

Gene Drive Development in Non-Insect Targets – including Vertebrates, Snails, Fungi and Plants

A Horizon Scanning Survey up to 1 September 2026



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Executive Summary

The assessment, regulation and international oversight of gene drive technology has been the subject of intense debate, particularly in the context of the governance and oversight of synthetic biology. These debates must be informed by sufficient and reliable information, or they risk becoming exercises in competing fantasies of the future.

Here, we provide an updated horizon scanning survey of gene drive development in non-insect species, systematically screening the scientific literature up to 1 September 2026.¹ We find that gene drives have been proposed or are being developed in 45 non-insect species and 5 broader taxonomic groups, from mammals and fish to snails, arachnids, fungi and plants (see table 1).

For non-insect gene drive systems, the most common goal is suppression/eradication, not modification of the target organism. In the vast majority of cases, the aim of these projects is to suppress or eradicate the target, either for agricultural, conservation or human health purposes.

Non-insect gene drive systems are less advanced than those for insects. Many insect gene drive systems use 'homologous recombination' technology, but there appear to be significant obstacles to apply it in non-insects. As discussed in this document, other approaches are being explored with some limited success, such as toxin-antidote gene drive systems in plants. For now, compared to gene drive systems in insects, the research presented here is further away from functioning sufficiently in the laboratory and thus likely further from environmental release.

For mammals, mice continue to be the main focus of research. Other than being a target in their own right, mice are seen as the key to developing gene drive systems that could be used in other mammals. Despite significant efforts, no systems that are even partially functional in mice have been reported in the peer-reviewed literature since 2022 (Gierus *et al.*, 2022).²

There is a breakthrough in plants – the first successful gene drive systems in a model plant – but it's unclear whether this approach will work in other plant species. Interest has been expressed in developing gene drive systems to suppress certain plants such as agricultural weeds or alien invasive species. Recently, a gene drive system was successfully developed in the model plant species *Arabidopsis thaliana* using a toxin-antidote gene drive system. A key unanswered question is how readily this technology can be transferred from *Arabidopsis* to other species.

When considering gene drives and other uses of synthetic biology, it is important to acknowledge where research results are moving away from initial conceptual work in the field. How and whether to govern the use and applications of synthetic biology, how and whether to apply synthetic biology for conservation purposes, especially when modifying the wild – are crucial questions. It is widely understood that these questions can only be answered through debates and reflections at multiple levels, with broad participation, and covering many angles and fields of knowledge. With regards to science, it is vital that these debates be grounded in the science

¹ This document supersedes our previous survey which covered developments up to the end of 2023.

² A pre-print paper (Lai *et al.*) was published in 2023 describing apparently partially functional gene drives in mice and rats (for medical research purposes), but it was never published in a peer-reviewed journal.

as it is developing, not just broad narratives of what the field hopes to achieve. Our horizon scanning survey of the literature here shows significant challenges to the successful development of most non-insect gene drives and also reveals the likely abandonment of a number of gene drive projects by lack of further publications (see table 3). What might this mean for policies and actors who are investing in genetic modification as a conservation strategy?

Context

Whilst homing gene drives were first conceived by Burt in 2003, it was the emergence of CRISPR/Cas technology that opened up practical possibilities to apply this concept. In 2014, Esvelt and colleagues published their conceptual paper on utilising the then-new CRISPR/Cas system to build a functional gene drive for the modification or eradication of wild populations (Esvelt *et al.*, 2014). Within a year, the first proof of concept for a gene drive was published for the fruit fly *Drosophila melanogaster*, a major model organism for insects (Gantz and Bier, 2015). In 2016, the National Academy of Sciences, Engineering, and Medicine published their report 'Gene Drives on the Horizon' and the UN Convention on Biological Diversity (CBD) first discussed the potential significance of gene drive research to the treaty's concerns in 2015 and at its 13th meeting of the Conference of the Parties (COP 13).

Gene drive research has therefore developed alongside global debates about its technologies and goals. At first, discussions on its promises and perils were largely based on extrapolations from the initial conceptual papers and early research results. As the field develops, however, it is important that current governance debates reflect its evolution. What gene drive systems are now being proposed, in which species and for what purposes? What ecosystems and habitats are they intended for? What are the current trends in research and development, and what is on the horizon? Where has development advanced and where has it hit obstacles?

Meaningful assessment and decision-making must be based on sufficient, reliable, and timely information. This is for example why the CBD identified broad and regular horizon scanning, monitoring, and assessment as tools for its decision-making on synthetic biology. To inform further discussion on gene drives, we have updated our horizon scanning survey of gene drive development in non-insect species, systematically screening the scientific literature up to 1 September 2026.

About this survey

The aim of this survey is to capture the current state of non-insect gene drive research and development. The survey gives an overview of:

- What research has taken place and where.
- Which species and taxa are targets for gene drive development, and which types of gene drives are being proposed.
- How the research landscape is changing over time – how far developments have progressed, what next stages of experimentation might be, and which projects appear to have ended.

The main table (i.e. table 3) is organized taxonomically and includes information providing context for each study – the geographic range of the target organism, its intended uses, who is funding the research, and how close it is to experimental release in the wild. Readers can also go to our website, www.genedrivemonitor.org, where we have an extensive database of gene drive projects that can be searched by taxonomic groups and species, class of technology, intended use, and more.

Please note, this survey does not cover the potential hazards and risks, difficulties in performing robust risk assessments or difficulties in confining, halting or reversing engineered gene drives.

KINGDOM	PHYLUM or SUB-PHYLUM	CLASS or SUPERCLASS or INFRAPHYLUM	ORDER	Entry number(s)
Animals				
	Vertebrates	Mammals	<i>Rodentia</i> (Rodents)	House mice  1.1.1 - 1.11
				Other rodents  2.1 - 6
			<i>Carnivora</i> (cats, dogs and related mammals)	 7.1-10
			<i>Diprotodontia</i> (Possums and related marsupials)	 11
			<i>Artiodactyla</i> (Deer, pigs and related mammals)	 12-13
			<i>Lagomorpha</i> (Rabbits and hares)	 14.1-14.4
			<i>Eulipotyphla</i> (Hedgehogs, moles, shrews and related mammals)	 15
		Birds		 16
		Amphibians		 17.1-18
		Bony fish		 19-21
		Jawless fish		 22.1-22.3
		Arthropods	Arachnids	 23-24
			Insects	 See separate table
		Molluscs		 25.1-25.3
		Nematodes		 26
		Flatworms		 27
Fungi				 28.1-31
Plants				 32.1-38

Table 1: Overview of current gene drive targets.

Overview of gene drive survey data in taxonomic order. Entry numbers correspond to rows in the main data table.

			Motivation for research			Intended direct effect		
Row	Gene drive targets (as listed in table 3)	Model org.	Agriculture	Biodiversity	Health	Suppression/ Eradication	Modification	Proof of principle
MAMMALS								
1	<i>Mus musculus</i> (House mouse)	x	x	x		x		x
2	<i>Peromyscus leucopus</i> (White footed mouse)				x		x	
3	<i>Rattus norvegicus</i> (Brown rat)	x		x		x		x
4	<i>Rattus rattus</i> (Common or black rat)		x	x		x		
5	<i>Rattus exulans</i> (Polynesian rat)			x		x		
6	<i>Sciurus carolinensis</i> (Grey squirrel)			x		x		
7	<i>Felis catus</i> (House cat & feral cat)			x		x		
8	<i>Vulpes vulpes</i> (European red fox)			x		x		
9	<i>Mustela erminea</i> (Stoats)			x		x		
10	<i>Mustela putorius furo</i> (Domestic ferret)			x		x		
11	<i>Trichosurus vulpecula</i> (Brushtail possum)		x	x		x		
12	<i>Cervid</i> family (Deer)				x		x	
13	<i>Sus scrofa</i> (Feral pig)		x	x		x		
14	<i>Oryctolagus cuniculus</i> (European rabbit)		x	x		x		
15	<i>Erinaceus europaeus</i> (European hedgehog)			x		x		
BIRDS								
16	<i>Sturnus vulgaris</i> (Common starling)		x	x		x		
AMPHIBIANS								
17	<i>Bufo marinus</i> or <i>Rhinella marina</i> (Cane toad)			x		x		
18	<i>Eleutherodactylus coqui</i> (Caribbean tree frog)			x		x		
FISH								
19	<i>Cyprinus carpio</i> (European carp)			x		x		
20	<i>Pterois volitans</i> (Red lionfish)			x		x		
21	<i>Oreochromis niloticus</i> (Nile tilapia)			x		x		
JAWLESS FISH								
22	<i>Petromyzon marinus</i> (Sea-lamprey)			x		x		
ARTHROPODS – ARACHNIDS								
23	<i>Tetranychidae</i> family (Spider mites)		x			x		
24	<i>Varroa destructor</i> (Varroa mite)		x			x		
MOLLUSCS - SNAILS								
25	<i>Biomphalaria glabrata</i> (or <i>Biomphalaria glabrata</i> and other snails spreading schistosomes parasites)				x	x	x	
NEMATODES								
26	<i>Caenorhabditis brenneri</i>	x						x
FLATWORMS								
27	<i>Schistosoma mansoni</i>				x	x		
28	<i>Schistosoma haematobium</i> also proposed as target				x	x		

			Motivation for research			Intended direct effect		
Row	Gene drive targets (as listed in table 3)	Model org.	Agriculture	Biodiversity	Health	Suppression/ Eradication	Modification	Proof of principle
FUNGI								
29	<i>Fusarium graminearum</i>		x				x	
30	<i>Fusarium verticillioides</i>		x			x		
31	<i>Saccharomyces cerevisiae</i>	x						x
32	<i>Candida albicans</i>	x						x
PLANTS								
33	<i>Arabidopsis thaliana</i> (Arabidopsis)	x						x
34	<i>Nicotiana tabacum</i> (Tobacco)	x						x
35	<i>Amaranthus palmeri</i> (Palmer amaranth)		x			x		
36	<i>Amaranthus tuberculatus</i> (Rough fruited water hemp)		x			x		
37	<i>Alopercus mysuroides</i> (Black grass)		x			x		
	<i>Amaranthus palmeri</i> (Palmer amaranth – counted above)							
	<i>Amaranthus tuberculatus</i> (Rough fruited water hemp - counted above)							
	<i>Ambrosia artemisiifolia</i> (Common ragweed)		x	x	x	x		
	<i>Cynodon dactylon</i> (Bermuda grass)		x	x		x		
	<i>Cyperus rotundus</i> (Purple nut sedge)		x			x		
	<i>Eichhornia crassipes</i> (Water hyacinth)		x	x		x		
	<i>Kochia scoparia</i> (Kochia)		x			x		
	<i>Lantana camara</i> (Common lantana)		x	x		x		
	<i>Lolium rigidum</i> (Rigid rye grass)		x			x		
	<i>Lupinus arboreus</i> (Yellow bush lupin/tree lupin)			x		x		
	<i>Lychnis coronia</i> (Rose campion)			x		x		
	<i>Tanacetum vulgare</i> (Common tansy)		x	x		x		
	<i>Setaria glauca</i> (Yellow foxtail)		x			x		
38	<i>Myrtaceae family</i> (incl. Eucalyptus species)			x			x	
39	‘Trees’			x			x	
Total		7	22	29	6	40	6	7

Table 2: Overview of motivations for gene drive development and intended direct effects

The table shows our assessment of the motivations for gene drive research & development and the intended direct effects, in each organism or group identified in table 3. The row numbers in this table are identical to the numbering in table 3. The categorisations are based on statements made in the original research publications – for more details see 'intended use' column in table 3.

There is one exception where the authors of a paper do not identify the specific motivations for developing gene drives: A research team from Australia proposes seven plant species as targets for purposes of both protecting agriculture and conservation without further clarifications (*Cynodon dactylon*, *Cyperus rotundus*, *Eichhornia crassipes*, *Kochia scoparia*, *Lantana camara*, *Lupinus arboreus*, *Lychnis coronaria*) (Kumaran *et al.* 2020). For these seven species we make an assessment of the likely reasons for targeting these species based on general information available for each plant on whether it is considered an agricultural weed and/or a threat to biodiversity in Australia.

Note that the 'health' column denotes research aiming to modify or suppress wild populations for health purposes, not laboratory based genetic research for medical purposes.

Findings

1. Gene drive systems for insects – in particular for mosquito disease vectors – generally attract more research funds, researchers, and media attention, but **gene drives have been developed or proposed in a wide range of non-insect species and taxonomic groups**, including mammals, birds, fish, amphibians, arachnids, snails, nematodes, schistosomes, fungi and plants. Of the 45 species³ our survey identifies, 14 are mammals and 16 are plants (table 1).
2. **Although less scientific papers have been published on gene drives in the past three years compared to the previous years, a significant amount of new research is still emerging.** The annual number of academic publications relating to gene drives peaked in 2019 with 135 publications and has since plateaued to just below or around 100 (see figure 1). These publications cover a wide range of disciplines, including ethics, social sciences, and regulatory issues.
3. A variety of motivations are driving the development of non-insect gene drive systems. **The most common goals are to remove invasive species for conservation purposes (29 cases) and to reduce the impacts of certain species on agriculture (22 cases) and human health (6 cases)** – see table 2. In the large majority of cases, the aim is to suppress or eradicate the target, in some cases by modifying the target to render it susceptible to suppression, such as modifying a plant to make it more susceptible to herbicides. Of the 50 species and groups identified in the survey as possible gene drive targets, suppression or eradication is the goal in 40 cases – see table 2. The aim of modifying a species to reduce its capacity to spread disease, impact crops or to protect it against disease or environmental stresses is a goal in 6 cases (in one of these - the snail *Biomphalaria glabrata* and its relatives - suppression and modification are both proposed). The remaining belong to the category of model organisms used in proof of principle experiments.
4. **Compared to gene drive systems in insects, gene drives in non-insects are further away from ‘functioning’ and thus from environmental release.** Development has advanced furthest in mice and in the model plant *Arabidopsis*, but major technical hurdles remain before any releases of gene drives targeting vertebrates or plants could be seriously proposed. It appears that developing gene drives in mice is technically much more challenging than for fruit flies or mosquitoes, and the same might be expected for other mammals. It has also become clear that the technology used in some insects (‘homing CRISPR’ gene drives) barely functions in mice (esp. male mice), and does not function in *Arabidopsis*, or many other organisms (see point 8).
5. **A significant amount of research has focussed on developing gene drives in mice, so far with limited success.** One gene drive system in mice, named ‘T-CRISPR’, is the focus of ongoing research (see entry 1.7), but so far it has only been constructed in a form that lacks an essential component (the Cas9 gene). Full proof of concept in the laboratory is thus lacking. Alternative genetic control approaches that aren’t gene drives are also being explored for mice (see entries 1.10 and 1.11) – for example, constructing a sex ratio distorter known as an ‘X-shredder’.⁴
6. **The development of gene drives in mice is often seen as a pathway to other mammalian gene drives.** For example, Castle *et al.*, (2022) explicitly use mice as a model organism with the ultimate aim of modifying deer (entries 1.6 & 12). More commonly, researchers discuss this larger goal in more general terms, without naming a specific eventual target. Some research projects are already working on gene drives for mammals other than mice; there have been attempts to develop gene drives in rats, though here for medical research purposes and not for release (3.1), and there are ongoing efforts in Australia to develop gene drive systems in rabbits (14.1).

3 The vast majority of the targets identified in the literature are single species, however some early-stage proposals relate to broader taxonomic groups, such as the *Cervid* family with deer (entry 12), the *Tetranychidae* family (spider mites) (23), a snail genera that hosts schistosome parasites (25.1–25.3), two species from the *Schistosoma* genus (27) and the *Myrtaceae* family (37). ‘Trees’ are also identified as a target (38).

4 We include research on such sex-ratio distorters in our survey because they resemble gene drives in some respects – for example in some cases employing CRISPR/Cas to interfere with reproduction – and are often developed by the same research teams. Whilst inherited in a Mendelian 50:50 fashion, X-shredders aim to substantially reduce the female population to crash local populations.

7. **Recently, two groups have reported laboratory proof of concept for gene drives in the model plant *Arabidopsis*** (thale cress) (entries 32.1 and 32.2) – a major breakthrough, but one that may be limited in its application. *Arabidopsis* is being used as model organism to develop the first gene drives in plants; there is no interest in using an *Arabidopsis* gene drive in the wild. However, at least 14 plants species have been named as potential targets for suppression using gene drives, of which 11 are agricultural weeds. No gene drive has yet been demonstrated in a plant species that is meant to be an actual target. And if that hurdle is passed, other challenges may surface in its actual use; for example many plants can reproduce vegetatively (e.g. shoots, suckers, rooting of branches) and bypass sexual reproduction; or the presence of seed banks in the soil could slow the spread of any plant gene drive by acting as a reservoir both for wild-type alleles and seeds (Kim *et al.*, 2026).
8. **A key technology used for insect gene drives doesn't seem to work in non-insects.** From the start, most of the high-profile research in gene drives (fruit flies and mosquitoes) has used a technological approach called 'homing CRISPR'. While this technology works in a handful of species, there appear to be barriers to applying it in other species and taxonomic groups. Homing CRISPR gene drives appear to be functional in laboratory settings in a number of dipteran insects (i.e. flies and mosquitoes)⁵ and some fungi (*S. cerevisiae* and *C. albicans*: 30.1–31), but the technology functions only to a very limited extent in mice (1.1.1–1.6). A recent publication, calling on previous evidence, reasserts that the favoured DNA repair pathway in mammals (non-homologous end joining) blocks the action of homing gene drives, which requires homologous repair (Peng *et al.*, 2026). And despite efforts to apply homing gene drive technology more widely, the evidence so far indicates that it does not function at all in plants (32.3), nematodes (26), flatworms (27), the fungi *Fusarium graminearum* (28.2), or some other insects.
9. **Approaches other than homing CRISPR may be more effective for gene drives in some species and taxonomic groups.** The gene drives demonstrated in plants are based on CRISPR but don't use it for homing – instead they use it as part of a toxin-antidote design (32.1 and 32.2). Approaches based on engineering natural selfish genetic elements such as the T-haplotype in mice (1.7) and Spok1 in *F. graminearum* (28.1) also appear to have made some progress in the laboratory. A project to develop gene drives in rabbits in Australia is seeking to identify natural selfish genetic elements that could be redesigned and engineered as gene drives (14.1).
10. **Many gene drive projects with mammalian targets aim to control or eliminate invasive species for conservation purposes.** We have identified publications exploring the potential of gene drives in fifteen mammalian targets since 2017. These projects seek to protect agricultural crops (e.g. Birand, Prowse *et al.*, 2025) and native species and ecosystems from invasive alien species including mammals such as house mice, black rats, rabbits, cats, and foxes (ex. Smertina *et al.*, 2026; Birand, Gierus *et al.*, 2025). While many proposals discuss the possibility of eliminating invasive mammals on islands, there are even grander ambitions, such as eradications across the entire continent of Australia (see Birand, Cassey, Ross, Thomas *et al.*, 2022).
11. **Genetic modification systems described as 'gene drives' have been developed in bacteria and viruses but are not included in this survey** (Valderrama *et al.*, 2019; Walter and Verdin, 2020). While these systems share some features with homing gene drives, such as employing CRISPR-Cas9, we have not included them in our survey because neither bacteria nor viruses reproduce sexually, and so these systems do not meet the established definition of a gene drive.

Please see main table (Table 3, pp.11-38) for details of findings.

5 See our June 2026 horizon scanning survey on gene drive development in insect targets (Wells and Steinbrecher, 2026).

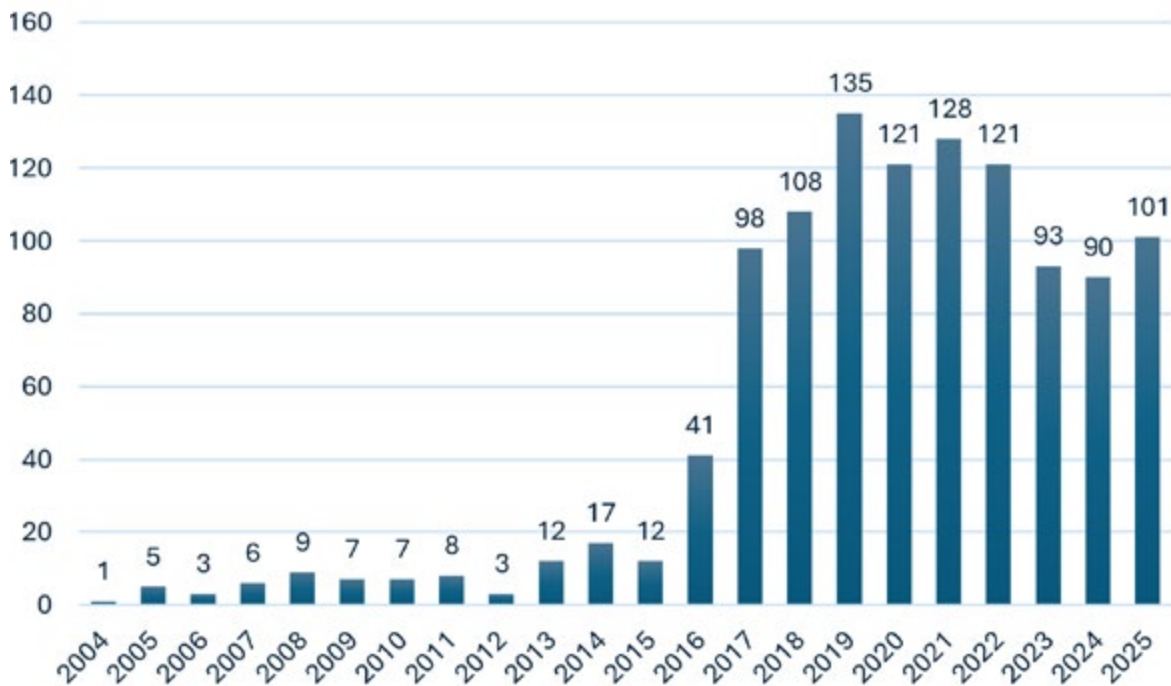


Figure 1: Number of publications per year related to gene drives

The key word search for “gene drive” or “gene drives” was conducted on the Web of Science. The articles found covered many disciplines, including laboratory research, modelling studies, theoretical studies, reviews, social sciences research, ethics, regulation and risk assessment.

Concluding remarks

While it is important for decision-makers to consider the potential risks related to gene drives, this horizon scanning exercise is focussed on simply capturing the research that is actually being carried out towards developing gene drives. This provides a perspective on the broad range of target organisms and approaches, and gives a sense of how gene drive development is evolving. Such a survey makes the bigger picture clearer so that it is possible to perceive trends as well as obstacles and concerns.

Since our last horizon scan that examined the gene drive literature up to the end of 2023, wide-ranging ambitions for gene drive technology are still evident, but increasingly scientists in the field are starting to turn away from attempts to apply homing CRISPR gene drives in non-insect species. Instead, these researchers are exploring other gene drive designs, such as toxin-antidote systems, or non-gene drive technologies such as X-shredders with similar aims.

Our data also show that the large majority of proposals for non-insect gene drives relate to suppressing or eradicating the targets, as opposed to modifying them to propagate different traits as also seen in most of the insect gene drives being developed. Why this commitment to suppression/eradication? Are gene drives starting to be perceived as a potential form of species-specific pesticide?

How might gene drive technology develop in non-insect targets in the medium term (i.e. the next 5 years)? Efforts to develop gene drives in mice and rabbits will likely continue, and possibly for other vertebrates too, but it's uncertain how effective they will be in the light of the difficulties faced thus far. It is likely that research will continue to seek to find, redesign and engineer natural selfish genetic elements to function as synthetic gene drives in vertebrates; however, even if progress is made in one species with such an approach, it may not easily translate to other species, such as we've seen with homing CRISPR. In plants, efforts to transfer gene drive technology

from the model plant *Arabidopsis* to other dioecious species (i.e. species with separate male and female plants) are almost certainly underway, but as they have not yet been reported in the literature, we don't yet know what technical difficulties they are facing.

Based on the current landscape of scientific research, environmental releases of gene-drive modified plants or vertebrates seem unlikely in the next 5-10 years, though substantial funding and research efforts remain devoted to this goal. Thus, the literature gives no indication that non-insect gene drive systems could be a viable tool for agriculture or conservation in the medium term.

Horizon scanning, such as this survey, does not lead to predictive results about the future of scientific research and technology development. But it can point to trends in the purposes, techniques, and goals of a scientific field, and this can direct us towards questions we should ask now, before technologies further develop. For example, what would it mean for gene drives to be used the ways pesticides have been in the past, when – unlike pesticides – gene drives could be self-propagating? What lessons from the (over)use of pesticides could be applied? What would use for such a purpose require from risk assessment, regulation, and governance? Who is equipped to model such a deployment and assess its consequences?

More broadly, we see this survey as informing discussions on synthetic biology and what role – if any – it can play in conservation, or for that matter in agriculture. Does the current science support a reliance on, or role for these technologies to solve our biodiversity crisis? How might an integrated and participatory multidisciplinary technology assessment add to our understanding of the promises and perils of deploying synthetic biology tools – such as gene drives?

Methodology and References:

Please see end of document.

Key to technology levels

- 1 Gene drive proposed
- 2 Gene drive proposed with supporting modelling work, or preliminary laboratory work funded
- 3 Preliminary laboratory work published
- 4 Research on gene drive construction funded
- 5 Limited proof of concept
- 6 Laboratory proof of concept
- 7 Non-insects- scaled up trials
Insects - large cage trials
- 8 Potential further contained trials
- 9 Experimental releases in natural environment
- X Abandoned project

Please see page 38 for a complete explanation of the technology levels

Colouring/symbols for progress of technology

	Evidence shows this approach doesn't work
	System is not intended for release
	No publications since December 2023
???	Uncertain if research has progressed to this stage
M	Modelling work has been done
G	Genome sequenced (with intention/possibility of constructing gene drive stated)

Key to geographic distribution maps

	Species is not present
	Species native range
	Species invasive range

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
Kingdom: ANIMALS Subphylum: Vertebrates Class: Mammals Order: (Rodentia) Rodents Species: House mice 															
1.1 <i>Mus musculus</i> Homing CRISPR – proof of concept only															
1.1.1	<i>Mus musculus</i> House mouse  After Musser <i>et al.</i> 2021	NA – intention is proof of concept of homing CRISPR gene drive in mammals Initial aims: 1) using gene drive technology to create lab mouse strains carrying multiple modifications (with otherwise impractical genotypes) for laboratory studies 2) finding a way to eliminate invasive rodent species or addressing rodent-borne diseases	Homing CRISPR CRISPR-Cas9 mediated gene drive	Grunwald <i>et al.</i> 2019 Weitzel <i>et al.</i> 2021 Grunwald, Weitzel and Cooper, 2022	1	2	3	4	5	6	7	8	9	K.L. Cooper University of California San Diego, USA	Kinship Pew Packard NIH Allen TATA UCSD
1.1.2		Population suppression Suppressing/eradicating invasive rodents on islands, and reducing impacts of rodents on agriculture	Split homing CRISPR CRISPR-Cas9 based gene drive (test both 'zygotic' and 'germline' forms)	Pfützner <i>et al.</i> 2020	1	2	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	DARPA
1.1.3		NA – proof of concept The production of complex strains harboring multiple humanizing genes	Split homing CRISPR Active genetics gene conversion system	Lai <i>et al.</i> 2023 (pre-print publication – no peer reviewed publication to date)	1	2	3	4	5	6	7	8	9	K. Jarnagin Synbal, USA (E. Bier, TSVI Goldenberg and V. Gantz are directors)	Not stated
1.1.4		NA - proof of concept Proof of concept for this gene drive design - intended to overcome low gene drive efficiency in male mice	Homing CRISPR 'CRISPR based gene drive' 'targeting haploinsufficient spermatogenesis gene'	Peng <i>et al.</i> 2026 (Note this entry is based on the pre-print version of this paper)	1	2	3	4	5	6	7	8	9	K. Esvelt MIT, USA	Not stated (in pre-print version)

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
1.2	<i>Mus musculus</i> Homing CRISPR – targetting female fertility														
1.2.1	<i>Mus musculus</i> House mouse	Population suppression	Homing CRISPR (targeting 'haplosufficient female fertility gene')	Roslin Institute, 2017 McFarlane, Whitelaw, and Lillico, 2018 – theoretical explanation of proposed GD designs McFarlane <i>et al.</i> 2020 – poster abstract No results published except poster abstract	1	2	3	4	5	6	7	8	9	C.B.A. Whitelaw S.G. Lillico Roslin Institute, University of Edinburgh, UK	CSC BBSRC
		The 2017 press release says the aim is to improve pest control methods	'Homing gene drive targeting female fertility' (2018 paper) 'CRISPR-Cas9 split gene drive which disrupts an essential female fertility gene' (2020 poster)												
1.2.2		Population suppression	Homing CRISPR (targeting 'haplosufficient female fertility gene')	Brown, 2021 - press release Birand, Cassey, Ross, Russell, <i>et al.</i> 2022 Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	T.A.A. Prowse P.Q. Thomas University of Adelaide, Australia	ARC New South Wales Government South Australia Government
		'eradicating mice from islands' or at continental scale [presumably Australia] to address their impacts on biodiversity	Homing gene drive												
1.2.3		Population suppression	Homing CRISPR (targeting locally ¹ fixed alleles of female fertility genes)	Sudweeks <i>et al.</i> 2019 Oh <i>et al.</i> 2021	1	2	3	4	5	6	7	8	9	A.L. Lloyd North Carolina State University, USA + A.J. Piaggio USDA APHIS Wildlife Services, USA	DARPA
		'Suppressing' invasive rodents on islands to reduce impacts on biodiversity, agriculture and human health	Localized synthetic gene drive												

1 Locally fixed alleles refers to alleles found in specific geographic locations - sometimes also referred to as 'private alleles'

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
1.2.4	Mus musculus House mouse	Population suppression	Homing CRISPR – four ² designs modelled	Prowse <i>et al.</i> 2017 (see also entries 1.3.3 and 1.5)	1	2 M	3	4	5	6	7	8	9	T.A.A. Prowse University of Adelaide, Australia	University of Adelaide
		'eradication of alien rodents on islands' to address impacts on biodiversity The impacts of rodents on agriculture are also noted as a driver	'CRISPR gene drive' 'Homozygotic XX sterility'												
1.3 Mus musculus Homing CRISPR sex ratio distorter – Sox9 cargo³															
1.3.1		Population suppression	CRISPR based gene drive involving <i>Sox9</i> – probably a homing CRISPR drive with <i>Sox9</i> cargo	Campbell <i>et al.</i> 2019 No results published despite substantial funding (the work described in entry 1.3.3 may have informed this project)	1	2	3	4	5	6	7	8	9	Probably P.Q. Thomas University of Adelaide, Australia	DARPA
		'eradicating invasive rodent populations on islands' to address impacts on biodiversity	Paper describes development of 'CRISPR/Cas9 and CRISPR/Cpf1 ⁴ gene drives with <i>Sox9</i> and Y-shredder'					?							
								?							
1.3.2		Population suppression	Homing CRISPR (with <i>Sox9</i> cargo)	Brown, Eikenbary and Landis, 2022	1	2 M	3	4	5	6	7	8	9	W.G. Landis Western Washington University, USA	Funders not stated
		Eradicating invasive mouse populations on islands to address biodiversity impacts - with the Southeast Farallon island used as a case study	' <i>Sox9</i> CRISPR cas9 gene drive'												
1.3.3		Population suppression	Homing CRISPR - four designs modelled ²	Prowse <i>et al.</i> 2017 (see also entries 1.2.4 and 1.5)	1	2 M	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	University of Adelaide
		'eradication of alien rodents on islands' to address impacts on biodiversity Aim ultimately is also to address impacts of invasive species (esp. mice and rabbits) on agricultural production	'CRISPR gene drive' Variants named: 'Heterozygotic XX sterility' 'Heterozygotic XX sex reversal'												

2 The designs modelled in this publication are covered in entries 1.2.4, 1.3.3 and 1.5

3 *Sox9* is an autosomal gene that codes for a developmental transcription factor crucial for sex determination.

4 Cpf1 is the old term for what is now named Cas12a

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
1.4	Mus musculus Homing CRISPR sex ratio distorter – ‘Y-shredder’ cargo														
1.4.1	Mus musculus House mouse	Population suppression	Homing CRISPR (with ‘Y shredder’ cargo)	Prowse <i>et al.</i> 2019 Campbell <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	J.V. Ross University of Adelaide, Australia	DARPA
		‘Suppression or eradication’ of rodent populations to reduce impacts on biodiversity and agriculture	Y chromosome shredding gene drive (Campbell <i>et al.</i> 2019) ‘Y-Chromosome deletion using Orthogonal Programmable Endonucleases (Y-CHOPE)’ (Prowse <i>et al.</i> 2019)	No results regarding gene drive construction published		M		?							
								?							
								?							
1.4.2		Population suppression	Homing CRISPR (with ‘Y-shredder cargo)	Combs <i>et al.</i> 2026	1	2	3	4	5	6	7	8	9	K.M. Pepin National Wildlife Research Centre, USA	USDA National Institute of Allergy and Infectious Diseases
		Eradication of invasive populations on islands to address biodiversity impacts	‘Y shredder’			M									
1.5	Mus musculus Homing CRISPR causing recessive embryonic lethality														
1.5		Population suppression	Homing CRISPR – four designs modelled ²	Prowse <i>et al.</i> 2017 (see also entries 1.2.4 and 1.3.3)	1	2	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	University of Adelaide
		‘eradication of alien rodents on islands’ to address impacts on biodiversity The impacts of rodents on agriculture are also noted as a driver	‘CRISPR gene drive’ ‘Homozygotic embryonic non- viability’			M									

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
1.6	<i>Mus musculus</i> Feasibility study for homing CRISPR for population modification in deer (see entry number 12)														
1.6	<i>Mus musculus</i> House mouse	Population modification	Homing CRISPR	Castle <i>et al.</i> 2022										D. Westaway University of Alberta, Canada	Alberta Prion Research Institute CFI University of Alberta
		To demonstrate feasibility of a gene drive rendering wild deer immune to chronic wasting disease [by spreading <i>PRNP</i> null alleles]	CRISPR/Cas9 gene drive												
1.7	<i>Mus musculus</i> T-haplotype⁵ targeting female fertility														
1.7		Population suppression	Split drive: a) <i>T</i> -haplotype element with gRNA cargo targeting 'haplosufficient female fertility gene' (<i>Pr1</i>) b) Cas9 expressed separately (in male germline)	Gierus <i>et al.</i> 2022 Piaggio <i>et al.</i> 2024 Birand, Prowse <i>et al.</i> 2025	1	2	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia A.J. Piaggio USDA National Wildlife Research Center, USA	Government of New South Wales Centre for Invasive Species Solutions Government of South Australia USDA Packard Nature Conservancy
		Aim is to explore the potential of an engineered form of the <i>T</i> -haplotype for 'mouse population suppression or even eradication on islands'	tCRISPR split drive												
1.8	<i>Mus musculus</i> T-haplotype sex ratio distorter - <i>Sry</i>⁶ cargo (T-Sry)														
1.8.1		Population suppression	<i>T</i> -haplotype sex ratio distorter (carrying <i>Sry</i> cargo)	Leitschuh <i>et al.</i> 2018 Campbell <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	J. Godwin North Carolina State University, USA	NSF DARPA
		Eradicating invasive populations on islands to address biodiversity impacts	<i>T</i> -complex drive	No results published despite substantial funding											

5 *T*-haplotype or t-complex is a selfish genetic element functioning as a meiotic drive and sex-ratio distorter that naturally occurs in mice, though does not spread widely. It is a form of a toxin-antidote system and allows for the insertion of 'cargo' genes into the t-complex, for example female infertility genes such as *Sry*. The *t*-haplotype is linked to the occurrence of taillessness (gene symbol T), which gave it its name.

6 *Sry* is a Y-chromosomal gene responsible for sex determination (sex-determining region Y) and is required for initiating male development. It is also described as the *male phenotype control gene*. In females it will result in infertility due to partial male development.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
1.8.2	<i>Mus musculus</i> House mouse		T-haplotype sex ratio distorter (carrying Sry cargo)	Backus and Gross, 2016	1	2 M	3	4	5	6	7	8	9	K. Gross North Carolina State University, USA	North Carolina State University NSF
			<i>t-Sry</i>												
1.8.3			T-haplotype sex ratio distorter (carrying Sry cargo)	Manser <i>et al.</i> 2019	1	2 M	3	4	5	6	7	8	9	T.A.R. Price University of Liverpool, UK	SNSF NERC
			synthetic sperm-killing gene drive: ' <i>t-Sry</i> '												
1.9	<i>Mus musculus</i> Y linked 'X-shredder' gene drive														
1.9.1		Population suppression	CRISPR based X-shredder gene drive '(driving Y)'	Brown, 2021 Birand, Cassey, Ross, Russell, <i>et al.</i> 2022 Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2 M	3	4	5	6	7	8	9	T.A.A. Prowse P.Q. Thomas University of Adelaide, Australia	ARC New South Wales Government South Australia Government
		'eradicating mice from islands' or at continental scale [presumably Australia] to address their impacts on biodiversity	X chromosome shredding gene drive												
1.9.2		Population suppression	CRISPR based X-shredder gene drive	Combs <i>et al.</i> 2026	1	2 M	3	4	5	6	7	8	9	K.M. Pepin National Wildlife Research Centre, USA	USDA National Institute of Allergy and Infectious Diseases
		Eradication of invasive populations on islands to address biodiversity impacts	X-shredder gene drive												
1.10	<i>Mus musculus</i> – 'X-shredder'														
1.10		Population suppression	X-shredder	Bunting <i>et al.</i> 2024	1	2	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	CSIRO New South Wales Government Center for Invasive Species solutions
		A proof of principle of this technology for eradication of invasive vertebrates to address impacts on biodiversity and economic costs	X-shredder												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
1.11	Mus musculus – ‘Y-linked editors’														
1.11	Mus musculus House mouse	Population suppression	A nuclease expressed from Y chromosome targeting female fertility genes	Verma <i>et al.</i> 2026	1	2 M	3	4	5	6	7	8	9	O.S. Akbari University of California, San Diego, USA J.M. Marshall University of California, Berkeley, USA	None declared
		Eradication of invasive rodents to address impacts on biodiversity and economic costs, especially on islands	Y-linked editor												
Kingdom: ANIMALS Class: Mammals Order: (Rodentia) Rodents Species: Other rodents 															
2.1	Peromyscus leucopus White footed mouse  After Cassola <i>et al.</i> 2016	Population modification	Not specified	Long <i>et al.</i> 2019	1	2	3 G	4	5	6	7	8	9	A.G. Barbour University of California Irvine, USA	NIH Bay Area Lyme Foundation UCI USC DoD
		To modify wild populations of this species to render them resistant to the bacteria causing Lyme's disease, and thus reduce spread of this disease to humans	Not specified												
2.2			CRISPR daisy drive	Buchthal <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	K.M. Esvelt MIT, USA	Greenwall Rainwater CDMRP - DoD Sloan Burroughs Wellcome Fund NIH MIT Media Lab
			Localized 'daisy drive' system												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?										Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9			
3.1	<i>Rattus norvegicus</i> Brown rat	NA – proof of concept	Split homing CRISPR	Lai <i>et al.</i> 2023 (pre-print publication — no peer reviewed publication to date)	1	2	3	4	5	6	7	8	9	K. Jarnagin Synbal, USA (E. Bier, TSVI Goldenberg and V. Gantz are directors)	Not stated	
	 After Khlyap 2012, appended after Hulme- Beaman 2021.	The production of complex strains harboring multiple humanizing genes	Active genetics gene conversion system													
3.2		Population suppression	Homing CRISPR (targeting 'haplosufficient female fertility gene' or 'haplosufficient zygote viability gene') and 'Y-shredder' (located on X-chromosome)	Champer <i>et al.</i> 2021	1	2 M	3	4	5	6	7	8	9	P.W. Messer Cornell University, USA	Predator Free NZ NIH BioHeritage NZ NERC	
		Eradicating invasive rat populations on islands to address their impacts on biodiversity	Three drives modelled: 'homing drive' targeting either female fertility or zygote viability; and 'Y-shredder located on the X-chromosome'													
3.3		Population suppression	Homing CRISPR	Birand, Gierus <i>et al.</i> 2025	1	2 M	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	New South Wales Government Centre for Invasive Species Solutions	
		'landscape-scale suppression of rodent populations' with use in 'eradication efforts on large islands' noted as a possibility	'Standard homing drives embedded in haplosufficient fertility or viability genes'													

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
3.4	<i>Rattus norvegicus</i> Brown rat	Population suppression	Homing CRISPR variant	Birand, Gierus <i>et al.</i> 2025	1	2 M	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	New South Wales Government Centre for Invasive Species Solutions
		'landscape-scale suppression of rodent populations' with use in 'eradication efforts on large islands' noted as a possibility	'homing rescue (HR) drive embedded in a haplolethal gene that also targets an independent fertility or viability gene'												
3.5		Population suppression	Homing CRISPR (targeting 'haplosufficient female fertility gene')	Roslin Institute, 2017 McFarlane, Whitelaw and Lillico, 2018	1	2	3	4	5	6	7	8	9	C.B.A. Whitelaw S.G. Lillico Roslin Institute, University of Edinburgh, UK	CSC BBSRC
		'to curb pest rodent populations'	Homing gene drive targeting female fertility												
3.6		Population suppression	T-haplotype sex ratio distorter (carrying Sry cargo)	Manser <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	T.A.R. Price University of Liverpool, UK	SNSF NERC
		To eradicate invasive populations on islands	synthetic sperm-killing gene drive: 't-Sry'												
3.7		Population suppression	Homing CRISPR or not specified	Dearden <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	Various institutions	Funder not stated for Dearden <i>et al.</i> Godwin <i>et al.</i> funded by DARPA
		To control or eradicate invasive populations in New-Zealand or on islands	NA – proposal only	Godwin <i>et al.</i> 2019 These papers make similar proposals so have been combined in one entry											

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
4.1	<i>Rattus rattus</i> Common rat or black rat	Population suppression	Homing CRISPR – two variants modelled	Prowse <i>et al.</i> 2017	1	2 M	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	University of Adelaide
	 After Shiels and Veitch, 2023 ⁷	‘eradication of alien rodents on islands’ to address impacts on biodiversity. The impacts of rodents on agriculture are also noted as a driver	‘CRISPR gene drive’ Two variants modelled: ‘Homozygotic embryonic non- viability’ ‘Homozygotic XX sterility’												
4.2		Population suppression	Homing CRISPR (targeting ‘haplosufficient female fertility gene’ or ‘haplosufficient zygote viability gene’) or ‘Y-shredder’ located on X-chromosome	Champer <i>et al.</i> 2021	1	2 M	3	4	5	6	7	8	9	P.W. Messer Cornell University, USA	Predator Free NZ NIH BioHeritage NZ NERC
		Eradicating invasive rat populations on islands to address their impacts on biodiversity	Three drives modelled: ‘homing drive’ targeting either female fertility or zygote viability ‘Y-shredder located on the X-chromosome’												
4.3		Population suppression	Homing CRISPR or ‘Y-linked X shredder’- Y-chromosome-linked X-shredder	Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2 M	3	4	5	6	7	8	9	T.A.A. Prowse University of Adelaide, Australia	ARC New South Wales Government South Australia Government
		Eradication of this species at continental scale, presumably in Australia, to address impacts on biodiversity	‘CRISPR homing drive targeting female fertility’ or Shredding drive (‘driving-Y’)												

⁷ This map shows countries and regions where this species is present, and so does not show the true geographic range. It may be that the species is not present in the whole territory of a country, for example it is probably absent from Arctic areas of Canada.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
4.4		Population suppression	T-haplotype sex ratio distorter (carrying Sry cargo)	Manser <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	T.A.R. Price University of Liverpool, UK	SNSF NERC
		To eradicate invasive populations on islands	synthetic sperm-killing gene drive: 't-Sry'												
4.5		Population suppression	Homing CRISPR or not specified	Dearden <i>et al.</i> 2018 Moro <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	Various institutions	Funder not stated in most cases.
		To control or eradicate invasive populations in Australia, New-Zealand or on islands	NA – proposal only	Godwin <i>et al.</i> 2019 Thresher, 2022 These papers make similar proposals so have been combined in one entry											Godwin <i>et al.</i> funded by DARPA
5	<i>Rattus exulans</i> Polynesian rat	Population suppression	Homing CRISPR or not specified	Dearden <i>et al.</i> 2018 Godwin <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	Various institutions	Funder not stated for Dearden <i>et al.</i>
	 After Ruedas <i>et al.</i> 2016	To control or eradicate invasive populations in New-Zealand or on islands	NA – proposal only	These papers make similar proposals so have been combined in one entry											Godwin <i>et al.</i> funded by DARPA
6.1	<i>Sciurus carolinensis</i> Grey squirrel	Population suppression	Homing CRISPR + Cleave and Rescue [Toxin Antidote] CRISPR combination, with 'daisy-field'	Faber, McFarlane <i>et al.</i> 2021	1	2	3	4	5	6	7	8	9	G. Gorjanc Roslin Institute, University of Edinburgh, UK	BBSRC
		To 'control a targeted grey squirrel population' to reduce impacts on biodiversity and damage to property in the UK (where it is invasive)	HD-CivR: 'composed of homing (H), daisyfield (D), and cleave-and-rescue (CivR) gene drives' (a highly speculative and complex drive)												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
6.2	<i>Sciurus carolinensis</i> Grey squirrel	Population suppression	This is a stakeholder engagement study and does not specify the type of technology proposed	Hartley and Smith, 2024	1	2	3	4	5	6	7	8	9	S. Hartley University of Exeter, UK + R.D.J. Smith University of Edinburgh, UK	Not stated
		'To control populations of this species to reduce impacts on biodiversity and forestry in the UK (where it is invasive)	See above												
Kingdom: ANIMALS Class: Mammals Order: <i>Carnivora</i> (Cats, dogs and related mammals) 															
7.1	<i>Felis catus</i> House cat & feral cat	Population suppression	Not stated	Australian Wildlife Conservancy, no date	1	2	3	4	5	6	7	8	9	Not known	AWC and/or CSIRO
	 After Bengsen <i>et al.</i> 2015	To eradicate or control feral cats in Australia to reduce predation of native species	Not stated												
7.2	 <i>Felis silvestris</i> (wild cat). After Yamaguchi <i>et al.</i> 2015 ⁸	Population suppression	Homing CRISPR or 'Y-linked X shredder' - Y-chromosome-linked X-chromosome shredding drive	Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	T.A.A. Prowse University of Adelaide, Australia	ARC New South Wales Government South Australia Government
		Eradication at continental scale, presumably in Australia, to address impacts on biodiversity	'CRISPR homing drive targeting female fertility' or (driving-Y')												

⁸ We have included the range of the wild cat, *Felis silvestris*, which can readily hybridise with the domestic cat, *Felis catus*.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
7.3	<i>Felis catus</i> House cat & feral cat	Population suppression	Homing CRISPR	Moro <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	M. Tizard Australian Animal Health Laboratory, Australia	No specific funder acknowledged All authors appear to be Australian Government employees
		Eradication or control of feral cats in Australia to address their impact on biodiversity, i.e. native fauna.	RNA-guided gene drive												
8.1	<i>Vulpes vulpes</i> European red fox	Population suppression	Homing CRISPR or 'Y-linked X shredder' Y-chromosome-linked X-chromosome- shredding drive	Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2 M	3	4	5	6	7	8	9	T.A.A. Prowse University of Adelaide, Australia	ARC New South Wales Government South Australia Government
	 After Hoffman and Sillero- Zubri, 2021	Eradication at continental scale, presumably in Australia, to address impacts on biodiversity	'CRISPR homing drive targeting female fertility' or 'driving-Y'												
8.2		Population suppression	Homing CRISPR	Moro <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	M. Tizard Australian Animal Health Laboratory, Australia	No specific funder acknowledged All authors appear to be Australian Government employees
		Suppression/eradication to address decline in 'Australia's terrestrial mammal fauna' caused by predation by foxes. The paper also states '...foxes are a serious agricultural pest'.	RNA-guided gene drive												
9	<i>Mustela erminea</i> Stoats	Population suppression	Homing CRISPR	Dearden <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	D.R. Penman Lincoln University, New Zealand	Funder not stated
		To control or eradicate this invasive species in New Zealand to reduce predation of native birds including kiwis	NA – proposal only												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
10	<i>Mustela putorius furo</i> Domestic ferret	Population suppression	Not specified	Clark <i>et al.</i> 2024										N.J. Gemmell University of Otago, New Zealand	Predator Free 2050 Fulbright New Zealand Ministry for Primary Industries Ministry for Pacific Peoples Genomics Aotearoa University of Otago NIH
		To reduce or eliminate invasive populations of this species in New Zealand, presumably for conservation purposes	Not specified												
Kingdom: ANIMALS Class: Mammals Order: <i>Diprotodontia</i> (Possums and related marsupials) 															
11	<i>Trichosurus vulpecula</i> Brushtail possum	Population suppression	Homing CRISPR	Dearden <i>et al.</i> 2018										D.R. Penman Lincoln University, New Zealand	Funder not stated
		To control or eradicate this invasive species in New Zealand to reduce damage to native trees and the spread of bovine tuberculosis	NA – proposal only												
Kingdom: ANIMALS Class: Mammals Order: <i>Artiodactyla</i> (Deer, Pigs and related mammals)  															
12	<i>Cervid family</i> Deer	Population modification	Homing CRISPR	Castle <i>et al.</i> 2022										D. Westaway University of Alberta, Canada	Alberta Prion Research Institute CFI University of Alberta
		To render the wild population immune to chronic wasting disease (by spreading <i>PRNP</i> null alleles) > see entry 1.6	CRISPR/Cas9 gene drive Initial work on rabbit and mouse cell lines only												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
13	<i>Sus scrofa</i> Feral pigs	Population suppression	Not specified	Carter <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	T. Strive Centre for Invasive Species Solutions, Australia	Not stated Probably CSIRO
		To address the 'social, economic and environmental burden' of this non-native species in Australia	NA – proposal only												
Kingdom: ANIMALS Class: Mammals Order: Lagomorpha (Rabbits and hares) 															
14.1	<i>Oryctolagus cuniculus</i> European rabbit	Population suppression	Proposal is to base gene drive system on natural selfish genetic elements – this study is seeking to identify such elements	Smertina <i>et al.</i> 2026	1	2	3	4	5	6	7	8	9	M. Jenckel CSIRO, Australia	CSIRO
	 After Tablado <i>et al.</i> 2009	Control or eradication of this invasive species in Australia - to address biodiversity impact	NA – preliminary study												
14.2		Population suppression	Homing CRISPR – two variants modelled	Prowse <i>et al.</i> 2017	1	2	3	4	5	6	7	8	9	P.Q. Thomas University of Adelaide, Australia	University of Adelaide
		Eradication of invasive rabbit populations on islands to address biodiversity impacts Impacts of rabbits on agriculture are also noted	CRISPR gene drive Two variants modelled: 'Homozygotic embryonic non- viability' 'Homozygotic XX sterility'												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders	
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9			
14.3	<i>Oryctolagus cuniculus</i> European rabbit	Population suppression	Homing CRISPR or 'Y-linked X shredder'- Y-chromosome- linked X-chromosome shredding drive	Birand, Cassey, Ross, Thomas, <i>et al.</i> 2022	1	2 M	3	4	5	6	7	8	9	T.A.A. Prowse University of Adelaide, Australia	ARC New South Wales Government South Australia Government	
		Eradication at continental scale, presumably in Australia, to address impacts on biodiversity	'CRISPR homing drive targeting female fertility' or 'driving-Y'													
14.4		Population suppression	Homing CRISPR or not specified	Moro <i>et al.</i> 2018 Thresher, 2022	1	2	3	4	5	6	7	8	9	Various institutions	Funder not stated in both cases.	
		To control or eradicate invasive populations in Australia or New-Zealand	NA – proposal only	These papers make similar proposals so have been combined in one entry												
Kingdom: ANIMALS		Class: Mammals	Order: <i>Eulipotyphla</i> (Hedgehogs, moles, shrews and related mammals)												Theoretical studies only	
15	<i>Erinaceus europaeus</i> European hedgehog	Population suppression	Not specified	Clark <i>et al.</i> 2024	1	2	3	4	5	6	7	8	9	N.J. Gemmell University of Otago, New Zealand	Predator Free 2050 Fulbright New Zealand Ministry for Primary Industries Ministry for Pacific Peoples Genomics Aotearoa University of Otago NIH	
		To reduce or eliminate invasive populations of this species in New Zealand, presumably for conservation purposes	Not specified													

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
Kingdom: ANIMALS		Class: Birds	Theoretical studies only												
16	<i>Sturnus vulgaris</i> Common starling	Population suppression	Homing CRISPR	Moro <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	M. Tizard Australian Animal Health Laboratory, Australia	No specific funder acknowledged
		Suppression to address 'impacts to biodiversity and agriculture', however this species is noted for the damage it causes to crops so this is likely the primary driver	RNA-guided gene drive												All authors appear to be Australian Government employees
Kingdom: ANIMALS		Class: Amphibians	Theoretical studies only												
17.1	<i>Bufo marinus</i> or <i>Rhinella marina</i> Cane toad	Population modification	Homing CRISPR	Tingley <i>et al.</i> 2017	1	2	3	4	5	6	7	8	9	R. Shine University of Sydney, Australia	Not stated
	 After Solís <i>et al.</i> , 2009	To 'detoxify' toads in Australia to address impacts on native species which are poisoned by eating them.	NA – proposal only												
17.2		Population suppression	Homing CRISPR	Moro <i>et al.</i> 2018	1	2	3	4	5	6	7	8	9	M. Tizard Australian Animal Health Laboratory, Australia	No specific funder acknowledged
		Suppression to address impacts on native species in Australia, which are either predated by toads or poisoned by eating them.	RNA-guided gene drive	Cooper <i>et al.</i> 2020 – conference abstract											All authors appear to be Australian Government employees
17.3		Population suppression	Z linked W-shredder, with variable parameters (to control species with ZW sex determination)	Holman, 2019	1	2	3	4	5	6	7	8	9	L. Holman University of Melbourne, Australia	ESEB SNSF
		Suppressing 'invasive populations of cane toads'	Z linked 'W-shredder' (analogue to Y linked X-shredder)												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
18	<i>Eleuthero-dactylus coqui</i> Caribbean tree frog	Population suppression	Homing CRISPR	Thresher, 2022										A.C. Thresher University of California San Diego, USA	Funder not stated
		Eradication or suppression of this species, (accepting risk of global extinction), to address biodiversity impacts of invasive populations	'CRISPR/Cas suppression-drive'												
Kingdom: ANIMALS Super-class: Bony fish 															
19	<i>Cyprinus carpio</i> European carp ⁹	Population suppression	Not specified	Minnesota Aquatic Invasive Species Research Centre, no date				?						M. Smanski University of Minnesota, USA	ENRTF
		Control of invasive populations of this species	Not specified												
20	<i>Pterois volitans</i> Red lionfish	Population suppression	Homing CRISPR	Vacura <i>et al.</i> 2018										P. Venturelli Ball State University, USA	Funder not stated
		To control or eradicate this invasive species to address damaging impacts to native reef communities in Caribbean and Western Atlantic	NA - preliminary theoretical study												
21	<i>Oreochromis niloticus</i> Nile Tilapia	Population suppression	Different options proposed	Bobo, 2026										E.D. Bobo University of Zimbabwe	No specific funder
		To reduce the biodiversity impacts of invasive populations of this species in Southern Africa and elsewhere	'CRISPR-Cas9 suppression gene drives, specifically homing and Driving-Y drive systems'												

⁹ Kopf *et al.* 2019 raised the possibility of using a gene drive to suppress invasive populations of carp but do not recommend this approach.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
Kingdom: ANIMALS		Infraphylum: Jawless fish		Theoretical studies only											
22.1	<i>Petromyzon marinus</i> Sea-lamprey  After NatureServe, 2013 ¹⁰	Population suppression	Sex ratio distorter	Jones <i>et al.</i> 2025	1	2	3	4	5	6	7	8	9	M.L. Jones Michigan State University, USA	Great Lakes Fishery Commission
		Suppression or eradication of the lamprey from the North American Great Lakes to prevent this parasitic species damaging fish stocks	'daughterless' strategy												
22.2		Population suppression	Various options proposed	Sarasamma <i>et al.</i> 2026	1	2	3	4	5	6	7	8	9	W.M. Li Michigan State University, USA	Great Lakes Fishery Commission
		Suppression or eradication of the lamprey from the North American Great Lakes to prevent this parasitic species damaging fish stock	'Various CRISPR based options proposed including 'A homing-type drive targeting lamprey sex-determining or gametogenic genes' and 'integrating daisy-chain architecture with small-molecule control elements'												
22.3		Population suppression or population modification to enable suppression	Options proposed include: Split homing CRISPR 'Y-Linked X-shredder' Homing CRISPR Toxin Antidote	Ferreira-Martins <i>et al.</i> 2021	1	2	3	4	5	6	7	8	9	M.S. Docker University of Manitoba, Canada	Funders not stated
		Suppression or eradication of the lamprey from the North American Great Lakes to prevent this parasitic species damaging fish stocks	Options proposed include: 'Split gene drive' 'Driving y' 'Homing suppression gene drive' 'Toxin-antidote gene drive'												

¹⁰ This map shows only the inland range for this species, that is watersheds and freshwater lakes where it is present. The species lives part of its life in saltwater and its native range also 'includes the Atlantic coast of North America from Newfoundland to northern Florida, the Atlantic coast of Europe, and the Baltic, western Mediterranean and Adriatic seas.' (Government of Ontario, 2021). In the great lakes, where it is invasive, it has adapted to live entirely in freshwater conditions (Government of Ontario, 2021).

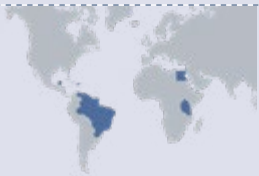
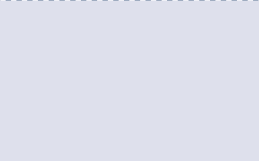
	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
22.4		Population suppression	Homing CRISPR or not specified	York, Thresher, and McCauley, 2021										Various institutions	Funders not stated
		Suppression or eradication of the lamprey from the North American Great Lakes to prevent this parasitic species damaging fish stocks	NA - proposal only	Lampman <i>et al.</i> 2021 These papers make similar proposals so have been combined in one entry											

Kingdom: ANIMALS Phylum: Arthropods Class: Arachnids 

23	<i>Tetranychidae</i> family Spider mites	Propose population replacement (to render them more susceptible to insecticides)	Homing CRISPR	Li <i>et al.</i> 2020	1	2	3	4	5	6	7	8	9	B.E. Tabashnik University of Arizona, USA	BARD
		Reduction of damage to agricultural and horticultural crops	NA - preliminary theoretical study												
24	<i>Varroa destructor</i> Varroa mite	Population modification to enable suppression	Homing CRISPR	Faber, Meiborg <i>et al.</i> 2021	1	2	3	4	5	6	7	8	9	B.A. Harpur Purdue University, USA	BBSRC University of Edinburgh Purdue University Project Apis M.
		Suppression or eradication of varroa mites from honeybee colonies to prevent harm to the colony and honey production	(homing) CRISPR Cas9 gene drive												

Kingdom: ANIMALS Phylum: Arthropods Class: Insects 

SEE SEPARATE TABLE

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
Kingdom: ANIMALS		Phylum: Molluscs	Class: Gastropods												
25.1	<i>Biomphalaria glabrata</i>  After Habib <i>et al.</i> 2021 ¹¹	Population modification The aim is to modify snail populations to increase their immunity to schistosome infection, thereby disrupting the schistosome lifecycle and reducing transmission to humans	Not specified but cites examples of homing CRISPR Not specified	Hambrook <i>et al.</i> 2020	1	2	3	4	5	6	7	8	9	P.C. Hannington University of Alberta, Canada	NSERC Canada
25.2	<i>Biomphalaria glabrata</i> (and other snails of <i>Biomphalaria</i> , <i>Bulinus</i> , <i>Oncomelania</i> & <i>Neotricula</i> genera which host schistosome parasites) All <i>Biomphalaria</i> species susceptible to <i>Schistosoma mansoni</i> . After Habib <i>et al.</i> 2021 ¹² 	Population suppression and/or Population modification 'Modification of natural snail populations' to reduce 'schistosomiasis prevalence and transmission'	Several approaches proposed Several approaches proposed	Maier <i>et al.</i> 2019 - presentation	1	2	3	4	5	6	7	8	9	M. Zamanian University of Wisconsin, USA J. Reinhard+Rupp Global Health Institute of Merck, Switzerland	Global Health Institute of Merck
25.3	<i>Biomphalaria glabrata</i> 	Population modification The aim is to modify snail populations to increase their immunity to schistosome infection, thereby disrupting the schistosome lifecycle and reducing transmission to humans	Homing CRISPR CRISPR gene drive	Grewelle <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	G.A. De Leo Stanford University, USA	Stanford University NSF

11 This map show countries where this species is present and does not show the exact geographic range.

12 This maps show countries where these species are present, and does not show the exact geographic range.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
Kingdom: ANIMALS		Phylum: Nematodes													
26	<i>Caenorhabditis brenneri</i>	Proof of principle experiments – not intended for release	daisy-chain drive, daisyfield drive, daisy quorum drive	Esvelt 2017a Esvelt 2017b No results have been published despite substantial funding	1	2	3	4	5	6	7	8	9	K.M. Esvelt MIT, USA	DARPA This funding has now ended
		To ‘test and optimize daisy-chain, daisyfield, and daisy quorum drives—including for daisy restoration—in fast-reproducing laboratory populations of worms...’	daisy-chain drive, daisyfield drive, daisy quorum drive												
Kingdom: ANIMALS		Phylum: Flatworms													
27	<i>Schistosoma mansoni</i> (<i>Schistosoma haematobium</i> also proposed) Blood flukes	Population suppression	Z linked W-shredder, with variable parameters (as described by Holman, 2019)	AAAS 2016 Iordanskiy <i>et al.</i> 2017 - conference abstract Holman 2019 No results have been published	1	2	3	4	5	6	7	8	9	K.M. Esvelt MIT, USA + P. Brindley George Washington University, USA	MaxMind and probably others This funding has likely ended
		To suppress schistosome parasites to thereby reduce human morbidity and mortality from schistosomiasis	One proposal would be a Z linked ‘W-shredder’ (as described by Holman, 2019) ‘all of the offspring will be born either female or male.’ (AAAS 2016)												
Kingdom: FUNGI															
28.1	<i>Fusarium graminearum</i>	Population modification	Engineered gene drive employing <i>Spok1</i> (spore killer meiotic drive from <i>Podospora</i> spp.)	Gardiner <i>et al.</i> 2020 Urquhart and Gardiner, 2023 ¹³	1	2	3	4	5	6	7	8	9	K. Kazan CSIRO, Queensland, Australia + D. M. Gardiner CSIRO, Queensland, Australia	CSIRO ARC Australian Government
		To modify populations of <i>F. graminearum</i> to disrupt virulence factors in this species, and so reduce head blight in wheat and barley	<i>Spok1</i>							?	?	?			

13 Urquhart and Gardiner (2023) report further experimental work to characterise *Spok1* using the model organisms *S. cerevisiae* and *E. coli*. The ‘genetic control of plant-pathogenic fungi’ is mentioned as a possible future goal, with *F. graminearum* mentioned specifically.

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
28.2		Population modification	Split homing CRISPR	Gardiner <i>et al.</i> 2020										K. Kazan Agriculture and Food, CSIRO, Australia	CSIRO
		To modify populations of the <i>F. graminearum</i> (presumably for same reasons as in 28.1)	Do not use any particular term – but give detailed description of design												
29	<i>Fusarium verticillioides</i>	Not specified	Engineered gene drive employing Spore Killer Candidate-1 (<i>SKC1</i>) from <i>F. verticillioides</i>	Lohmar, Rhoades, Hammond, <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	T. M. Hammond University of Illinois, USA	NSF USDA
		To control this plant pathogen which causes 'ear and stalk rot of maize' and which can 'contaminate maize kernels with fumonisin mycotoxins'	'SKC1 based control practices' [which would 'require modifications to SKC1']	Lohmar, Rhoades, Patel, <i>et al.</i> 2022										+ D.W. Brown USDA, Agricultural research service, Illinois, USA	
30.1	<i>Saccharomyces cerevisiae</i> Brewer's or baker's yeast	Population modification	Split homing CRISPR	DiCarlo <i>et al.</i> 2015	1	2	3	4	5	6	7	8	9	G.M. Church Harvard Medical School, USA	DOE NCI NIDDK Wyss Institute
		Proof of principle of population modification via a split homing gene drive in this model organism	'split CRISPR-Cas9 gene drive'							?	?	?			
30.2		Population modification	Split homing CRISPR	Roggenkamp <i>et al.</i> 2017	1	2	3	4	5	6	7	8	9	G.C. Finnigan Kansas State University, USA	NIH Kansas State University
		To generate homozygous diploid states in modified yeast	Cas9 gene drive system												
30.3		Population modification	Probably homing CRISPR (as team had used this technology in other work)	Aguilera, 2017 - press release No results published	1	2	3	4	5	6	7	8	9	S. Kryazhinsky J. Meyer University of California San Diego, USA	DARPA
		To study gene drives over many generations to understand the emergence of resistance	NA – no publications												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
30.4		Population modification	Split homing CRISPR	Roggenkamp <i>et al.</i> 2018										G.C. Finnigan Kansas State University, USA	NIH USDA Kansas State University
		To test various methods to modulate gene drive activity, e.g. Cas9 expression level (Roggenkamp <i>et al.</i> 2018), expression of anti-CRISPR proteins (Basgall <i>et al.</i> 2018) and Cas9 nuclear localisation (Goeckel <i>et al.</i> 2019).	CRISPR-Cas9 gene drive / CRISPR gene drive	Basgall <i>et al.</i> 2018 Goeckel <i>et al.</i> 2019						?					
30.5		Population modification	Multi-locus split homing CRISPR	Yan and Finnigan, 2018										G.C. Finnigan Kansas State University, USA	NIH USDA
		To test a split gene drive system to simultaneously propagate gene drives at three different loci	Multi-locus CRISPR gene drive							?					
30.6		Population modification	Split homing CRISPR employing Cas12a	Lewis, Yan, and Finnigan, 2021										G.C. Finnigan Kansas State University, USA	Kansas State University USDA
		Proof of principle of population modification via a split homing gene drive based on Cas12a	'Cas12a-based gene-drive system'							?					
30.7		Population modification	Split homing CRISPR	Bakerlee <i>et al.</i> 2022										M.M. Desai Harvard University, USA	DoD NSERC Canada NIH NSF
		To generate a library of 'all combinations of 10 missense mutations from across the genome' to study interactions between these mutations (epistasis)	'hierarchical' CRISPR gene drive							?					

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
30.8		Population modification	Homing CRISPR variant	Abdullah <i>et al.</i> 2023										A.H. Kachroo Concordia University, Montreal, Canada	NSERC Canada CFI Québec Ministère de l'Économie, de la Science et de l'Innovation Concordia University Welch Foundation Army Research Office NIH
		To 'readily combine genetically engineered loci' in yeast	Marker-less enrichment and recombination of genetically engineered loci (MERGE)												
31	Candida albicans	Population modification	Split homing CRISPR	Shapiro <i>et al.</i> 2018 Halder <i>et al.</i> 2019										J. Collins MIT & Harvard University, USA + R.S. Shapiro University of Guelph, Canada	Allen CIHR NIH Wyss Institute NSERC Canada Banting Burroughs Wellcome Fund
		To create single and double deletion mutants in this species for laboratory studies	CRISPR-Cas9 based gene drive							?					
										?					
										?					
Kingdom:  PLANTS															
32.1	Arabidopsis thaliana Arabidopsis	Population suppression and population modification both proposed	Toxin antidote gene drive	Oberhofer <i>et al.</i> 2024										B.A. Hay California Institute of Technology, USA	Caltech Center for Evolutionary Science Caltech Resnick Sustainability Institute NIH USDA
		Proof of concept for gene drives in plants - 'to rapidly drive population modification or suppression'	Cleave and Rescue gamete killer												

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9		
32.2	<i>Arabidopsis thaliana</i> Arabidopsis	Population suppression and population modification both proposed	Toxin antidote gene drive	Liu <i>et al.</i> 2024	1	2	3	4	5	6	7	8	9	W.F. Qian Chinese Academy of Sciences, China	Chinese Academy of Sciences
		Proof of concept for gene drives in plants - 'for rapid genetic modification or suppression of outcrossing plant populations'	CRISPR-Assisted Inheritance utilizing NPG1 (CAIN)												
32.3		Population modification	Homing CRISPR	Zhang, Mudgett <i>et al.</i> 2021	1	2	3	4	5	6	7	8	9	Y. Zhao University of California San Diego, USA	TIGS UCSD NIH
		The intention was to demonstrate a gene drive system in a plant model species. The authors state this technology could 'accelerate crop breeding'	CRISPR/Cas9-based gene drive	Zhang <i>et al.</i> 2022 paper WITHDRAWN after a year											
33	<i>Nicotiana tabacum</i> Tobacco	Population modification	TALEN gene-drive mutagenesis	Forner <i>et al.</i> 2022	1	2	3	4	5	6	7	8	9	R. Bock Max Planck Institute for Molecular Plant Physiology, Germany	Max Planck Society ERC
		The aim is to demonstrate a technology for modifying the plant mitochondrial genome for laboratory experiments and to 'enable the exploitation of mitochondria in biotechnology and synthetic biology'	transcription activator-like effector nuclease (TALEN) gene-drive mutagenesis (GDM), or TALEN-GDM												
34	<i>Amaranthus palmeri</i> Palmer amaranth	Population suppression	Sex ratio distorter (but mechanism of gene drive not specified)	Montgomery <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	P.J. Tranel University of Illinois, USA	USDA Max Planck Society
		To reduce the effects of this species on crop yields	'gene-drive system to manipulate sex ratios' (male-bias)	Montgomery <i>et al.</i> 2021											
35	<i>Amaranthus tuberculatus</i> Waterhemp	Population suppression	Sex ratio distorter (but mechanism of gene drive not specified)	Montgomery <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	P.J. Tranel University of Illinois, USA	USDA Max Planck Society
		To reduce the effects of this species on crop yields	'gene-drive system to manipulate sex ratios' (male-bias)	Montgomery <i>et al.</i> 2021											

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?									Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system												
PLANTS															
36	Various weed and invasive species: <i>Alopecurus myosuroides</i> Black grass ¹⁴ <i>Amaranthus palmeri</i> Palmer amaranth ¹⁴ <i>Amaranthus tuberculatus</i> Rough fruited water hemp ¹⁴ <i>Ambrosia artemisiifolia</i> Common ragweed ¹⁴ <i>Cynodon dactylon</i> Bermuda grass ¹⁴ <i>Cyperus rotundus</i> Purple nut sedge ¹⁴ <i>Eichhornia crassipes</i> Water hyacinth <i>Kochia scoparia</i> Kochia ¹⁴ <i>Lantana camara</i> Common lantana ¹⁴ <i>Lolium rigidum</i> Rigid rye grass ¹⁴ <i>Lupinus arboreus</i> Yellow bush lupin/tree lupin <i>Lychnis coronia 'Alba'</i> Rose campion <i>Tanacetum vulgare</i> Common tansy ¹⁴ <i>Setaria glauca</i> Yellow foxtail ¹⁴	Population modification to enable suppression To reduce the presence and impact of weed species on agricultural production by modifying them, potentially to render them less competitive, or more sensitive to herbicide. The technology might also be used to tackle other invasive plant species.	Homing CRISPR is most common proposed technology NA - Proposals only	Neve, 2018 Chen <i>et al.</i> 2019 Kumaran <i>et al.</i> 2020 Perotti <i>et al.</i> 2020 Tek and Budak, 2022 Wong <i>et al.</i> 2022 Croghan <i>et al.</i> 2023 Kumam <i>et al.</i> 2023 Kim <i>et al.</i> 2026 All the above papers make similar proposals so have been combined into one entry Mitchell and Bartsch (2020) suggest common ragweed as a target	1	2	3	4	5	6	7	8	9	Proposals from several funded CSIRO researchers including at the University of Queensland, Australia, and researchers at Rothamsted Research UK	Various funders including BBSRC and CSIRO

	Species	Intended direct effect	Type of gene drive (our categories)	Publication(s) where research is described	How close is strain/system to experimental releases in the wild?										Project leader(s) Institution	Funders
	Geographic range	Intended use (as stated by authors)	Developer's name for gene drive system		1	2	3	4	5	6	7	8	9			
37	Myrtaceae family (including <i>Eucalyptus</i> <i>spp.</i>)	Population modification	NA	Barrett <i>et al.</i> 2019	1	2	3	4	5	6	7	8	9	D.M. Gardiner CSIRO Agriculture and Food, Australia	CSIRO	
		To modify wild populations in Australia to render them resistant to the fungal pathogen <i>Puccinia psidii</i>	The proposals do not focus on any particular type of gene drive													
38	Trees	Population modification	Not clearly specified but cites published toxin antidote systems in Arabidopsis	Cao <i>et al.</i> 2024	1	2	3	4	5	6	7	8	9	O. Gailing & G.T.H. Vu University of Göttingen, Germany	University of Göttingen, Germany	
		To modify wild tree populations to spread 'climate resilience traits' or 'genetic defenses' against 'invasive pathogens'	NA – proposal only													

Key to technology levels

- 1 **Gene drive proposed:** a proposal has been put forward in the scientific literature or from another academic source (e.g. funding body)
- 2 **Gene drive proposed with supporting modelling work, or preliminary laboratory work funded:** a proposal has been made in the scientific literature supported by modelling work, or preliminary laboratory work has been funded but has not yet been published
- 3 **Preliminary laboratory work published:** laboratory research relevant to gene drive construction published (e.g. developing molecular biology methods) with possibility or intention to construct gene drive stated
- 4 **Research on gene drive construction funded:** research on gene drive construction has been funded, but no results yet published OR results published showing non-functional gene drives, or similar very limited progress
- 5 **Limited proof of concept:** Published results show a gene drive is to some extent functional, however there are outstanding technical issues such as resistance or low efficiency
- 6 **Laboratory proof of concept:** Taking published results at face value, the system works effectively in the laboratory
- 7 **Scaled up trials:** Data published from scaled up trials in contained environments, offering a more accurate simulation of conditions in natural environment
- 8 **Potential further contained trials:** After large cage trials (or other scaled up trials), it is not currently clear what further trials may take place prior to experimental releases. One possibility is trials in outdoor cages
- 9 **Experimental releases in natural environment:** Field trials are underway with releases in the natural environment. This does not indicate that the technology has been shown to be effective or safe
- X **Abandoned project:** Research to construct a gene drive has been carried out, but has been unsuccessful and to our knowledge is no longer active

Abbreviations for funders and other organisations

Allen	Allen Frontiers Group
ARC	Australian Research Council
AWC	Australian Wildlife Conservancy
Banting	Banting Research Foundation
BARD	United States—Israel Binational Agricultural Research and Development Fund
BBSRC	UK Biotechnology and Biological Sciences Research Council
BioHeritage NZ	New Zealand Biological Heritage National Science Challenge
CDMRP - DoD	Congressionally Directed Medical Research Programs Department of Defense
CFI	Canada Foundation for Innovation
CIHR	Canadian Institutes of Health Research
CSC	Commonwealth Scholarship Commission
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DARPA	US Defense Advanced Research Projects Agency
DoD	US Department of Defense
DOE	US Department of Energy
ENTRF	Environment and Natural Resources Trust Fund
ERC	European Research Council
ESEB	European Society for Evolutionary Biology
Greenwall	Greenwall Foundation
Kinship	Kinship Foundation
NCI	US National Cancer Institute
NERC	UK Natural Environment Research Council
NIDDK	US National Institute of Diabetes and Digestive and Kidney Diseases
NIH	US National Institutes of Health
NSERC Canada	Natural Sciences and Engineering Research Council of Canada
NSF	US National Science Foundation
Packard	David and Lucile Packard Foundation
Pew	Pew Charitable Trust
Predator Free NZ	New Zealand Predator Free Program
Rainwater	Rainwater Foundation
Sloan	Sloan Foundation
SNSF	Swiss National Science Foundation
TATA	TATA trusts
TIGS UCSD	Tata Institute for Genetics and Society University of California San Diego
UCI	University of California Irvine
UCSD	University of California San Diego
USC	University of South Carolina
USDA	US Department of Agriculture
Wyss Institute	Wyss Institute for Biologically Inspired Engineering

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Methodology

Literature searches

Literature searches for 2004 through to the 31 December 2023 were carried out using the advanced search function in the Web of Science Core Collection database, with the search term TS= (“gene drive” or “gene drives”). Relevant journal articles were identified by systematically screening titles and abstracts from the search outputs. Press releases from academic institutions and other relevant materials on the web were identified using appropriate web searches (e.g. searching for the names of group leaders, target species, and the term ‘gene drive’). We recognise that all relevant material on the web may not have been identified.

Criteria for inclusion

Laboratory research and modelling on gene drives in non-insect species as reported in the academic literature and other sources such as press releases from funders and universities, has been included. This includes ‘preliminary research’ – i.e. research that states it could potentially support gene drive construction – for example genome sequencing or identification of target genes.

Proposals for gene drives which do not include any modelling or laboratory research are included if they are the first such proposal, and if no more advanced work has taken place for this target. Additional proposals are included at our discretion, for example if they contain novel ideas for gene drive technology (e.g. the Z-linked W-shredder), novel applications, or indicate wide interest in a particular target species.

Basis for generating entries in table

Broadly, each entry in the table describes development of a particular gene drive concept in a specific target species or group, as described in the relevant literature. In some cases where multiple options are considered in a single publication, multiple proposed gene drives are described in a single row (generally these are early-stage proposals or modelling studies). Where similar proposals to target a particular species have been made in different publications without any supporting modelling or laboratory work, these are also combined into one entry. The ‘project leader’ is identified as the last author on the publications describing the research or proposals.