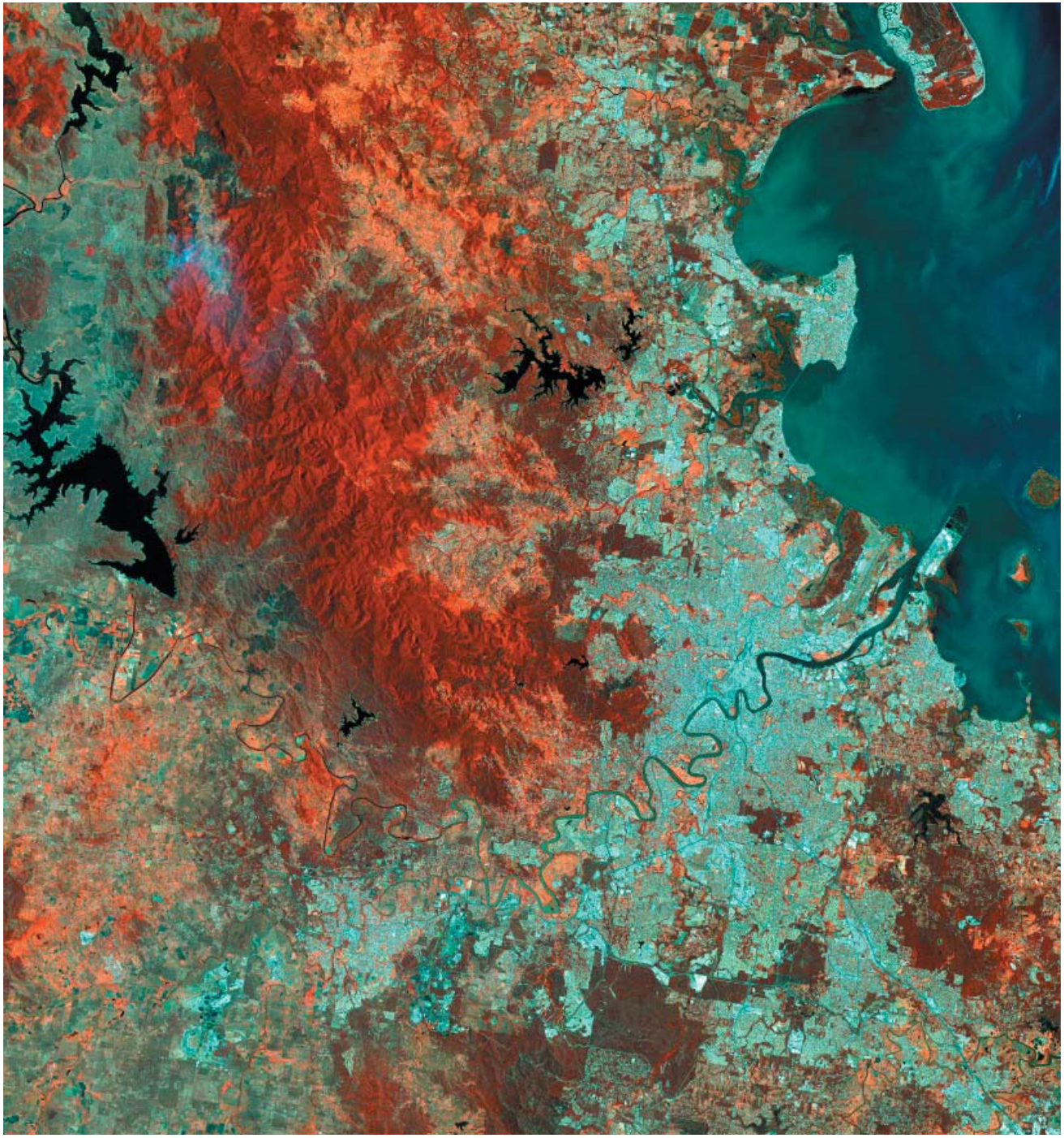
USGS Landsat archive provides temporally dense 30m multi-spectral image data over the target area

Landsat based fire scar extraction is conducted using over 130 image capture dates (and counting) collected by Landsat 5 TM and Landsat 7 ETM+ since 02/06/2000.

While this method of mapping fire scars will always have limitations in terms of cloud cover, ground resolution element, and signal and sensor anomalies, it is currently the best option particularly when retrospective fire scar mapping is required.

This image was captured on 27 November 2004 (Brisbane time) from the Landsat 5 TM sensor

The smoke plume of an active bushfire event can be seen to the north of Wivenhoe Dam. Seasonal rainfall was well below average and many active wildfires occured late in the season around SEQ.

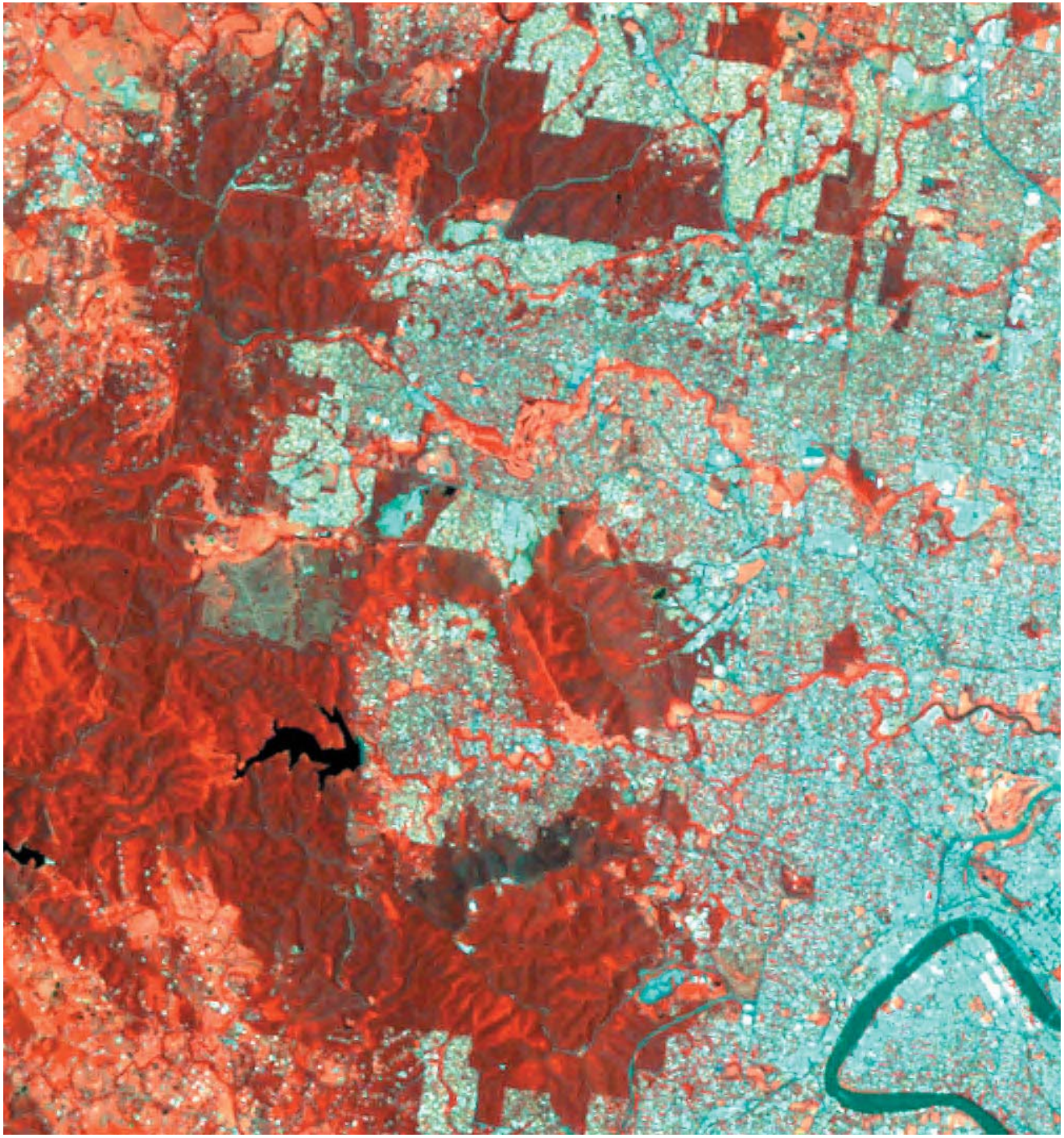


Viewing the near infrared band (band 4) through the red channel allows us to see more variability in the reflectivity of vegetation

This band combination reveals that quite a few possible fire scars are apparent in this image, however a semi-automated process has been developed in order to extract fire scar data from Landsat with a higher level of certainty.

Previously, many remote sensing operators used manual methods associated with temporal variations of the normalized difference vegetation index (NDVI) to map fire scars.

While we have retained the use of NDVI for mapping burn intensity, a combination of long wave infrared bands (i.e. band 5 and band7) is used here in order to take advantage of the thermal emission properties of charcoal and bare earth



Preliminary Landsat Based Fire Scar Data

This zoom shows part of the urban/bushland interface in Brisbane's west

While a fire scar is reasonably apparent on the north-western slopes of Mount Cootha, the fire scar situation for the remainder of the scene is less clear. Single date fire scar mapping is fraught with obstacles due to the effects of curing and older, faded fire scars, and vegetation clearing.

By introducing a multi-temoral fire scar mapping methodology, we can increase our analysis range from 8-bit to 24-bit by using multi-date composites.

The method employs three consecuative image capture dates (depending on available image quality) consisting of a pre-fire event image, a near fire event or target image, and a subsequent image to avoid ephemeral anomalies as much as practicable. In this way a scar can be defined as not having existed prior to the event and having persisted for up to 64 days following the event.

This image shows the enhanced 24-bit analysis raster generated using long wave infrared over three capture dates

In this image cyan pixels represent fire scars resulting from bushfire events which occurred between 8 September 2004 –10 October 2004.

Older fire scars can also be identified in this image as well as a degree of forest curing, however the mapping target has now been isolated sufficiently to extract fire scars for the current capture date.

Using a simple decision tree to separate fire scars from scars induced by vegetation clearing, target pixels are extracted and returned to 8-bit for further processing

Once extracted as 8-bit rasters, fire scars may be polygonized for further GIS based analysis to determine such information as fire history, burn frequency, and time since burning

Also, with additional processing, the rasters are ready for their intended purpose, which is as reduction rasters for fuel modelling.

In this context, reduction rasters define the area and amount of fuel reduction to be modelled as well as localized patterns of fuel load re-accumulation over time.

This is one of the key ways that fuel hazard maps can be kept reasonably current and act as management tool for prescribed burning

Polygonized fire scars are GIS ready. These data are verified using a combination of Sentinel hotspots, AIRS data and local records

Fire scar extraction obtains landsat scene capture dates only, but can be more precisely defined through the verification process.

Fire ‘footprints’ such as these are useful in many further analysis projects, however these alone give us no information about burn intensity

Fire scar intensity polygons can assist with identifying areas of increased fuel hazard

For example, although intensity data is inferred and more field work is required to calibrate these results, the data suggests that the channel 10 television studios faced an elevated risk during the circumstances of this fire event.

The station faced a similar hazardous bushfire in 2000 and intensity mapping for the event suggests that while the footprint was smaller, the burn was more intense, and was part of a very active series of large bushfires in the broader area during the spring of that year.

Intensity rating

- Very High
- High
- Moderate
- Low

2000

2000
2001

Preliminary Landsat Based Fire Scar Data


2000
2001
2002

Preliminary Landsat Based Fire Scar Data

Preliminary Landsat Based Fire Scar Data

Preliminary Landsat Based Fire Scar Data

Preliminary Landsat Based Fire Scar Data

Preliminary Landsat Based Fire Scar Data

Preliminary Landsat Based Fire Scar Data

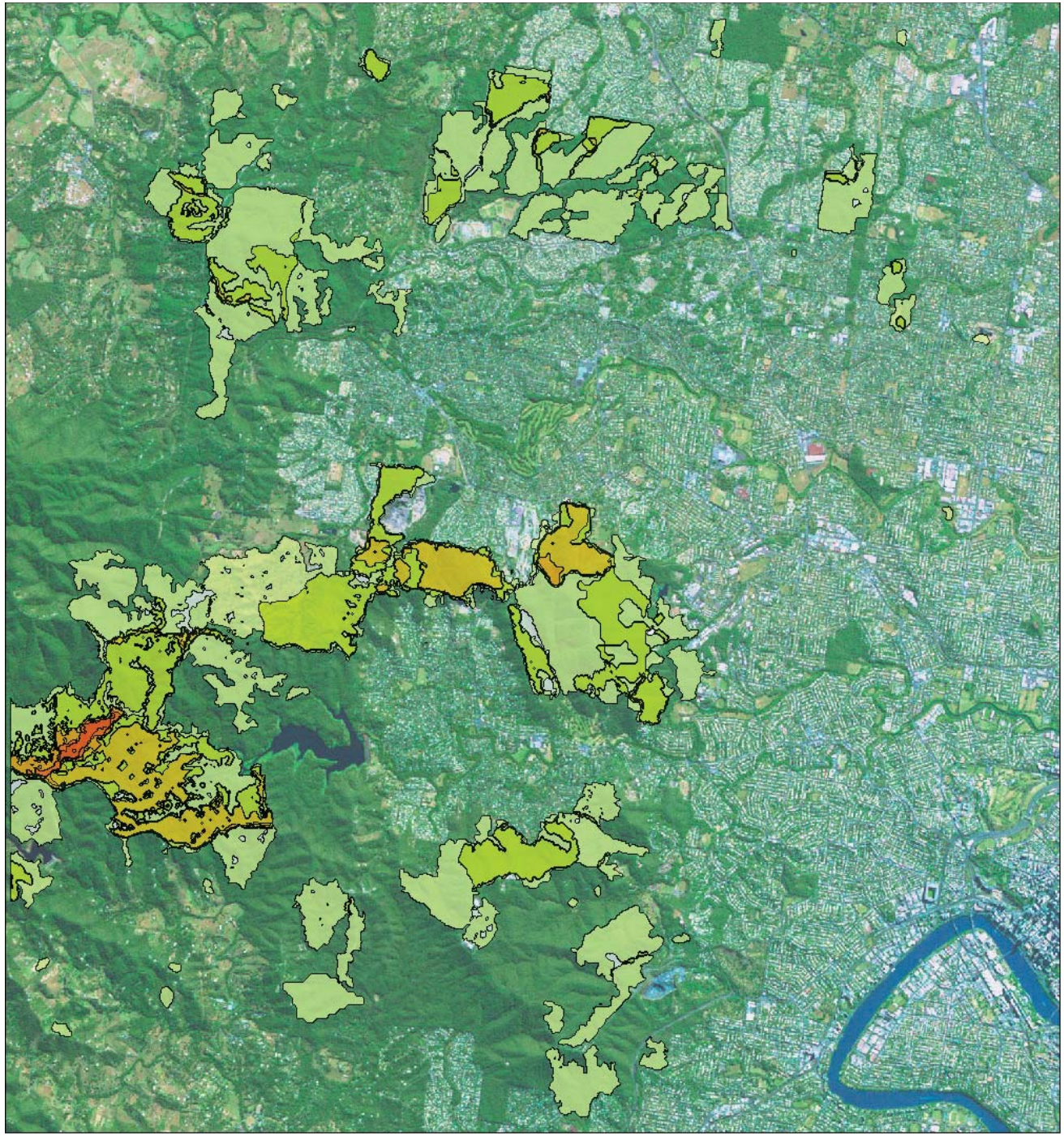
Preliminary Landsat Based Fire Scar Data

This image shows preliminary results for 10 year fire history mapping currnetly being undertaken. The red outline shows existing BCC wildfire data for the period

These polygons are overlaid sequentially so that some earlier fire scars may be obscured by more recent events.

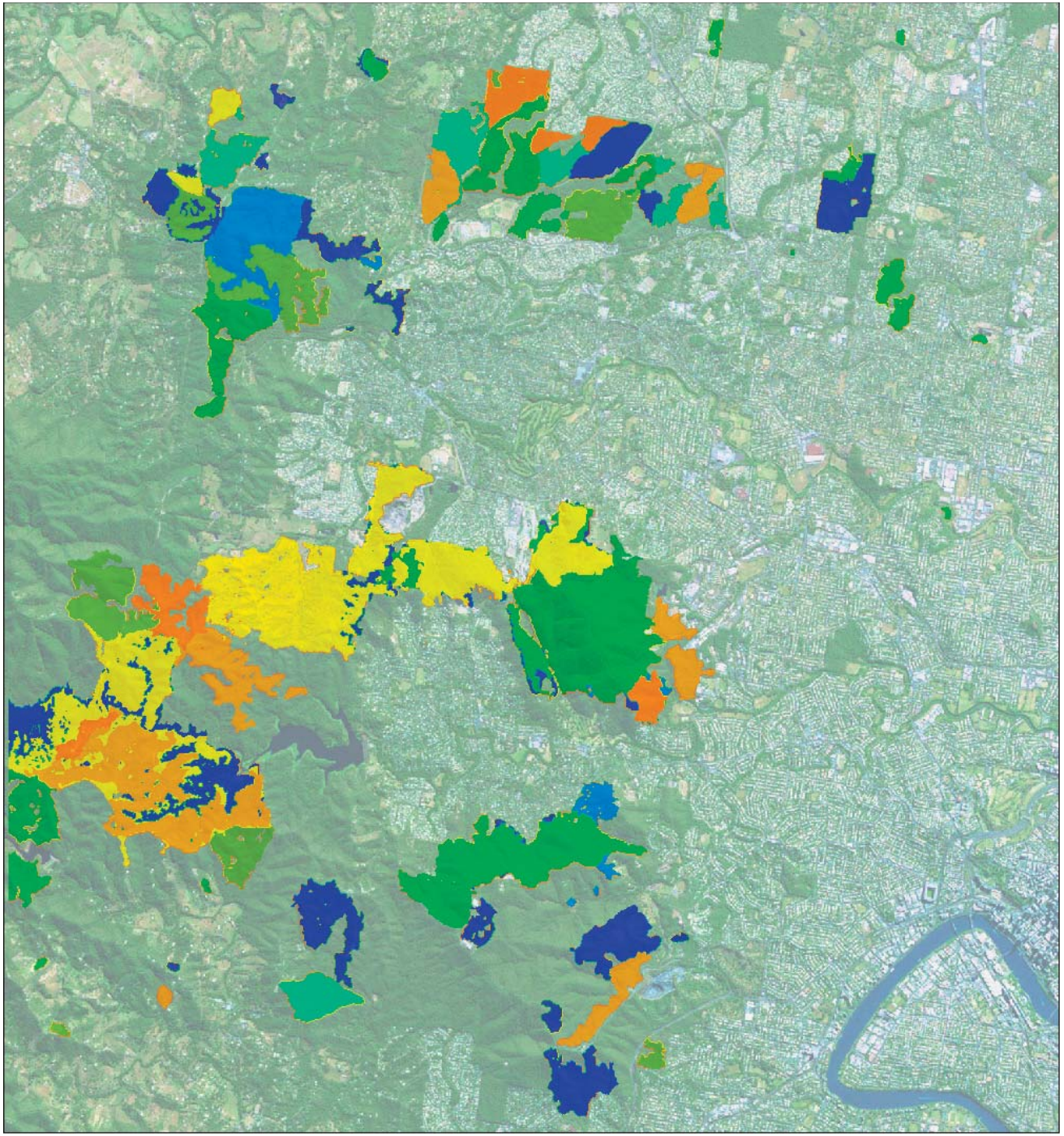
While BCC fire history data aligns quite well for wildfires, some precribed burn events remain unidentified from Landsat data

It should be noted that full verification hasnot yet been completed. Reasons behind descrepencies are currently unresolved, however early indications suggest that some planned burns may not have been ignited.



1 fires in 10 years
2 fires in 10 years
3 fires in 10 years
4 fires in 10 years
5 fires in 10 years

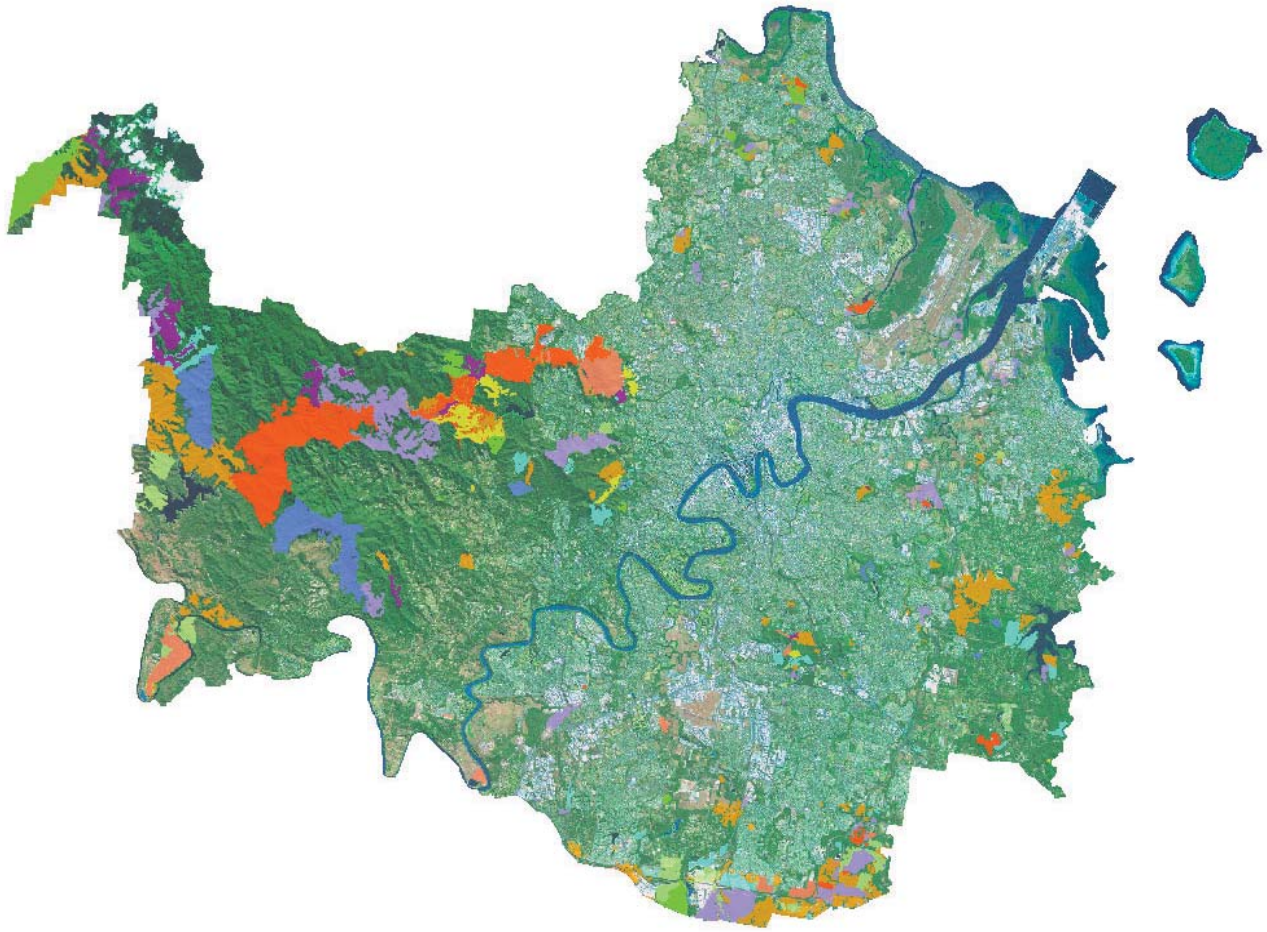
Burn Frequency

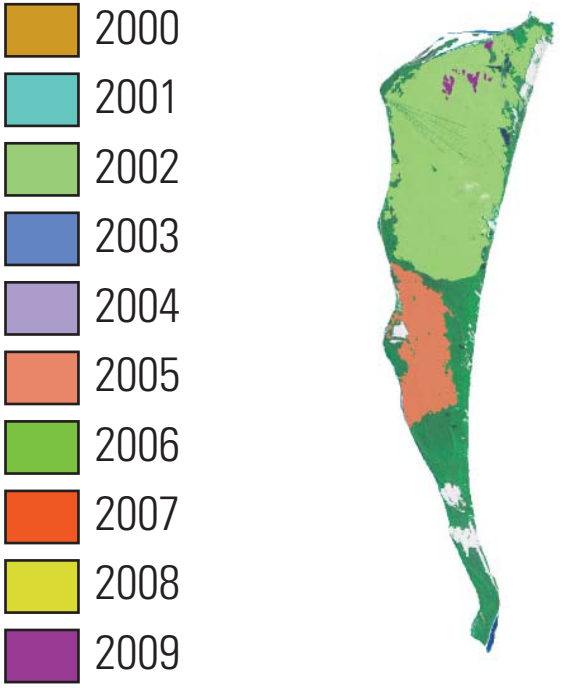


- up to 1 year
- 1 to 2 years
- 2 to 3 years
- 3 to 4 years
- 4 to 5 years
- 5 to 6 years
- 6 to 7 years
- 7 to 8 years
- 8 to 10 years

Time Since Fire

Brisbane Local Government Area





A verification data set – generated using Sentinal hotspots, AIRS data and BCC records– is expected to be ready by 11 November

This will provide a data source for cross-referencing and enable us to establish a level of confidence for the data. Although retrospective fire scar mapping will always be problematic, It is expected that this data may fill an existing knowledge gap.