Communicating Climate Change
Module 13
An initiative of the National Agriculture and Climate Change Action Plan
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Climate change impacts on pest animals and weeds

Key facts

- Producers are likely to have time to adapt their pest animal and weed management strategies to climate change.
- Pests will generally extend southwards and to higher altitudes as a result of warming trends.
- Increased pest surveillance is crucial to prevention and management.
- With greater climatic variation, strategic pest management will become more important.
- Weeds with efficient seed dispersal systems (e.g. wind, water, birds) will invade faster than weeds that rely on vegetative dispersal.
- Extreme events such as cyclones can help to spread weeds.
- Disturbed habitats may be more easily colonised by pest animals and weeds (for example, after a drought).
- Herbicides may become less effective under warmer and drier conditions.
- Producers may need to adjust the timing of pest control as pest life cycles respond to climate change.

Climate change projections

Predicted changes in climate will affect the spread and competitiveness of pest animals and weeds in Australia. For example, in **southern Australia**, we can expect to see:

- more very hot days (in excess of 35°C)
- less incidence of frost
- less winter rainfall across all southern regions; spring rainfall is expected to be lower in south-eastern Australia, and autumn rainfall is more likely to be lower in the south-west of Western Australia
- more frequent droughts, particularly for the south-west of Western Australia
- increased seasonal variability, delivering above average rainfall
- higher risk of fire, with the warmer and drier conditions

A cooperative venture between

MANAGING CLIMATE VARIABILITY R&D PROGRAM
mla MEAT & LIVESTOCK AUSTRALIA
BCG shared solutions
Australian Government
Department of Agriculture, Fisheries and Forestry
Bureau of Meteorology

Climate and the ecology of animals and plants

Temperature and rainfall determine where each species can live and reproduce. Climate change will directly affect:

- the geographic range of species
- the timing of species' life cycles
- the population dynamics of species
- the location of natural habitats (some species will have to move with their host habitats)
- the structure and composition of ecosystems (i.e. the decline and extinction of some species and the invasion of other species)

While warmer temperatures will force some species to relocate, adapt or perish, some pests will be better able to survive winter, and species that are active in summer will develop faster.

Animals and plants have already begun to spread to higher altitudes in response to climate change. As the climate warms, temperature-sensitive species are being restricted to higher altitudes. In relatively flat areas, this effect on range is magnified because, without the ability to avoid higher temperatures by moving to higher ground in their local area, species must relocate further afield.

To adapt to climate change, animals and plants will have to either develop tolerances to warmer temperatures and drier soil conditions or relocate to a habitat that suits their current climatic tolerances i.e. shift their range.

Weeds with efficient dispersal mechanisms such as water, wind or birds are better equipped to shift their range, while species with short generation times are better equipped to evolve, and increase their tolerance of warmer temperatures. Each species will cope and adapt in different ways, so their ranges are likely to expand and contract at different rates, which will affect competition between species.

Weeds are usually very competitive and often find an opportunity to establish new populations when natural or desirable plant species decline. The projected increase in fire and drought will favour the establishment of some weeds. Climate change may also favour some native plants to the extent that they may become weeds.

Climate and the physiology of animals and plants

Higher levels of carbon dioxide could stimulate the growth of some weed species, especially summer-active weeds in higher rainfall zones. However, the decline in rainfall predicted for southern Australia may counteract this. Woody weeds will benefit from increased carbon dioxide more than grasses.

Many plant species respond to accumulated day degrees—the cumulative sum of daily temperatures—to 'read' the season and trigger critical development stages such as stem elongation and flowering. Warmer temperatures will accelerate the rate at which day degrees accumulate, so the life cycles of some plant species may accelerate. Because plants are host to many pest animals, the life cycle of some pest species, such as Red Legged Earth Mite, aphids and rabbits, will respond to their plant hosts and change their feeding and reproductive patterns accordingly.

Warmer temperatures will directly affect the ability of animals to maintain their body temperature and avoid heat stress.

Increased levels of carbon dioxide can affect the carbon-to-nitrogen ratio of plant material, thereby reducing the nitrogen available to plant-eating animals and insects. Insects that need lower temperatures to activate dormancy may have shorter overwintering periods.

Warmer temperatures may reduce the production of dew which is an important source of moisture for many insects and smaller vertebrate species.

Implications for producers

Pest control strategies will change

Across farming regions in southern Australia, the winter growing season is expected to shorten. This will have implications for weeds and for plant-eating pests such as rabbits. Warmer winter temperatures will accelerate the development of plant species that use accumulated day degrees to trigger developmental stages (e.g. tillering, flowering). As a result, pastures, crops and weeds are likely to mature and start to decay earlier.

Accelerated plant development has important implications for crop and pasture protection and for weed control. For example, producers may need to adjust the timing of the control of Red Legged Earth Mite as the mite's life cycle responds to climate change. Similarly, the timing of pasture topping may need adjusting to match changes in season length and plant development rates.

In lower-rainfall regions, a shorter winter growing season will mean longer periods of dry feed over summer. This may reduce the breeding window for rabbits and feral pigs, and could increase the effectiveness of some control programs.

Feed and water shortages in extreme seasons may increase competition between kangaroos and domestic livestock; kangaroos may be better able to take advantage of changed conditions and become dominant. At the same time, feral goats and camels may have a competitive advantage over native species, posing a threat to conservation but offering a commercial harvest opportunity. Baiting to control pest animals such as foxes may be more effective when food is scarce. As insect breeding cycles adjust to changes in season timing and length, producers may need to change the timing of insect control using, for example, the sterile insect technique and bait spraying.

Pest populations will change

Projected warming will help some pest species to survive winter and will accelerate development of summer-active species. While projections for rainfall are less certain than those for temperature, summer rainfall, particularly in southern Australia, is not predicted to decline as much as winter rainfall. So summer weeds, in particular, are likely to do well. Blowfly populations could also increase because flies breed better and grow faster in warmer conditions.

Higher temperatures may reduce the reproductive potential of a number of important agricultural pests. Rabbits need cool temperatures to breed and when the temperature is above 29^{o}C females cannot produce enough milk for their young. Lice populations are also expected to decline in hotter environments. Adult lice can move around an animal to maintain an optimal temperature of 37^{o}C, but lice eggs cannot survive extreme temperatures. Germination of winter annual weeds may be affected by reduced winter rainfall.

Pests will migrate

In any particular location, climate change may not mean more pest animals and weeds, but it could mean *new* pest animals and weeds. The range of pests will generally move southwards and shift to higher altitudes as a result of warming trends. Temperate weeds are expected to be displaced southwards. During wetter years, southern Australia will have the potential to host traditionally semi-tropical weeds and parasites, such as lantana and cattle ticks. Temperature-sensitive species such as blackberry are already invading higher altitudes, and frost-intolerant species such as rubber vine and *Chromolaena* are predicted to move southwards.

Table 1 provides a summary of how climate change may affect the distribution of significant weed species.

As the potential range of weeds expands with climate change, the actual range may lag while the weed species adapt to the higher temperatures. Weeds with efficient seed-dispersal systems (wind, water, birds) will invade more quickly than weeds that rely on vegetative dispersal. An increase in extreme events, such as cyclones, storms and associated floods, may increase the dispersal of weed species that rely on wind and

water to move seeds or pollen. Cyclones and storms may also help the spread of insects within Australia and facilitate exotic species incursions from neighbouring islands. Habitats disturbed by extreme events such as drought leave empty niches which pest animals and weeds can colonise. Pests often recover from extreme climatic events faster than other species.

Table 1: Potential impacts of climate change on weeds significant to agriculture in southern Australia

Weed	**Impact**
Blackberry	Expected to retreat southwards and to higher altitudes because it is sensitive to higher temperatures and drought.
Chilean needle grass	Expected to increase its range because it is highly invasive (long-lived, seed dispersed by wind and water) and drought tolerant.
Gorse	Expected to retreat southwards because it is drought sensitive.
Lantana	Expected to continue its move southwards into high-rainfall zones of northern New South Wales.
Mesquite	Some risk that it may move into lower-rainfall areas because it is very drought tolerant.
Parthenium	Not suited to winter-dominant rainfall areas. May move into summer-dominant, higher-rainfall (>500 mm) regions.
Serrated tussock	Expected to retreat southwards and to higher altitudes because it is sensitive to higher temperatures. As a drought-tolerant plant, it should become more invasive in areas where temperature allows.
Prickly acacia	Expected to move southwards and into arid areas.

Effectiveness of pest control will change

Climate change will impact the effectiveness of pesticides. Weeds that are under moisture stress can respond by thickening their leaf cuticles, slowing down vegetative growth and flowering rapidly. Drought-stressed weeds are more difficult to control with post-emergent herbicides than plants that are actively growing; for example, systemic herbicides that are translocated within the weed need active plant growth to be effective.

Pre-emergent herbicides or herbicides absorbed by plant roots need soil moisture and actively growing roots to reach their target species. Drying winter and spring rainfall trends have the potential to reduce the effectiveness of pre-emergent herbicides such as triazines or atrazine.

Figure 1: Chilean needle grass distribution under current and potential future climate conditions

New environmental weeds will emerge

Climate change will provide the opportunity for environmental weeds to invade new ecosystems.

Environmental weeds not associated with agriculture have the potential to significantly reduce the biodiversity value of on-farm native vegetation and riparian areas. They are hard to control once established, because it is difficult to use traditional control methods in native bush and riparian areas.

Drying soil conditions and lower incidence of frost could increase the range of bitou bush and boneseed, which are significant environmental weeds. Producers should monitor and report new weed outbreaks in native vegetation to facilitate control of their spread.

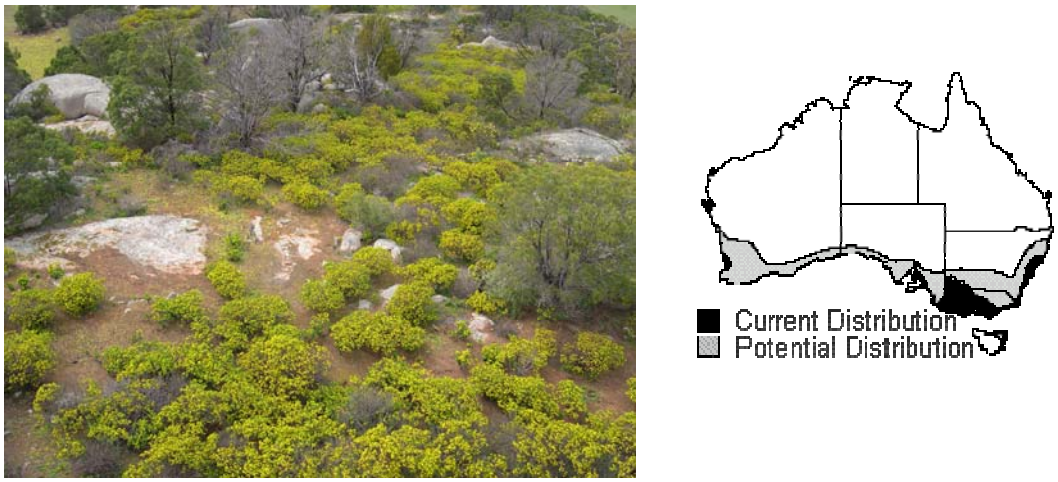

Figure 2: Boneseed distribution under current and potential future climate conditions

Opportunities for producers

Producers are likely to have time to adapt their pest management strategies to climate change.

Continued strategic implementation of pest control measures coordinated across jurisdictions will help protect agriculture from the full impact of climate change over the medium term.

Climate change will offer opportunities to control traditional pests; for example, producers can learn from strategies used in the north to control southward-moving pests.

Producers can take advantage of the natural stress conditions that traditional pest species will face, by reducing population numbers and host species whenever economically feasible and encouraging the adaptation of desirable species.

Climate change may help to control some pests, such as rabbits, blackberries, serrated tussock, gorse and lice. Rabbits may struggle with the longer periods of dry feed, higher temperatures and expected increased effectiveness of calicivirus under drier conditions.

Adapting to the changing climate

Australian producers are already adapting to a changing climate. They should continue to adapt by being well prepared to manage the condition of their land, including seasonal outbreaks of pests and weeds. Understanding that current pest animal and weed species may decline and that new pests may become a threat is a key part of preparing for and adapting to climate change.

Working to prevent the establishment of new pest animal and weed species must be a priority for all landholders. Climate change may provide an opportunity for vigilant landholders to tackle new pests before they become established.

To maximise the opportunities presented by climate change, pest management practices must adapt with the biology and ecology of the pests and producers need to understand

the impacts of seasonal variability. To reduce the impacts of pests, it is crucial that producers take advantage of adverse seasonal conditions that can facilitate pest control, and to then maintain low pest populations to prevent their resurgence under more favourable seasonal conditions.

Tactical pest control will become more important because some traditional pests and weeds will need less years to set seed, build numbers and multiply. However, pests, by their very nature, are highly adaptive; so monitoring for population increases and incursions of new species remains critical.

To compensate for any loss of herbicide effectiveness under warmer and drier conditions, producers may need to review the reliance on herbicide use in any integrated weed management approach.

Producers can prepare for the future by:

- planning for change
- planning for an integrated approach to pest management
- planning for the extra effort required to remove traditional pests and prevent introducing new ones

Research into weeds

The Australian Government is investing $15.3 million over four years from 2008 to establish the National Weeds and Productivity Research Program. The program will investigate and address significant invasive plant problems and provide advice to the farm and forestry sectors on managing invasive plants in forests, pastures and native vegetation. It includes funding of $0.3 million for research into the control of fireweed.

The program will also establish a national weed research centre to fund research into more effective weed management now and in future climates.

Further information

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