Classic Article

Introduction to McArthur and Cheney's Article

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Forest fires are usually characterised and described according to the level of interest of the observer. Fire managers and fire behaviour scientists commonly describe fires in terms that convey information about the difficulty of suppression or damage potential of the fire, such as rates of spread, rates of perimeter and area growth, flame dimensions, spotting potential, and intensity. There is ample literature defining, modelling, and describing ways of measuring these variables (e.g., Davis 1959, Luke and McArthur 1978).

However, when studying the acute impacts of fire on vegetation (or other biotic and abiotic elements), it is equally important to identify and measure fire characteristics that are linked to these and that give rise to ecological responses or physical damage to the biota. It is insufficient to consider fire as a binary event—that an ecosystem burned or it didn't; such a simplistic characterisation will likely lead to erroneous interpretations and conclusions. Fire ecologists have generally displayed indifference to how fires actually produce their ecological effects, and this was certainly true prior to 1966 when Alan McArthur and Phil Cheney published their paper, "The characterisation of fires in relation to ecological studies" in *Australian Forestry.*

Alan McArthur was born in Sydney, Australia, in 1923. As a forester and an employee of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), he spent more than 25 years studying the behaviour of fires in eucalypt forests and grasslands. He is acknowledged as the "father" of fire behaviour prediction and fire danger rating in Australia and produced the first empirically based fire behaviour models in the country, which, with some adjustments and refinements along the way, are still in use today. Phil Cheney worked with, and was mentored by, McArthur soon after graduating from forestry school, and went on to become the nation's leading bushfire scientist.

The primary focus of McArthur and Cheney's 1966 paper was to describe what and how to measure fire in order to assist with interpreting its effects and acute impacts on vegetation and some soil properties. Their paper provides details on how to calculate fire intensity (Byram 1959) and relates this to physical damage to crop trees in a timber production context, using a young stand of jarrah (*Eucalyptus marginata* Donn ex Sm.) poles as an example. They also show a relationship between fire intensity and potential monetary loss (of timber value) for the same stand. While the paper focuses on commercial forests, the concept of linking a quantifiable measure such as Byram's fireline intensity with the "killing power" of the fire was an important contribution that could be used in a wider context. Similarly, they identified the importance of combustion residence time (flame dwell time or burnout time) and its potential effect on soil micro-organisms, and provide detail on how to calculate and quantify this measure. In addition

to interpreting the acute impacts of fire, knowledge of the general relationship between fire intensity and damage to vegetation such as crop trees assists with planning prescribed burns—burn intensity limits can be set to minimise damage.

While there have been advances in identifying, describing, and linking fire characteristics to acute impacts that give rise to ecological responses (e.g., Van Wagner 1973, Alexander 1982, Ryan *et al*. 1988, Cheney 1990, Burrows 1995), it is disconcerting that much of the contemporary fire ecology literature continues to ignore, or inadequately describe, the fire being studied. This is especially in relation to landscape-scale responses in which the variable nature of fire behaviour is usually ignored and fire is considered as not only a binary event but, when it occurs, as a "homogeneous" event—everything burned with uniform intensity. Historically, it has been difficult or cost-prohibitive to accurately characterise the temporal and spatial variability of fire at landscape scales; however, advances in remote sensing and satellite technology are pushing back the frontiers of ignorance and are providing new and exciting ways of characterising the landscape-scale impacts and effects of fires on the biota.

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