

Fire Severity Mapping

A.C Edwards, S.W Maier and L.D. Hutley

Department of Environment Health & Science, Charles Darwin University, Darwin, Northern Territory, Australia

R.J Williams

Tropical Ecosystems Research Centre, CSIRO, Darwin, Northern Territory, Australia

A Fire Severity Field Guide was developed to define terminology, to provide qualitative illustrations and quantitative tables for Fire Severity Classification in the tropical savannas:

Fire Severity Categories for the Tropical Savanna Woodlands of northern Australia

Tropical Savannas
Originally: Although the term *savanna* is believed to have originally come from a word in Arawak (Amerindians of the West Indies) describing "land which is without trees but with much grass either tall or short" (Oviedo y Valdes, 1535¹), by the late 1800s it was used to mean "land with both grass and trees".

Today: A savanna is a tropical/subtropical woodland ecosystem². Tropical savannas cover 12% of the world's land surface³. Tropical savannas are landscapes with a continuous grass layer below and regular tree cover above.³ Tropical savannas are also characterised by seasonal water availability, with the majority of rainfall being confined to one season of the year.⁴

The Extent of TROPICAL SAVANNAS on the Australian Continent

Tropical Savannas cover ~25% of the Australian continent.

We now use the broader definition of tropical savanna that includes both woodland and grasslands

Definition of terms:

Scorch Height – is the height to which former green leaves still suspended on plants are turned brown by the heat of a fire.

Char Height – is the height to which former green leaves still suspended on plants are turned black by the flame of the fire. NB This can **not** be measured on the stems of plants as fire "climbs" the bark.

Patchiness – a percentage or proportion of the ground layer vegetation (grasses, herbs and trees/shrubs < 1m) **not** affected by fire. I.e. 20% patchiness = 80% burnt.

Fire Intensity – a measure of the energy released by fire in kiloWatts for each metre of the fire line. (also known as the Byram fire-line intensity).

Fire Severity – a measure of the effect of fire on vegetation and soil after the fire (e.g. vegetation consumption, vegetation mortality, soil alteration).

Burn Severity – relates to the amount of time necessary to return to pre-fire levels of biomass or ecological function.

The Fire Continuum

Time moves forward from left to right. The illustrations below the time line represent: 1. the **Ignition**; 2. the **Fire Event**; and 3. the **Post-fire Recovery of the habitat**.

The boxes above the line represent the fire terminology with respect to time: 1. **Fire Intensity**, as the fire is in progress; 2. **Fire Severity**, measuring the effect of the fire post-fire; and 3. **Burn Severity**, measures and descriptions of the time and processes to reach a "recovery" state.

For example: in a typical savanna grassland burnt in the previous season, the fire intensity after 3 months without rain will be moderate to high, depending on the conditions. The fire severity will be very high consuming large portions of the above ground biomass. However, in these ecosystems, grasses and forbs typically rejuvenate quickly, so burn severity is low.⁵

Fire Severity: PATCHY

Scorch height ≤ 2 m

Patches of unburnt Grass and Litter in the understory

Fire Severity: MODERATE

Scorch height 2 to 5 m

No Patchiness

Fire Severity: HIGH

Complete Scorch

No Patchiness

Fire Severity: EXTREME

Complete Leaf Char

No Patchiness

Fire Severity Class: PATCHY
Scorch height: ≤ 2 m
Patchiness: YES
Fire Intensity: $<< 100 \text{ kWm}^{-1}$
Category Description: A patchy fire of low severity where:
- the ground material was not all affected by the fire;
- the height of scorched leaves is no higher than 2 metres.

Fire Severity Class: MODERATE
Scorch height: $> 2 \text{ m} \ \& \ \leq 5 \text{ m}$
Patchiness: NO
Fire Intensity: $100 - 500 \text{ kWm}^{-1}$
Category Description:
- all of the ground material is affected by the fire;
- Leaf scorch height is $> 2 \text{ m}$ but $\leq 5 \text{ m}$;
- all or most mid-storey canopy leaves were scorched;
- upper canopy leaves may be partly scorched.

Fire Severity Class: HIGH
Scorch height: Complete canopy scorch
Patchiness: NO
Fire Intensity: $500 - 10,000 \text{ kWm}^{-1}$
Category Description:
- all ground material was affected by the fire;
- all mid-storey canopy leaves were scorched;
- all upper canopy leaves were charred/scorched.

Fire Severity Class: EXTREME
Scorch height: Completely Charred
Patchiness: NO
Fire Intensity: $> 10,000 \text{ kWm}^{-1}$
Field Description:
Ground, mid-storey and upper-canopy are completely affected by the fire, most leaf material is removed or charred.

Fire Severity was previously based on seasonality – Early Dry Season fires (May to July) were assumed to be less severe than Late Dry Season fires (Aug to Dec). An algorithm to characterise the Fire Severity from satellite imagery will produce maps. The Fire Severity Guide provides standardisation of terms and classification.

