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Responses of Ground-Foraging Ant Communities to Three Experimental Fire Regimes in a Savanna Forest of Tropical Australia[1]

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ABSTRACT

Ants were sampled using pitfall traps in two replicate 1 ha plots of each of three experimental fire treatments (annually burned, biennially burned, and unburned for over 14 years) in a eucalypt-dominated savanna of tropical northern Australia. The ant fauna was extremely diverse, with 81 species from 24 genera recorded. Species were classified into functional groups based on habitat requirements and competitive interactions, with the most important groups being dominant species of *Iridomyrmex* (11 species, 14–63% total ants in traps); generalized myrmicines (mostly species of *Monomorium* and *Pheidole*; total of 22 species, 11–61% total ants in traps); hot climate specialists (species of *Melophorus*, *Monomorium* ("*Chelaner*") and *Meranoplus*; total of 14 species, 1–16% total ants in traps); cryptic species (many genera; total of 13 species, 2–27% total ants in traps); and, opportunists (mostly species of *Rhytidoponera* and *Tetramorium*; total of 11 species, 3–12% total ants in traps). Ant communities in the annually burned plots were characterized by relatively high numbers of dominant *Iridomyrmex*, hot climate specialists and opportunistic *Rhytidoponera aurata*, and low numbers of generalized myrmicines and cryptic species. The reverse was true for unburned plots. Many species were common under one fire regime, but were rarely or never recorded under the other. These differences were attributed to structural changes in the habitat caused by fire, and in particular to the levels of litter accumulation and insolation on the ground. These changes influenced ants directly, but also had important indirect effects through their influence on the abundance of dominant *Iridomyrmex*, and therefore on competitive interactions. The ant communities in the biennially burned plots were generally intermediate to those of the unburned and annually burned plots. However, one was more similar to those in the annually burned plots, while the other resembled those in the unburned plots.

These results demonstrate that different fire regimes have a major influence on one of the most important faunal groups in tropical savannas, and this has important implications for conservation management in these ecosystems.

FIRE IS AN IMPORTANT LAND MANAGEMENT TOOL in many ecosystems throughout the world (Naveh 1975, Gill 1977, Hobbs & Gimingham 1987, Moore 1987), but especially in tropical savannas (Gillon 1983, Murphy & Lugo 1986, Stott 1986), where fires are often annual and lit almost exclusively by humans (Braithwaite & Estbergs 1985, Gillon 1983). Studies of the effects of fire in tropical savannas have largely focused on the responses of grasses (Stocker & Mott 1981, Gillon 1983) and, to a lesser extent, woody plants (Miyanishi & Kellman 1986, Stark 1986), with little attention paid to the fauna. Indeed, some recent reviews of the ecological effects of fire in tropical savannas ignore the fauna completely (Coutinho 1982, Lacey *et al.* 1982, Sarmiento 1984). Moreover, most faunal studies have been concerned with responses to single fires (Gillon 1983, Gandar 1982, Frost 1985), rather than to different fire regimes. This lack of information on the influence of different fire regimes on faunas makes it difficult for managers of tropical savannas to devise appropriate fire management plans, especially in areas like national parks where conservation is the prime management objective.

Here I report on the effects of three experimental fire regimes on communities of ground-foraging ants in a forested savanna in Kakadu National Park, in tropical northern Australia. Ants are a dominant faunal group in most tropical savannas (Levieux 1983), but are particularly abundant and diverse in those of northern Australia, where more than 100 species can occur within 500 m² (Andersen, in press a, b). Kakadu savannas have been burned by aboriginal people for at least 20,000 years (Jones 1969, Haynes 1985, Kershaw 1985), but details of the frequency, timing, and extent of their burning are poorly understood (see Horton 1982). The contemporary fire regime is one of dry season burning at least once every three years, and, typically, annually (Braithwaite & Estbergs 1985, Day 1985). The fires include both prescription burns by management authorities, which usually occur early during the dry season (May/June) and are often relatively low in intensity and small in area, and unprescribed burns lit by the public, which tend to

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