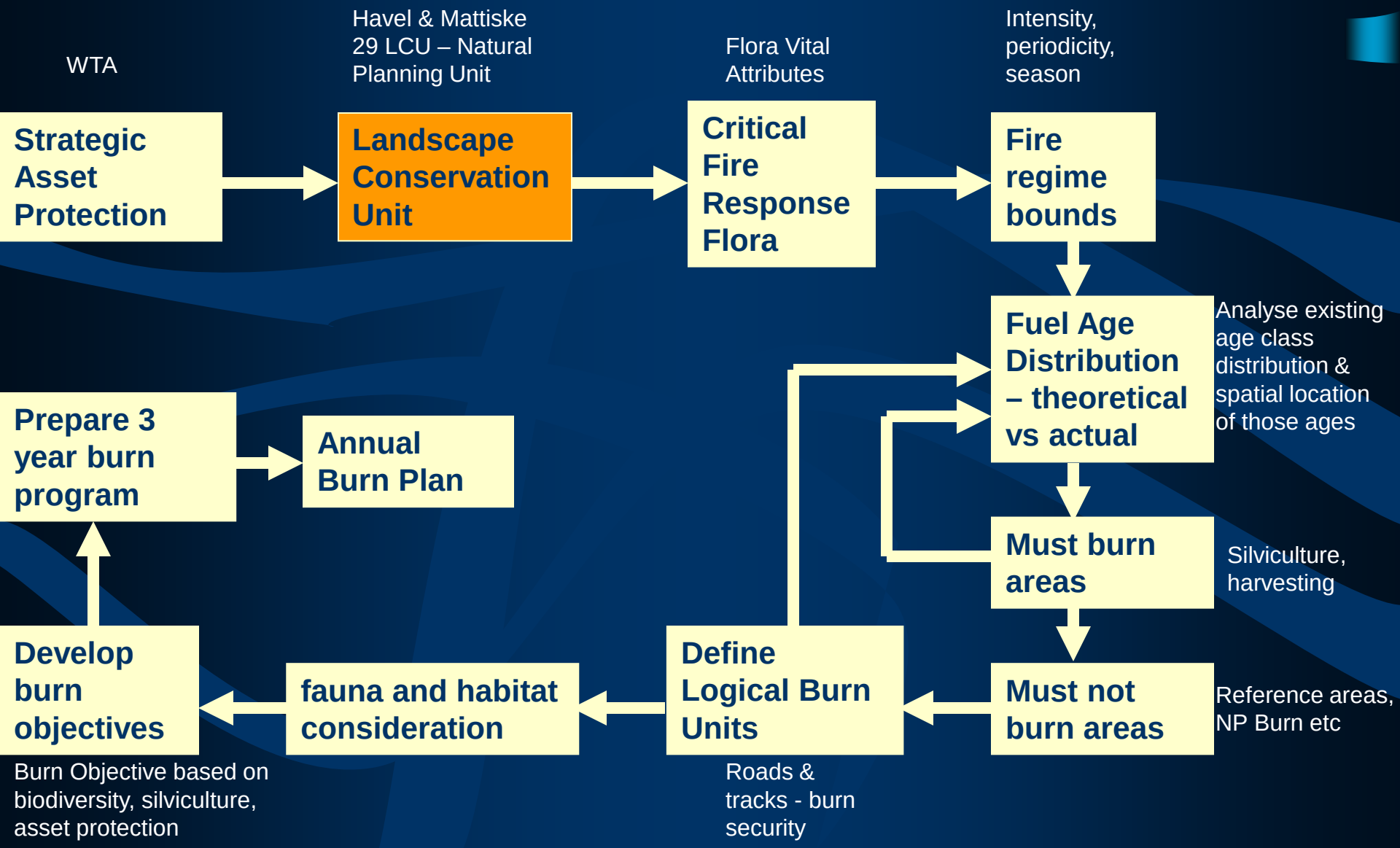

Predicted Fireline Intensity
(Headfires)
(for 95 percentile weather conditions)
Legend
Headfire Intensity (kW/m)
Important Note:
Recent research indicates the currently available models used severely under predict fire behaviour. Actual values may be up to 2 or more times higher.
0-350 Low intensity prescribed burning. Fires readily suppressed.
351-800 Handtool/tanker attack posible. Crown scorch at upper end of range.
801-2000 Machine & tanker attack possible.
2001 - 3000 Direct attack not possible. Complete crown scorch in most forest.
3001 - 7000 Fire suppression not possible. Crown fires in low open forest.
7001 - 100000 Crown fires in all types. Fire storms.
Region HQ
District HQ
Work Centre
Region Boundary
Note: Data is derived from best available information at the time of compilation.
Fire History is current to June 2000.
Wanneroo
Fremantle
Kensington
Jarrahdale
Mandurah
Harvey
Bunbury
Busselton
Margaret River
Walpole
50
0
50
100 Kilometers
Map 3

Suppression Response

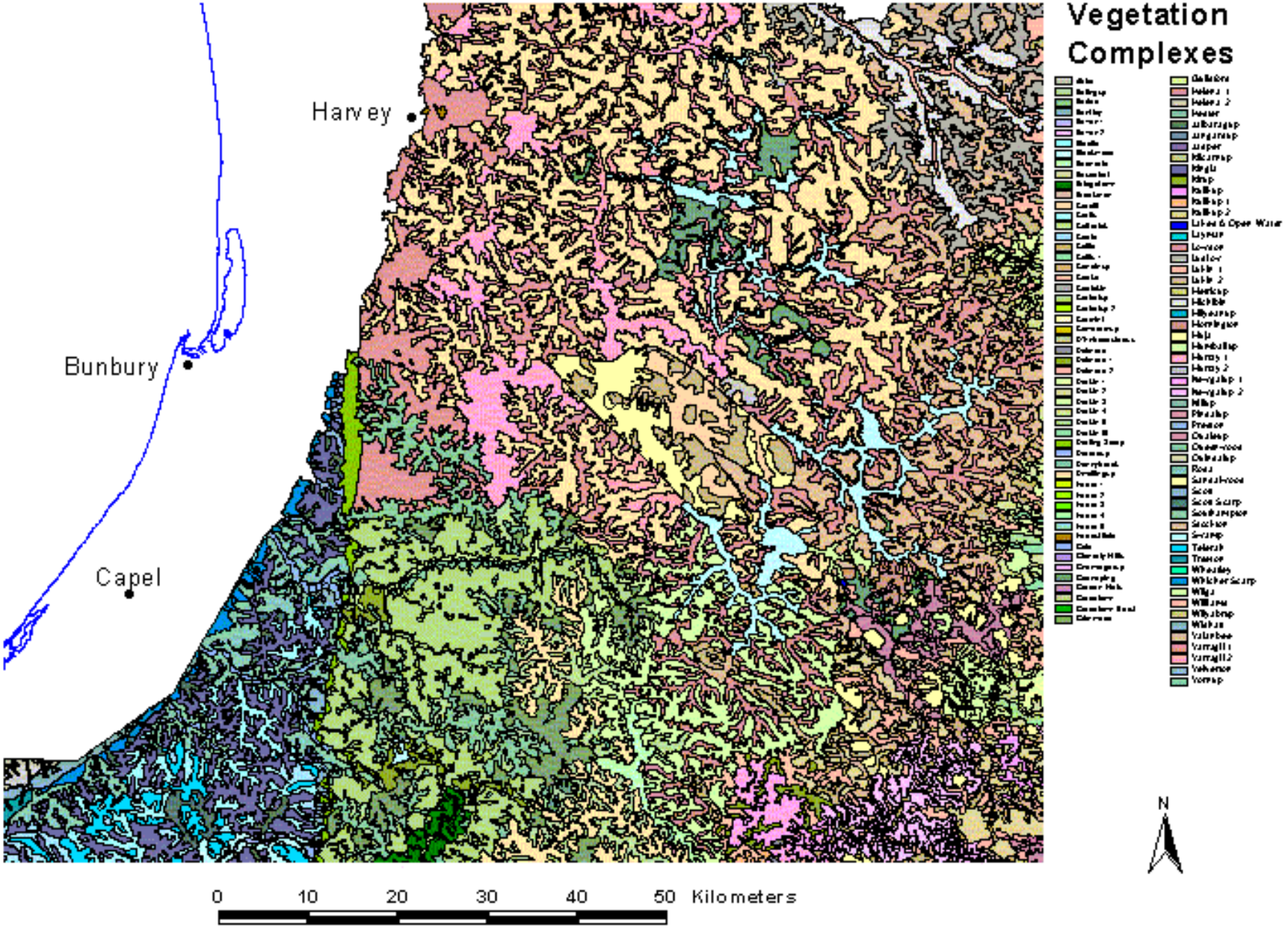
- Location of Ground/Aerial Forces
- Number of Personnel, Tankers, Dozers, Aircraft
- Roading Network
- Fire Response Zones for initial attack
- Provides coverage to high values concentrations, about 40 kilometre radius from Work Centres.


Fire Response Zones
within the three Forest Regions
(Standard of Fire Cover Model)
Legend
Fire Response Zone
- Jarrah 40Km
- Karri 30Km
- Pine 30Km
12
People resource required for fire fighting
(Standards of Fire Cover Model)
Values
Highest priority values
(eg. Towns, major recreation sites
and young forest regrowth)
Moderately high values
(eg. National parks, reference areas
and logging coupes)
Moderately low values
(eg. Mature forests and other
Crown reserves)
Private plantations and sharefarms
external to CALM lands
Region HQ
District HQ
Work Centre
Region Boundary
District Boundary
Note: Data is derived from best available information at the time of compilation.
Busselton
Walpole
50 0 50 100 Kilometers
Map 6

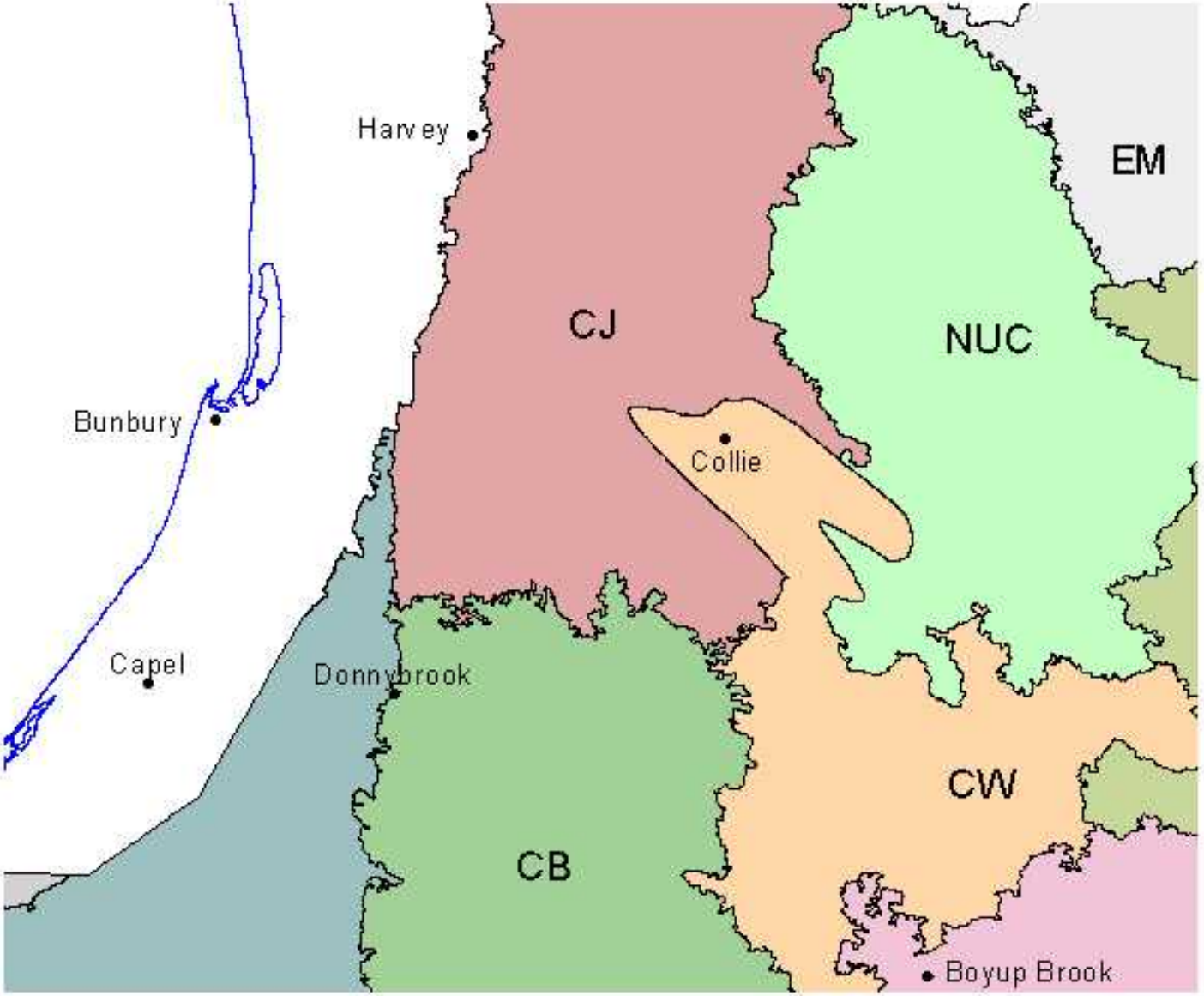
Fire Management for Biodiversity



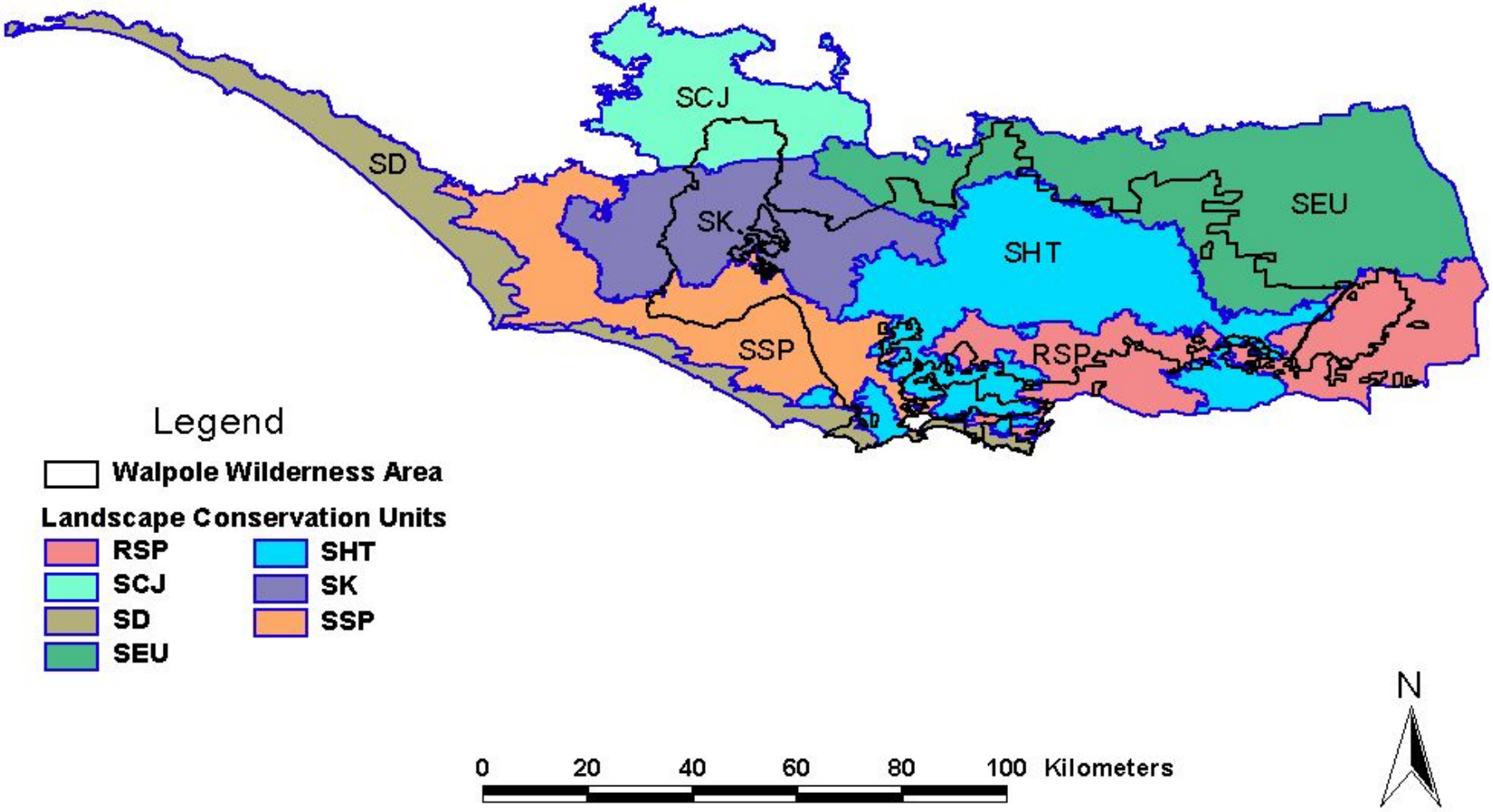
Vegetation Complexes



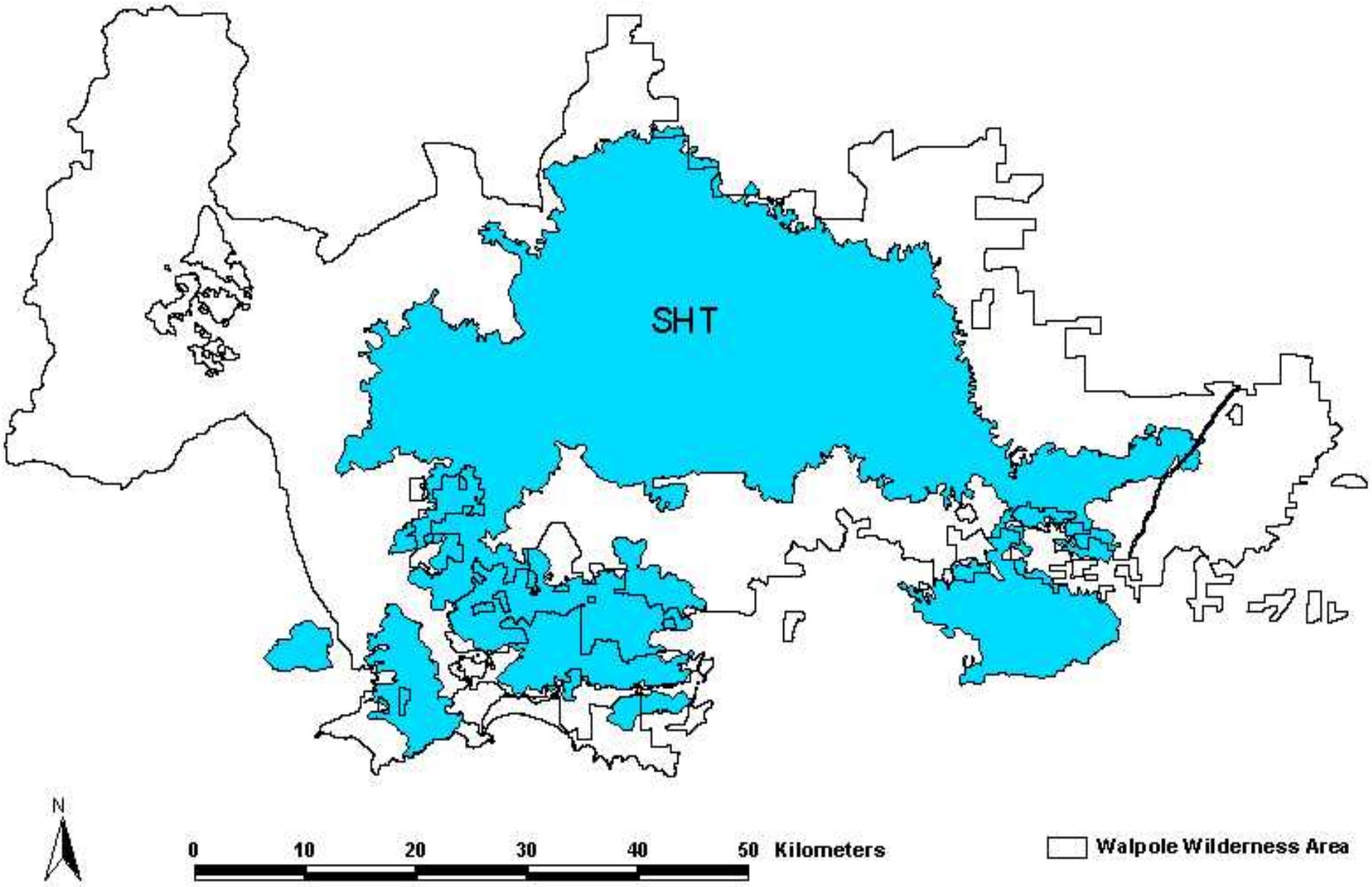
Landscape Conservation Units



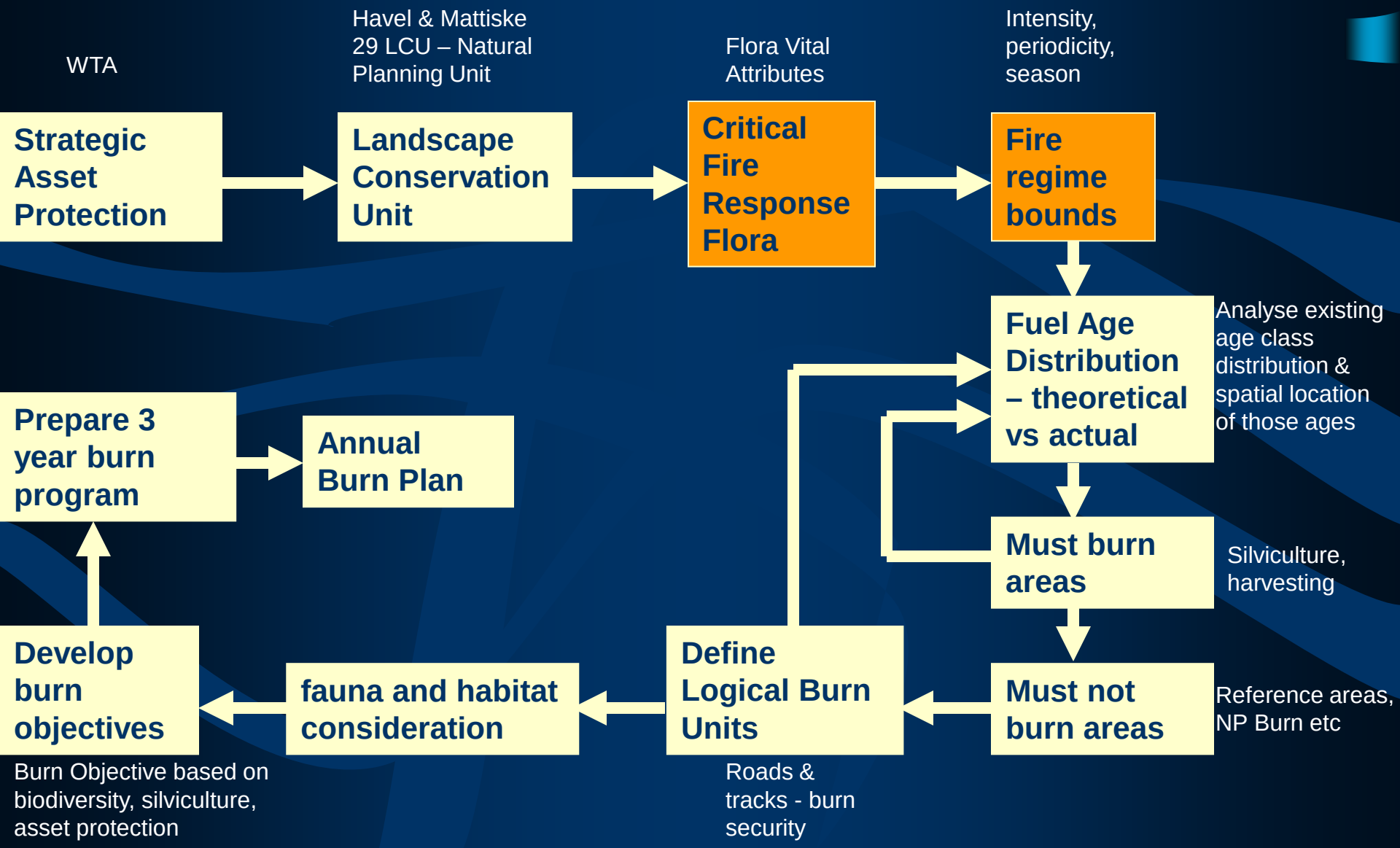
Landscape Conservation Units Within Walpole Wilderness Area



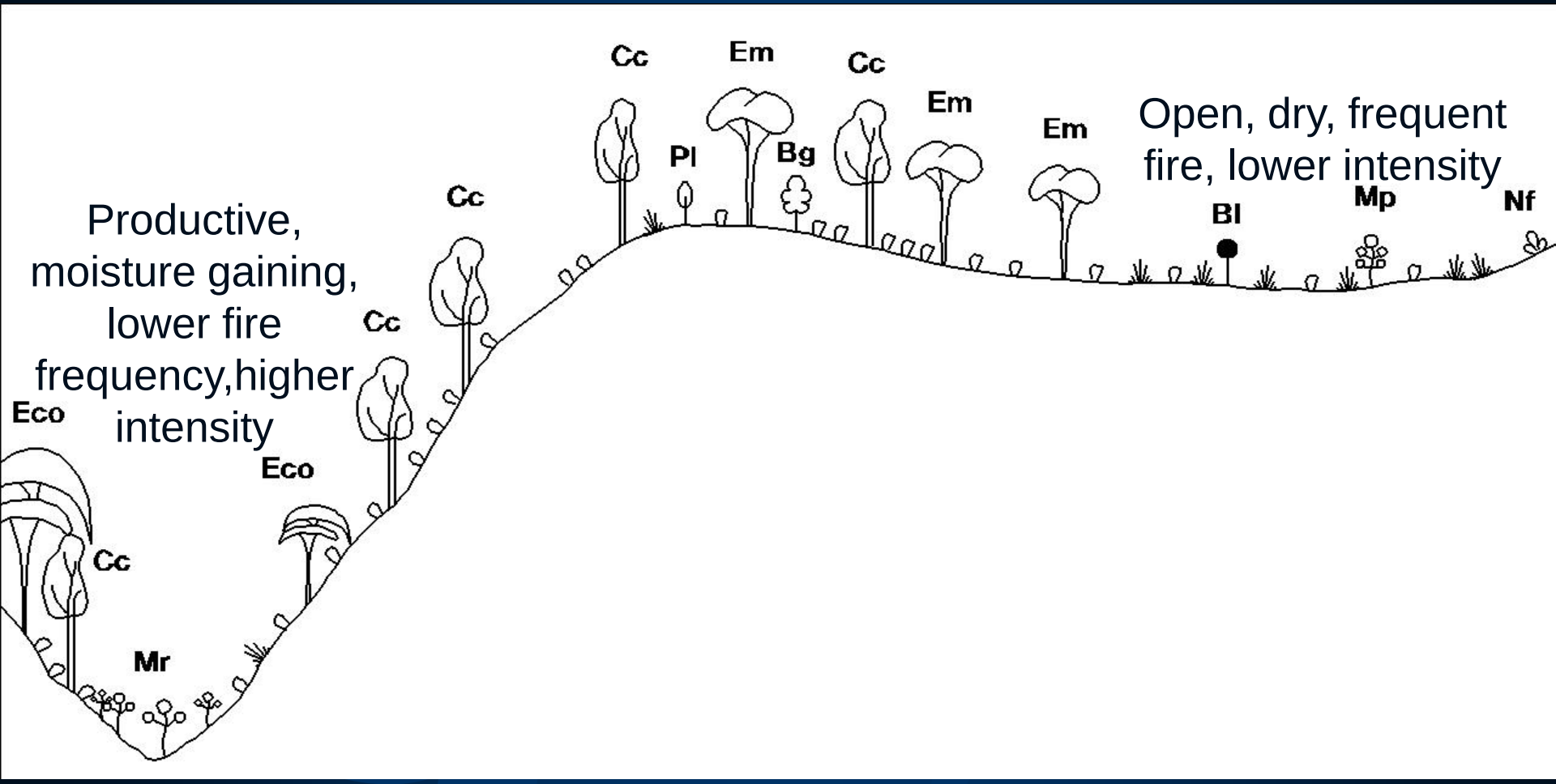
Southern Hilly Terrain Landscape Conservation Unit



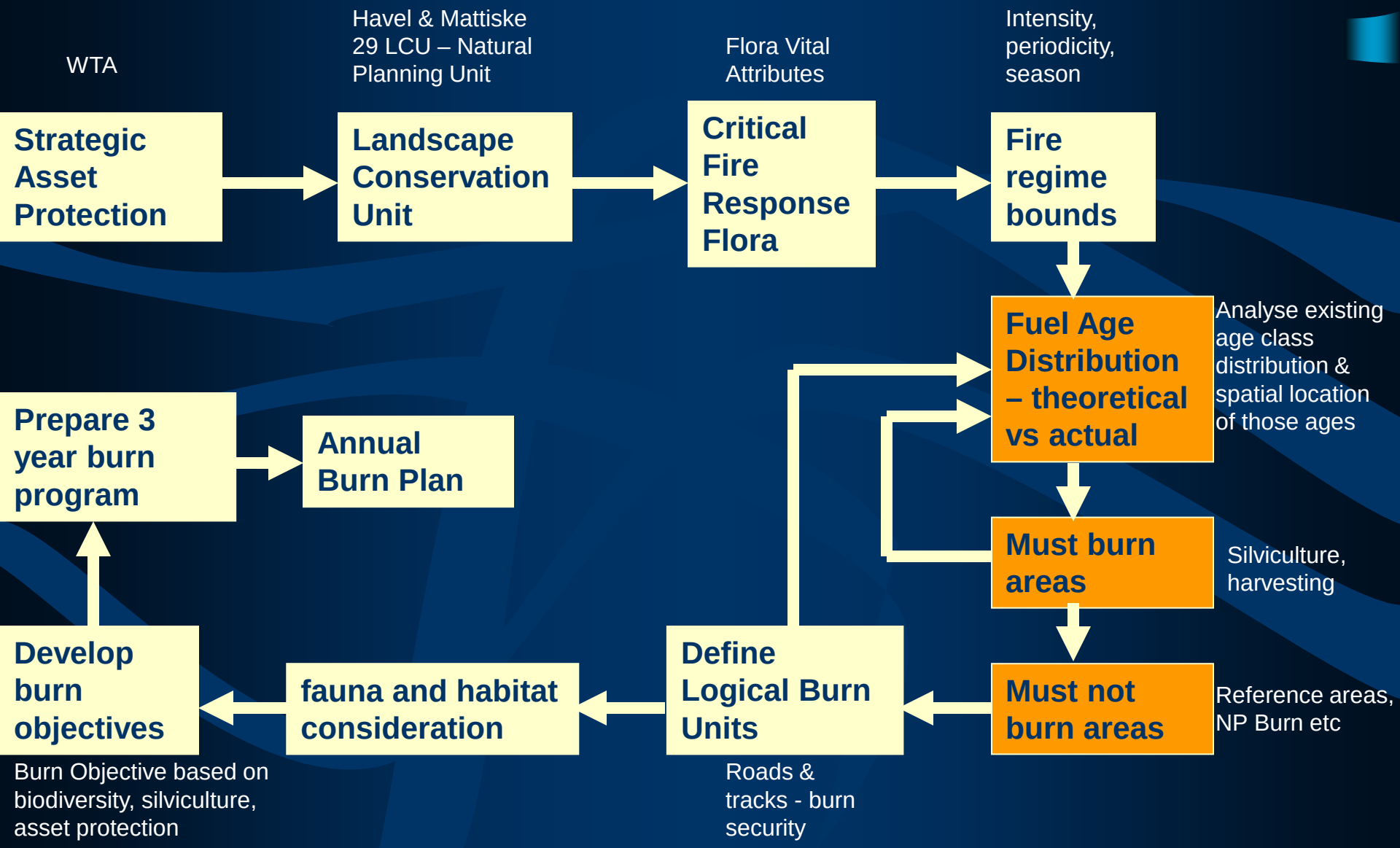
Fire Management for Biodiversity



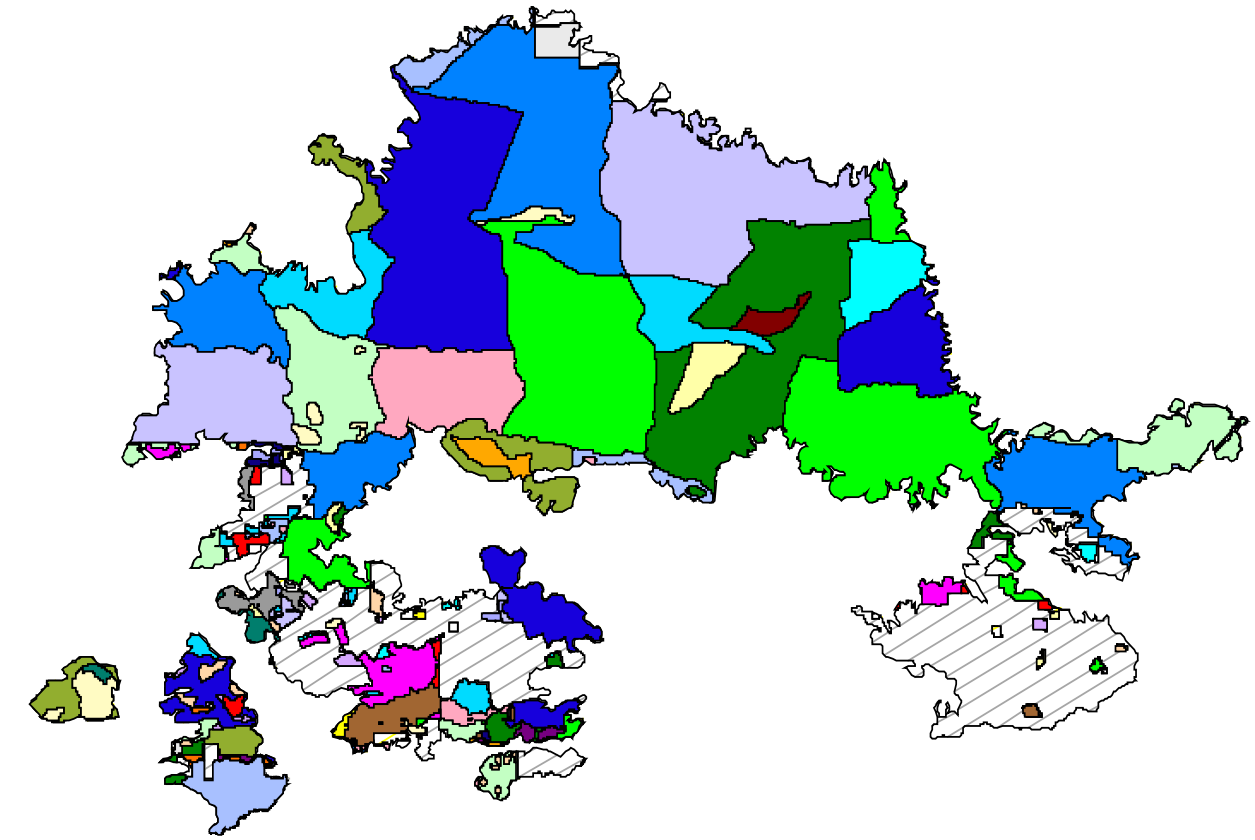
Fire Proneness



Fire Management for Biodiversity



Actual Fuel Age Distribution 30/6/2002 - Southern Hilly Terrain LCU



YEAR OF LAST BURN
- 2001 - 2002
- 2000 - 2001
- 1999 - 2000
- 1998 - 1999
- 1997 - 1998
- 1996 - 1997
- 1995 - 1996
- 1994 - 1995
- 1993 - 1994
- 1992 - 1993
- 1991 - 1992
- 1990 - 1991
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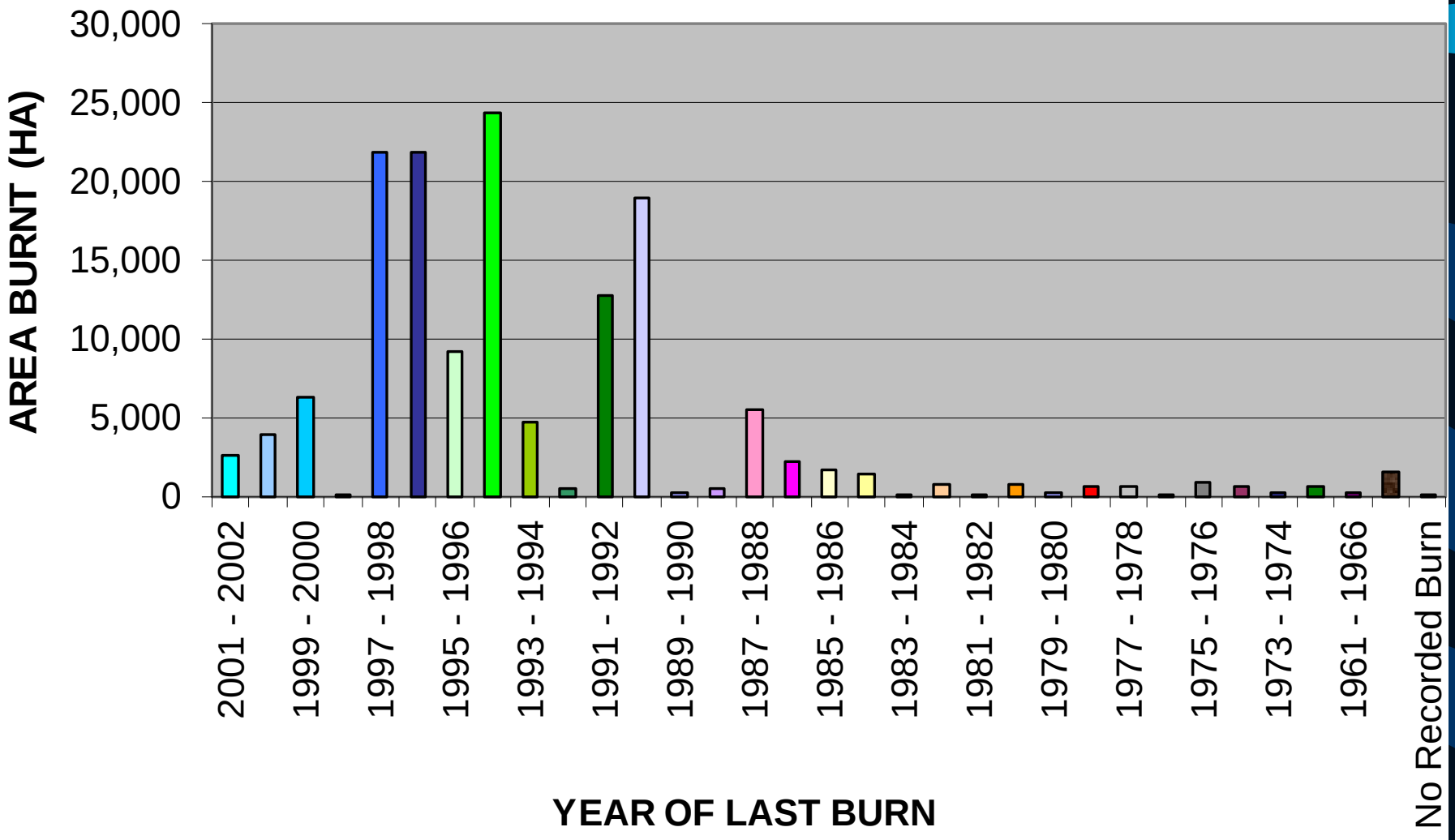
- 1980 - 1981
- 1979 - 1980
- 1978 - 1979
- 1977 - 1978
- 1976 - 1977
- 1975 - 1976
- 1974 - 1975
- 1973 - 1974
- 1967 - 1972
- 1961 - 1966
- Prior to 1960
- No Recorded Burn
- Non CLM Managed land

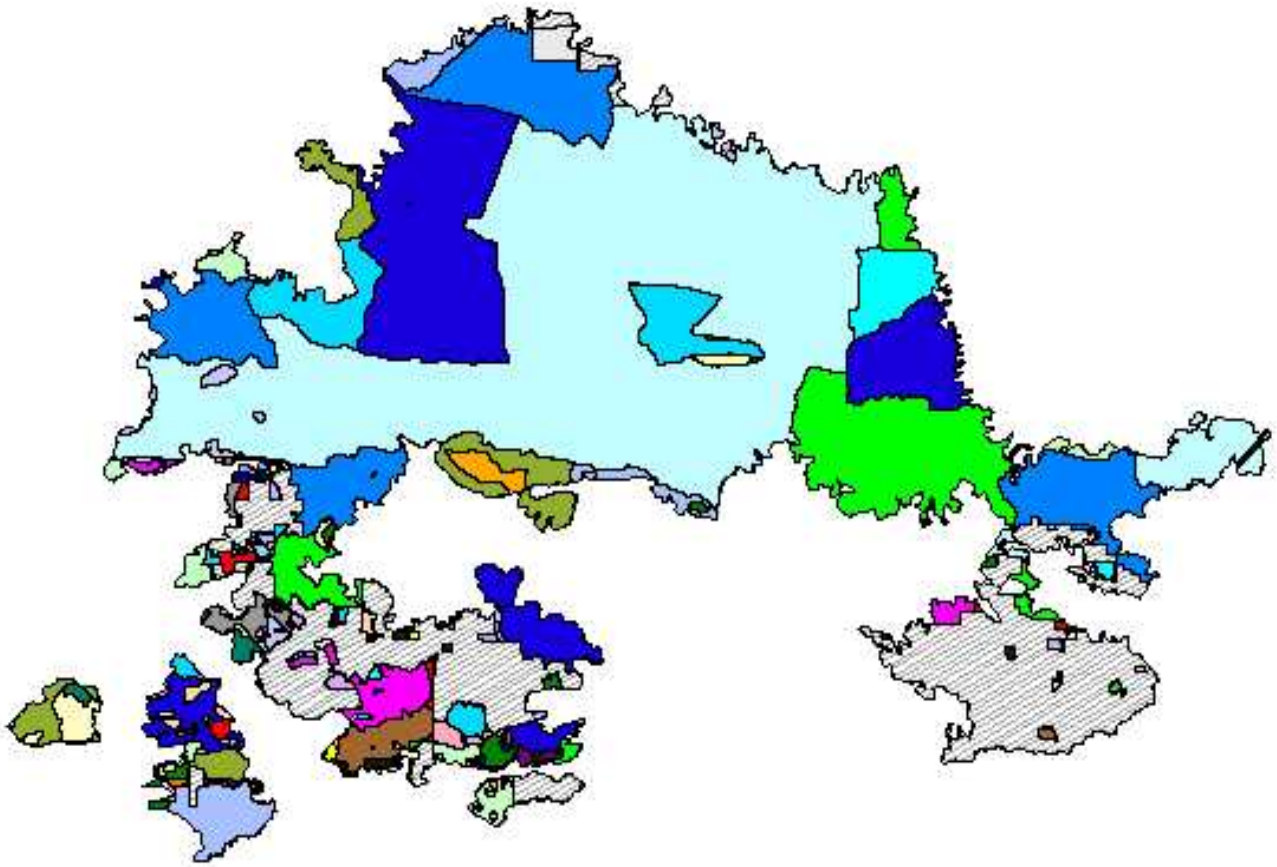
N

0 10 20 30 40 50 Kilometers

Actual Fuel Age Distribution
Southern Hilly Terrain LCU - 30th June 2002



Actual Fuel Age Distribution 30/6/2003 - Southern Hilly Terrain LCU



Year of Last Burn
- 2002 - 2003
- 2001 - 2002
- 2000 - 2001
- 1999 - 2000
- 1998 - 1999
- 1997 - 1998
- 1996 - 1997
- 1995 - 1996
- 1994 - 1995
- 1993 - 1994
- 1992 - 1993
- 1991 - 1992
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- 1978 - 1979
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- 1976 - 1977
- 1975 - 1976
- 1974 - 1975
- 1973 - 1974
- 1967 - 1972
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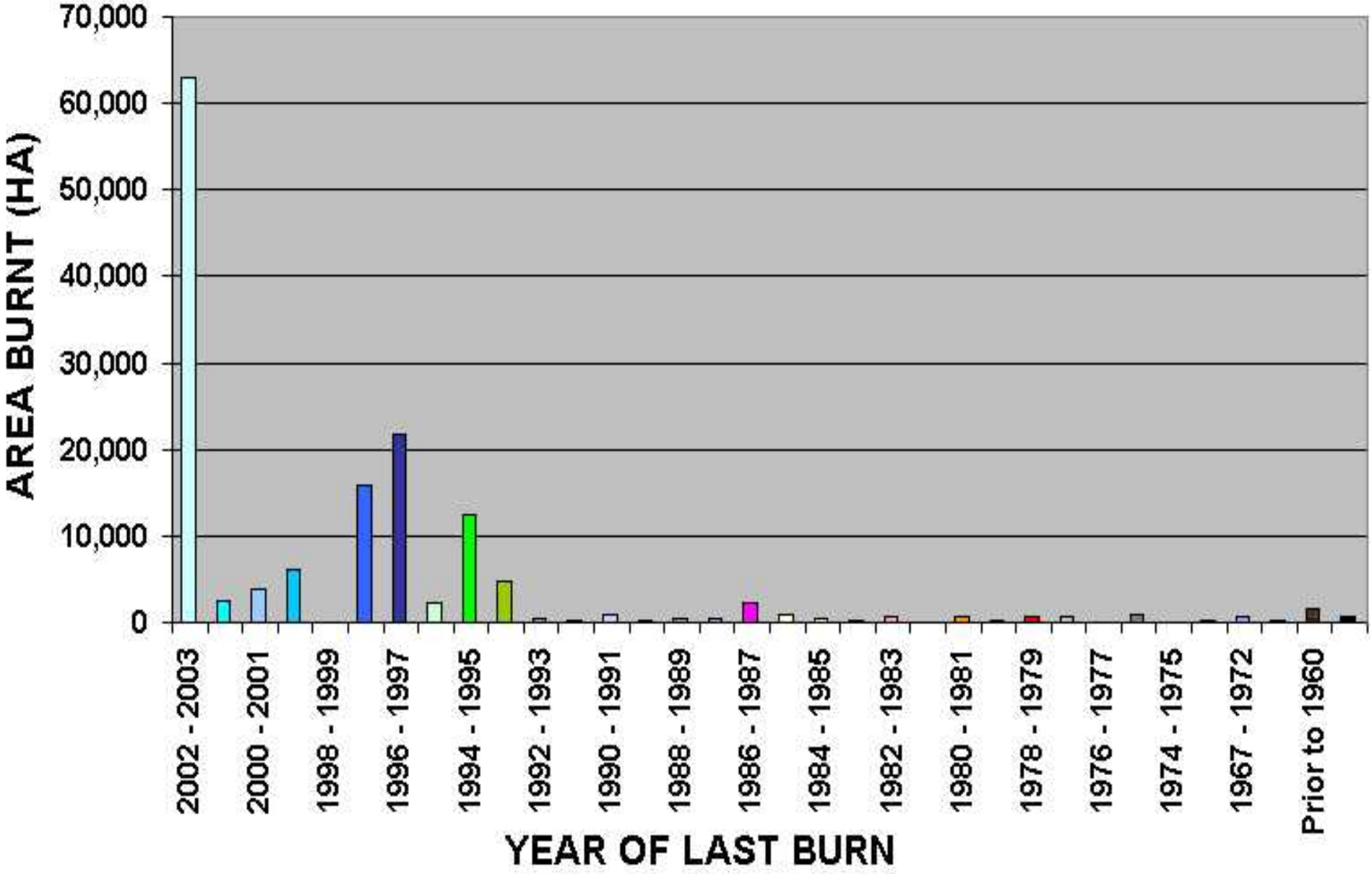
N

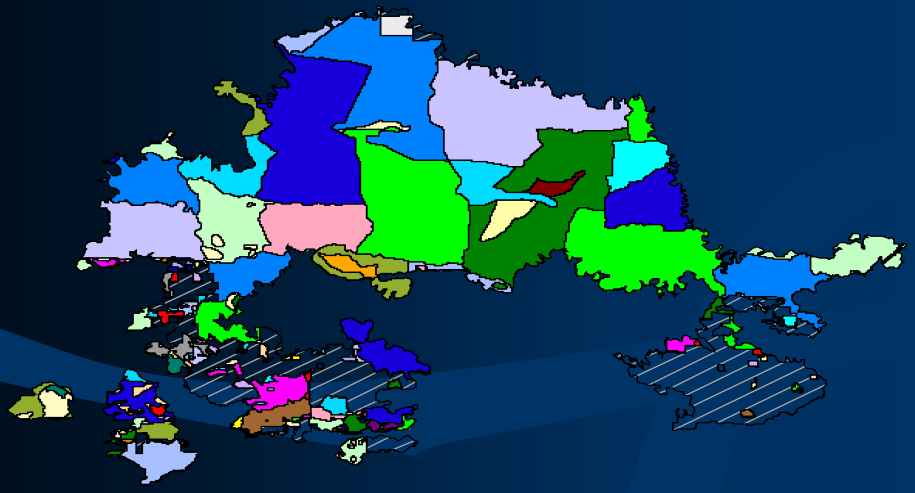
0 10 20 30 40 50 Kilometers

Actual Fuel Age Distribution
Southern Hilly Terrain - 30th June 2003

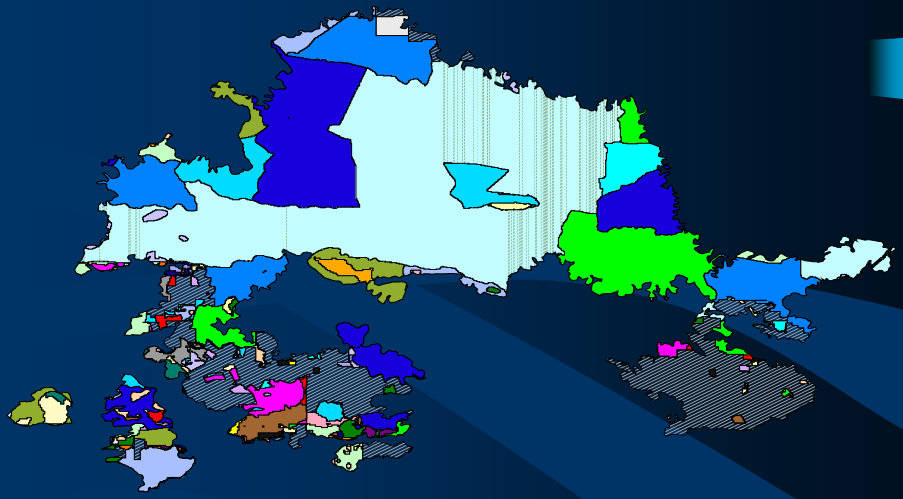


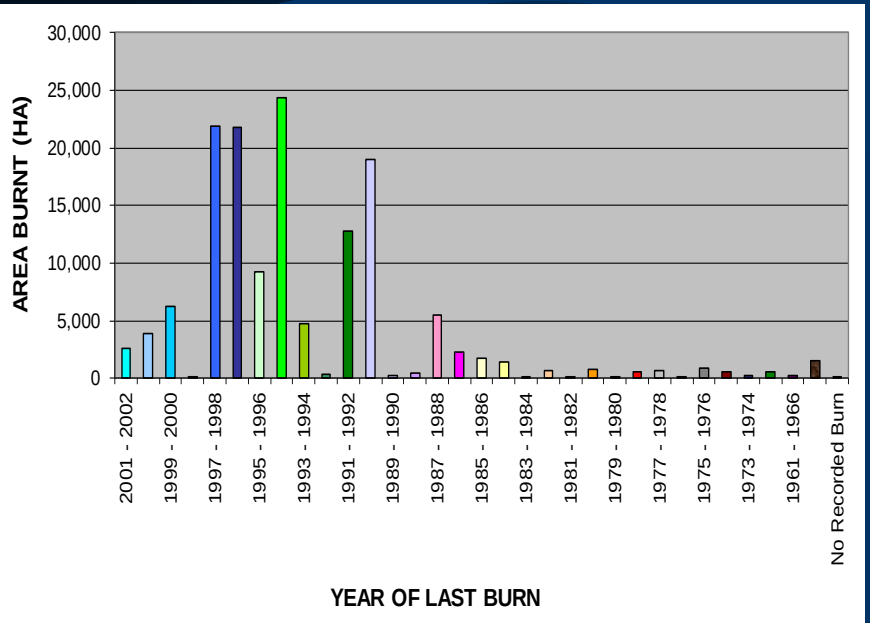
Comparison of Actual Fuel Age Distribution Southern Hilly Terrain

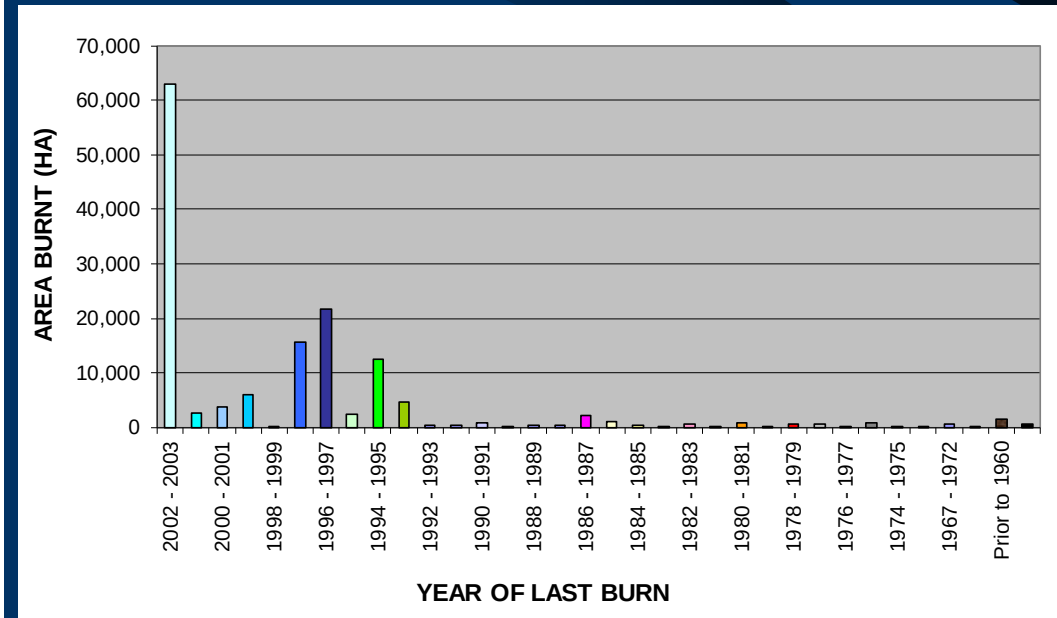
30th June 2002



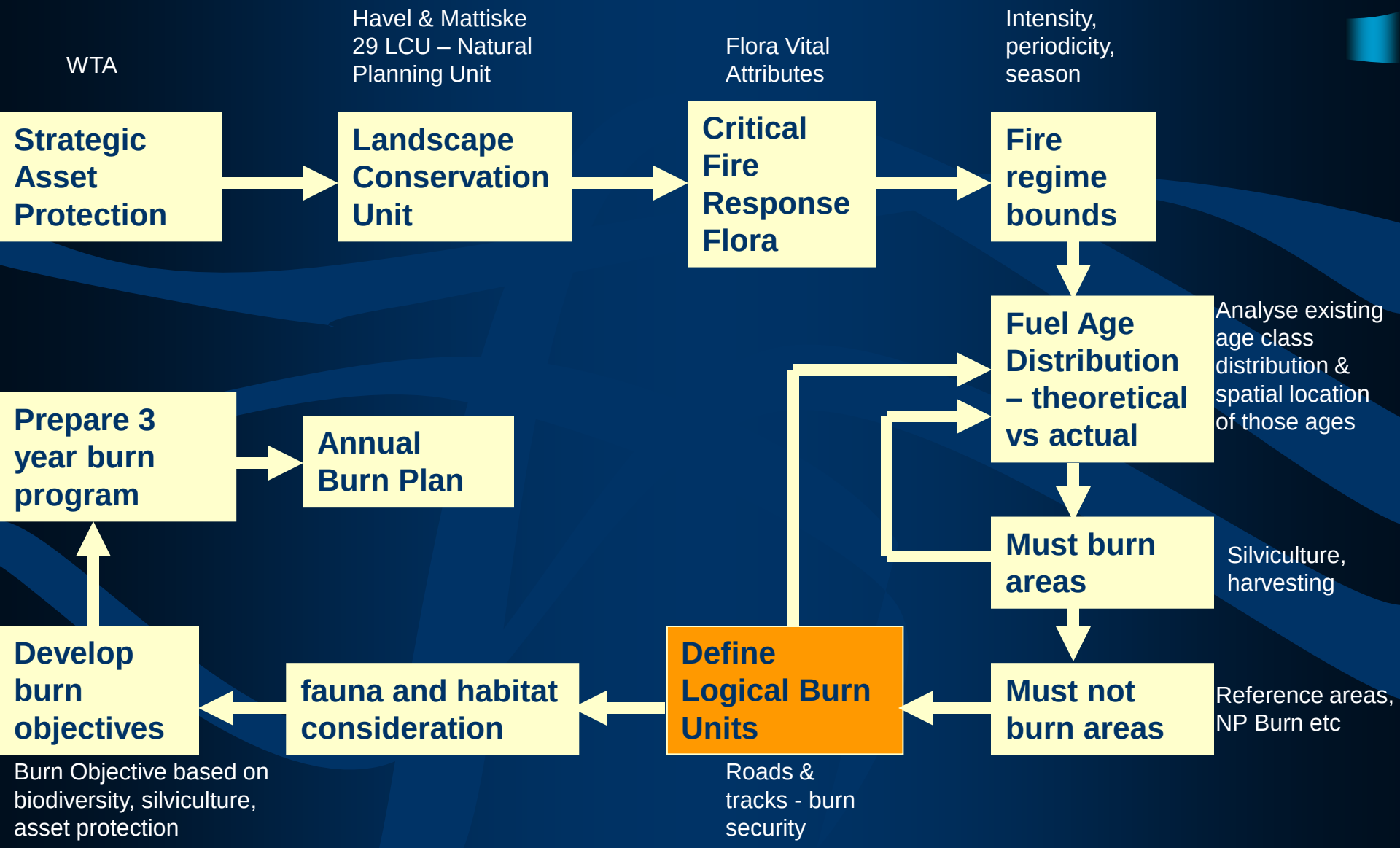
30th June 2003



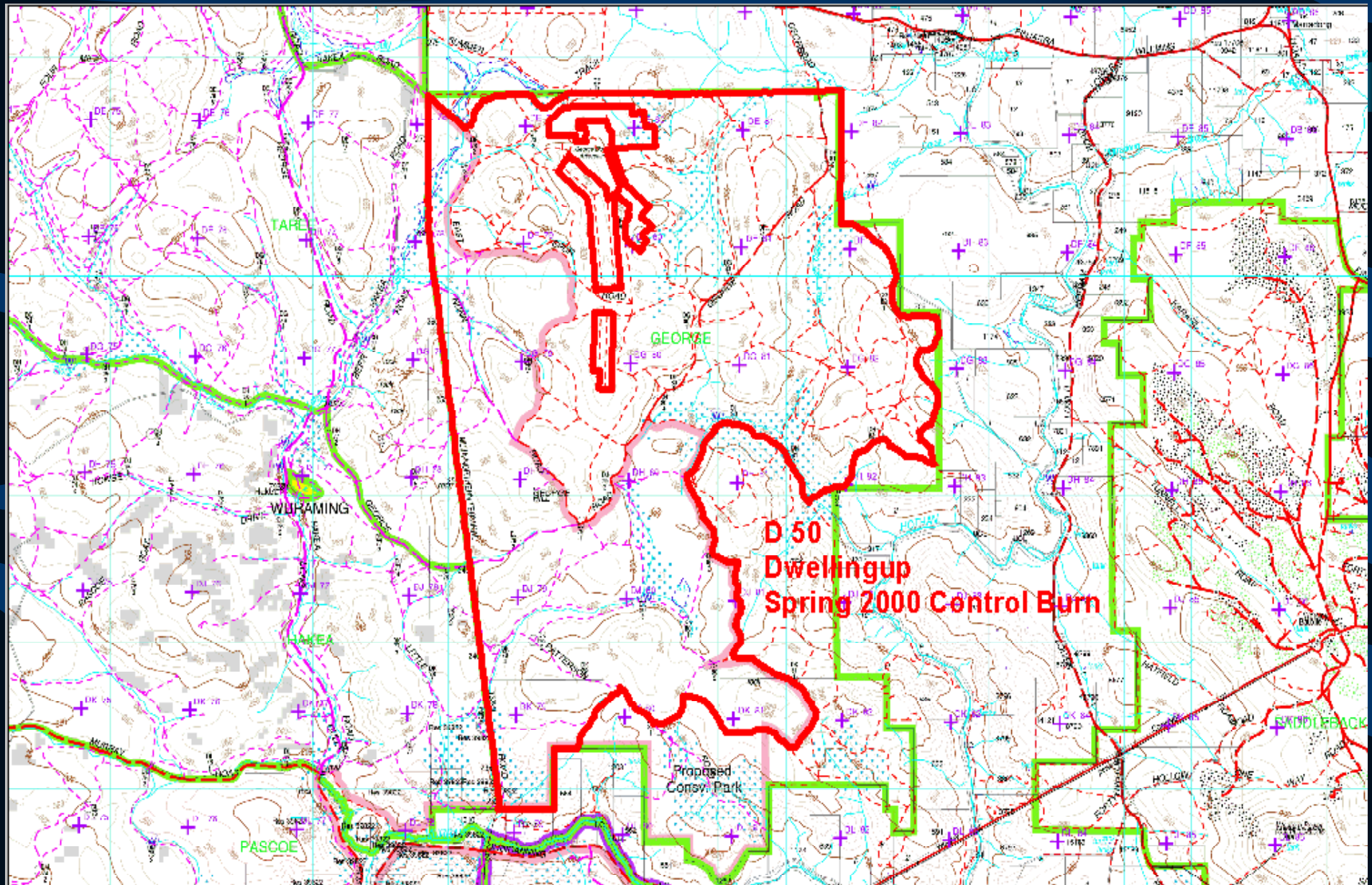




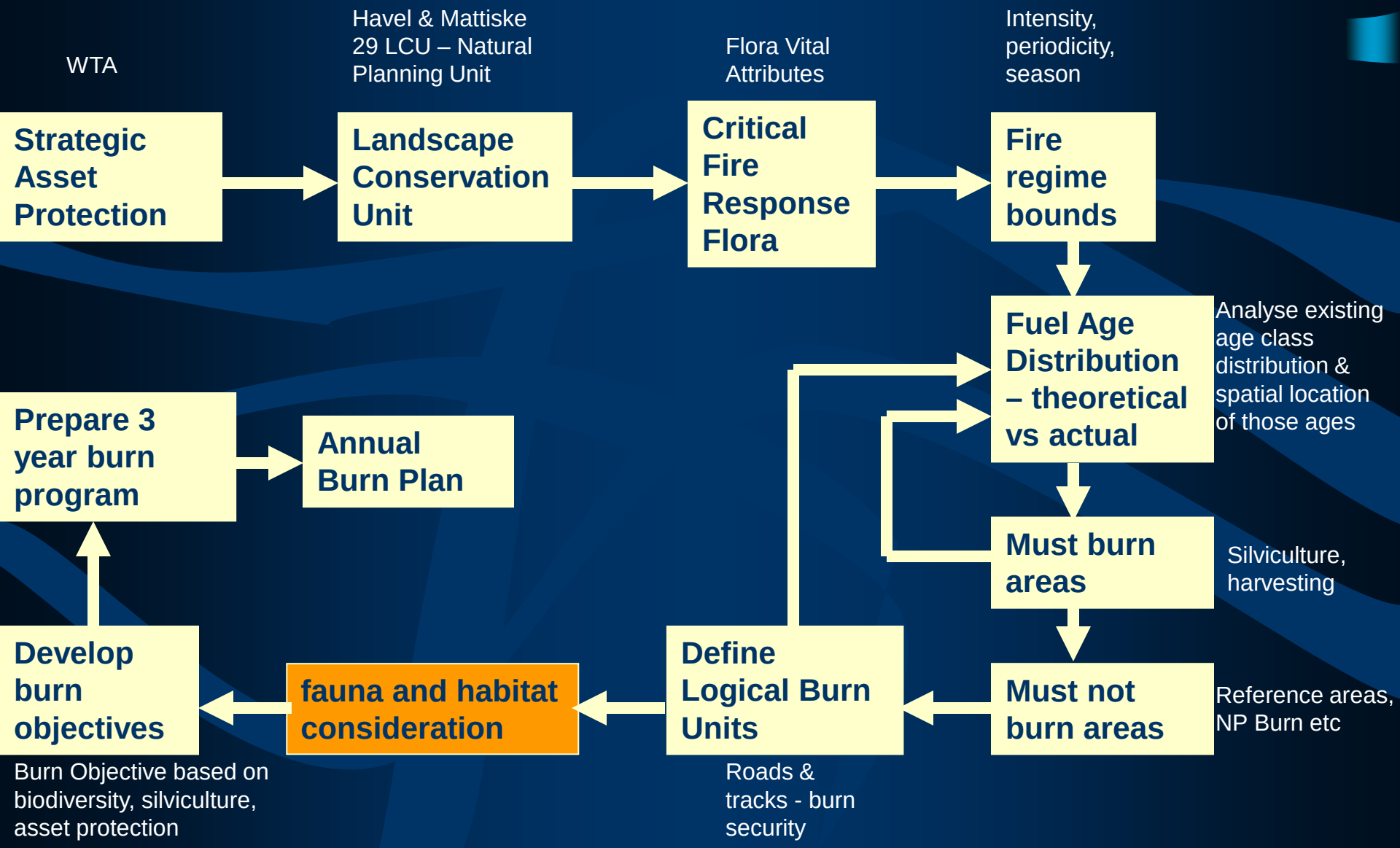
Fire Management for Biodiversity



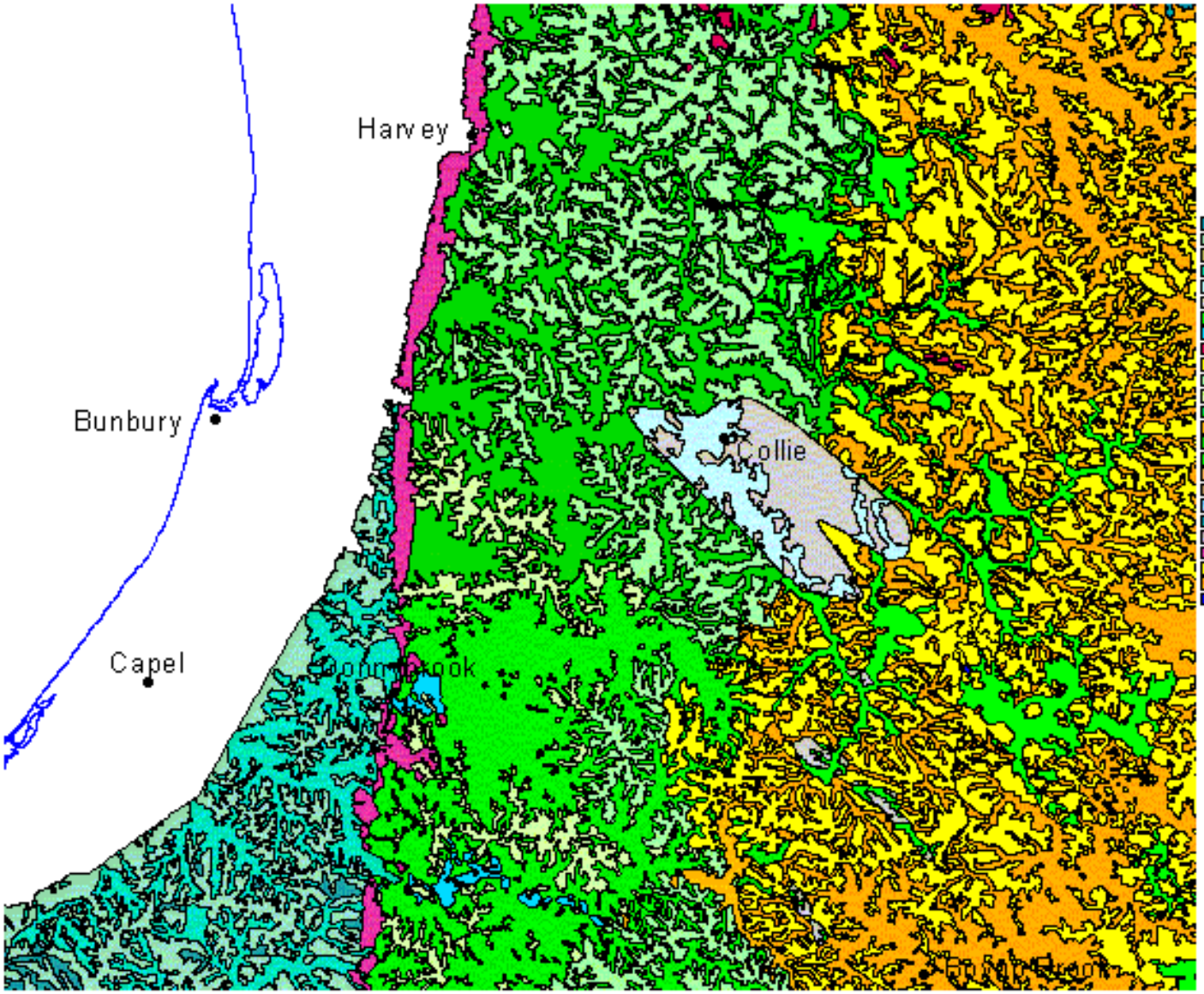
Logical Burn Unit



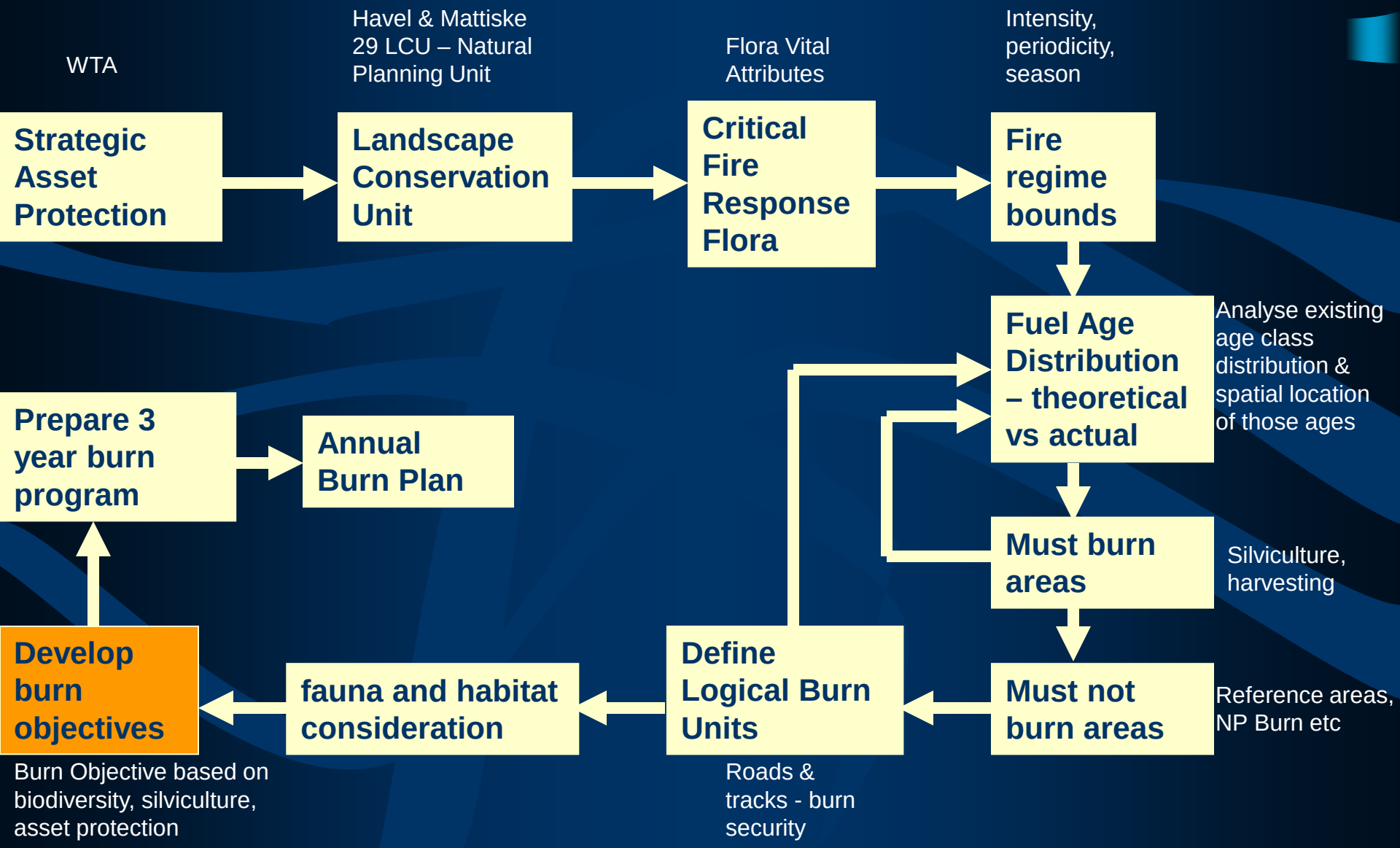
Fire Management for Biodiversity



Fauna Habitat Types



Fire Management for Biodiversity



Specific Patch Objectives

To protect and maintain suitable habitat for Tammar Wallaby/ Quokka communities through development of patchy burn mosaic (60-80%) on upland sites, and less than 30 % burn within broad valleys/ riparian zones.


•Tammar Wallaby

A MANAGED FIRE REGIME FOR JARRAH FOREST

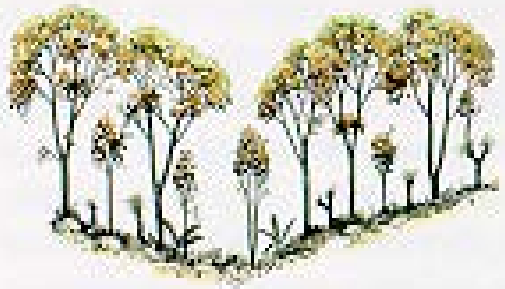
SPRING BURN

6–8 years

Year 6–8
SPRING
BURN

- Low intensity
- Moist soil
- patchy burn
- Protect creeks, valleys
- Burn ridges, midslopes
- Fuel reduction

6–8 years



Year 12–16
AUTUMN
BURN

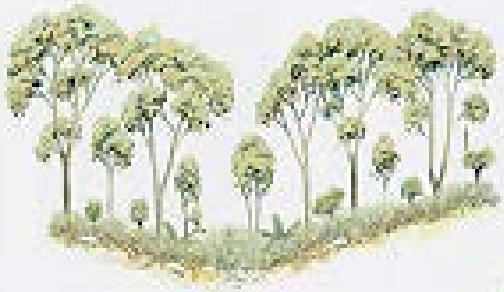
- Moderate intensity
- Dry soil
- Complete burn
- Fuel reduction
- Habitat regeneration

6–8 years

Year 18–24
NO BURN

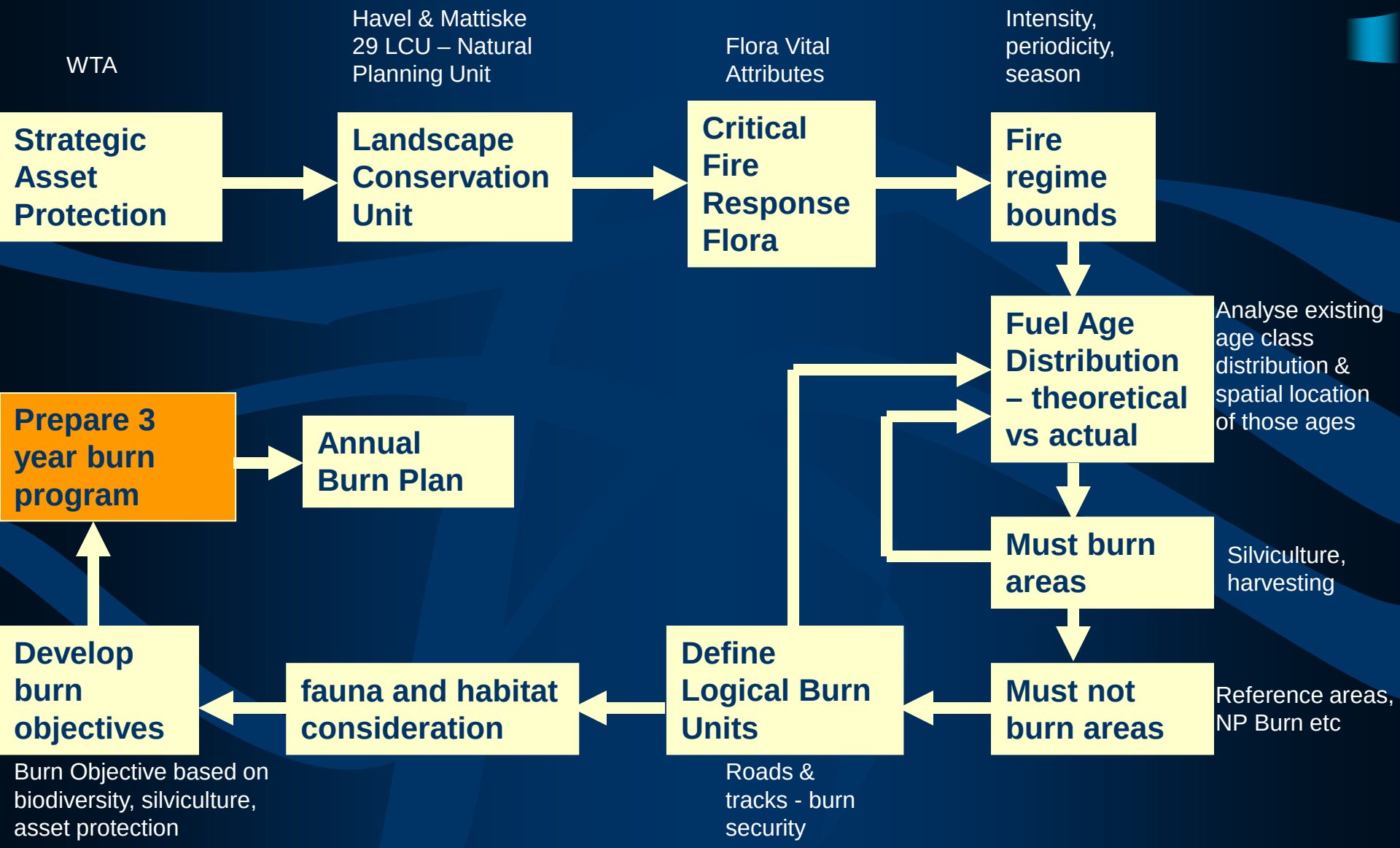
- Allow regeneration to mature
- Recovery of seed banks
- Recovery of fauna

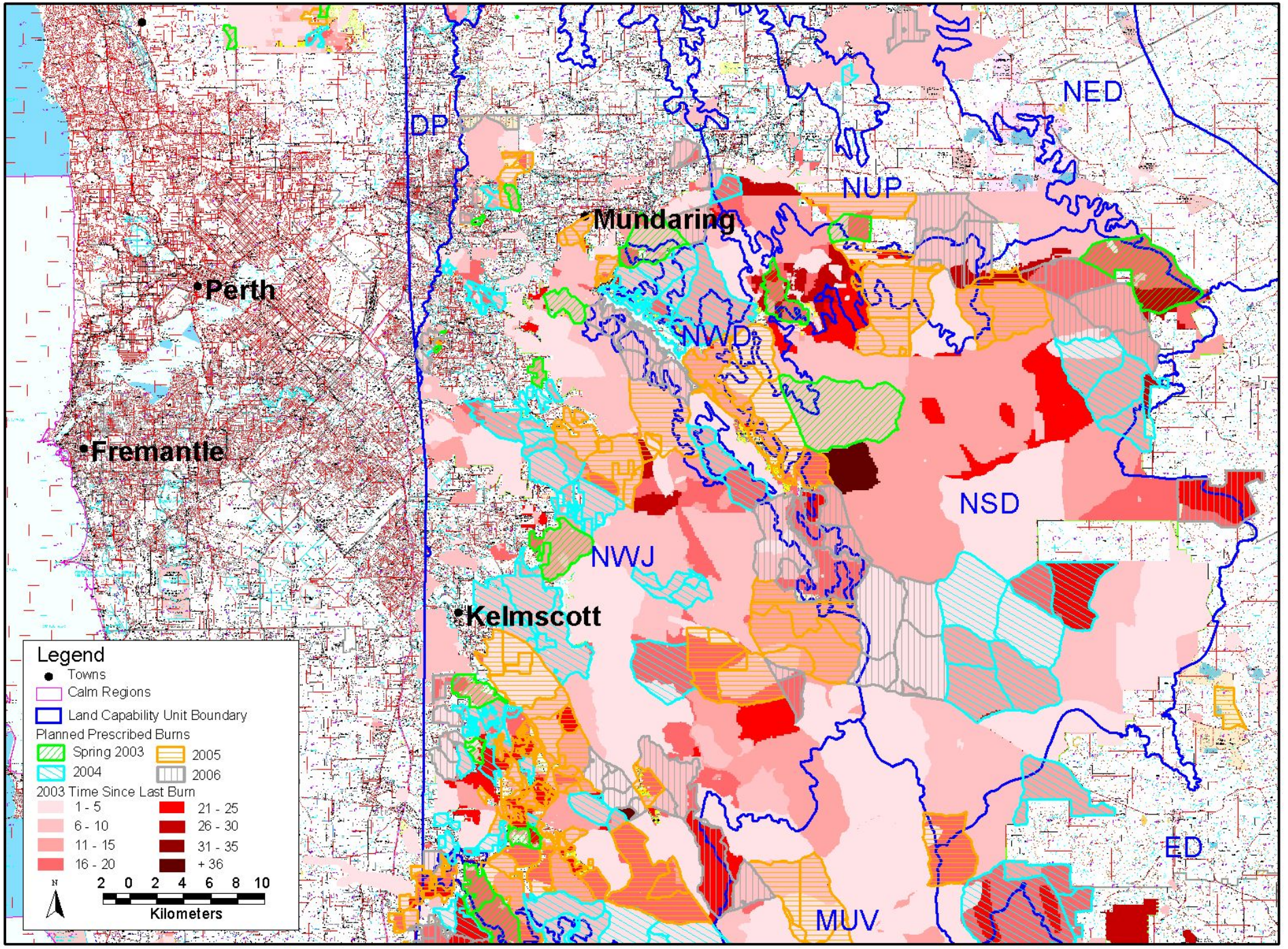
6–8 years



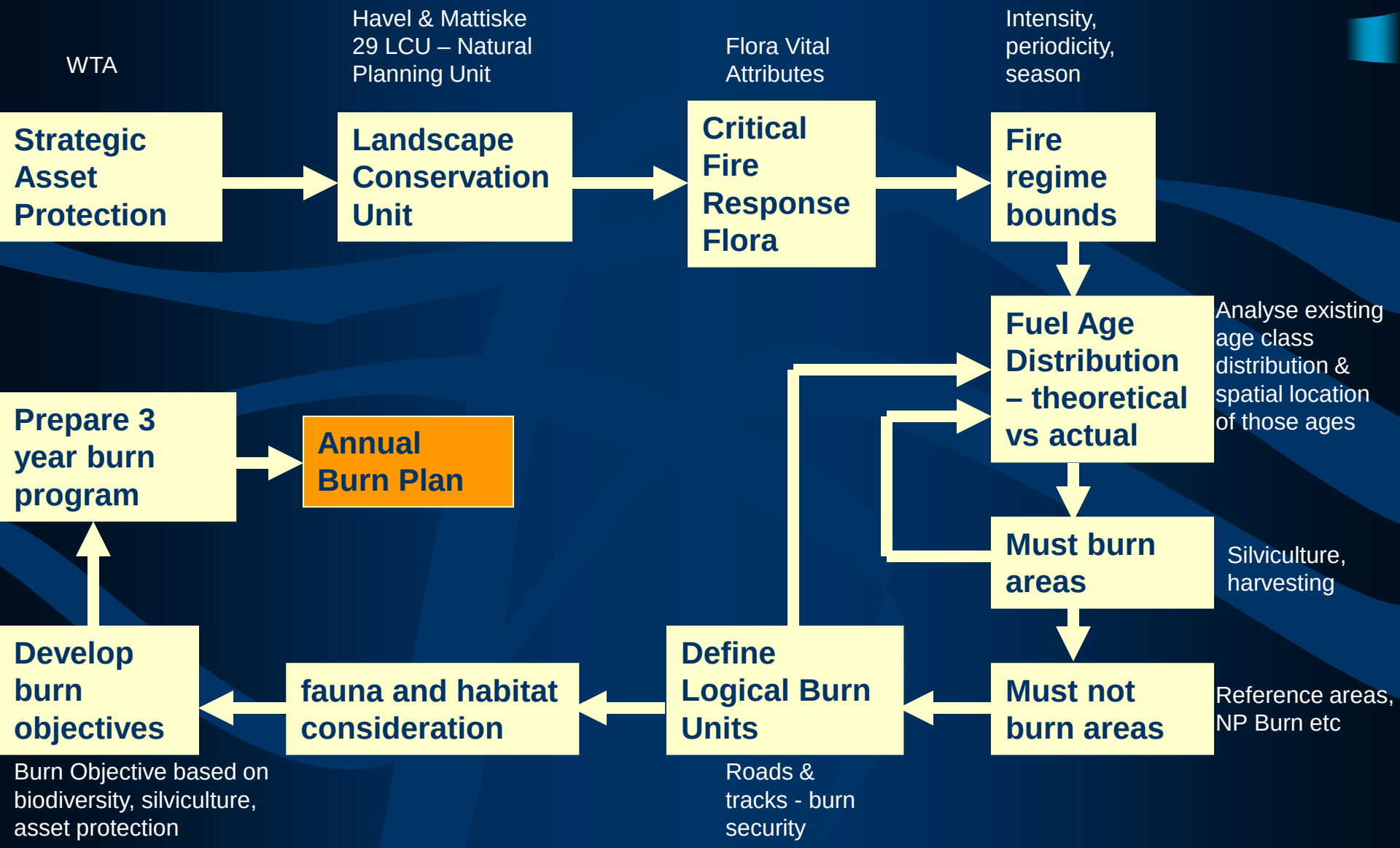
Year 24–30
NO BURN

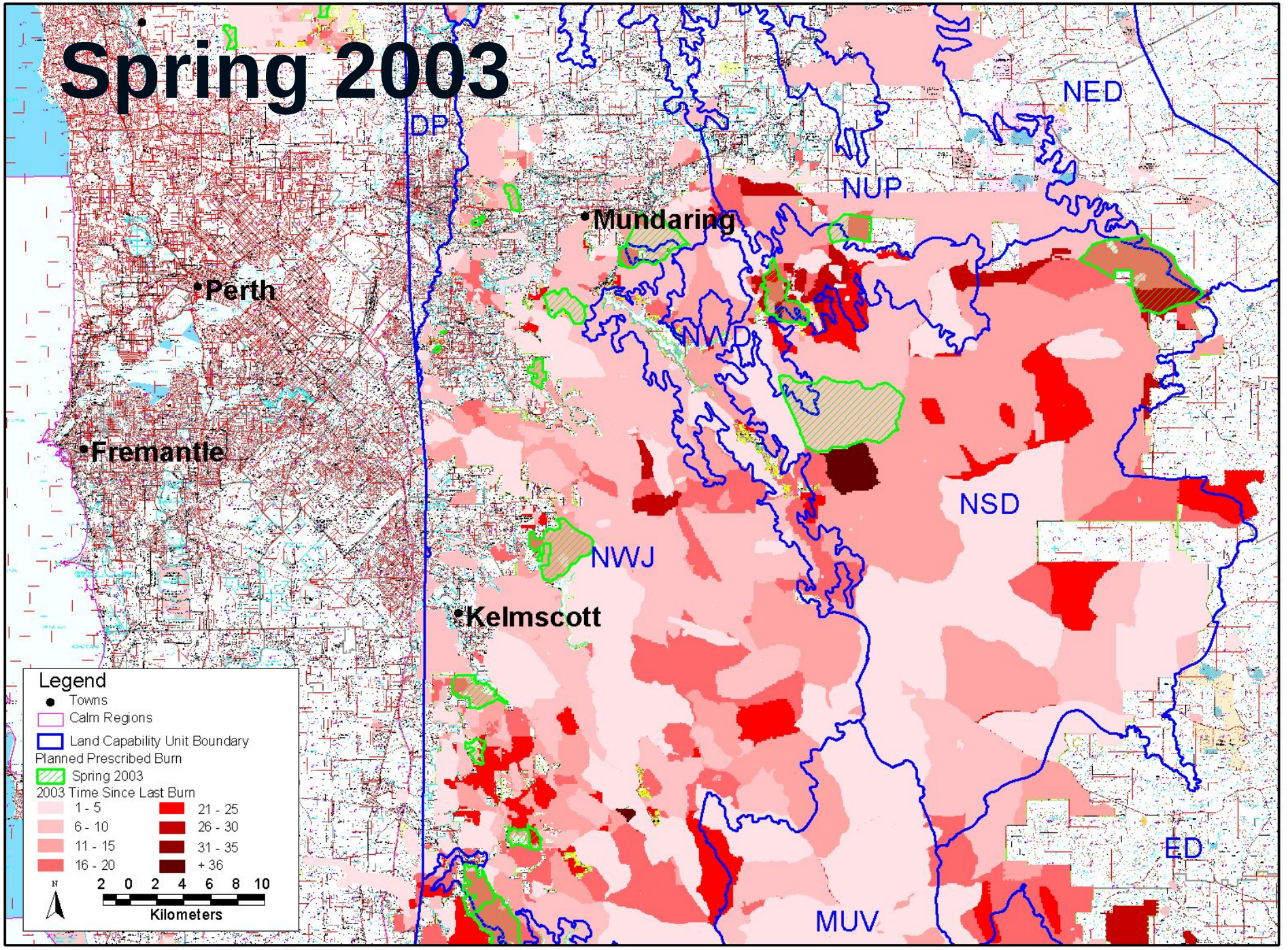
Fire Management for Biodiversity



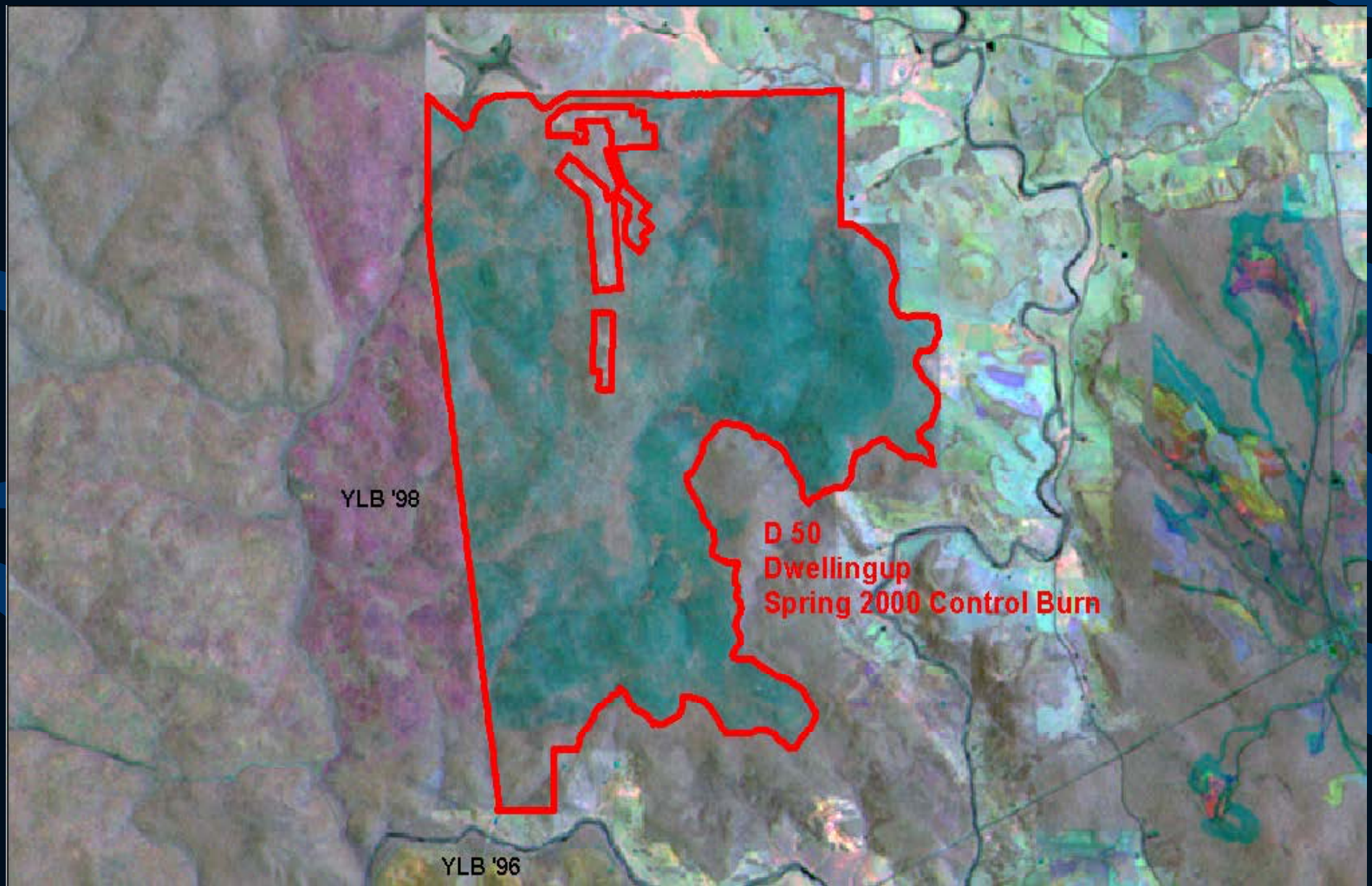

DP
NED
NUP
Mundaring
Perth
NWD
Fremantle
NSD
NWJ
Kelmscott
ED
MUV
Legend
Towns
Calm Regions
Land Capability Unit Boundary
Planned Prescribed Burns
Spring 2003
2004
2005
2006
2003 Time Since Last Burn
1 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
+ 36
N
2 0 2 4 6 8 10
Kilometers

Fire Management for Biodiversity




Spring 2003
DP
NED
NUP
Mundaring
Perth
NWD
Fremantle
NSD
NWJ
Kelmscott
ED
MUV
Legend
Towns
Calm Regions
Land Capability Unit Boundary
Planned Prescribed Burn
Spring 2003
2003 Time Since Last Burn
1 - 5
6 - 10
11 - 15
16 - 20
21 - 25
26 - 30
31 - 35
+ 36
N
2 0 2 4 6 8 10
Kilometers

Post Burn Evaluation

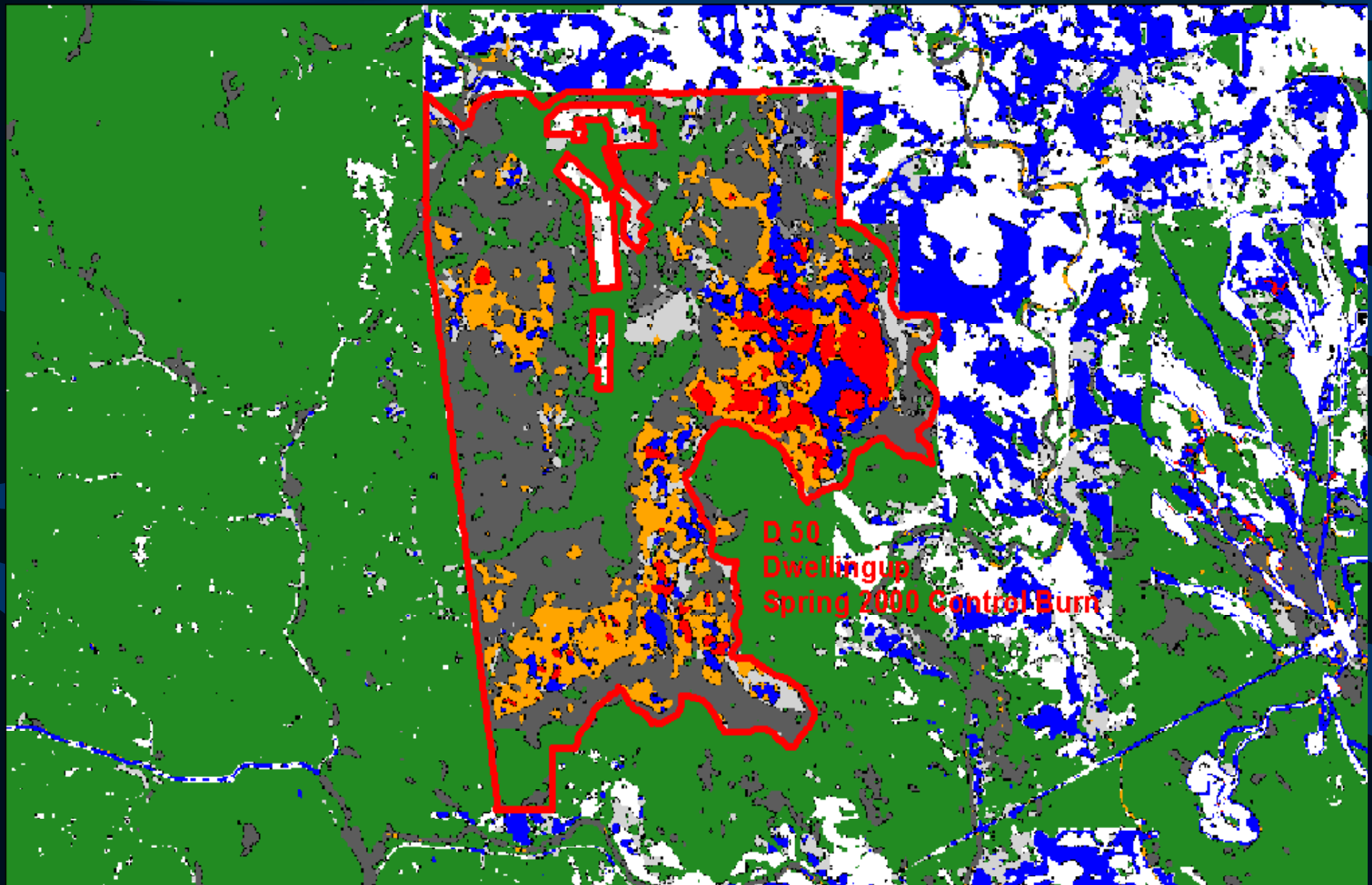


Field Validation

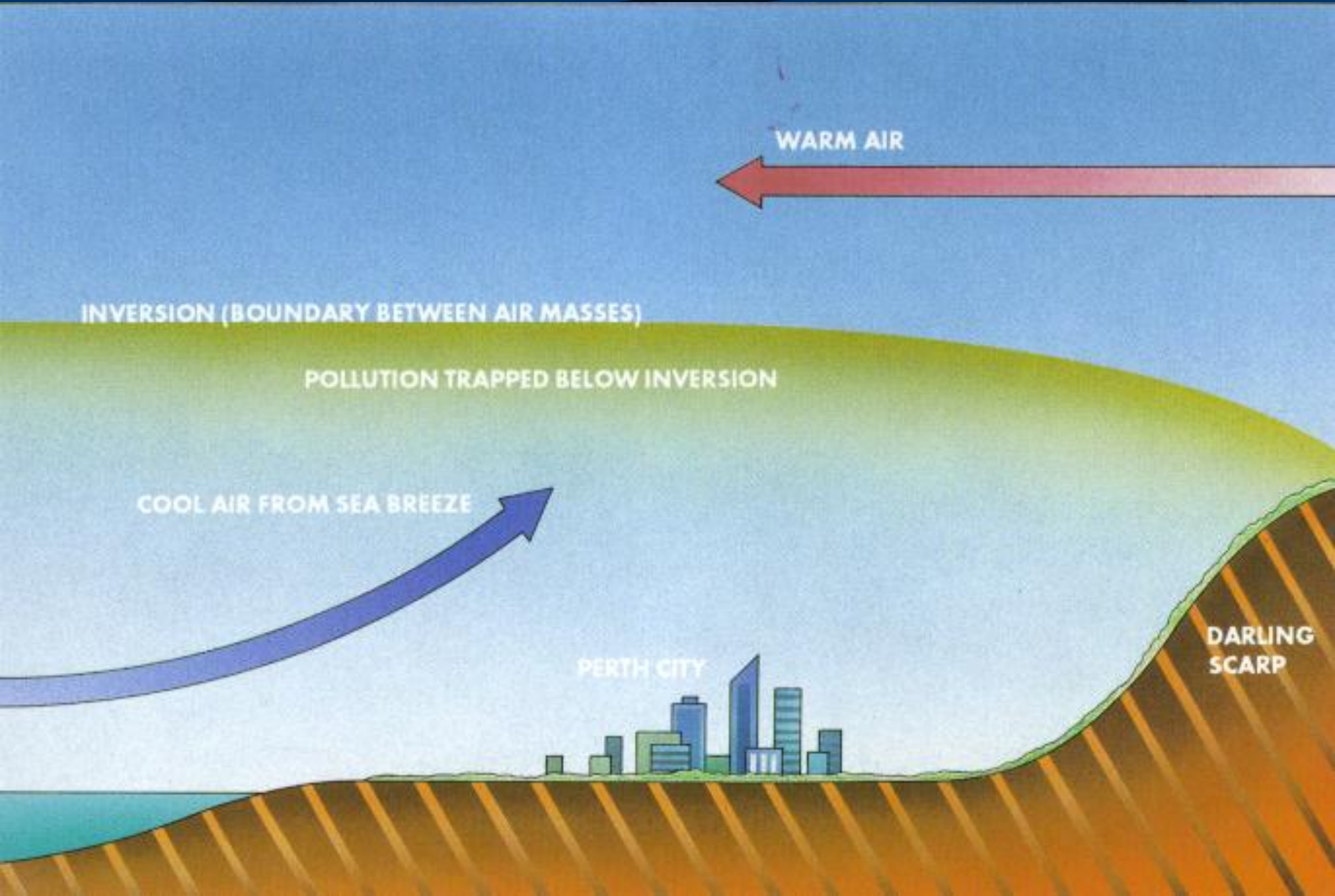
Low Scorch

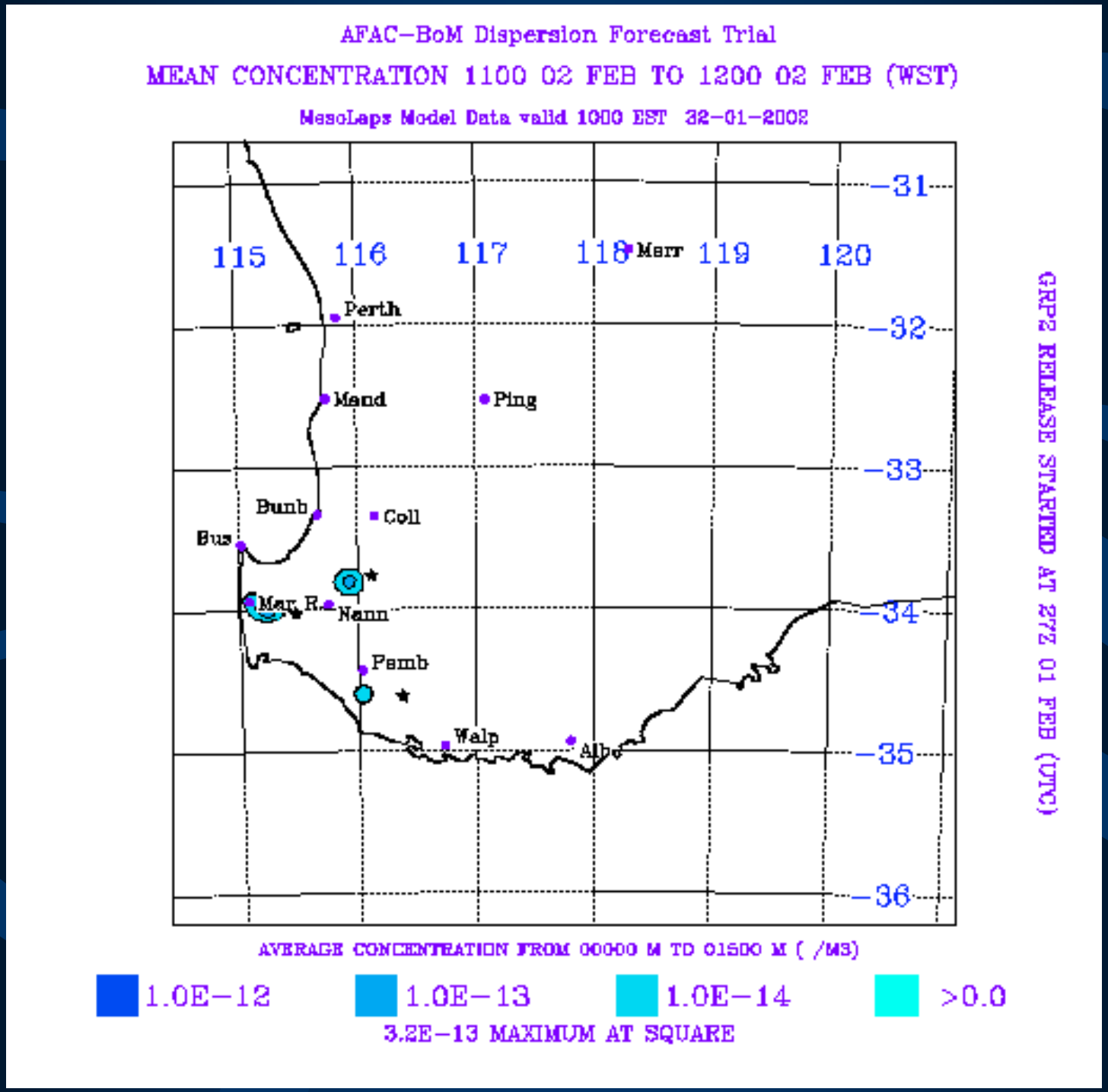
Full Scorch

Fire Impact Classification



Smoke Management


WARM AIR
INVERSION (BOUNDARY BETWEEN AIR MASSES)
POLLUTION TRAPPED BELOW INVERSION
COOL AIR FROM SEA BREEZE
PERTH CITY
DARLING SCARP


AFAC–BoM Dispersion Forecast Trial
MEAN CONCENTRATION 1100 02 FEB TO 1200 02 FEB (WST)
MesoLaps Model Data valid 1000 EST 32-01-2002
115
116
117
118
119
120
-31
-32
-33
-34
-35
-36
Merr
Perth
Mand
Ping
Bunb
Coll
Bus
Mar
R.
Nann
Pemb
Walp
Albe
GRP2 RELEASE STARTED AT 2?Z 01 FEB (UTC)
AVERAGE CONCENTRATION FROM 00000 M TO 01500 M (/M3)
1.0E-12
1.0E-13
1.0E-14
>0.0
3.2E-13 MAXIMUM AT SQUARE

Test for Ecologically Sustainable Fire Management

- Does fire management restrict frequency of large wildfires?

Test for Ecologically Sustainable Fire Management

- Does it provide an acceptable level of protection to life, property and fire vulnerable ecosystems?

Test for Ecologically Sustainable Fire Management

- Does fire interval allow for replacement of seed banks?

Test for Ecologically Sustainable Fire Management

- Does the fire regime include a fire-free period to allow for maturation of special habitats?

Test for Ecologically Sustainable Fire Management

- Does the fire regime include seasonal diversity?

Test for Ecologically Sustainable Fire Management

- Does the fire regime maintain a fire-induced mosaic at the appropriate scale?