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Analysis

A Human Rights Analysis of Gene Drives

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I. Introduction

On October 16, 2018, a broad alliance of civil society organizations (CSOs) published a "Call to Protect Food Systems from Genetic Extinction Technology," calling for a global moratorium on gene drives.[1] This new biotechnology, which forces genetically engineered traits through entire populations of insects, plants, animals and other organisms, is a major threat to biodiversity, food sovereignty and the human right to food and nutrition.

This note provides an analysis of gene drives and their consequences from a human rights perspective. It aims to strengthen the arguments and advocacy to protect peasants' rights and food sovereignty.

II. What are Gene Drives?

A gene drive is a technology aimed at spreading genetically engineered traits through a whole population of plants or animals. It is a technique intended to alter the genetic make-up of whole populations or species by releasing 'engineered selfish genes.' The term 'selfish' refers to the way one or more genetic traits spread through a population automatically with each successive generation. Normally, offspring of sexually reproducing organisms have a 50:50 chance of inheriting a gene from their parents. Gene drives are designed to be an invasive technology, ensuring that, within a few generations, an organism's entire offspring will bear the desired engineered gene. The interest in harnessing gene drives has surged with the advent of CRISPR-Cas9 gene editing, which can be used to copy a mutation from one chromosome into another, creating synthetic or engineered gene drives. Gene drive organisms (GDOs) – i.e. organisms containing engineered gene drives – are designed to replace non-GDOs of the same species in a population over time via an uncontrolled chain reaction. This ability may make them a far more dangerous biohazard than genetically modified organisms (GMOs), which mostly spread engineered genes by accident.

Since their emergence in 2014, gene drives have been promoted by the biotech industry as a "magic bullet" for many challenges, in particular global health and conservation.[2] Millions of dollars have gone to the development of gene drives, in particular coming from philanthro-capitalist foundations, such as the Bill and Melinda Gates Foundation and the Open Philanthropy Institute. The US Military has also put considerable financial resources into the research and development of this technology.[3] The first test of gene drives will be the release of genetically modified (GM) mosquitoes in Burkina Faso in the context of the Target Malaria project.[4] The declared objective of this project is to reduce the risk of malaria transmission through the release of sterile GM mosquitoes that are intended to reduce the target population of mosquitoes (known as "population suppression").[5]

Even though the use of gene drives for agriculture is not prominent in the public relations of the biotech industry, it is arguably the main – and most profitable – field of application. Internal communications indicate that researchers and agribusiness corporations are deliberately silent about the applications of gene drives in agriculture, in order to avoid repeating the PR disaster of GMOs, which have been opposed by an overwhelming majority of people all over the world.[6] In fact, several heavily funded research projects already exist on the agricultural applications of gene drives, and a number of patents have already been granted.[7] It is also here that some of the main risks of gene drives lie.

III. What are the implications of gene drives for human and peasants' rights?

Biodiversity as well as the access to genetic resources (seeds, breeds etc.) and their use by food producers are essential for the realization of the human right to food and nutrition in the context of food sovereignty, as well as other human rights. States' obligations in this regard are anchored in a number of international conventions and treaties, as well as soft law instruments. These include, among others:

- the International Covenant on Economic, Social and Cultural Rights (ICESCR);
- the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW);
- the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA);
- the UN Declaration on the Rights of Indigenous Peoples (UNDRIP);
- the Convention on Biological Diversity (CBD);
- the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization; and
- the Cartagena Protocol on Biosafety.

Peasants' rights to seeds and biodiversity have been reaffirmed in the UN Declaration on the Rights of Peasants and other People Working in Rural Areas (UNDROP), recently adopted by the UN Human Rights Council.

Gene drives have huge implications for ecosystems and the realization of human rights. Precisely because research is still in an early phase and it is not certain whether the technology will work as its proponents hope, the risks associated with gene drives need to be taken very seriously.

1. Gene drives undermine peasants' control over genetic resources

Currently, most research in the field of gene drives for agriculture focuses on combating pests, weeds and invasive species in nature, by introducing edited traits into these organisms.[8] However, gene drives may also be used as an agricultural breeding tool for crops and livestock. Concretely, the technology could be used to ensure that a chosen trait is passed on to offspring and quickly enters stocks of seed and animal breeding lines. As such, gene drives could be used by agribusiness corporations to further increase the dependency of peasants and herders on commercial species and varieties/races. Gene drives could also be used as a tool to speed up the introduction and spreading of engineered genes. Given that such genes are patented, peasants risk being charged licensing fees in order to be able to use and sell seed. In addition, gene drives are designed to spread, persist and create large-scale changes in populations, and entail a high risk of contamination of other varieties and species. This will make it impossible to defend non-modified crops against genetic pollution. Overall, gene drives will further concentrate global control over genetic resources.

Peasants' and indigenous peoples' control over genetic resources and their sustainable use are among the backbones of food sovereignty and are critical elements for the realization of the right to food and nutrition. States are therefore required to protect and guarantee peasants' and indigenous peoples' rights to save, use, exchange and sell their seeds, to ensure the sustainable use of genetic resources, and to protect their knowledge, practices and innovations.[9] This includes protecting farmer-managed seed systems and ensuring that intellectual property rights do not undermine these rights. States' human rights obligations also require them to ensure the free, prior and informed consent of affected individuals and groups for all decisions that affect them, including in the context of agriculture.[10] States are further obligated to protect people from the risks of

biotechnology, including the risk of contamination of non-GM organisms.[11]

2. Gene drives undermine agroecology and sustainable food systems

The use of gene drives is likely to further entrench a system of industrial agriculture based on genetically engineered crops and intensive use of agro-toxins. As has been said, most of ongoing research on gene drives focusses on the suppression or elimination of "weeds" or "pests," i.e. organisms that disrupt the efficiency of industrial agricultural production.[12] Many research projects are about gene drives that would eliminate populations of organisms, such as fruit flies, moths, aphids, plant hoppers and beetles, rodents or nematodes.[13] Others try to engineer pests so that they avoid crops (e.g. by manipulating them so that they do not like a given crop's taste). Proponents argue) that this will reduce the use of agrochemicals – an argument also put forward by agribusiness and the biotech industry regarding "conventional" GMOs such as Bt maize, despite – at least – mixed evidence. At the same time, gene drives are also being considered as a tool to overcome herbicide resistance in weeds. Indeed, weed resistance to herbicides, especially to glyphosate used to spray GM Roundup Ready crops, is becoming an increasing problem for industrial farmers. Researchers are therefore considering spreading gene drives in weeds in order to make them once again susceptible to products such as Bayer-Monsanto's Roundup. It is argued that spreading sensitizing gene drives could also make weeds and pests vulnerable to chemicals that are less toxic to humans. Research is thus based on an industrial agriculture paradigm, which sees "weeds," "pests" and other organisms as external compounds that must be eliminated in order to maximize production and profits.

Seventy per cent of our food is produced by peasants, herders, artisanal fishers, fish workers, and other small-scale food producers. Their knowledge, practices and innovations sustain humanity and ensure a respectful relationship with nature. Peasant food webs and territorial markets provide decent work and nutritious, healthy food to millions of people.[14] On the contrary, industrial agriculture has a huge ecological fingerprint, reduces plant and animal biodiversity, and creates exploitative working conditions. There is nowadays broad consensus that this model has failed and that a transition towards sustainable food systems is urgent in order to respond to current crises. Agroecology is increasingly recognized as a comprehensive approach to achieve the necessary transformation, one that also addresses the power imbalances and systemic discrimination that are inherent to the industrial food system.[15] States should support the transition towards agroecology to fulfill their human rights obligations, to ensure the realization of the right to food and nutrition, and to decent work as well as to halt environmental destruction.

3. Gene drives threaten biodiversity and ecosystems

Ongoing research on gene drives explicitly aims to remove or eradicate species. Gene drives have the potential to forever change the genetic makeup of species, or even drive certain species to extinction. Indeed, they are designed to set off a chain reaction, which is potentially uncontrollable and unstoppable. "Removing a pest may seem attractive from the point of view of efficient monoculture food production, but even pests have their place in the food chain and may in other contexts (particularly outside of farmland) turn out to be essential or keystone species for maintaining biodiversity."[16] This means that the intended extinction of one species could lead to the unintended extinction of others because of the disruption of food chains and ecosystems. Another risk of gene drive technology is that it could produce new invasive species or organisms, the spread of which would be impossible to control. It is not sure whether gene drive organisms will work as effectively as proponents hope, and there is already evidence that organisms can develop resistance to gene drives.[17] What is

clear at this stage is that the threat for biodiversity and ecosystem is huge.

The Convention on Biological Diversity's (CBD) objectives are the conservation of biodiversity and the sustainable use of its components.[18] This is more important than ever, as the world faces a severe decline in biological diversity and the rapid disappearance of species, varieties and races.[19] The CBD explicitly recognizes the close dependence of indigenous and local communities and their livelihoods on biodiversity, and underlines the vital role that women play in the conservation and sustainable use of biological diversity.[20] As such, maintaining and promoting biodiversity must also be part of strategies to realize the right to food and nutrition, recognizing that small-scale food producers play a critical role in protecting, conserving and expanding biodiversity through their knowledge and sustainable practices.[21] A technology that explicitly seeks to suppress and eliminate species cannot contribute to conserve biodiversity, protect ecosystems and realize human rights.

4. Gene drives entail incalculable risks for human and animal health

Gene drive organisms carry, at least, the same biosafety risks as other GMOs. Like all GMOs, they carry the potential for unanticipated behaviors, traits and effects. However, the gene drive mechanism raises major additional concerns because it is expressly designed to spread, persist, and create large-scale changes in wild populations and therefore intentionally impact entire ecosystems. This means that engineered genetic mutations could spread in an uncontrolled manner in both wild and domestic species (genetic pollution). This in turn increases the risk of unexpected mutations. This risk is real, as there is increasing evidence that the CRISPR gene editing system is not as clean and precise as the biotech industry claims it is, but is creating unexpected "off-target" effects.[22] Rural people would be those most immediately exposed to the risks of gene drive organisms in agriculture.

The precautionary principle is a well-established principle of international law, which requires states to take precautionary measures to protect the environment, even in the absence of scientific certainty that serious or irreversible damage will occur.[23] States' obligation to implement the precautionary principle enshrined in the CBD entails regulating, managing and controlling the risks posed by modified living organisms resulting from biotechnology, which are likely to have adverse environmental effects.[24] In addition, in accordance with the Cartagena Protocol, states are required to take measures to protect biological diversity as well as indigenous and local communities against the potential risks posed by genetically modified organisms.[25] Upholding these obligations and enforcing them is all the more important now that the biotech industry and agribusiness are trying to circumvent biosafety regulations by claiming that organisms developed through CRISPR and other gene editing techniques should not be considered as genetically engineered.[26]

In the context of gene drives, the precautionary principle is also critical to ensure the respect, protection and fulfilment of the human right to health.[27] The example of the Target Malaria project in Burkina Faso shows how the biotech industry and funding institutions do not hesitate to use local people as guinea pigs to test their dangerous technologies: local people were convinced, for a small financial compensation,[28] to sign consent forms to expose themselves to be bitten by the GM mosquitoes, despite the absence of a comprehensive risk assessment and even though Target Malaria acknowledges that the proposed GM mosquito release will not (in its first phase) provide any direct benefit to the local population in terms of malaria control.[29]

5. Gene drives exemplify the corporate capture of research and science

Research on gene drives is pushed for and largely financed by corporations and philanthro-capitalist foundations. However, research institutions and projects also receive public funding.[30] As such, gene drives are a blatant example that illustrate how science and the production of knowledge are heavily

controlled by corporate interests, and consequently biased towards outcomes that serve these. This also compromises the role of scientists and researchers, who are increasingly oriented towards responding to the demands of the private interests that pay for the research, rather than producing knowledge to advance the public interest. The paradigms and assumptions underlying research into gene drives limit the scope and role of science, and privileges a certain – Western – conception of what constitutes knowledge, innovation, technology and progress.

Science and knowledge production need to serve the public interest and well-being, instead of particular interests that are geared towards financial gains. They also need to acknowledge that other forms of knowledge and Cosmo visions based on different paradigms are equally legitimate and "scientific". This is required to respect and protect existing cultural diversity.[31] A "humanization" of science and research therefore requires not only ensuring the independence of science from undue influence of corporate and private interests, but also promoting a dialogue among different forms of knowledge. It also requires social control over science and research, through public governance institutions that can oversee, regulate and orient the research agenda towards the public interest and well-being; ensure that knowledge is, first and foremost, a public good; ensure accountability of science to peoples; and address conflicts of interest. In this context, the recent establishment of the UN Forum on Science, Technology and Innovation (STI Forum) has the potential to provide a global governance space to deal with these issues. The Forum has taken up the issue of addressing corporate concentration and technology monopoly. It is crucial, however, that this forum's work be clearly based on human rights standards and that it addresses the conflicts of interests due to its set up as a multi-stakeholder platform.

In the face of the gene drive technology's huge risks and likely adverse impacts on humans and nature, States are required to observe their obligations in the context of human rights, biodiversity and biosafety. This includes to:

- **put in place a global moratorium on any release of engineered gene drives;**
- **ensure adequate and effective monitoring and regulation of research on gene drives and other invasive technologies;**
- **bring the discussion on gene drives and its risks to the UN Committee on World Food Security (CFS);**
- **strengthen the UN Forum on Science, Technology and Innovation as a space to discuss the role of science, technology and innovation to advance human well-being and protect planet Earth, and to monitor research on gene drives and other invasive technologies, ensuring the Forum's grounding in human rights and ensuring the absence of conflicts of interest among its members.**

Update, December 2018:

At the fourteenth meeting of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD), which took place in Sharm El-Sheikh, Egypt, from 17 to 29 November 2018, 196 governments passed a global decision about gene drives. The decision urges precaution and reinforces as a priority the need to seek free, prior and informed consent or approval from all potentially impacted communities and Indigenous Peoples before even considering environmental release of gene drive organisms. This decision is not the formal legal moratorium that peasant, indigenous peoples and civil society organizations had pushed for. However, it sets barriers to the release of gene drives. Specifically, the text places three preconditions before "considering release of gene drives": States need to (a) do thorough risk assessment, (b) ensure risk management measures are in place to "prevent or minimize adverse effects," and (c) ensure to seek consent of "potentially affected Indigenous Peoples and Local Communities." The decision also specifically notes that a release of gene drives may affect the "traditional knowledge, innovation, practices, livelihood and use of land and water" of Indigenous Peoples and local communities. At the same meeting, states also established a Risk Assessment Ad Hoc Technical Expert Group, which will develop specific guidance on risk assessment in the context of gene drives.[32]

References

[1] Available at: www.etcgroup.org/sites/www.etcgroup.org/files/files/call_to_protect_food_systems_oct_17th.pdf. Much of the information used in this note is taken from: ETC Group/Heinrich Böll Stiftung (2018), Forcing the Farm. How Gene Drive Organisms Could Entrench Industrial Agriculture and Threaten Food Sovereignty, October 2018, available at: www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_hbf_forcing_the_farm_web.pdf.

[2] ETC Group/Heinrich Böll Stiftung (2018), p. 8.

[3] ETC Group/Heinrich Böll Stiftung (2018), p. 8.

[4] Target Malaria is a consortium of research institutes that receives core funding from the Bill & Melinda Gates Foundation and the Open Philanthropy Project Fund, an advised fund of Silicon Valley Community Foundation. Individual laboratories also receive additional funding from a variety of sources to support each laboratory's work, including the United Kingdom government (the UK Department of Environment, Food and Rural Affairs and the Medical Research Council), the Wellcome Trust (a UK-based charity), the European Commission, the Ugandan Ministry of Health, and the Uganda National Council for Science and Technology (UNCST). Target Malaria also works in Mali and Uganda, but to our knowledge, has not yet sent any GM mosquitoes to these countries. See: African Center for Biodiversity/Third World Network/GeneWatch UK (2018), GM Mosquitoes in Burkina Faso. Briefing Paper, November 2018, available at: https://acbio.org.za/sites/default/files/documents/GM_mosquitoes_in_Burkina_Faso_A_briefing_for_the_Parties_to_the_Cartagena_Protocol_on_Biosafety.pdf.

[5] The Target Malaria project consists of three phases, the last of which foresees the release of gene drive mosquitoes; see African Center for Biodiversity/Third World Network/GeneWatch UK (2018).

[6] See ETC Group/Heinrich Böll Stiftung (2018), pp. 8-9.

[7] ETC Group/Heinrich Böll Stiftung (2018).

[8] For an overview of current research projects see ETC Group/Heinrich Böll Stiftung (2018), pp. 17-21.

[9] ICESCR, art. 11; General Comment No. 12 of the UN Committee on Economic, Social and Cultural Rights (CESCR); General Recommendation No. 34 of the CEDAW; CBD, arts. 8(j) and 10(c); Nagoya Protocol, art. 12; ITPGRFA, arts. 5, 6 and 9; UNDRIP, arts. 11 and 31; UNDROP, art. 19. See also De Schutter, Olivier (2009), Seed Policies and the Right to Food: Increase Agricultural Biodiversity and Promote Innovation. Report of the UN Special Rapporteur on the Right to Food, UN Document No. A/64/170.

[10] ITPGRFA, art. 9; Nagoya Protocol, arts. 6 and 7; UNDRIP, art. 32

[11] Cartagena Protocol, art. 1; ITPGRFA, art. 6.

[12] Most research conducted so far is on insect pest eradication, but gene drive proponents also envisage gene drives in plant species, which could allow suppressing and eradicating plant weed populations. See ETC Group/Heinrich Böll Stiftung (2018), p. 13.

[13] See ETC Group/Heinrich Böll Stiftung (2018), pp. 17-21.

[14] See Policy Recommendations on "Connecting Smallholders to Markets" of the UN Committee on World Food Security (CFS), available at www.fao.org/3/a-bq853e.pdf; ETC Group (2017) Who Will Feed Us? The Peasant Food Web vs. The Industrial Food Chain, 3rd edition, available at www.etcgroup.org/sites/www.etcgroup.org/files/files/etc-whowillfeedus-english-webshare.pdf; La Via Campesina (2015), 'Peasant Agroecology for Food Sovereignty and Mother Earth', No. 7 Notebook, La Via Campesina, November 2015, available at https://viacampesina.org/en/wp-content/uploads/sites/2/2015/11/CUADERNO%207%20LA%20VIA%20CAMPESINA%20INGLES.compressed.pdf.

[15] See, for instance, the outcomes of the two International Symposia on Agroecology organized by the Food and Agriculture Organization of the UN (FAO), held in 2014 and 2018, as well as the FAO Regional Seminars on Agroecology. See FAO (2015), Final report for the international symposium on agroecology for food security and nutrition. 18–19 September 2014; available at www.fao.org/3/a-i4327e.pdf; and FAO (2018), Catalysing dialogue and cooperation to scale up agroecology: outcomes of the FAO regional 26 seminars on agroecology, available at: www.fao.org/3/I8992EN/i8992en.pdf. The High Level Panel of Experts of the UN Committee on World Food Security (CFS) is currently producing a report on "Agroecological approaches and other innovations for sustainable agriculture and food systems that enhance food security and nutrition."

[16] ETC Group/Heinrich Böll Stiftung (2018), p. 25.

[17] The biotech industry is already working to make gene drives more powerful and invasive, in order to overcome gene drive resistance. See ETC Group/Heinrich Böll Stiftung (2018), p. 28.

[18] CBD, arts. 1 and 6.

[19] More and more experts speak about a sixth, human-made, great extinction.

[20] CBD, Preamble.

[21] CBD, Preamble as well as arts. 8(j), 10(c), and 14; Nagoya Protocol, arts. 5 and 12; ITPGRFA,

Preamble as well as art. 9. See also De Schutter, Olivier (2009).
[22] See, for example: Heidi Ledford (2018), CRISPR gene editing produces unwanted DNA deletions. DNA-cutting enzyme used for genetic modification can create large deletions and shuffle genes. In: Nature. International Journal of Science, 16 July 2018. Available at: www.nature.com/articles/d41586-018-05736-3.
[23] Rio Declaration on Environment and Development, principle 15; Caratagena Protocol, art. 1. Article 4 of Annex III to the Cartagena Protocol on risk assessment stipulates that the "lack of scientific knowledge or scientific consensus should not necessarily be interpreted as indicating a particular level of risk, an absence of risk, or an acceptable risk."
[24] CBD, art. 8(g).
[25] Cartagena Protocol, art. 1
[26] In an important judgement, the Court of Justice of the European Union declared, in September 2018, that gene-edited organisms including those modified using CRISPR techniques are subjected to the same regulation as other GMOs. See Court of Justice of the European Union press release, No. 111/18, Luxembourg, 25 July 2018: https://curia.europa.eu/jcms/upload/docs/application/pdf/2018-07/cp180111en.pdf.
[27] ICESCR, art. 12; CEDAW, arts. 11, 12 and 14; Convention on the Rights of the Child, art. 24; International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families, arts 28, 43 and 45; General Comment No. 14 of the CESCR; Constitution of the World Health Organization; Cartagena Protocol, art. 1.
[28] There is evidence that Target Malaria is paying compensation of 400 Francs CFA (approximately 70 US cents) per hour to local villagers to allow for the collection of biting female mosquitoes from their own bodies. The consent forms are available at: https://acbio.org.za/sites/default/files/documents/doc04065120180719114656.pdf (English translation: https://acbio.org.za/sites/default/files/documents/Consent%20form%20Target%20Malaria%20ENG.pdf.
[29] See African Center for Biodiversity/Third World Network/GeneWatch UK (2018). This goes against the World Medical Association's Declaration of Helsinki, which outlines the internationally agreed ethical principles for medical research involving human subjects (see www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects).
[30] See, for instance, the involvement of public funders in the Target Malaria project (supra note 4).
[31] UNDRIP, Preamble and art. 31; CBD, art 8(j).
[32] Decisions CBD/COP/14/L.31 and CBD/CP/MOP/9/L.13, available at: www.cbd.int/conferences/2018/insession.