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# EFFECTS OF WORK CAPACITY AND THERMAL ENVIRONMENT ON PHYSIOLOGICAL STRAIN AND PRODUCTIVITY OF MEN CLEARING FIREBREAKS IN AUSTRALIA

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In contrast to controlled laboratory studies of responses to environmental and metabolic stresses, field studies incorporate the influence of behaviour that may moderate the total physiological demands acting on the subject. Thus they provide objective information about the actual stresses and strains experienced in real life.

The present paper examines the effects of physical work capacity and the effects of the thermal environment on the physiological responses and productivities of Australian bushfire fighters constructing firebreaks with hand tools in the absence of fire. The firefighters' maximum oxygen uptakes ($VO_2$ max) ranged from 2.4 to 4.5 l $min^{-1}$. Heart rates, body temperatures, and productivity were measured frequently throughout a series of work trials lasting 2 to 3 hours. The air temperatures in which these trials were conducted ranged from 17°C to 36°C (WBGT 15°C to 28°C). During this work the firefighters, regardless of their individual work capacities, sustained work heart rates that averaged 147 (range 129 - 174) bts $min^{-1}$ and average peak deep body (rectal) temperatures of 38.5 (range 38.1 - 39.0)°C. These responses, and independent estimates of energy expenditure, indicate that they chose to work at about 60% $VO_2$ max. Consequently productivity varied directly with $VO_2$ max. Increasing environmental warmth was accompanied by increasing body temperatures and heart rate and by reduced productivity. From the coolest to the warmest weather (WBGT 15 to 28°C) heart rate increased from 135 to 160 bts $min^{-1}$, thigh skin temperature from 32.0 to 34.5°C, and rectal temperature from 38.3 to 38.7°C, while productivity declined by 20% from 2.5 to 2.0 m $min^{-1}$. The changes in skin temperature and heart rate were significant ($P<0.05$), those in rectal temperature and productivity almost so ($P<0.10$).

It appears that these men, engaged in a strenuous outdoor job but allowed to work at their own pace, adopted work rates that resulted in optimal work performance and yet, even in warm conditions, allowed satisfactory thermoregulation.