Weeds in the Burdekin Rangelands: **Lifecycles**

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Life cycle of a weed

If a plant is to become a weed once it has been introduced, it must be able to complete its life cycle and spread in its new range. A weed's life cycle can be analysed in terms of life stages that are linked by key processes (Figure 1). While it is possible to draw general pictures of the life cycles of many weeds of the Burdekin Rangelands, comprehensive quantitative information is available for relatively few. There is enormous variation between species.

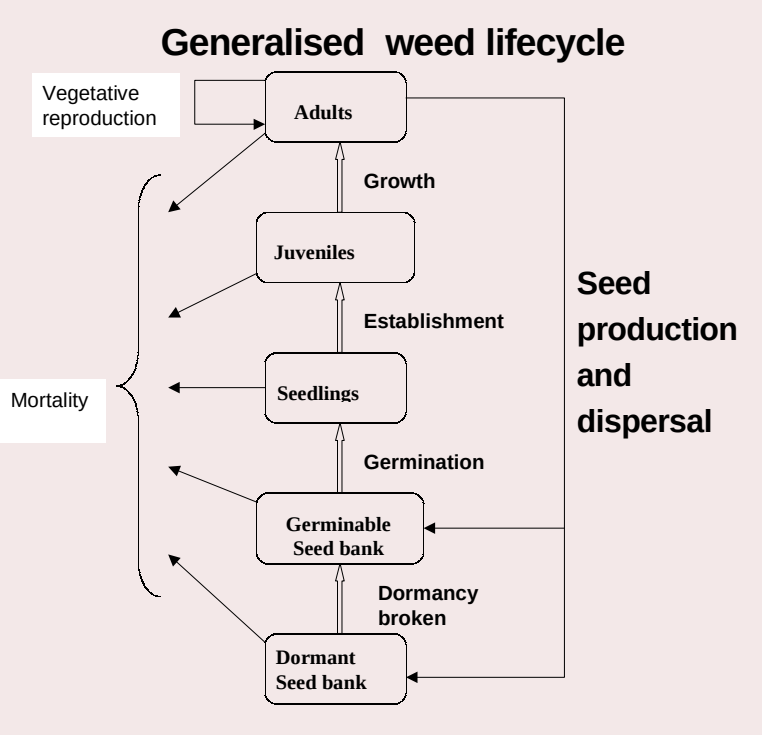


Figure 1 **Generalized weed lifecycle (from Campbell**

Weed reproduction & survival

Long-lived woody perennials

Woody perennial weeds, such as prickly acacia, mesquite (*Prosopis* spp.), chinee apple and rubber vine, live for many years. Some, like chinee apple, may reach ages of one hundred or more years. They may take up to several years to reach a size at which they are capable of producing seeds but, over their life span, they can produce many thousands of seeds. Mesquite, prickly acacia and chinee apple form persistent soil seed-banks, which even without replenishment may take several years to become depleted by death and germination. Most seeds of rubber vine, on the other hand, either germinate or decay within 12 months of being released from the parent plant.

The pattern of recruitment of new individuals into populations of long-lived perennials no doubt varies with the rainfall regime. The wet-dry annual cycle of rainfall in the Burdekin Rangelands dictates that most germination occurs between December and March but it is likely that germination can occur whenever soil moisture levels are adequate. At Lansdown, north-east of Charters Towers, germination of rubber vine has been observed after rain in August, January, February and March. The likelihood of germination will be greater in higher rainfall zones in the east of the region.

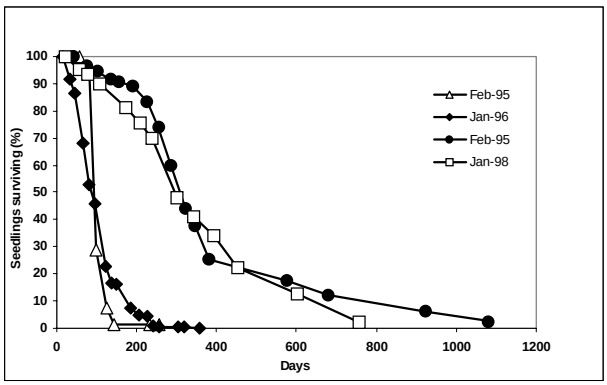
Regardless of the time of germination, most seedlings that emerge from the soil do not become established plants (Figure 2). The most critical time for them is the first dry season after germination. In at least some species, recruitment into the adult population is episodic, with massive recruitment occurring in exceptionally wet years or sequences of years. This phenomenon is likely to be more pronounced in zones of lower rainfall.

The long-lived woody perennials of the Burdekin Rangelands tend to reproduce sexually (via seeds) and not vegetatively. However, most exhibit some capacity to sprout following damage to the above-ground parts of the plant. The ways in which species may vary in their ability to sprout is illustrated by the different responses of chinee apple and rubber vine to fire. Most chinee apple sprout after a late dry-season fire, whereas a large proportion of rubber vine under 2 m high, and 50% of those over 2 m fail to do so (Figure 3).

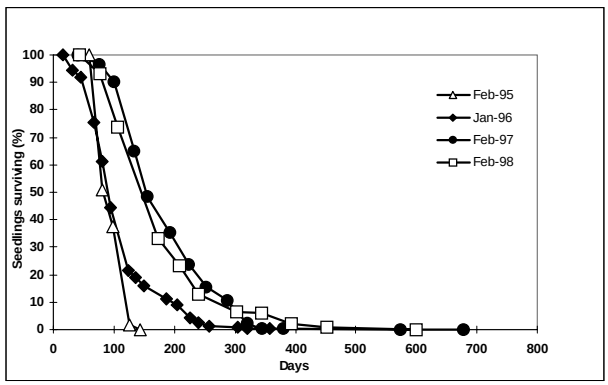
Other woody species that sprout from the base following damage to or removal of the above-ground part of the plant are parkinsonia, mesquite, prickly acacia, lantana and yellow oleander.

Perennial grasses

The exotic perennial grasses of the Burdekin Rangelands include both tussock and stoloniferous growth forms. Individual tussocks of species such as buffel grass and the rat's tail grasses (*Sporobolus indicus*, *S. jacquemontii*, *S. pyramidalis*) live for several years. Giant rat's tail grass, in particular, is a prolific seeder. Stoloniferous grasses such as Indian couch rely on both vegetative and seed reproduction. The soil seed-banks of perennial grasses are typically small and individual seeds are short-lived. There can be substantial numbers of seeds of Indian couch in the soil at any one time but these seed-banks are probably maintained by regular large inputs rather than by seeds being very long-lived.

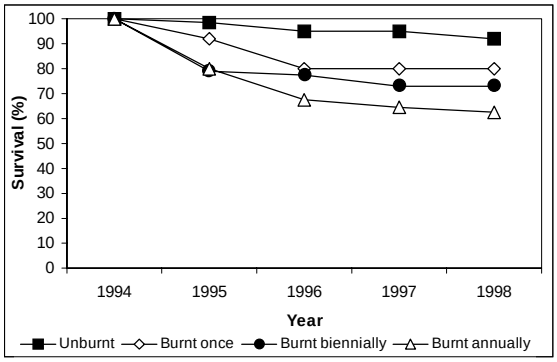


(a) chinee apple

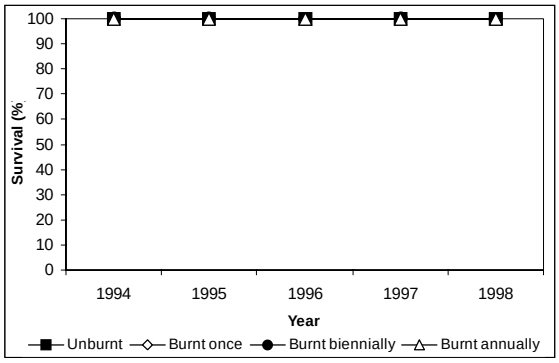


(b) rubber vine

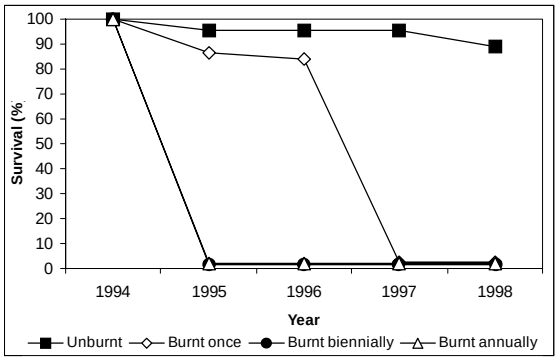
Figure 2 Most seedlings of (a) chinee apple and (b) rubber vine die within 12 months of germination (Grice and Whiteman, unpublished data).



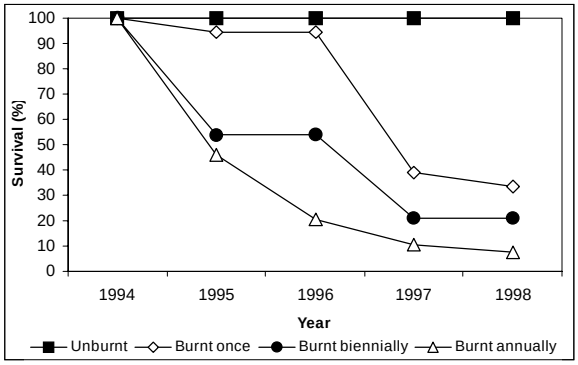
(a) small chinee apple (height < 1 m)



(b) large chinee apple (height > 2 m)



(c) small rubber vine (height < 1 m)



(d) large rubber vine (height > 2 m)

Figure 3 Percentages of chinee apple and rubber vine dying under four different fire regimes in the late dry season: a single fire (1996), four annual fires (1994, '95, '96, '97), two biennial fires (1994, '96) and unburnt (from Grice unpublished data).

Annuals

Little information is available on the population biology of most annual weeds found in the Burdekin Rangelands. There have been reasonably detailed studies of at least two species, parthenium (*Parthenium hysterophorus*) and noogoora burr (*Xanthium pungens*), though these studies have not taken place within the Burdekin Rangelands.

Parthenium is a threat not only because of its effects on pastures but also because of its impact on human health through the allergic reactions that it engenders. It seeds prolifically and seeds are readily dispersed on farm machinery and other motor vehicles. This allows its spread along roads and the disturbed nature of many roadsides facilitates its establishment there. It is also more inclined to proliferate in heavily grazed paddocks in which the perennial grasses have been depleted.

Dispersal of weeds

Dispersal is a key process contributing to any plant invasion. The weeds of the Burdekin Rangelands employ a wide variety of dispersal mechanisms.

Table 1 Dispersal mechanisms of some alien plants of the Burdekin Rangelands	
Method of dispersal	**Alien plant**
Wind-dispersed	Rubber vine; Buffel grass
Water-dispersed	Parkinsonia; Hymenachne; Giant rat's tail grass
Explosion of fruits	Castor oil plant
Following ingestion by animals	Prickly acacia; Chinee apple; Mesquite (*Prosopis* spp.); Harrisia cactus; Sicklepod; Lantana
Dispersal by attachment to animals	Khaki weed; Spiny head sida; Noogoora burr; Giant rat's tail grass
On motor vehicles/farm machinery	Giant rat's tail grass

Most propagules (the various ways in which are plant propagates including seeds,bulbs, runners and spores etc.) are dispersed either by wind, water or animals, though there are many variations on these basic mechanisms (Table 1). Some species have in-built mechanisms for catapulting their seeds away from the parent plant. Even in species that have special adaptations for dispersal, many seeds may fall directly to the ground and may remain close to the parent plant.

Animal-aided dispersal is important for several serious weeds of the Burdekin Rangelands. In some, seeds are dispersed when the fruits are consumed by animals and subsequently deposited after passage through its digestive tract. For example, chinee apple is dispersed following ingestion by cattle, feral pigs, wallabies (*Macropus agilis*), bustards and probably other birds (Grice 1996, 1998). Passage of seeds through an animal's digestive tract may increase the likelihood of germination. Seeds of another group of species are dispersed on the outsides of animals, their fruits having structures that enable them to attach to an animal's fur.

Wind can play a role in the dispersal of seeds of many species but some have specific adaptations for wind dispersal. The most obvious example from the Burdekin Rangelands is rubber vine whose seeds possess a tuft of fine hairs that enables the seeds to float on the wind.

Human activity contributes substantially to the dispersal of weeds. People transport seeds attached to their clothing. Large numbers of seeds can also be moved long distances on farm, mining or road maintenance machinery and other vehicles. Farm machinery, for instance, has played a major role in the long distance dispersal of parthenium (Navie et al. 1998). Transport of cattle is another means whereby human activity contributes to the dispersal of weeds (see box below).

Potential for long-distance dispersal of chinee apple during cattle transport

Large numbers of viable seeds of chinee apple are voided in the dung of cattle that have been feeding on chinee apple fruits. A sample of 58 dung pats yielded an average of 16 viable seeds per dung pat. Assuming that each beast produces 10 such dung pats before it has voided all seeds, a road train transporting 80 cattle would be transporting 16 x 10 x 80 = 12,800 viable seeds. This could initiate an infestation.

References

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Navie, S.C., McFadyen, R.E., Panetta, F.D., & Adkins, S.W., (1998), '*Parthenium hysterophorus L.Panetta*', F. D., Groves, R. H., & Shepherd, R. C. H., (eds), *The Biology of Australian Weeds*, Melbourne, R.G. and F.J. Richardson, p. 157–176.

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