

## ISAAA POLICY BRIEFS

# Field Evaluations of Gene Drive Organisms

ISAAA Inc. and the Outreach Network for Gene Drive Research

## Introduction

Current research suggests that gene drives could offer potential solutions to some of the global challenges currently posed by invasive alien species (IAS) and vector-borne diseases. Despite the enormous resources currently invested in addressing these challenges, IAS continue to proliferate, putting threatened species at risk of extinction, while hundreds of thousands of people die annually of malaria and other diseases spread by insect vectors. New approaches are therefore needed to tackle these problems, which could eventually include gene drive as a complementary tool alongside other technologies and techniques.

However, before a specific gene drive application could be used this way, it would have to undergo an extensive experimental testing and risk assessment process. This would, by necessity,

require field evaluations: experimental releases of gene drive organisms into the environment. Laboratory studies and virtual modeling cannot perfectly mimic real-world conditions. While safety of gene drive organisms can be evaluated through various contained studies, field evaluations are needed to understand the performance, spread, and persistence of a gene drive organism in a given environment.

Several field evaluations of different designs and sizes might be needed to demonstrate the effectiveness of a proposed application. Field evaluations may entail many experimental releases, for example, under different circumstances or at different sites.

## Key considerations before proposing a field evaluation involving an experimental release

Field evaluations of a proposed gene drive application will be part of a multi-phase research process, building on a large amount of prior work. This work will inform several important considerations that researchers must address to prepare for an experimental release: its safety and impacts, its acceptability for affected stakeholders, and the logistics of its implementation.

With regards to safety and impacts, assessments will need to be conducted to ensure that the release does not pose unacceptable risks and

### A DECISION ON WHETHER TO CONDUCT ANY EXPERIMENTAL RELEASE FOR RESEARCH PURPOSES MUST ALWAYS BE:



PRECEDED BY CAREFUL EVALUATION OF THEIR SAFETY AND POTENTIAL RISKS AND IMPACTS



SUBJECT TO PERMISSION FROM NATIONAL BIOSAFETY AND/OR OTHER REGULATORY AUTHORITIES OF THE COUNTRIES INVOLVED



AGREED BY THE LOCAL COMMUNITIES THAT MAY BE POTENTIALLY BE DIRECTLY AFFECTED

to determine what the negative and positive impacts on human and animal health and the environment could be. These risk and impact assessments will be multi-disciplinary processes, drawing on information from all relevant fields of scientific research and also on dialogue with external stakeholders.

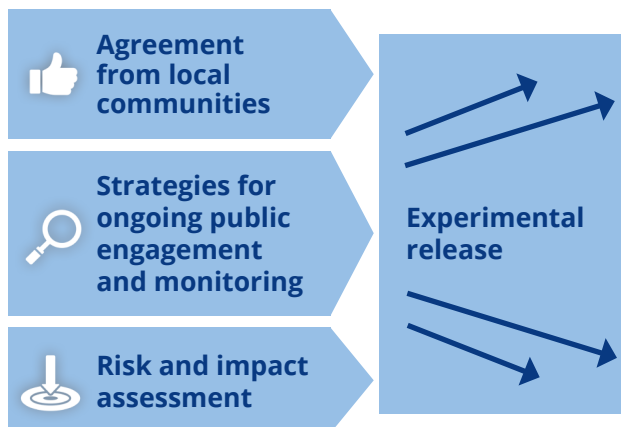
Determining the safety of a proposed field release is necessary but insufficient before proceeding. Its acceptability to relevant stakeholders must also be assured. This entails granting regulatory approval by relevant biosafety and/or environmental authorities and agreement from local communities that may be impacted. Extensive and carefully designed consultations with those communities will need to be carried out to guarantee that agreement if obtained, is informed and representative of the view of the community (and not just elected representatives or community leaders).

Finally, planning for a proposed field trial must take into consideration the concrete logistical steps needed to carry it out. Researchers must ensure that they have the needed resources and capabilities at their disposal. This will often require a scaling-up of the production of organisms compared with lab work, as well as detailed strategies for ongoing public engagement and environmental monitoring, which can include contingency and remediation plans. All of these factors will need to be considered before practical preparations for a release can begin.

## Field release preparation and design

The undertaking of field evaluation will depend on what data is being sought. A field evaluation is designed to answer a specific set of questions, and its final form depends on what researchers are trying to determine or discover. Field evaluations can demonstrate efficacy and increase understanding of multiple factors, such as the spread, longevity or environmental persistence of the gene drive organism being evaluated. The purpose of any field release study should be clear prior to its initiation, and

## KEY CONSIDERATIONS FOR AN EXPERIMENTAL RELEASE



detailed experimental protocols should be developed in advance. The data a field release study can provide is crucial because it will contribute to decisions and the next steps to take in developing the technology and potentially about whether to authorize its use. For instance, demonstration of efficacy through field evaluations is a critical determinant for decision-making about implementation.

The WHO's [Guidance Framework for Testing Genetically Modified Mosquitoes](#) recommends several potential pathways for release. This guidance framework constitutes the principal guidance from an international body tailored for the release of genetically modified insects. While this guidance is focused on mosquitoes, it is broadly relevant to other potential gene drive organisms, including rats and mice, for IAS control. In the case of gene drive mosquitoes, the WHO's [Vector Control Advisory Group](#) would, in addition, play an active role in the process of evaluation of these organisms by undertaking an independent evaluation of the public health value of the proposed new technology and advising WHO on whether a deployment is justified. While there is no strict WHO equivalent for organisms focused on IAS control, national authorities and other organizations would play a similar role in guiding and evaluating new tools for IAS control.



PHOTO SOURCE: TARGET MALARIA

Field evaluations involving the release of mosquitoes, for example, can take on many different forms. Some are entomological and focus on the impact of a release on other insects.

How do genetically modified mosquitoes interact with wild mosquitoes? Others are directly concerned with public health and attempt to determine the extent to which a release has reduced malaria transmission in a given area.

A field release is not conducted in a vacuum – it is an essential part of a step-by-step approach to the development of a gene drive and the consideration for its release. A phased testing pathway is recommended, similar to the development pathway for many other new public health tools, with a systematic iterative assessment of safety and efficacy.

Phased testing means, for example, starting with contained research in indoor facilities and then moving to small-scale, followed by larger-scale field releases. There might be one or more field releases depending on the type of data researchers are looking for. Monitoring the release results is also an essential part of the iterative process. The transition from one phase to the next is subject to a variety of decision criteria which include not only measures of efficacy and safety but also regulatory and ethical approvals and social acceptance.

## Field release approval and oversight

Approval for each next new stage of testing is the responsibility of the relevant national authority. The ultimate decision on implementing the gene drive will involve the national regulatory authority. National authorities will take both potential

benefits and potential risks into account, and factor in the social acceptability of the project.

The design and undertaking of field releases can also be driven in parts by a specific country's requirements. While researchers typically conduct the releases, their work and its context are shaped by a wider co-development effort with national authorities who are involved in the research process from beginning to end. The process may involve authorities responsible for determining national or regional disease control priorities who can suggest releases in some specific areas or guide the researchers toward public health priorities or make specific requests for data on issues they consider important.

Cooperation and ongoing engagement with national authorities are also key when considering the prospect of scaling up field trials. This can only be done with adequate governance and partnership capacity in the participating country.

Most importantly, there can be no field releases without the agreement of the communities living in potential release areas. This entails working closely with local participating communities to ensure that no activity goes ahead without their agreement. In the case of phased testing, engagement is sustained through different steps in the research, and includes seeking agreement for monitoring activities following the release.



PHOTO SOURCE: TARGET MALARIA

## Policy recommendations

Field trials provide invaluable data and are essential in providing evidence on the efficacy of proposed applications of gene drive. A significant body of knowledge and experience in similar fields exists on how they can be conducted in a manner that presents minimal risks to the environment and local communities and that ensures that they are acceptable to those communities. Researchers and national authorities considering field releases of gene drive organisms can draw on prior experience in agriculture, pest biocontrol, public health, and other fields, as well as guidance from authorities such as the WHO.

In line with that body of knowledge, any field release should be the result of a step-by-step approach to developing a proposed gene drive application and will need to build on years of prior data and research. Therefore, although an effective regulatory framework must be in place before a field release can be considered, blanket bans or moratoriums on field releases may unnecessarily hamper vital research.

National authorities have a key role to play as decision-makers both in designing and implementing the regulatory frameworks that will govern potential field trials, as well as in determining whether their results support broader uptake and deployment of a proposed gene drive application. In order for that decision-making to be effective, capacity-building and strong national biosafety frameworks are key. Biosafety capacity-building and information-sharing initiatives should therefore be prioritized and expanded, including through international forums such as the UN Convention on Biological Diversity.

In addition, building national capacity in key areas such as entomology, bioinformatics, ecology, molecular biology, and other fields is essential to ensure there are researchers and experts in the country with the knowledge and capacity to conduct monitoring and surveillance, and to contribute to the design and implementation of field studies.



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**OUTREACH NETWORK FOR  
GENE DRIVE RESEARCH**

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<https://genedrivenetwork.org/>

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