BUSHLAND AND FIRE

Nature Conservation Information Sheet

Fire and biodiversity

Planned burns are used in remnant vegetation to reduce fire risk and/or encourage regeneration. An understanding of the ecological impacts of fire will enable land managers to plan and implement burns in a way that will minimise negative impacts on the ecosystem and hopefully result in improvements in condition. Fire ecology is complex and it isn't possible to give broad prescriptions on best practice. Hopefully the information and links in this document will help you make decisions that suit your objectives and protect the biodiversity values of your remnant vegetation.

Fire is culturally significant to Indigenous Australians. The use of fire by many Indigenous Australians to shape the landscape is widely acknowledged. As we learn more from Indigenous Australians about traditional burning practices recommendations on how to burn whilst protecting biodiversity are likely to change.

Effects of fire on remnant vegetation

The effect of fire on native vegetation communities depends on many factors. The primary considerations are: the frequency, seasonality and patchiness of burning; the type of vegetation community and species present; and the condition, size and connectivity of the remnant vegetation. These factors are discussed briefly below.

1. **Frequency.** The frequency of fire will have a significant impact on the vegetation community and ecosystem. Whilst some species may benefit from frequent fire (e.g. native grasses, annual and biennial herbs, some re-sprouting shrubs, kangaroos, some fungi and invertebrates), others need longer intervals between fire to reach maturity and set seed, and to provide habitat and resources for fauna that prefer mature vegetation.

2. **Seasonality.** The season in which a burn is conducted influences the way that fire behaves, and its effects on plants, animals and other features of the environment. Points to consider in regard to the seasonality are included in Table 1. No matter what season you plan to burn in it is important to take in to consideration the actual conditions

that year before going ahead. For example, rapid early drying in spring, or warm dry conditions extending into late autumn will have significant implications for a planned burn.

Table 1: Points to consider in regard to timing of fires	
Season	Considerations
Summer/early autumn	Not recommended as summer fires are potentially difficult to manage and very risky.
Late autumn (April-May)	Some generalisations about autumn burning include: • dry conditions may result in hot, intense, fast moving fires that consume most leaf litter and logs, and may burn down mature trees; • generally result in more extensive areas of mineral ashbed from burnt logs; • the dry soil conditions and heating of the soil to a greater depth triggers germination of buried seed; • can favour obligate seeders especially legumes such as acacias and peas; and • fire is often followed by winter rain and this encourages good regeneration. Note: Autumn burns, particularly in the early part of the season, can be dangerous and difficult to control. They are not recommended for most landholders to attempt without the support of local brigades. Very late autumn fires carried out after first autumn/winter rains will likely have reduced intensity.
Winter	Winter burns may be useful for safely reducing fuel loads in higher risk instances or reducing specific elements of the fuel load such as grasstrees in order to facilitate subsequent spring or autumn burns. Winter burns are generally not preferred for regeneration. Some generalisations about winter burning are that these: • are generally low intensity, low, slow burns; • can be very hard to get started and can be patchy: • often fail to achieve desired fuel reductions; • are often not hot enough to break the dormancy of buried seeds; • can promote introduced grasses where these are present; • can disrupt the life cycle of flora and fauna - annual species reliant on setting seed each year can be particularly vulnerable; and • they often focus on some of the higher risk/fuel load elements of a piece of bushland such as grasstrees.
Spring	Control burning is generally not achievable during early spring. However, mid to late spring is often favoured for fuel reduction burns due to reduced intensity and increased predictability. The soil and litter layer will normally be wet and will dry from the top downwards with the onset of warm, dry weather. Logs on the ground and areas of organic soil will also be damp following winter rains, and therefore less prone to catching alight during planned burns. Although spring is the breeding season and spring burns can impact breeding of many species, some birds will have already raised their first clutches by mid October and spring burns generally burn patchily, leaving pockets of unburnt vegetation as wildlife refuge. Spring burns: • are generally of moderate intensity depending on the vegetation type; • are good for breaking dormancy of surface and shallow seed but not for buried seed; • can promote native plant species that have evolved to respond to spring burns.; • can disrupt and harm animals and birds during breeding; • can provide a competitive advantage to resprouting plants due to the extent of growth they can achieve prior to reseeders germinating with the first rains of the following autumn; • can eliminate or seriously reduce that year's flowering (with subsequent impacts on nectar and pollen feeders) and subsequent seeding; • can trigger spring germination that can then be lost to the following dry summer.

3. Patchiness of burning. Best practice is to burn remnant vegetation in sections over time so there is a mosaic of vegetation of differing ages. This will maximise the resources for fauna, provide a seed source from unburnt areas and increase the resilience of the bushland. In larger areas of bushland it may be possible to leave some patches unburnt, particularly areas of fire sensitive vegetation communities such as wetlands, creeks and granite outcrops.

4. **The type of vegetation community and species present.** Different vegetation communities and species vary in their response to fire. Some are quite resilient to frequent fire and re-establish to their pre-fire state relatively quickly, while sensitive vegetation communities may take decades to return to a mature condition. Fire sensitive species are most often associated with less flammable parts of the landscape including seasonal wetlands, watercourses and stream banks, exposed coastal dunes, sand plains and granite communities. These systems can tolerate only infrequent fire at greater than 20 year intervals. They are best left unburnt where possible by burning out from their edge towards surrounding vegetation. Excluding controlled burns from these fire sensitive vegetation communities however, also needs to be balanced against any damage that would be caused by the need to create a fire break or access track to enable a contained burn.

   Table 2 at the end of this Information Sheet provides suggested fire regimes for different vegetation types within the Margaret River region. A range is provided for the suggested frequency or fire interval period. The lowest end of the range is only recommended where fuel load needs to be reduced due to other risk considerations. The higher end of the fire interval range would be required for some specialist plants and animals but would increase the risk of high intensity fires. A decision on fire frequency will need to balance both the need to minimise fuel loads and the protection of biodiversity.

5. **The condition, size and connectivity of the remnant vegetation.** The condition of the remnant vegetation being burnt also affects the response to fire. Degraded bushland may not regenerate well following a fire. Regeneration of native species may be limited as the seed bank is likely to be diminished and weeds may increase as many weed species regenerate strongly after fire.

   The effect on flora and fauna populations will be less if the remnant is connected to or near other bushland, is burnt in sections over time so that some unburnt habitat remains, and logs and hollows are protected from fire if possible through the removal of surrounding debris.

Management after fire

Management of environmental weeds, Phytophthora dieback, grazing and feral animals before and after a fire, as outlined below, will result in the best biodiversity outcomes for your remnant vegetation.

1. **Weeds.** Most priority environmental weeds in the south west regenerate strongly after fire. Without management it is likely that a fire will result in an increase in weed extent and density. Tips and considerations for managing weeds after fire are:

   - Map weeds in your bushland so you know what species and areas need targeting following a fire. Be aware that new species may also emerge from the soil seed bank or be transported into the area by animals, wind or water.
   - Weed and native seedlings and new growth can sometimes be difficult to identify with confidence. Your identification needs to be accurate to ensure that native species are not removed and that your control methods target the invaders. Help is available from Florabase (http://florabase.dpaw.wa.gov.au) and 'Western weeds: a guide to the weeds of Western Australia'.
   - Commence monitoring soon after a fire and start planning to take advantage of some of the opportunities described below – they may not present themselves but if they do you want to be ready. If the burn occurred during dry conditions, first germination will be triggered by following rain.
   - Fire can kill weeds. Whilst most priority weed species in the south west respond well to fire (either through resprouting or reseeding) a limited number of species are fire sensitive and can be managed using fire. For

example, seedlings and even larger plants of sweet pittosporum (*Pittosporum undulatum*), which is native to rainforest areas of the eastern states, can be killed by warmer burns.

- Fire can facilitate removal of large, mature plants.
- Fire will generally thin out much of the understorey. This can provide rare but short windows of opportunity to control weeds in areas previously very difficult or impossible to access (eg, blackberry thickets, weeds among dense native vegetation).
- Where weed species germinate or reshoot quicker than natives, selective control can be undertaken.
- Fire can provide an opportunity to control almost the entire soil seed bank of some species (eg weedy wattles such as Sydney golden wattle and Flinders Range wattle) which would otherwise gradually germinate over a decade or more.
- The young fresh shoots and regrowth of weed species following fire are more receptive to chemical uptake than the old hardened foliage (eg, tambookie grass).
- Young weed seedlings can be particularly susceptible to herbicide and early control can reduce the amount of herbicide required.

2. **Phytophthora dieback and fire.** The root rot plant disease Phytophthora dieback is widespread through the Margaret River region and impacts up to 40% of south west plant species. It spreads throughout the landscape by movement of contaminated soil or water. Phytophthora dieback can be introduced and spread by firebreak creation and maintenance, and during fire control. Hygiene is critical. Remember that once introduced, dieback can't be eradicated from bushland – only managed. Refer to information available via the Dieback Working Group: www.dwg.org.au

3. **Grazing post fire.** Remnant vegetation is susceptible to grazing and browsing following a fire. Grazing of newly germinated seedlings and resprouting plants by domestic stock, rabbits and kangaroos can severely impact on regeneration. To protect and encourage regeneration ensure that stock are not able to access regenerating areas, and assess kangaroo and rabbit pressure prior to planned burns and undertake management where necessary to keep numbers down for at least two years. For small patches of high value vegetation, fencing out rabbits and kangaroos may be an option.

4. **Feral animals.** Feral predator control is important for conservation of wildlife at all times but especially following burns. Foxes and feral cats can sniff out a fire and travel long distances to predate upon animals fleeing a fire. Animals remaining are also vulnerable to predation without the protection afforded by vegetation. Feral animal control post fire may help protect surviving wildlife.

Fire as a regeneration tool

As discussed above, fire can result in regeneration of native vegetation communities. Where regeneration rather than fuel reduction is the primary objective it is worth considering alternative regeneration techniques that trigger germination such as rake and pile burns and creating of ash beds. Rake and pile burns involve raking up leaves, large twigs and branches in a cleared or degraded area in bushland, preferably where there is no overhanging trees, and burning on a cool, fine day in winter. Provided there is a seed bank in the soil, natural regeneration should occur in the ash bed the following spring/summer. Smoke may also trigger germination in the surrounding bush. Weed control and protection of the area from grazing will improve regeneration.

Monitoring and adaptive management

There will always be uncertainty and risks surrounding the outcomes of planned fire regimes. These can be reduced by adopting an adaptive management approach that includes some simple actions:

- Prepare a long-term ecological fire management plan using all of your site knowledge and drawing on expert assistance available in the community.
- Prepare a plan for each burn based on a check-list including preparatory and follow-up actions.
- Keep records of when and how fire was used (eg. weather conditions, pattern of lighting, flame height, ease of control).
- Monitor the outcome of burning and post-burn management (eg. photographic points, notes about plant and animal response, any loss of large trees).
- Review whether your objectives were achieved, and adapt your plan as required.

Table 2: Suggested fire regimes for vegetation communities of the Margaret River region

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
Peppermint woodland: dense or open woodland of *Agonis flexuosa* found on sandy coastal limestone soils and sheltered parts of the ridge. Important habitat for the endangered western ringtail possum which is sensitive to widespread hot fires 	**Frequency**: 5-15 year intervals **Season**: Early spring and late autumn **Intensity**: Low intensity, slow spreading fires with flames less than 1 m tall **Comments** Mature *Agonis* woodlands with large old trees can be maintained by mild fires that do not scorch the crowns of the trees. Intense fires will kill mature trees back to ground level and result in dense thickets of young trees that will be sensitive to fire for several decades.
Banksia woodland: woodlands dominated by *Banksia attenuata* or *Banksia ilicifolia* on sand. These communities are already being heavily impacted by Phytophthora dieback. Nectar and seed from mature trees are important food sources for wildlife including black cockatoos and honey possums.	**Frequency**: 5-15 year intervals **Season**: Early spring and late autumn **Intensity**: Low intensity, slow spreading fires with flames less than 1 m tall **Comments** Banksia woodlands typically occur on sandy soils that dry rapidly following rain, and often have an understorey of shrubs that may burn readily. Low intensity fuel reduction burns help protect mature trees from wildfire. An occasional hot, summer burn is needed to establish a new generation of trees from seed; with such fires hopefully limited in extent by maintaining low fuel.

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Karri forest: tall forest of *Eucalyptus diversicolor* often with a dense shrub understorey. Confined to river valleys and sandy loam soils over deep limestone. Karri forests of the Leeuwin-Naturaliste Ridge are associated with a range of endemic flora and provide habitat for a range of significant mammal and bird species, some of which rely on old trees with hollow and long unburnt understorey. 	**Frequency**: Vary intervals between 7 – 20 years in a patchwork that maintains some areas at the middle to higher end of the range **Season**: Autumn **Intensity**: Low to moderate intensity fires with flames less than 1.5 m **Comments** Karri forest typically has a deep layer of leaves and twigs that will not dry sufficiently to burn until early summer (December), and opportunities to burn safely in spring will be limited in most years. Large old trees with hollow butts may fall if they catch fire. Removing the fuel around the base of large hollow butt trees by raking or using a small machine can minimise the risk of trees catching alight.
Jarrah-marri forest: our most common vegetation community with a very diverse range of understorey species depending on soil, fire history, hydrology and topography. Important habitat for black cockatoos and a range of important flora and fauna.	**Frequency**: 5-15 year intervals **Season**: Spring and autumn **Intensity**: Low intensity, slow spreading fires with flames less than 1 m **Comments:** The height and density of the understorey shrub layer in jarrah-marri forest will influence the amount of fuel present and the rate at which it dries after rain. Grazing by cattle and sheep has altered the understorey of some remnant jarrah-marri forest on agricultural land, with annual grasses replacing shrubs in heavily grazed remnants. The shortest fire interval can promote native 'fire weeds' of the pea family which grow rapidly, set seed then die off, re-establishing a high fuel load. A longer burning interval can break this vicious cycle if the fire weeds are replaced by slower-growing, less fire promoted understorey species. Some wildlife of the jarrah-marri forest is confined to long

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	unburnt vegetation. Ideally, patches of forest and stream-zones should be protected from burning for as long as possible, with surrounding patches maintained at lower fuel levels to prevent extensive fire if a wildfire occurs. Large old trees with hollow butts may fall if they catch fire. Removing the fuel around the base of large hollow butt trees by raking or using a small machine can minimise the risk of trees catching alight. Fallen branches and woody debris may be piled and burnt to create ashbeds that will favour regeneration of eucalypt and some shrub seedlings. In late autumn it may be possible to burn individual piles under moist conditions when fire will not spread in the leaf litter layer.
Sheoak woodland: Woodlands of common sheoak with or without jarrah or banksia on sandy soils over granite 	**Frequency**: 5-15 year intervals **Season**: Early spring and late autumn **Intensity**: Low intensity, slow spreading fires with flames less than 1 m **Comments:** Sheoak woodlands typically occur on sandy soils that dry rapidly following rain, and often have an understorey of shrubs that may burn readily. Low intensity fires can maintain a low fuel load that helps maintain a habitat of mature trees and prevent intensive, extensive wildfire.
Granite communities: A unique suite of species suited to withstanding both inundation and extreme drying in summer. Important habitat for reptiles and a number of unique and threatened flora species. 	**Frequency**: Only as required to meet specific conservation management objectives **Season**: Late autumn **Intensity**: Very low intensity, slow spreading fires with flames less than 0.5m **Comments**: Granite outcrops often have a sparse vegetation cover and little or no leaf litter to carry fire. Patches of vegetation and wildlife inhabitants close to this fire barrier will often be spared from burning, thus providing a survival refuge from an intense, extensive bushfire. Periodic low intensity burning of forest or woodland surrounding granite outcrops can reduce the potential for intense summer bushfires that can spread onto granites under very dry and windy conditions.
Sand plains: These areas of sandy/ peaty soils over clay are often damp in winter and generally support heathland vegetation.	**Frequency**: Only as required to meet specific conservation management objectives **Season**: Early spring and late autumn **Intensity**: Fires in heathland vegetation may not sustain and spread under mild conditions, but can burn with high rate of

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	spread and intensity under dry windy conditions. **Comments:** If substantial areas of peat or organic soil are present then fire should be restricted to periods when the peat is moist and unlikely to ignite.
Coastal Heath: Dense shrubland ranging up to 3m or more in height. The dense nature of this community can provide excellent habitat for a range of bird and mammal species 	**Frequency**: 5-15 year intervals **Season**: Dry periods during winter, early spring and late autumn **Intensity**: Fires in heathland vegetation may not sustain and spread under mild conditions, but may burn with high rate of spread and intensity under dry windy conditions. **Comments**: To burn safely and effectively in coastal heath it may be necessary to establish a low fuel buffer strip (eg. 20-30 m wide) by slashing or other mechanical treatment. Burning against a paddock of green grass in spring, or an eaten out paddock in autumn can also provide a secure boundary. If the heath contains dense thickets of grass trees and has not been burnt for some time, spells of fine weather during the winter months can provide an opportunity for selective burning of individual grass trees to reduce the amount of dense thatch suspended on the tree. This can reduce the intensity and flame height during subsequent planned burns. Note: Rottnest Teatree present in patches along the Leeuwin Naturaliste coast is a recognised as a Priority Ecological Community and is very fire sensitive and requires specific consideration to enable very low intervals between fire.
Winter wet swamps and wetlands: These areas typified by winter inundation but with minimal flow and are generally dominated by a diverse range sedges and rushes 	These systems can only tolerate infrequent fire at greater than 20 year intervals. Generally avoid/ minimise control burns within these systems by burning out from the edge to surrounding vegetation.
Watercourses and stream banks: Wet areas at the bottom of the landscape with flowing water and dense vegetation	These systems can only tolerate infrequent fire at greater than 20 year intervals. Generally avoid/ minimise control burns within these systems by burning out from the edge to surrounding vegetation.

Vegetation Type	Suggested Fire Regimes for Ecological Maintenance
	
Coastal Dunes: This dynamic and harsh coastal environment is dominated by low often open communities critical in stabilised mobile soils and reducing wind and wave erosion. 	Do not burn - fire sensitive. Burn out from the edge to surrounding vegetation where necessary to minimise fire incursion.

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