A flammability guide for some common New Zealand native tree and shrub species

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Cover Photograph: Rural/urban interface fire on Bluff Hill, Napier, 23 November 1994.

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A flammability guide for some common New Zealand native tree and shrub species*

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Contents

Abstract

Information about the flammability of selected New Zealand native species was collated by means of two surveys. Fire managers were asked to place each species into one of four classes according to observations of flammability at wildfires and prescribed burns under different fire danger conditions. The original classes were modified in the light of comments by respondents and again by statistical procedures. A final list was produced containing 42 species ranked and classified on the basis of flammability characteristics. Information about the suitability of each species for green breaks and as components of vegetation near homes and buildings is included. Problems encountered in deriving useful guidelines from the survey responses are discussed. The list/guide is presented as a "state of our knowledge" summary that can and should be refined as a result of future suggestions and observations.

The report summarises the methodology used to produce the brochure *Flammability of Native Plant Species: a guide to reducing fire hazard around your home*.

Introduction

The flammability[1] of a vegetation fuel complex significantly affects fire intensity which has a strong influence on: (i) fire control (Cheney 1981, Alexander 2000), (ii) chance of homes or buildings being destroyed or damaged by fire (Wilson 1984, 1988), and (iii) the degree of damage to timber resources (Nicholls and Cheney 1974, Buckley 1990). High flammability fuels have chemical and physical characteristics which greatly assist fire spread. These characteristics often include heavy fuel loads (McArthur 1967) with a high proportion of dead material (Sneeuwjagt and Peet 1985), as well as aerated and continuous arrangements (Cheney *et al*. 1992) which dry rapidly and provide ladder fuels or fuel bed bulk densities that promote combustion (Rothermel 1972). The individual fuel particles that comprise a fuel array may have one or more properties that enhance ignition and combustion such as a high surface area to volume ratio, low mineral content (Rothermel 1972), the presence of volatile oils or extractives and low foliar moisture contents.

Fuel is the only component of a fire environment that can be altered to reduce the probability of occurrence of extreme wildfires (McArthur 1962). Reduction of fuel quantity by burning (McArthur 1962, Underwood *et al.* 1985), and modification of other characteristics by mechanical alteration (e.g., pruning and thinning) are commonly and successfully used to reduce local and regional fire hazard[2]. A promising, but less commonly used alternative, is the use of low flammability species in *green breaks* (Johnson 1975) positioned to divide flammable landscapes, or to reduce fire hazard in the immediate vicinity of property and settlements (Simpfendorfer 1989).

[1] For the purpose of this study, fuel flammability is defined as the ease by which part or all of a fuel complex is ignited. This determines whether a fire will spread through a stand as a surface or crown fire and subsequently, the level of exposure to the gradient wind, the rate and relative amount of fuel consumption, and in turn, the rate of head fire spread and intensity.

[2] Fire hazard is the exposure or vulnerability to injury or loss due to the effect a fuel complex has on ease of ignition, fire behaviour and suppression difficulty (Luke and McArthur 1978).

Photo 1. Fires in manuka (*Leptospermum scoparium*) or kanuka (*Kunzea ericoides*) scrub typically burn with high intensities, and provide an example of High flammability species.

Selection of species for green breaks is difficult because plants are variable in form and composition. Genetic and physiological factors including provenance, age, and response to environmental influences (soil fertility, aspect, elevation, climate) contribute to this variability.

Published lists of species with high and low flammability exist (e.g., Evans 1983, Moore 1991, Hutt City Council 1996), but some of the information available is limited and can be misleading. Rigorous scientific assessment of the flammability of species is likely to be costly and time consuming, making the development of comprehensive lists difficult. For example, lists based on an estimate of green leaf flammability will not indicate how a species will respond to fire in drought conditions and is likely to ignore features of the whole fuel complex that contribute to flammability (e.g., the proportion of dead material, the arrangement of fine fuels). Assessment based on the knowledge and experience of fire managers is likely to be subjective (i.e., influenced by personal opinion, infrequent observation and sometimes inaccurate recall). However, fire managers do possess a wide range of valuable and practically useful knowledge that can be quickly and cheaply accessed. Wilson (1992, 1993) has used interpretations of fire manager experience in the production of photo guides relating scrub and bark fuels to fire hazard in Australian eucalypt forests.

An ideal flammability guide would combine the best elements of systematic scientific approach with the best elements of a fire manager assessment and would remain open to further

incorporation of field observations and rigorous scientific testing. This report describes the compilation of a ranked list of New Zealand native tree and shrub species derived from scientific examination of fire manager assessments of relative flammability. In doing so, it outlines the methodology used to produce the species flammability list contained in the brochure *Flammability of Native Plant Species: a guide to reducing fire hazard around your home* previously released by the Forest and Rural Fire Research Programme (NZ Fire Research 2000). The intention of this research was to provide a state-of-our-knowledge summary of the flammability of native New Zealand plant species in the form of an interim guide that can be updated as more information becomes available.

Methodology

An initial questionnaire listing 25 species was sent to 250 fire managers throughout New Zealand. The mailing list was compiled from the National Rural Fire Authority Rural Fire Management Directory and the membership roll of the Forest and Rural Fire Association of New Zealand. Ex-New Zealand Forest Service personnel who had been involved in many land clearing burns were also asked to respond. The species list was compiled from results of two previous surveys identifying species that do not easily carry fire (Evans 1983) and those that suppress or replace other vegetation with a higher fire risk (Moore 1991). In total, 59 responses were received. This survey was used to identify additional species that warranted assessment. A second questionnaire listing 25 species was sent out to the 59 original respondents, of whom 36 replied. In both surveys, most respondents categorised at least 75 % of the species, but some categorised as few as 8%.

In both surveys, respondents were asked to classify species on the basis of observations during or after burns and wildfires. The criteria were as follows:

- *High flammability*: burns readily in Low to Moderate fire danger conditions.
- *Moderate flammability*: partially ignites in Moderate conditions and burns readily in High to Very High fire danger conditions.
- *Low flammability*: partially ignites in High to Very High fire danger conditions and burns readily in Extreme conditions.
- *Not flammable*: will not burn even under Extreme fire danger conditions.

Respondents were asked to isolate species from the vegetation communities in which they commonly grow, and to try to remember individual species being burnt by a head fire, or remaining after a high intensity burn-off. The fire danger conditions were based on the Forest Fire Danger Class Criteria (Alexander 1994), because this has been the forest fire danger rating and fire management decision support system used in New Zealand since 1980/81 (valentine 1978, Fogarty *et al*. 1998).

Sixteen of the respondents found that the flammability classes where too broad and often used composite classes such as Low/Moderate. To adequately account for the variation of the responses for each species and the numerous comments received, 7 flammability classes were needed to define species flammability. The following criteria were used to categorise species according to the revised flammability classes:

- *Not-flammable*: greater than or equal to 75% of all responses in the Not-flammable category.

- *Not-flammable/Low*: greater than or equal to 50% but less than 75% in Not-flammable category, and greater than or equal to 75% in Not-flammable and Low categories.
- *Low*: greater than or equal to 75% in Not-flammable and Low categories.
- *Low/Moderate*: greater than or equal to 50% but less than 75% in the Not-flammable and Low categories, and greater than or equal to 75% in Not-flammable, Low and Moderate categories.
- *Moderate*: greater than or equal to 75% in Not-flammable, Low and Moderate categories.
- *Moderate/High*: greater than or equal to 50% but less than 75% in the Not-flammable, Low and Moderate categories and greater than or equal to 75% in the Not-flammable, Low, Moderate and High categories
- *High*: greater than or equal to 75% in the Not-flammable, Low, Moderate and High categories.

These selection criteria were applied starting from Not-flammable criteria and ending with High flammability criteria (i.e., each species was initially tested against the Not-flammable criteria, then the Not-flammable/Low criteria and so on). The minimum acceptable number of responses per species set for inclusion in the study was 14. On this basis, 8 species had to be omitted from the final assessment. For each of the remaining 42 species, frequency of response to each flammability category was determined from a scoring system in which 0 = Not-flammable, 1 = Low flammability, 2 = Moderate flammability, and 3 = High flammability.

When species were ranked using the average flammability score, they formed a continuum, with few clear divisions between groups of species. To test whether the revised flammability classes could be regarded as statistically robust groupings, the Least Significant Difference (LSD) (Snedecor and Cochran 1972) value was calculated using the species scores. Where the difference in the weighted score of two species exceeds an LSD value of 0.37, the separation between them was significantly different at the 95% level of confidence. The calculated LSD value was used to refine the boundaries of the classes in borderline cases. The range of scores within each of the final classes was approximately equal to the LSD range.

Results

Figure 1 shows the mean score for each species, boundaries of the revised flammability classes, the LSD range boundaries for flammability scoring and the final class boundaries. In general, the flammability classes were close to the boundaries assigned using the LSD range. Two species that were initially borderline were re-classified so that the final classes corresponded better with the LSD boundaries. These were:

- ti kouka/cabbage tree (*Cordyline australis*), which was transferred from the Moderate to the Low/Moderate flammability class; and
- kanuka (*Kunzea ericoides*) which was transferred from the Moderate/High to the High flammability class.

The status of *Carpodetus serratus* was reviewed because its flammability score was close to the LSD boundary. It was decided that the Low flammability rating should be retained because 12 out of 16 people had given it a Low flammability rating.

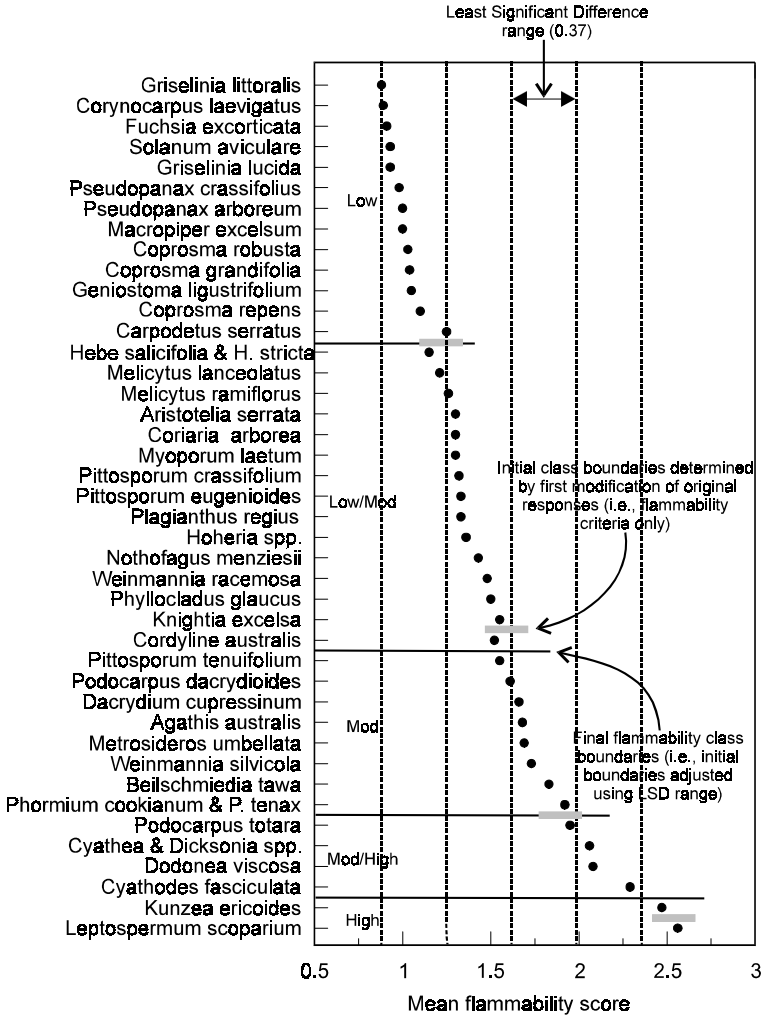

Figure 1. Determination of final flammability classes for 42 native New Zealand shrubs and trees.

Ranking by species score and final classification compared favourably. All species in each flammability class were contiguous in the rankings (for example, the Low flammability species ranked from 1 to 14, and no Low/Moderate species were interspersed among them). Most importantly, the boundaries assigned to the revised set of flammability classes, and those of the LSD ranges were found to be in close proximity, with re-classification required for only 2 species that had been regarded as borderline. Many respondents provided reasons for placing species in a particular flammability class and commented on flammability changes with age and situation. Using these comments and the final classification, flammability classes used to describe the species can be interpreted as follows:

- *Not-flammable*: dense stands will not burn, even in Extreme forest fire danger conditions. Suitable for green breaks or defensible space[3].
- *Not-flammable/Low flammability*: dense stands will partially burn in Extreme forest fire danger conditions, especially during drought. Suitable for green breaks or defensible space, but when in the immediate vicinity of structures, a distance greater than 3 m between crowns[4] is needed to reduce continuity and prevent crown fires under Extreme fire danger conditions.

[3] *Defensible space* is a low fuel or low fire hazard area around a house or other structure, that allows heat and embers from a wildfire to dissipate before they reach the structure (see Figure 2).

[4] As a rule of thumb, crown cover should be reduced to less than 35% with a minimum of 3 m (10 feet) of open space between crowns (Dennis 1983, Schmidt and Wakimoto 1988).

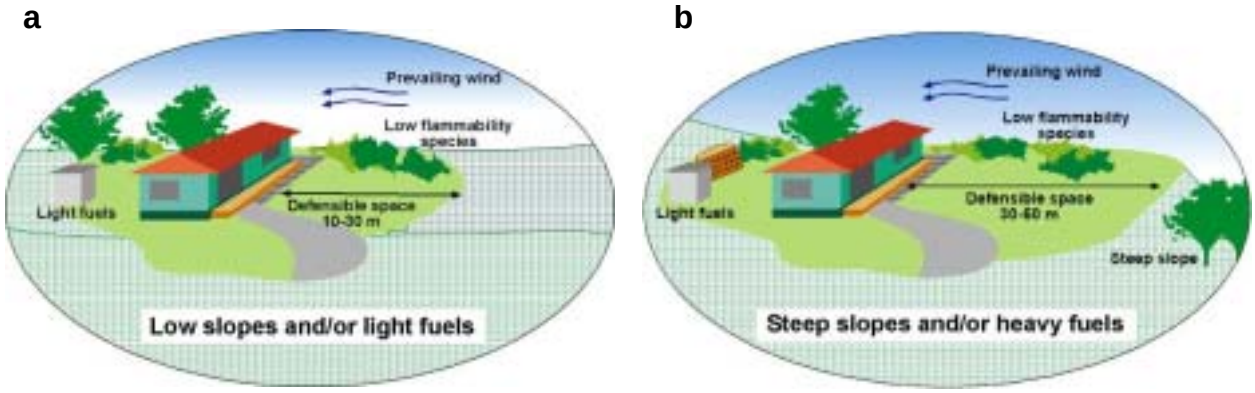

Figure 2. Defensible space requirements around a house in (**a**) low slopes and/or light fuels, and (**b**) steep slopes and/or heavy fuels.

- *Low flammability*: dense stands established as green breaks on moist or fertile sites will usually reduce a crown fire in adjacent forest or scrub to a surface fire under High to Very High forest fire danger conditions, but will burn readily in Extreme conditions. Suitable for green breaks or defensible space, but when in the immediate vicinity of structures, a distance greater than 3 m between crowns is needed to reduce continuity and prevent crown fires under Extreme forest fire danger conditions.
- *Low/Moderate flammability*: dense stands will burn readily in Very High to Extreme forest fire danger conditions especially on dry and/or infertile sites. Surface fires will be sustained in Moderate to High fire danger conditions. Not recommended for green breaks. If present in defensible space, elevated dead material and litter should be removed regularly. Crowns should be more than 4 m apart and a minimum of 10 m from any structure.
- *Moderate flammability*: dense stands will partially ignite under Moderate forest fire danger conditions, and burn readily in High to Very High fire danger conditions. Species may have flammable green foliage, or produce heavy accumulations of litter or elevated dead material. Not recommended for green breaks or defensible space.
- *Moderate/High flammability*: dense stands burn readily in Moderate to High forest fire danger conditions, and partially ignite in Moderate conditions. Species may have flammable green foliage, or produce heavy accumulations of litter or elevated dead material. Not recommended for green breaks or defensible space.
- *High flammability*: burn readily at Low to Moderate forest fire danger conditions. Not recommended for green breaks or defensible space.

The name(s), relative ranking, class and any additional comments for each species are presented alphabetically and in the order of lowest to highest flammability in Appendices 1 and 2 respectively. Comments by respondents are summarised in Appendix 2.

Photos 2-5, clockwise from top left. Lancewood (*Pseudopanax crassifolius*) is a Low flammability species which will only carry fire if planted on dry, infertile sites or amongst other more flammable species; flaxes (*Phormium* spp.) are classified as having Moderate/High flammability which increases with age due to the build up of dead material, and have been observed to "explode" when burnt; the cabbage tree (*Cordyline australis*) is a Moderate flammability species which increases with age due to retention of elevated dead material; tree ferns (*Cyathea* and *Dicksonia* spp.) are Moderate/High flammability due to hanging dead fronds and accumulations of flammable litter.

Discussion

Ranking and classification of species flammability provides fire managers and home owners with a list of species that can be used to reduce the risk of injury or loss by wildfire. The flammability of species in Appendix 1 is considered to range between Low and High. None of them were classified as Not-flammable or Low/Not-flammable.

Only species in the Low category are recommended for planting in green breaks or defensible space. Vegetation types normally considered to be impervious to fire will often burn with higher intensity under drought or other critical fire weather conditions (Kiil and Grigel 1969). It is expected that use of species in the Low flammability class will reduce, but not eliminate the probability of fire spread in Extreme fire danger conditions.

Species in the Low/Moderate flammability class are not recommended for use in green breaks, but can be planted in defensible space provided that spacing is adequate and any debris is removed regularly. They should not be planted within 10 m of a house or structure. Species in the Moderate and Moderate/High flammability categories are not recommended for use in green breaks or defensible space. The flammability of many of the species in these classes often increases to High with age.

Many respondents remarked that flammability is increased by unsuitable sites, mixture with other more flammable species, and sparse planting. Species growing outside their preferred environmental range may have different characteristics that influence flammability (e.g., lower foliar moisture content and increase litter accumulation). The suitability of a species for a given site needs to be determined from one of the many bushland revegetation manuals available (e.g., Pollock 1986, Porteous 1993). Selection of trees and shrubs for planting in areas adjacent to flammable vegetation will require particular care. Scrub dominated by gorse (*Ulex europaeus*) or manuka (*Leptospermum scoparium*) (see Photo 1) has High flammability and could generate a fire intensity capable of overriding the normal flammability classification of nearby vegetation. This effect is likely to occur along the edges of green breaks.

The final classification cannot be regarded as definitive in all situations since the initial assessment by the respondents contained considerable variability, reflecting a wide range of knowledge and experience. For example, although some species in the Low flammability class (i.e., *Fuchsia excorticata* and *Pseudopanax crassifolius*) were considered by a relatively small proportion of respondents to have Moderate rather than Low flammability, the final classification conforms with the majority of experience. The flammability classes undoubtedly require further testing and refinement in the light of future observations made at experimental, prescribed and accidental fires.

The species listed in the guide include those published previously and others recommended by respondents to the first survey. It is by no means extensive and the following commonly planted species should receive priority in any future upgrade of the guide:

- pohutukawa (*Metrosideros excelsa*).
- pukatea (*Laurelia novae-zelandiae*).
- Olearia spp.
- puriri (*Vitex lucens*).
- kowhai (*Sophora tetraptera*).
- pigeonwood (*Hedycarya arborea*).
- tanekaha/celery pine (*Phyllocladus trichomanoides*).
- red beech/tawhairaunui (*Nothofagus fusca*).

Toetoe (*Cortaderia* spp.), although neither trees nor shrubs, also warrant inclusion because of widespread use in shelterbelts.

Conclusion

The flammability of New Zealand native vegetation is perceived by fire managers to vary between species, and also within species when environmental differences are taken into account. Some species are considered to be suitable for green breaks and defensible space; others are not recommended near forests, buildings or areas of highly flammable scrub.

A list is presented as the current "state-of-our-knowledge" summary of information about the flammability of some New Zealand native shrub and tree species. It requires improvement based on testing, observation and comparison, but in the meantime can be used for fire management and landscape design purposes with some degree of confidence.

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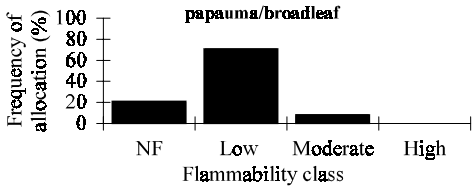
Appendices

Appendix 1. Flammability guide for 42 native New Zealand trees and shrubs – alphabetical list of species with flammability class.

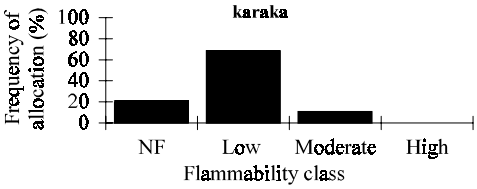
Botanical Name	Maori/European Name	Flammability class
Agathis australis	kauri	Moderate
Aristotelia serrata	makomako/wineberry	Low/Moderate
Beilschmiedia tawa	tawa	Moderate
Carpodetus serratus	putaputaweta	Low
Coprosma grandifolia	raurekau, kanono	Low
Coprosma repens	taupata	Low
Coprosma robusta	karamu	Low
Cordyline australis	ti kouka/cabbage tree	Low/Moderate
Coriaria arborea	tutu	Low/Moderate
Corynocarpus laevigatus	karaka	Low
Cyathea and *Dicksonia* spp.	tree ferns	Moderate/High
Cyathodes fasciculata	mingimingi	Moderate/High
Dacrydium cupressinum	rimu	Moderate
Dodonea viscosa	ake ake	Moderate/High
Fuchsia excorticata	kotukutuku/fuchsia	Low
Geniostoma ligustrifolium	hangehange	Low
Griselinia littoralis	papauma/broadleaf	Low
Griselinia lucida	puka	Low
Hebe salicifolia and *H. stricta*	koromiko	Low/Moderate
Hoheria spp.	houhere/hoheria/lacebark	Low/Moderate
Knightia excelsa	rewarewa	Low/Moderate
Kunzea ericoides	kanuka	High
Leptospermum scoparium	manuka	High
Macropiper excelsum	kawakawa/pepper tree	Low
Melicytus lanceolatus	mahoe wao	Low/Moderate
Melicytus ramiflorus	mahoe/whiteywood	Low/Moderate
Metrosideros umbellata	southern rata	Moderate
Myoporum laetum	ngaio	Low/Moderate
Nothofagus menziesii	tawhai/silver beech	Low/Moderate
Phormium cookianum and *P. tenax*	flax/harakeke	Moderate/High
Phyllocladus glaucus	toatoa	Low/Moderate
Pittosporum crassifolium	karo	Low/Moderate
Pittosporum eugenioides	tarata/lemonwood	Low/Moderate
Pittosporum tenuifolium	kohuhu	Moderate
Plagianthus regius	manatu/ribbonwood	Low/Moderate
Podocarpus dacrydioides	kahikatea/white pine	Moderate
Podocarpus totara	totara	Moderate/High
Psuedopanax arboreum	five finger	Low
Pseudopanax crassifolius	horoeke/lancewood	Low
Solanum aviculare	poroporo	Low
Weinmannia racemosa	kamahi	Low/Moderate
Weinmannia silvicola	tawhero/towhai	Moderate

Appendix 2. Flammability guide for 42 native New Zealand trees and shrubs – list of species ranked by flammability class, with summaries of factors relating to their flammability characteristics. Graphs show frequency of allocation to flammability class (%) by respondents.

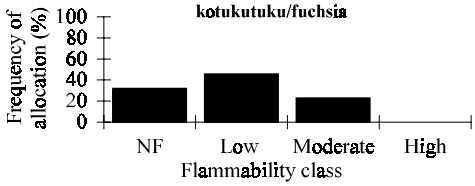
Species Name: *Griselinia littoralis*
Relative ranking: 1
Flammability class: Low
Comments: Broad, succulent leaves do not ignite easily. Flaky bark may burn and provide embers for spot fires under Extreme fire danger conditions.



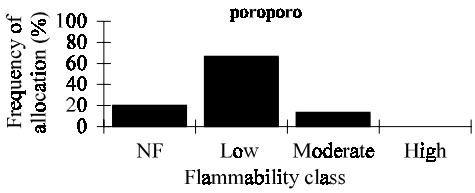
Species Name: *Corynocarpus laevigatus*
Relative ranking: 2
Flammability class: Low
Comments: None received.



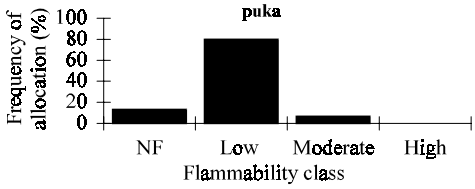
Species Name: *Fuchsia excorticata*
Relative ranking: 3
Flammability class: Low
Comments: Flaky bark is flammable. Deciduous. Litter may need to be removed in spring, but the surface litter is often damp and difficult to ignite on favourable sites.



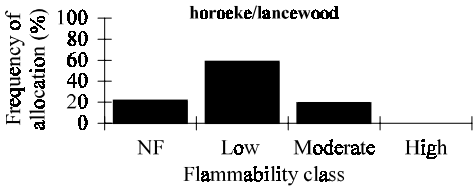
Species Name: *Solanum aviculare*
Relative ranking: 4
Flammability class: Low
Comments: None received.



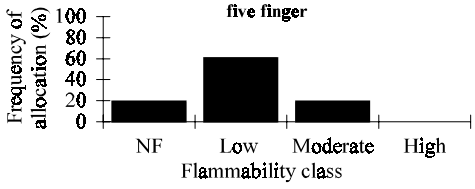
Species Name: *Griselinia lucida*
Relative ranking: 5
Flammability class: Low
Comments: Broad, succulent leaves do not ignite easily. Flaky bark may burn and provide embers for spot fires under Extreme fire danger conditions.



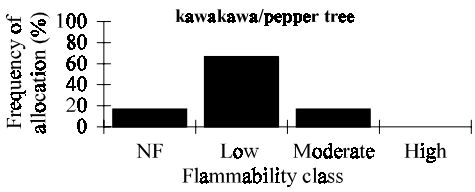
Species Name: *Pseudopanax crassifolius*
Relative ranking: 6
Flammability class: Low
Comments: Will carry a fire if planted on dry infertile sites, or in mixed scrub.



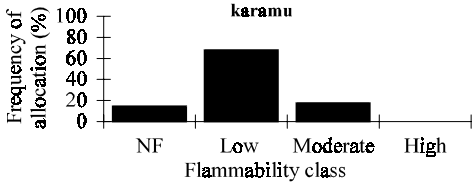
Species Name: *Pseudopanax arboreum*
Relative ranking: 7
Flammability class: Low
Comments: None received.



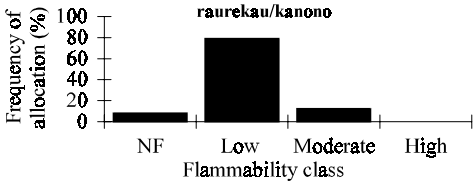
Species Name: *Macropiper excelsum*
Relative ranking: 8
Flammability class: Low
Comments: None received.



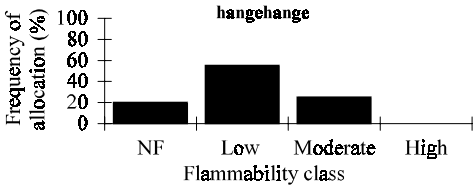
Species Name: *Coprosma robusta*
Relative ranking: 9
Flammability class: Low
Comments: Can produce large amounts of surface litter.



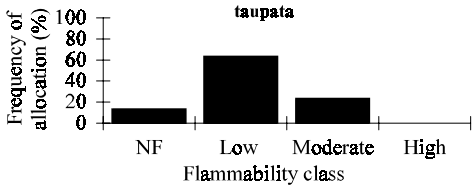
Species Name: *Coprosma grandifolia*
Relative ranking: 10
Flammability class: Low
Comments: None received.



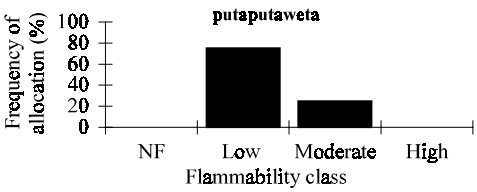
Species Name: *Geniostoma ligustrifolium*
Relative ranking: 11
Flammability class: Low
Comments: None received.



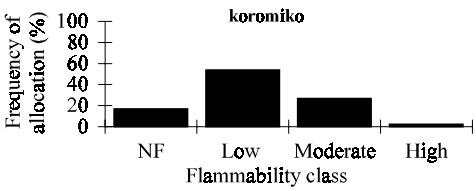
Species Name: *Coprosma repens*
Relative ranking: 12
Flammability class: Low
Comments: None received.



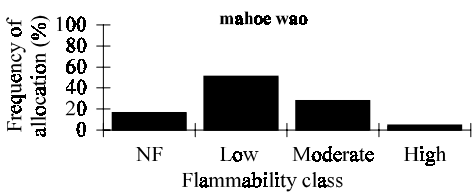
Species Name: *Carpodetus serratus*
Relative ranking: 13
Flammability class: Low
Comments: None received.



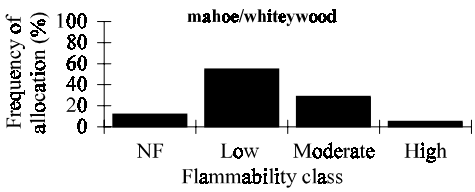
Species Name: *Hebe salicifolia* and *H. stricta.*
Relative ranking: 14
Flammability class: Low/Moderate
Comments: Must be planted densely to maintain moisture in surface litter layers. Will burn readily at Moderate to High fire danger conditions on dry sites or when sparsely mixed with more flammable scrub.



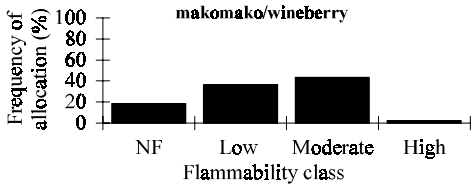
Species Name: *Melicytus lanceolatus*
Relative ranking: 15
Flammability class: Low/Moderate
Comments: None received.



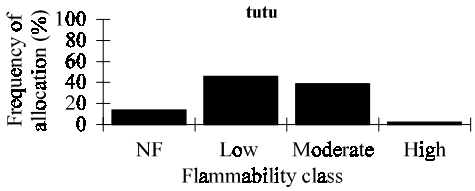
Species Name: *Melicytus ramiflorus*
Relative ranking: 16
Flammability class: Low/Moderate
Comments: Becomes more flammable with age.



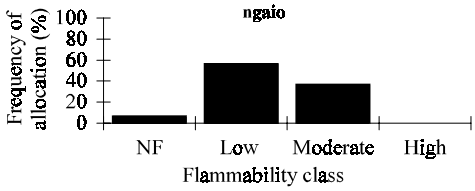
Species Name: *Aristotelia serrata*
Relative ranking: 17
Flammability class: Low/Moderate
Comments: Produces elevated dead material that should be removed annually near homes and structures. Partially deciduous in colder climates. Litter may need to be removed in spring.



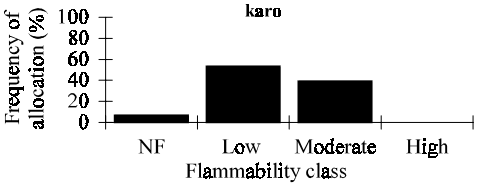
Species Name: *Coriaria arborea*
Relative ranking: 18
Flammability class: Low/Moderate
Comments: Surface litter accumulation can be heavy. Old plants may have Moderate to High flammability.



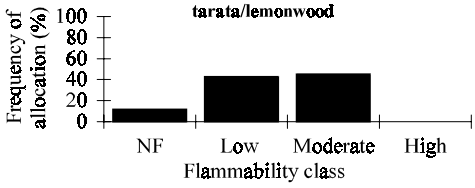
Species Name: *Myoporum laetum*
Relative ranking: 19
Flammability class: Low/Moderate
Comments: None received.



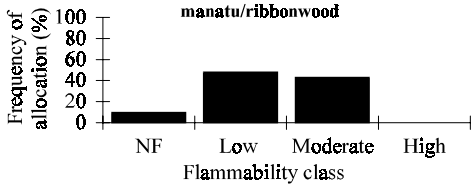
Species Name: *Pittosporum crassifolium*
Relative ranking: 20
Flammability class: Low/Moderate
Comments: None received.



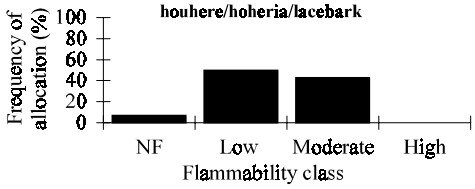
Species Name: *Pittosporum eugenioides*
Relative ranking: 21
Flammability class: Low/Moderate
Comments: Old plants may have Moderate flammability.



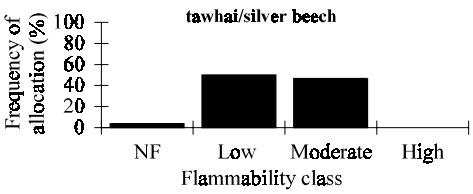
Species Name: *Plagianthus regius*
Relative ranking: 22
Flammability class: Low/Moderate
Comments: Deciduous. Litter may need to be removed in spring.



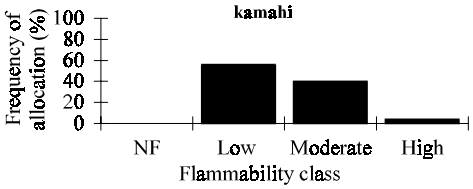
Species Name: *Hoheria* spp.
Relative ranking: 23
Flammability class: Low/Moderate
Comments: None received.



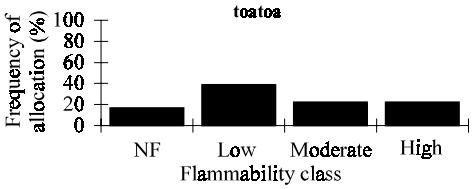
Species Name: *Nothofagus menziesii*
Relative ranking: 24
Flammability class: Low/Moderate
Comments: More flammable when immature. Mature trees often have dead branches that ignite easily and provide embers for spot fires.



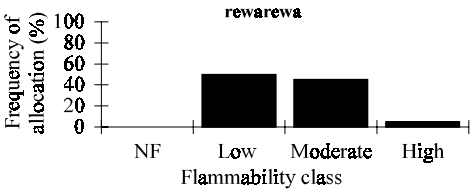
Species Name: *Weinmannia racemosa*
Relative ranking: 25
Flammability class: Low/Moderate
Comments: Mature stands may be less flammable.



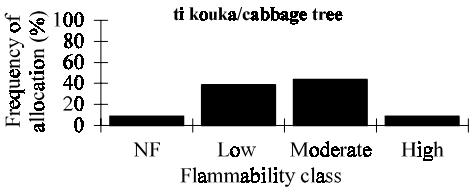
Species Name: *Phyllocladus glaucus*
Relative ranking: 26
Flammability class: Low/Moderate
Comments: None received.



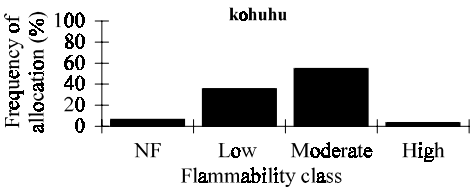
Species Name: *Knightia excelsa*
Relative ranking: 27
Flammability class: Low/Moderate
Comments: Large quantities of litter (leaves and twigs) often accumulate. Near houses or in "green breaks", this material must be removed.



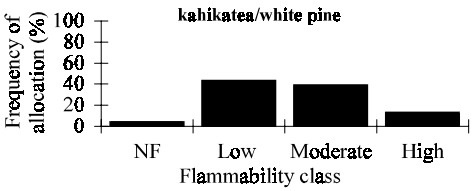
Species Name: *Cordyline australis*
Relative ranking: 28
Flammability class: Low/Moderate
Comments: Flammability increases with age due to elevated dead material. Old trees have High flammability. Near houses or in "green breaks", flammable material must be removed.



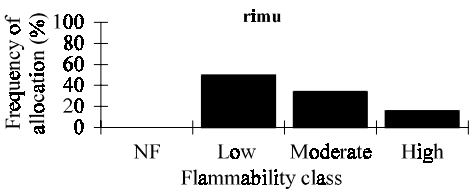
Species Name: *Pittosporum tenuifolium*
Relative ranking: 29
Flammability class: Moderate
Comments: None received.



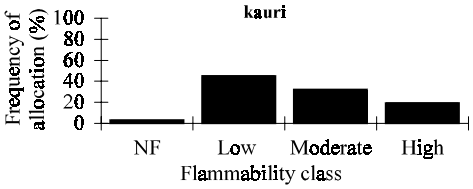
Species Name: *Podocarpus dacrydioides*
Relative ranking: 30
Flammability class: Moderate
Comments: Flammability may decrease with age. Mature trees often have dead branches that ignite easily and provide embers for spot fires.



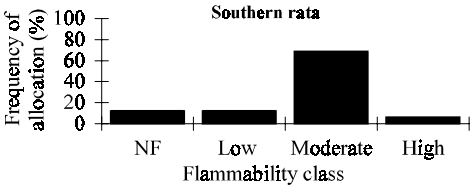
Species Name: *Dacrydium cupressinum*
Relative ranking: 31
Flammability class: Moderate
Comments: Flammability changes with age, and may be Moderate/High when very young; Low/Moderate when mature. Dead stem and branch material in overmature trees is susceptible to ignition from airborne embers.



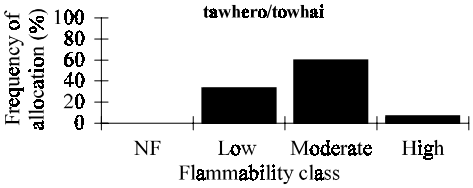
Species Name: *Agathis australis*
Relative ranking: 32
Flammability class: Moderate
Comments: None received.



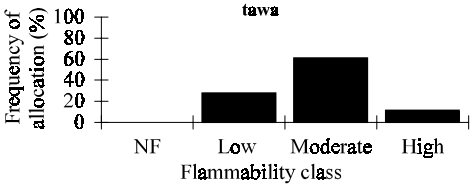
Species Name: *Metrosideros umbellata*
Relative ranking: 33
Flammability class: Moderate
Comments: None received.



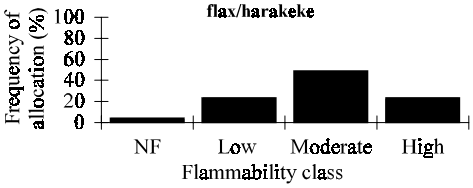
Species Name: *Weinmannia silvicola*
Relative ranking: 34
Flammability class: Moderate
Comments: None received.



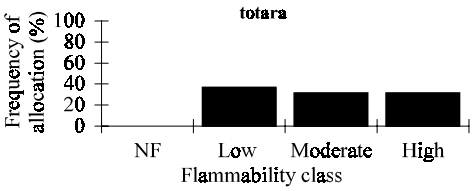
Species Name: *Beilschmiedia tawa*
Relative ranking: 35
Flammability class: Moderate
Comments: Large quantities of litter often accumulate. Near houses or in "green breaks", this material must be removed.



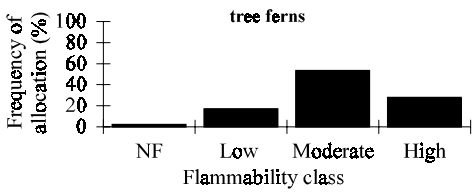
Species Name: *Phormium cookianum* and *P. tenax*
Relative ranking: 36
Flammability class: Moderate/High
Comments: Becomes more flammable with age due to build up of dead material. Has been observed to "explode" when burnt in Very High and Extreme fire danger conditions. Flammability increases in drought conditions.



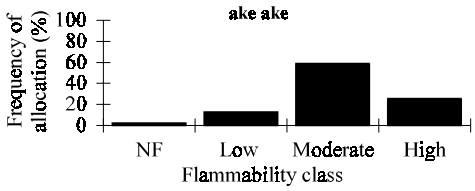
Species Name: *Podocarpus totara*
Relative ranking: 37
Flammability class: Moderate/High
Comments: Flammability changes with age, and may be Moderate/High when young; Low/Moderate when mature. Dead stem and branch material in overmature trees is susceptible to ignition from airborne embers.



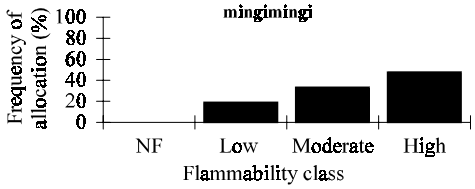
Species Name: *Cyathea* and *Dicksonia* spp.
Relative ranking: 38
Flammability class: Moderate/High
Comments: Carries elevated dead material that assists fire spread, and increases fire intensity.



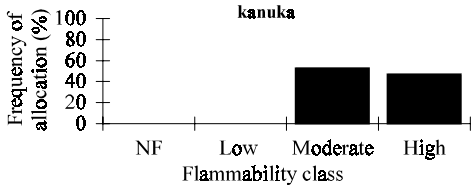
Species Name: *Dodonea viscosa*
Relative ranking: 39
Flammability class: Moderate/High
Comments: Flaky bark and flammable foliage.



Species Name: *Cyathodes fasciculata*
Relative ranking: 40
Flammability class: Moderate/High
Comments: None received.



Species Name: *Kunzea ericoides*
Relative ranking: 41
Flammability class: High
Comments: Flammability changes from High when young to Moderate when mature. Mature stands with a flammable understorey that can provide a "ladder" for fire spread into the crowns have High flammability.



Species Name: *Leptospermum scoparium*
Relative ranking: 42
Flammability class: High
Comments: Flammability changes from High when young to Moderate when older.