APPENDIX 1

Guidelines for Completing the Invasiveness and Impacts Criteria Questionnaire

Each attribute would be ranked on a qualitative point scale. Non-parametric rank analysis will then be applied to the responses from each of the panel members to obtain a weed's ranking for the invasiveness and impacts criterion.

Invasiveness

What is the weed's ability to establish amongst existing vegetation?

For certain weeds, existing plants can create an unsuitable environment for germination[1]. In addition, existing plants can kill young weeds by competing for light, water, nutrients, and/or space. A weed's establishment ability will be poor if it mainly germinates and establishes following disturbance of the existing plants (e.g. by fire, flood, cultivation, drought, or overgrazing). Strong establishment ability could be expected from weeds that have large seeds and/or large vegetative propagules (e.g. bulbs, tubers, rhizomes, corms, abscission of daughter plants), which provide more reserves to aid seedling/juvenile vigour. Establishment ability is also favoured in those weeds that can tolerate or avoid competitive stresses (e.g. by rapid root growth, fixing own nitrogen, or rapid vertical shoot growth). Examples of weeds with strong establishment ability include wild radish, lantana, woody legumes, bridal creeper and alligator weed.

What is the tolerance of seedlings/juveniles of the weed to routine weed control practices?

The routine weed control practices, which usually target a range of weed species, may include the use of herbicides, cultivation, cutting/slashing, grazing, fire, and maintaining the competitiveness of desirable vegetation (e.g. fertilising, pest/disease control). Examples of weeds with high tolerance to weed control practices are alligator weed, skeleton weed, silverleaf nightshade, sicklepod, groundsel bush, rubber vine and perennial grasses.

How competitive is the weed when it is established?

What attributes does the weed have to maximise its uptake of resources (light, water, nutrients, space), at the expense of other plants? Attributes for strong competitiveness include a dense leaf canopy (e.g. blue thunbergia, Paterson's curse, salvinia), extensive root system (e.g. bracken fern, serrated tussock, hymenachne), thick rhizome mat (e.g. bridal creeper), and/or release of plant toxins (e.g. tamarix).

What is the likelihood of long-distance dispersal (>1 km) by water, flying birds, wild terrestrial vertebrates, wind?

Germination is considered here as growth from seeds, spores, or vegetative propagules.

For dispersal by water, consideration is given to whether the propagules are buoyant, if the weed is typically located in or near to moving water, and the frequency of floods. Examples of weeds commonly dispersed long-distance by water include para grass, floating aquatics, rubber vine, mimosa, and seed-producing willows.

Dispersal by flying birds includes native and exotic birds present where the weed is located in Australia. Consideration is given to whether the propagules are eaten and remain viable after defecation or regurgitation, likely to attach to feathers due to hooks, barbs or sticky substances. Examples of weeds commonly dispersed long-distance by birds include boneseed/bitou bush, broad-leaved pepper tree, olives and camphor laurel.

Wild terrestrial vertebrates includes native and exotic terrestrial mammals, birds and reptiles, whose movements are not contained by humans. Consideration is given to dispersal of propagules following ingestion and by external attachment. Examples of weeds commonly dispersed long-distance by wild terrestrial vertebrates include blackberry, horehound, spiny burr-grass, Ward's weed, hyptis, and pond apple.

Research has shown that the majority of wind-dispersed propagules land within close proximity to the parent plant. Dispersal beyond 1 km is not common. Occasional long-distance dispersal is likely for tall plants which produce light seeds with wings, plumes or hairs, and which are typically subject to strong winds. Occasional long-distance dispersal is also likely for small plants which dehisce after fruiting, and roll across sparsely-vegetated ground. Examples of weeds occasionally dispersed long-distance by wind include kochia, African turnip weed, Siam weed, seed-producing willows, and serrated tussock.

What is the likelihood of long-distance dispersal (>1 km) by accidental and/or intentional human movement, human transport, produce contaminant, domestic terrestrial vertebrates?

Dispersal by human transport applies to weeds whose propagules are likely to be accidentally transported by footwear, clothing or vehicles (including farm machinery and boats). Weeds with small propagules, or with propagules which are hooked, barbed, or sticky, and which grow in heavily trafficked areas, are more likely to be dispersed by this means. Examples of weeds commonly dispersed long-distance by accidental human transport include calotrope, salvinia, innocent weed, horehound and serrated tussock.

Intentional human transport includes plant species historically planted for use in agriculture, forestry, horticulture, amenity, windbreaks and/or soil stabilisation? Examples of weeds which have historically been commonly planted include willows, alligator weed, annual ryegrass, Parkinsonia, blackberry, bitou bush, Mission grass, and gorse.

Produce contamination occurs in crop seed, pasture seed, hay, soil, gravel, fertilisers, manures, and/or mulch. Examples of weeds commonly dispersed long-distance as a produce contaminant include wild radish, yellow burrweed, Paterson's curse, soursob, skeleton weed and parthenium weed.

Domestic terrestrial vertebrates are mostly sheep, cattle and horses used for agricultural or recreational purposes. Dispersal of propagules follows ingestion and by external attachment. Examples of weeds commonly dispersed long-distance by domestic terrestrial vertebrates include silverleaf nightshade, barley grass, horehound, prickly acacia, Noogoora burr and serrated tussock.

Impacts

How long does an infestation of the weed last?

Long-term impacts are more likely where the weed species is long-lived, can regenerate underneath its own canopy, is not replaced by other plant species in the process of succession, and/or is not controlled by the land-user's current (and best practice) weed management system.

What percentage reduction in the amount of desired vegetation is caused by the weed?

This is considered relative to adjacent, similar-aged vegetation, which is free of the weed species. Examples of weeds causing a major reduction in desired vegetation include Mimosa pigra, serrated tussock, water hyacinth, rice grass, rubber vine, and willows.

Does the weed limit the recruitment of desired vegetation?

Recruitment phases are the sowing of crop and pasture seeds, post-fire regeneration in native forestry and many natural ecosystems, planting of seedlings in perennial horticulture and plantation forestry, and seasonal germination of annuals and perennials in pastures and natural ecosystems. Consideration is given to the extent the weed prevents germination and/or causes the death of seedlings/juveniles in these recruitment phases. The weed may be an adult during these recruitment phases, or may be regenerating itself. Examples of weeds which have major limits on recruitment are Paterson's curse, Scotch broom, rubber vine, and watsonia.

Does the weed form thick infestations which physically limit the movement of humans, animals, vehicles or water?

Constraints on movement include slowing of stock mustering (e.g. mesquite), blockages of farm machinery at crop sowing and/or harvesting (e.g. skeleton weed), slowing of water flow in irrigation systems (e.g. alligator weed), interference with boat access (e.g. rice grass), interference with thinning operations in forestry (e.g. blackberry), preventing stock access to pasture and/or water (e.g. prickly acacia), and preventing animal access to nesting sites (e.g. African boxthorn).

Does the weed cause negative ecosystem changes?

Effects are more likely where a weed species substantially changes ecosystem structure, such as forming a new, dominant canopy.

Negative ecosystem changes include acidification (pine leaf litter, and senescence of dense mats of floating aquatic weeds), providing major food and/or habitat sources for feral animals (blackberries, olives, gorse, broad-leaved pepper tree and *Mimosa pigra*), causing a major reduction in food and/or habitat for native and/or domestic animals (tamarix, rubber vine, blue thunbergia, buffel grass, and *Spartina* spp.), having major effects on fire frequency, intensity and/or timing (perennial veldtgrass, buffel grass, mission grass, brooms and sweet pittosporum), microclimate changes such as changes in temperature, light and humidity at ground level (major effects on the microclimate are most likely where a weed forms a dense canopy above existing vegetation such as with rubber vine, willows, water hyacinth, bridal creeper), major detrimental effects on nutrient cycling such as the production of a physical barrier or toxic substances which limits the decomposition of litter by microfauna, and/or the subsequent incorporation of released nutrients into the soil (woody legumes in natural ecosystems both terrestrial and aquatic, and willows), increased soil and/or water salinity levels (tamarix and iceplant which have saline leaf litter), increased soil erosion or silting of waterways (willows and Spartina spp), or a substantial increase/decrease in total water use (alligator weed, willows and annual grasses).

Does the weed adversely affect the health of native and/or domestic animals due to physical injuries, poisoning or allergic reactions?

Weeds with major adverse animal health effects include fireweed, Paterson's curse, green cestrum, cape tulip, lantana, spiny emex and innocent weed.