November 2006

Tuart decline

RESEARCH FINDINGS

Eucalyptus gomphocephala

Tuart Bulletin No.7 A series outlining key research findings associated with tuart health in south-west Western Australia

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Tuart regeneration and restoration

Katinka Ruthrof (Murdoch University) and Dugald Close (Bushfire CRC/Murdoch University)

Natural tuart recruitment: informing tuart restoration

Ecological studies on seedling survival and growth over the past 10 years have led to an increase in understanding of the factors that facilitate the natural regeneration of tuart.

Tuart relies on mass seedling recruitment following fire given that high numbers of seedlings fail to establish during interfire periods. Successful recruitment following fire is linked with:

- the synchronous mass release of canopy stored seed following fire;
- a temporary satiation of seed harvesters; and
- the production of a temporary soil seed reserve.

Fire creates the 'ash-bed' effect (Pryor 1963), a germination medium high in plant-available nutrients and with an abundance of safe sites for germination and establishment. Fire increases the number of safe sites by:

- removing biological opposition to recruitment, such as soil-litter micro-organisms, pathogens and herbivores that inhibit seedling survival and growth;
- altering soil characteristics such as reducing bulk density that increases water infiltration and availability and;
- removing competition from surrounding vegetation for resources such as light, nutrients and water.

Information regarding natural recruitment events informs planning and restoration activities. Such information includes seedling density at the time of recruitment, and potential survival and growth rates (Figures 1 and 2).

Summary

Tuart has life history characteristics similar to many temperate eucalypts including a regeneration strategy of mass recruitment of seedlings following fire.

Information on recruitment from seed and the early growth and survival of tuart can be used to increase the success of restoration and serve as a benchmark for restoration activities.

Experiments have indicated that restoration of tuart in severely degraded areas can be successful if certain restoration protocols are followed.

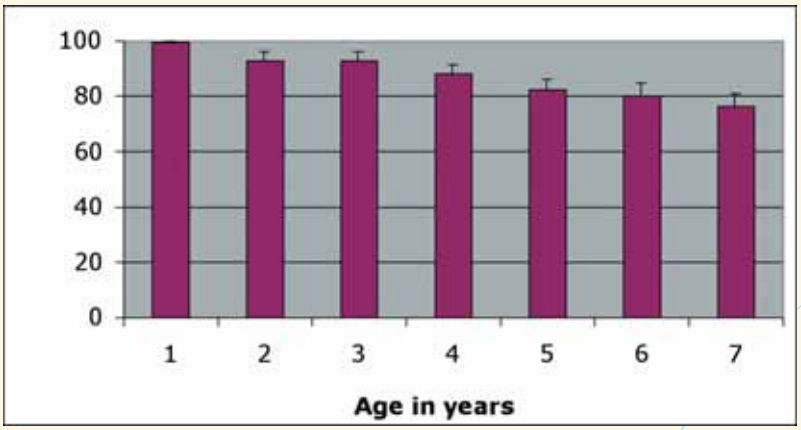

Figure 1: Survival (%) of naturally recruited tuart seedlings following a fire in Kings Park in 1996.

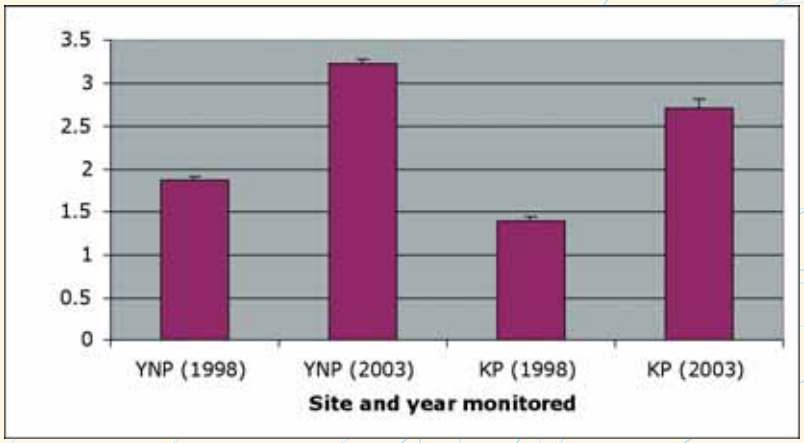

Figure 2: Height (m) of tuart seedlings naturally recruited following fires in 1996 in Yalgorup National Park and Kings Park.

The use of fire to faciliatate successful regeneration of tuart in bushland restoration is not always appropriate. This is due for a number of reasons including public safety, low levels of canopy stored seed available, the potentially negative effects of fire on other plant and animal species and the invasion of exotic weeds.

Restoration experiments can test whether it is possible to mimic some of the factors that can lead to successful regeneration. These experiments can inform the development of restoration protocols that enable successful restoration of tuart.

Tuart restoration: current knowledge

Experiments of tuart restoration in urban bushlands indicate that:

- slightly older seedlings (seven months old) had a higher survival rate than younger seedlings (four or five months old);
- the addition of fertiliser significantly increased seedling growth but had no significant effect on survival;
- plastic tree guards protect against herbivory but increase significantly the ambient temperature that can lead to seedling stress and/or mortality. Shadecloth tree guards maintain relatively low temperatures, protect seedlings from herbivory and promote successful tuart restoration;
- seedlings planted in recently burnt areas had higher survival rates than those planted in unburnt areas, even though the soil moisture content during summer can be lower in burnt areas;
- although watering during summer months increased plant survival rates, high levels of survival can be attained without the use of irrigation;
- high survival can be reached in highly degraded areas when particular restoration protocols are followed. These include selection of sites without established trees that out compete seedlings for light, water and nutrients, and effective weed and herbivore control;
- seedlings planted in May or early June, or as soon as the soil moisture content is three to five per cent at a 5 cm depth, survived better than those planted later in the year. Planting in July or August should be avoided; and
- basic planting principles apply (i.e. bury the seedling root ball at least 2 cm below the soil surface, firm down to prevent air pockets forming around the root ball, tree guards must be taut to prevent collapse and seedling suffocation), and quality control of planting should be undertaken.

Monitoring of seedling survival (by Russell Barrett).

Monitoring

Ongoing monitoring of restoration experiments should be undertaken to determine long-term seedling survival and responses to treatments given temporal variation of seasonal and annual climatic conditions, episodic insect attack, rabbit/possum browsing, trampling, etc.

Successful restoration of tuart using shade-cloth tree guards.

Acknowledgments

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Further reading

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