

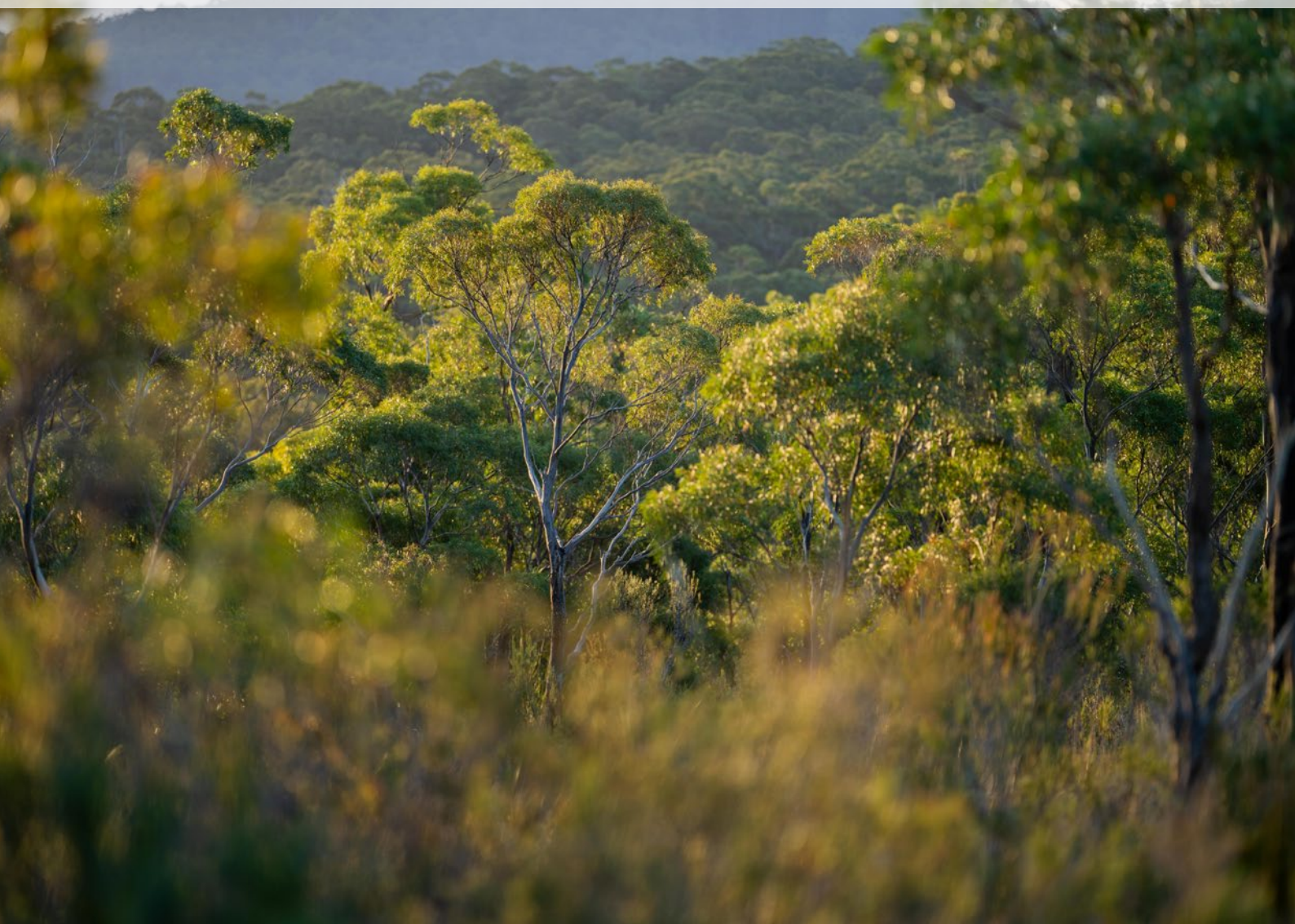


Australia's National
Science Agency

The future of biological management in Australia

Executive summary

2025



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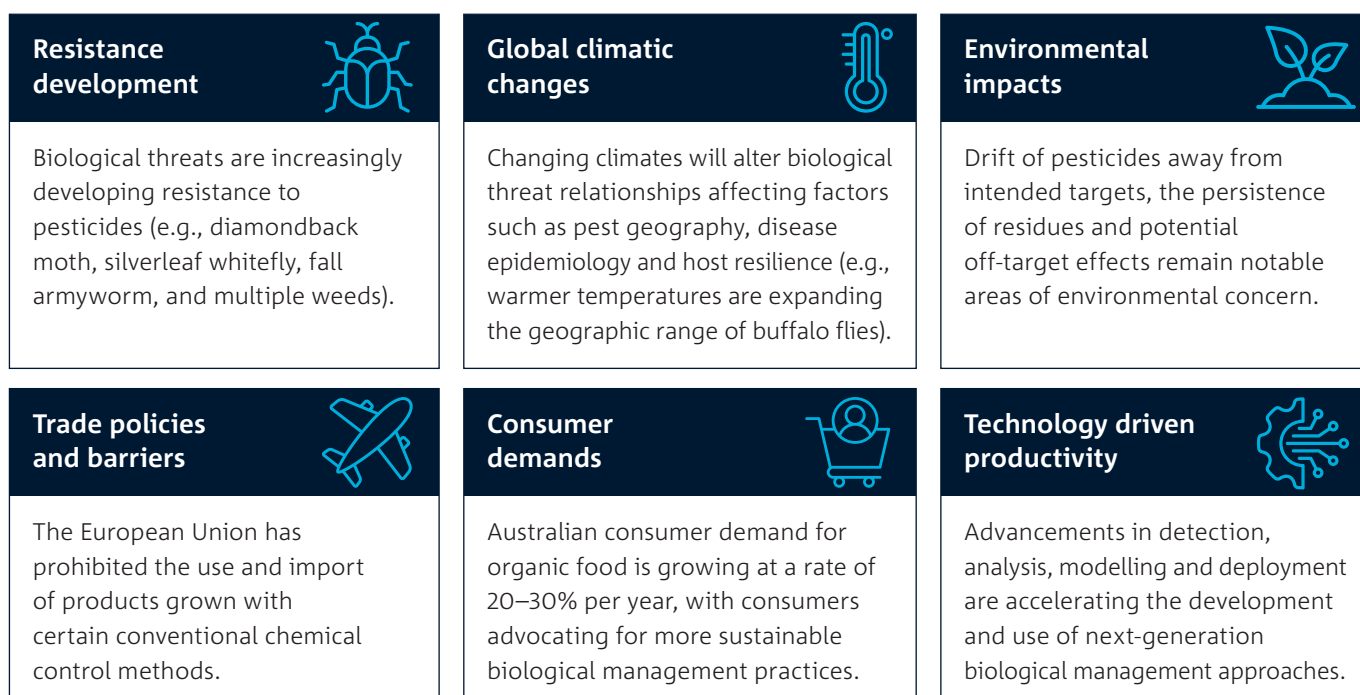
This discussion paper articulates the need for more sophisticated approaches to manage biological threats to Australia's agricultural industries and environment. It provides an overview of next generation approaches to biological management, cross-cutting challenges, and the national planning required to support the development and deployment of these approaches within the Australian context. The content of this paper was informed by desktop research and consultation with CSIRO scientists.

More sophisticated approaches to biological management will be critical to protect Australia's natural assets and support productive, resilient and sustainable industries.

Australia boasts strong agricultural and tourism industries worth a combined \$150 billion annually. These industries are integral to both domestic and global markets. Biological management is imperative for safeguarding these industries and Australia's unique environmental assets from biological threats.

Traditional approaches to biological management, including the use of conventional pesticides, have been effective for Australia. However, there are several factors driving changes to the threats themselves, as well as the types of approaches deemed suitable for their management (Figure 1).

Figure 1: Factors driving the demand for different biological management approaches



Next generation approaches are emerging that could offer solutions to the evolving needs of biological management.

Five next generation approaches were considered which leverage advancements in biochemistry, genomics, engineering biology and computational technologies to produce more targeted and effective outcomes. As noted in Figure 2, several of the approaches explored have technically and commercially mature examples globally; however, these often relate to a small number

of target species and contexts of use and require further development for application within the Australian context. While suitable regulatory pathways exist in Australia for all five of the approaches assessed, only two had examples that had gone through the full approval process.

Each next generation approach was found to have wide applicability across different threats, sectors, and stages of biological management. Technologies like advanced bioinformatics, advanced deployment techniques and *ex vivo* models were found to be key enablers to the successful development and deployment of these approaches.

Figure 2: Snapshot of assessment ratings for next generation approaches (criteria definitions in Appendix 1)

	CRITERIA							
	Technology readiness level (max. global)	Commercial readiness index (max. global)	Large-scale deployment (Australia)	Regulation (Australia)	Applicability	Sector	Stage	Example threats
Biopesticides and biostimulants	9	6	< 5 years	Demonstrated	Diseases Pests (invertebrates) Weeds	Environment Horticulture	Exclusion Management Containment	<ul style="list-style-type: none"> Green peach aphid Powdery mildew <i>Septoria tritici</i> blotch
Pheromones and behaviours modifiers	9	6	< 5 years	Demonstrated	Pests (invertebrates) Weeds	Forestry Horticulture Livestock	Management Containment Surveillance	<ul style="list-style-type: none"> Diamondback moth Fall armyworm Parkinsonia
Gene silencing	9	6	5–15 years	Pathway exists	All threats	All sectors	Exclusion Management Containment	<ul style="list-style-type: none"> Cotton bollworm Fall armyworm Myrtle rust fungus
Sex biasing systems	9	3	5–15 years	Pathway exists	Diseases (via vectors) Pests (all)	All sectors	Management Containment	<ul style="list-style-type: none"> Fall armyworm Mosquito species Silver carp
Gene drives	5	1	By 2050	Pathway exists	All threats	All sectors	Exclusion Management Containment	<ul style="list-style-type: none"> Invasive rodents Mosquito species European rabbit

Australia needs a clearer plan for the future of biological management.

While the need for more sophisticated approaches is already here, their development and large-scale deployment could be more than a decade away for some applications. These timelines are driven by several challenges, including the increased technical complexity of next generation approaches, limited large-scale production systems, low end-user and investor awareness and understanding, the need for enhanced monitoring and data sharing, and the need for more sustained funding.

There is an urgent need for Australia to have a clear plan for how next generation approaches will be sustainably invested in, tailored for the Australian context, and made accessible for those who need them. CSIRO considers this an activity of national importance and is seeking partners to support further analysis against the objectives and example research questions outlined below.

Objective 1: Support the case for investment in biological management

1. What is the value of biological management to Australia and what is the potential future value of next generation approaches?
2. What are well quantified examples of successful biological management in Australia?
3. How does Australia's investment in biological management compare to other countries?

Objective 2: Develop a 2050 vision and strategy for biological management in Australia

1. What is the maturity of next generation approaches across different contexts of use and applications that will be beneficial for biological management in Australia?
2. What might the use and combination of traditional and next generation approaches look like in 2050, and how does this differ from the current state?
3. Which next generation approaches are Australia best placed to focus on based on local threats and capability (e.g., research, development, commercialisation, production, and large-scale deployment)?

Objective 3: Develop priority actions to support a 2050 vision

1. What are the key technical barriers that could delay or prevent the development and adoption of next generation approaches in Australia?
2. What are the key non-technical and system-level barriers that could delay or prevent the development and adoption of next generation approaches in Australia?
3. What infrastructure and skill gaps exist that will be required to support the production, deployment and monitoring of next generation approaches in Australia?
4. How can regulators be supported to improve efficiency, adaptability, and coordination, while maintaining robust and independent oversight in a fast-changing technological and threat landscape?
5. How might industry, government, and other stakeholder groups (e.g., philanthropic organisations) prioritise and better align or complement their investments to support a 2050 vision and strategy?
6. What new business and collaboration models might help to ensure value is captured by all stakeholders along the development pathway of next generation approaches?

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