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PEST SUPPRESSIVE LANDSCAPES FACT SHEET

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NORTHERN, SOUTHERN AND WESTERN REGIONS

PEST MANAGEMENT USING NATIVE VEGETATION

Native remnant vegetation can support beneficial predatory insects. Pest suppressive landscapes are those that have the right mix of habitats that support beneficial insects and allow them to move into crop fields, while discouraging the build-up of pest insect species.

KEY POINTS

- Both pests and beneficial insects (also known as beneficials) can be found in a range of habitats in grain cropping landscapes, throughout the year.
- Pests are more commonly found on exotic weeds than on native plants.
- Weedy pastures can provide habitat for pest populations.
- Stands of native vegetation offer both opportunities and risks for pest management. Native vegetation remnants in good condition (containing few weeds and with an intact understory) may reduce the number of pests and support beneficials, but can also harbour some crop pests.
- Generally, native vegetation remnants in the landscape mean that crop paddocks are in a better position to suppress pests throughout the season.

Introduction

Natural pest control is an important ecosystem service that directly benefits grain growers.

There is a strong interest in developing integrated pest management (IPM) on a large scale because pests are mobile. They do not recognise paddock or farm boundaries, and attempts at controlling them using field-based approaches often fail.

Evidence that some landscapes are less prone to invertebrate pest infestations than others suggests certain features of landscapes may be managed to create more pest suppressive landscapes.

Grain-growing landscapes

Grain-growing landscapes comprise a mosaic of different habitat patches, including:

- annual crops such as wheat, barley, canola, cotton, mungbeans and sorghum;
- a range of natural and improved pastures;
- fallow fields;
- degraded weedy areas along roadsides;
- riparian vegetation; and
- patches of remnant native vegetation.

The majority of insect species present in these landscapes, especially pests, are good at moving between these habitats and seeking out the resources they need, such as food and shelter for all or part of the year.

Ideally, pest suppressive landscapes will have the right mix of habitats that support beneficial insects and allow them to move into crop fields, but discourage the build-up of pests.

Pest Suppressive Landscapes project

One objective of the GRDC-funded Pest Suppressive Landscapes project was to understand which habitats harbour pests and support beneficials throughout the year.

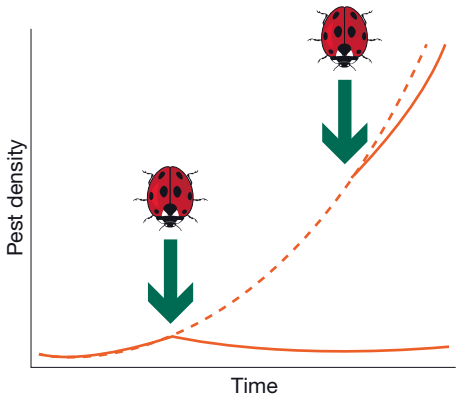
Key pests and beneficials were monitored monthly over two years in six landscapes (two in each region of Western Australia, New South Wales and Queensland). Crops, pastures, weeds and native plants were sampled for pests and beneficials.

Weedy pastures were found to play a key role throughout the year in providing habitat for pests, while native plants provided better habitat for predators. Grasses hosted both pests and predators.

Pest species included sucking pests (aphids, bugs, thrips) and chewing pests (grubs and earwigs). Beneficials included many types of predators (ladybirds, lacewings, spiders).

Weeds that are high risk in terms of supporting pests include nightshade, capeweed, fleabane, mustard, wild radish and grass weeds such as ryegrass.

FIGURE 1 A pest population in a crop field growing through time.



When beneficials arrive late, there is only a minor suppression in pest densities. However, when beneficials are added to the system early, pest suppression is more likely.

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Plants that are favoured by beneficial predators are native shrubs and eucalyptus trees.

Movement of pests and beneficials between habitats

Both pests and beneficials move into a cropping field at the start of the season.

They may potentially travel from nearby habitat patches of other crop types, pastures and remnant vegetation patches, or migrate over larger distances from inland Australia.

Regardless of where they originate, the relative timing of arrival of pests and their beneficials is crucial for pest suppression.

If beneficials arrive late, the pest populations have had time to build up in a paddock and may be harder to control.

The study observed large numbers of insects moving from native vegetation into the crop paddocks early in the growing season.

The type of vegetation on the edges of a cropping area influenced the movement of predators and parasitoids (and, to a lesser extent, the movement of pests).

Researchers suspect that beneficials are

TABLE 1 High-risk weeds that harbour pests.

Region	Name	Description	Pests hosted	Appearance
Western Southern	**Capeweed** *Arctotheca calendula*	Annual plant with small yellow flowers, germinates in autumn and winter. Found in pasture, native vegetation remnants and disturbed areas.	Earth mites such as redlegged earth mites and blue oat mite, leafhoppers and Rutherglen bugs.	
Western Southern	**Wild radish** *Raphanus raphanistrum*	Annual up to one metre tall with yellow, white, purple, pink or brown flowers clustered at the end of stem branches. Germinates from autumn to winter.	Redlegged earth mites, balaustium mites, aphids such as green peach aphids, and Rutherglen bugs.	
Western Southern	**Nightshade (blackberry nightshade)** *Solanum nigrum*	Annual or rarely perennial herb or small shrub. Germination occurs mainly in spring and summer. Flowering occurs 5 to 9 weeks after germination.	Redlegged earth mites, balaustium mites, European earwigs, green vegetable bugs and brown shield bugs.	
Western Southern	**Fleabane** *Conzya bonariensis*	Annual, biennial or short-lived perennial plant. Seeds germinate from autumn to spring with a flush in late winter to spring. Flowers from September to May.	Redlegged earth mites, Rutherglen bugs, balaustium mites and aphids such as green peach aphids.	
Southern	**Paterson's curse** *Echium plantagineum*	Annual or short-lived perennial that germinates in autumn and winter and produces characteristic purple flowers.	Earth mites such as redlegged earth mites and blue oat mite, aphids, Rutherglen bugs, thrips and leafhoppers.	
Southern	**Mixed grasses**, multiple species (native and exotic)	A range of grass species in native vegetation patches and pastures host pests.	Earth mites such as redlegged earth mites and blue oat mite, lucerne flea, Rutherglen bugs and leafhoppers.	
Southern	**Scotch thistle** and other thistle species *Onopordum* spp.	Annual to biennial weed. Seeds can germinate at any time with a flush in late summer to autumn or late winter to spring.	Earth mites such as redlegged earth mites and blue oat mite, aphids, Rutherglen bugs and leafhoppers.	
Southern	**Goosefoot** or mintweed (small crumbweed) *Chenopodium pumilio (Dysphania pumilio)*	Annual or perennial herb that germinates in spring or summer. Found in pastures, remnant native vegetation and disturbed areas. Native to Australia and can be a weed of pastures.	Earth mites such as redlegged earth mites and blue oat mite, aphids, Rutherglen bugs, green mirids and leafhoppers.	

NIGHTSHADE AND GOOSEFOOT IMAGE: © M. FAGG, AUSTRALIAN NATIONAL BOTANIC GARDENS

more likely to use resources only found in these native vegetation patches and therefore will display a stronger response to native vegetation edges in comparison to pests.

The relative timing of arrival of pests from native vegetation was closely matched by that of the parasitoids (beneficial parasitic wasps) from native vegetation. This may be because many of these wasps use aphids as hosts and are able to detect these aphids in crop fields. As the aphid numbers build up in the crop field, the parasitoids move out into the crop and search for these hosts.

Furthermore, the beneficial predators always moved more frequently from native vegetation, even after crop emergence.

The net result of these movement patterns is that having native vegetation remnants in the landscape means that crop fields are in a better position to suppress pests throughout the season because there are nearby source areas for beneficial species that move into crop fields.

Time of crop colonisation

Early colonisation of crop fields by beneficials is crucial for keeping pest densities low. Figure 1 (page 1) shows a situation where a pest population in a crop field is growing through time.

TABLE 2 Native plants that support beneficial insects.

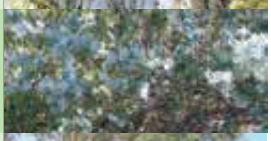
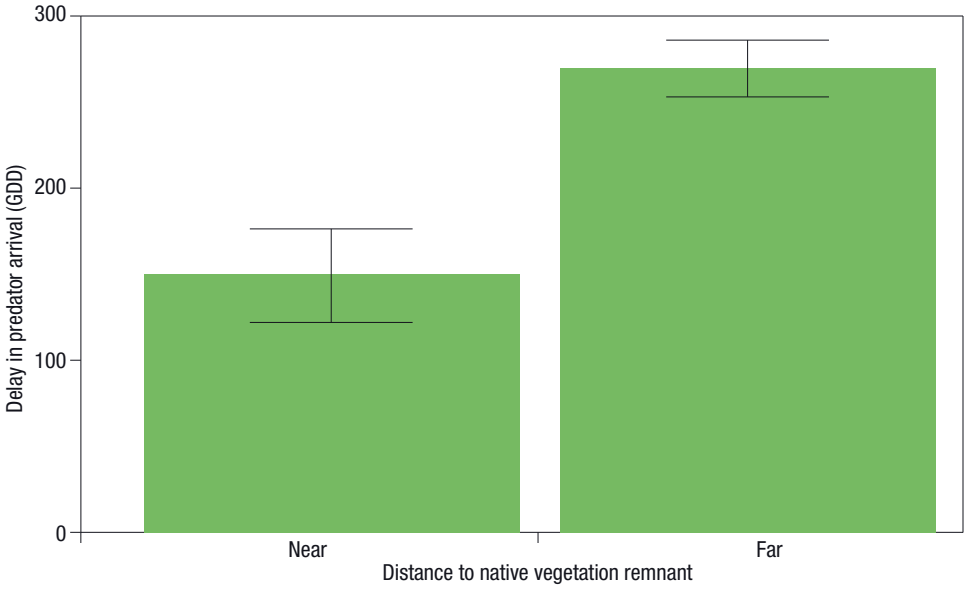
Region	Name	Description	Predators hosted	Appearance
Southern	White Cyprus pine	Fire-sensitive native conifer.	Spiders, brown lacewing adults, ladybird beetles and spiny shield bugs.	
Southern	Paper bark trees *Melaleuca* sp.	Spring-flowering shrub to tree with papery bark.	Spiders, brown lacewing adults, ladybird beetles, spiny shield bugs and damsel bugs.	
Southern	Wattles *Acacia* spp.	Shrub to tree that flowers sporadically in response to rainfall.	Spiders, green and brown lacewing adults, ladybird beetles and spiny shield bugs.	
Southern	Eucalypts *Eucalyptus melloidora, E. macrocarpa, E. albens, E. polyanthemos, E. blakelyi*	Native trees that are a feature of open box woodlands.	Spiders, green and brown lacewing adults, ladybird beetles and spiny shield bugs.	
Northern	Berry saltbush *Rhagodia parabolica*	A perennial plant that flowers from spring through to early January.	Spiders, ladybird beetles, rove beetles and brown lacewings.	
Northern	Climbing saltbush *Einadia nutans*	Perennial plants that mainly flower spring through to January.	Spiders, ladybird beetles, rove beetles and brown lacewings.	
Northern	Black roly poly *Sclerolaena muricata* var. *muricata*	Perennial small shrub.	Spiders, ladybird beetles, rove beetles and brown and green lacewings, predatory bugs such as the brown smudge bug, damsel bug and spiny shield bugs.	
Northern	Sally wattle *Acacia salicinia* (pictured) and Swamp wattle *Acacia stenophylla*	Perennial plants that flower mainly during winter.	Spiders, ladybird beetles, brown and (adult) green lacewings and spiny shield bugs.	
Northern	Wilga *Geijera parviflora*	Perennial plant that flowers winter through spring. Not widely grown due to difficulties in propagation.	Spiders, ladybird beetles, brown and green lacewings and assassin bugs.	
Northern	Brigalow	Perennial plant that generally flowers April through October (not every year).	Spiders, ladybird beetles, brown and green lacewings and assassin bugs.	
Western	Native shrubs and grasses from the families: Anarthriaceae, Cyperaceae, Dasypogonaceae, Haemodoraceae, Juncaceae, Phormiaceae, Restionaceae, Xanthorrhoeaceae	Consists of a range of species found in remnant native vegetation patches along roadsides and laneways. Pictured are shrubs and grasses under a eucalyptus overstorey.	Spiders, predatory mites (pasture snout mites and mesostigmatid mites), ladybird beetles, brown lacewings, rove beetles and assassin bugs.	
Western	Eucalypts: *Eucalyptus angulosa, E. astringens, E. buprestium E. cf loxophleba E. decipiens, E. falcata, E. accidentalis, E. pachyloma, E. phaenophylla, E. platypus, E. preissiana, E. tetraptera*	Native trees that are a prominent feature of remnant native vegetation patches. Also found along roadsides and laneways.	Spiders, predatory mites (pasture snout mites and mesostigmatid mites), ladybird beetles, brown lacewings, rove beetles and assassin bugs.	

FIGURE 2 **Research from Queensland showing the delay in predator arrival following aphid arrival in a crop field, as determined by distance to native vegetation remnant.**



There was greater delay in predator arrival further from native vegetation remnants (greater than 300 metres) compared to near (less than 100 metres) based in two years of observations at 12 winter cereal crop field sites.

Distance from crop

Distance of remnant native vegetation from the crop appears in some cases to influence the time it takes for beneficial insects to colonise the crop following the arrival of pest species.

Research undertaken in Queensland as part of this project showed the greater the distance from native remnant vegetation to the crop, the greater the offset in time of colonisation, as illustrated in Figure 2.

While there was a significant offset at the Queensland field site, the same effect was not observed on other field sites in New South Wales, so more data is needed to determine if distance is a consistent factor in pest/beneficials arrival time in crop.

Implications

Native vegetation patches in cropping landscapes are important for the recruitment of beneficials into crop fields early in the season.

However, native vegetation patches were also associated with crop colonisation by pests. They offer both opportunities and risks for pest management.

It is therefore important to develop a targeted management strategy in native vegetation patches (such as targeting weeds that harbour pest species).

This should reduce the risk of early season crop colonisation by pests without hindering population buildup of beneficials.

Management of weeds in pasture fields may be crucial for achieving pest suppression in nearby grain crops.

Highly weedy native vegetation patches may also be sources of pests. Take stock of where these are on your property in relation to high-risk crops.

If you are thinking about revegetation there are many 'low-risk' native plants that do not harbour pests but do support beneficials.

USEFUL RESOURCES

National Invertebrate Pest Initiative: Pest Suppressive Landscapes
www.nipi.com.au/research/pest-suppressive-landscapes/

MORE INFORMATION

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