

Driving Under the Influence

A review of the evidence for bias and conflict of interest in the IUCN report on synthetic biology and gene drive organisms

Executive Summary

In May 2019, the IUCN published an assessment of a highly controversial field of biotechnology: synthetic biology. In reviewing those involved with this report, evidence suggests a majority of the authors hold a pre-existing bias towards strongly supporting synthetic biology and gene drives in particular. In addition, many of them have conflicts of interest, not all of which were disclosed in their signed Conflict of Interest statements to IUCN. The credibility of the resulting report, which advances a position strongly in favour of both synthetic biology and gene drive organisms, is rendered suspect due to the conflicts of interest, known biases of the authors and unbalanced constitution of the taskforce membership.

- In September 2016 the membership of the international Union for the Conservation of Nature (IUCN) passed a resolution requesting the organization undertake an assessment of the implications of the emerging field of synthetic biology and in particular controversial “gene drive” technologies while refraining from advocating for or supporting this technology.
- IUCN members might have made the reasonable assumption that the leadership of the IUCN would take a precautionary and even-handed approach to an assessment with such potentially far-reaching implications for biodiversity.
- Instead, the IUCN chose a different path, appointing a chair who is a well-known, enthusiastic advocate for the technology, Dr. Kent Redford.

- Redford in turn appointed a cohort of individuals whose track record clearly points to them being likely to take a strongly positive view of “gene drive” technologies and other developments in synthetic biology.

This document analyses the group of authors and taskforce members that IUCN chose for its synthetic biology assessment. It examines evidence of pre-existing biases as well as factors that could be perceived as conflicts of interest. Key findings include:

- Of the approximately 40 individuals associated with the report, over half display evidence of pre-existing bias in favor of the technology and/or potential conflict of interest. By contrast, not a single member of the group shows evidence of a pre-existing leaning towards critical views of synthetic biology. The group authoring this report was thus extremely unbalanced.

Many of the authors have conflicts of interest, not all of which were disclosed in their signed statements

- Three pro-synthetic biology interest groups appear to have had a disproportionate influence on the writing of this report: at least 15 members of the group appear to be associated with or employed by either Revive and Restore, Genetic Biocontrol of Invasive Rodents project (GBIRd) or Target Malaria. Those three organizations are among the world’s most prominent and well-funded proponents of

the development and deployment of gene drive organisms for environmental release.

- Although the IUCN decision explicitly named collaborative documents and networks of civil society groups who monitor synthetic biology as among those who should be involved in the assessment, it appears that such networks were not invited to participate.
- Several members of the assessment group failed to disclose relevant factors that could be perceived as potential conflicts of interest. This includes chair Kent Redford, who failed to report past consulting and association with both Dupont and Revive and Restore.
- In 2017 about a dozen members of the group were implicated in a deliberate effort to covertly influence the UN Biodiversity Convention's Online Open Forum on Synthetic Biology coordinated by Emerging Ag Inc. - a Public Relations company funded by and for agribusiness. This includes the chair Kent Redford, who gives the appearance of having actively followed instructions by the staff of that PR company on what to post (see Annex B)

History

In September 2016, at their World Conservation Congress in Hawaii, member organizations and governments of the International Union for the Conservation of Nature (IUCN) passed Resolution 086, "Development of IUCN policy on biodiversity conservation and synthetic biology." The originally submitted draft of the resolution, authored by a small group of like-minded enthusiasts of synthetic biology, praised developments in the technology. IUCN members changed it quite substantially. In its final form, Resolution 086 became a precautionary resolution that expressed concern about developments in synthetic biology and gene drives in particular.¹

The resolution, passed in September 2016, called upon IUCN leadership to undertake an assessment of the implications of developments in synthetic biology for conservation and sustainable use of biological diversity and associated social, economic, cultural and ethical considerations. Striking a cautionary note, the decision also bound IUCN and its commissions

to refrain from "supporting or endorsing research, including field trials, into the use of gene drives for conservation or other purposes until this assessment has been undertaken." Synthetic biology has been a highly contentious topic for over a decade and has been under negotiation as a topic at the UN Convention on Biological Diversity since 2010. In 2012, over 111 organizations, many of them focused on environmental and conservation concerns, called for a moratorium on commercial developments in the field in a report that was noted in resolution 086.² Recently, concern has focused on gene drives. In 2016, over 170 organizations authored³ a letter calling for a moratorium on gene drive releases and applications. This year, over 250 organizations and experts signed a similar open letter.⁴ It should have been apparent to IUCN leadership that this is a controversial and contested topic, to be handled with sensitivity, balance and precaution.

In 2017 about a dozen members of the group were implicated in a deliberate effort to covertly influence the UN Biodiversity Convention's Online Open Forum on Synthetic Biology coordinated by Emerging Ag Inc. - a Public Relations company funded by and for agribusiness

In response to resolution 086, IUCN mandated a task force and a technical subgroup comprised of 28 individuals to develop a report. Surprisingly, the role of chair was handed to Dr. Kent Redford, a clear promoter for the field and one of the individuals associated with the original (enthusiastic) version of resolution 086, which was subsequently modified by the membership. Redford was responsible for determining the wider composition of the study

² <https://www.sciencemag.org/news/2012/03/111-organizations-call-synthetic-biology-moratorium>

³ <https://www.etcgroup.org/content/160-global-groups-call-moratorium-new-genetic-extinction-technology-un-convention>

⁴ http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_ftfsignonletter113018engweb_1.pdf

¹ <https://portals.iucn.org/library/node/46503>

taskforce. That report, provisionally titled “Genes for Nature”, was made available in draft form for an extremely short peer review (initially less than a month) in August 2018, the end of the Northern Hemisphere’s summer. When the draft for peer review became public, civil society and conservation groups were shocked to discover that the membership of the taskforce and technical subgroup was exceedingly biased to proponents of synthetic biology applications - in line with the views of the chair. The draft report itself was overwhelmingly boosterish, and the report was built around case studies and boxes authored by leading proponents of gene drives, transgenic trees and other genetic engineering applications. Several authors had clear conflicts of interest (see below), including financial interests, in this technology. The final report was subsequently released with little fanfare in May 2019. It had been retitled “Genetic frontiers for conservation: an assessment of synthetic biology and biodiversity conservation: technical assessment.”⁵ That second version includes some additional authors to the earlier “Genes for Nature” draft and curiously, some of the original task force members appear to have removed their names from the document.⁶ The synthesis for policymakers accompanying the report acknowledged that the earlier draft had received substantial criticism for being unbalanced, noting that:

“Opportunities for comment generated a diversity of responses both positive and negative, including criticisms of the choice of authors and limitations of the process... Specifically, some raised the concern that the assessment authors did not represent the full diversity of actors who might be affected by applications of synthetic biology and engineered gene drive, and did include those who work directly on synthetic biology applications.”

The report authors responded by claiming, “It is impossible for the authorship of such an assessment to span the full diversity of geography, discipline and life-ways; and to be possible, the assessment did indeed engage with those who are highly knowledgeable

about the technologies, especially those who have been working at the frontiers of innovation.”⁷ The suggestion that only proponents of the technology, and particularly those working, “at the frontiers of innovation,” can be considered, “highly knowledgeable,” is not only inaccurate, but also reflects the profound bias in the process. There are many “highly knowledgeable” people in the fields of ecology, biology, genetics and conservation as well as human rights and the social sciences who have expressed concerns about, and critiques of, synthetic biology and gene drive organisms.

Analysis of bias and conflict of interest

Reading the original “Genes for Nature” draft, one is left with the impression of a deeply unbalanced report drafted by a handpicked team of synthetic biology boosters. That impression is only slightly better balanced in the final report where a more balanced summary for policymakers was added, but the overall thrust remains extremely upbeat and excited about the technology and its bold promises – especially in the key ‘case studies’ section where the writing of text was handed to the individuals with the strongest stake in advancing each application described. This picture comes further into focus with a closer analysis of the individuals whose names have so far been associated with the document (including the chair, members of the taskforce and technical subgroup and the additional box and case study authors). Of the 40 or so individuals, the immediate affiliations of 22 invoke concern about bias, potential bias and/or potential conflict of interest. The bias is starker when one examines who “holds the pen.” Of the 14 “case study and box authors” in the original “Genes for Nature,” for example, 11 are actively involved in developing or promoting applications of genetic engineering and synthetic biology for conservation uses – particularly gene drives.

The panel appears to have other alarming biases. The group is overwhelmingly Northern with only seven individuals drawn from either the global South (including China) or from an Indigenous group – this is greater than a 3:1 North–South ratio. Indeed, despite sections of the report dedicated to the importance of involving Indigenous knowledge and perspectives,

5 Available at <https://portals.iucn.org/library/node/48408>

6 Authors that appear to have removed themselves from the final report (or were removed?) include Simon Stuart, Cyriaque Sondashonga and Risa Smith. Additional authors in the final report that were not in the earlier draft include Johanna E Elsensohn, Reid Harris and Louise-Rollins-Smith.

7 See page 11 - https://research.ncsu.edu/ges/files/2019/05/IUCN_Genetic-frontiers-for-conservation_5-3-2019.pdf

there is only one Indigenous representative among the entire team (a Maori panelist from New Zealand). This, despite at least six IUCN resolutions which have mandated inclusion of Indigenous rights and participation in policymaking processes, and despite the experience of Indigenous experts in policy processes around synthetic biology: Indigenous movements in Hawaii, New Zealand, North America and Latin America have all spoken out on these issues and the UN CBD's Ad Hoc Technical Expert Group (AHTEG) on Synthetic Biology maintains two Indigenous participants on its panel. Interestingly, the IUCN process originally only chose to involve one expert associated with the AHTEG on Synthetic Biology – a second IUCN author was later added to the AHTEG as a IUCN representative. Both have been associated with gene drive development through the GBIRD consortium.

Revive and Restore is itself a funder of synthetic biology development and manages a multimillion dollar “science catalyst fund” for biotechnology research

Synthetic biology, and especially gene drives, have potentially profound impacts on Indigenous rights, traditional practices and livelihoods, as well as implications for Southern countries. Concerns about these impacts have been a marked feature of negotiations and discussions on synthetic biology under the UN Convention on Biological Diversity in the past decade. It is worrisome that IUCN did not care to reflect this in its selection of taskforce members or link more closely with the CBD processes, especially since resolution 086 explicitly referenced an existing CBD resolution calling for the full participation of Indigenous and local communities in matters regarding synthetic biology and resolution 086 also requested that the study examine, “associated social, economic, cultural and ethical considerations.” There

were also no farmer, peasant or food system experts involved, despite claims around synthetic biology and gene drives in agriculture that will impact sustainable use and conservation of biodiversity.⁸

A further analysis reveals that among the authors responsible for the report, a smaller core group of 10 appear to have left an outsized imprint on the report. Either they are members of both the task force and technical subgroup or their names are associated with more than one chapter (in many cases both factors are true). Four of the ten ‘core group’ (Kuiken, Delborne, Thizzy, and Tompkins) are or have in the past been associated with teams actively developing gene drives with an intention to release them for research (either GBIRD or Target Malaria) and another of the core team (Perello) is a principal director in a private synthetic biology company and also consults with the pro-biotech NGO, Revive and Restore.

Based on these names, it also appears that three interest groups have exercised a disproportionate influence on this draft IUCN report. These are Revive and Restore, the GBIRD Consortium, and Target Malaria. Each is discussed in more detail below

Revive and Restore is a California-based not-for-profit organization associated with “ecomodernist” champion Stewart Brand. Its mission is to promote radical biotechnologies for conservation. Besides the close working relationship of the task force and subgroup Chair, Kent Redford, with Revive and Restore, three of the organization’s five staff provided input to the IUCN document, and a further task force member, Edward Perello, is paid as a consultant to Revive and Restore. The task force includes Revive and Restore founder and Executive Director Ryan Phelan (a former biotech executive) and two Revive and Restore staff members, Ben Novak and Tom Maloney, were asked to draft boxes or case studies. Revive and Restore is itself a funder of synthetic biology development and manages a multimillion dollar “science catalyst fund” for biotechnology research for conservation purposes, which was initially established with a \$3 million USD gift from biotech tools company Promega.⁹ Additionally many of the group members

8 Full list of panel members are here: <https://www.iucn.org/theme/science-and-economics/our-work/other-work/synthetic-biology-and-biodiversity-conservation/task-force-and-technical-subgroup>

9 <https://www.businesswire.com/news/home/20180823005522/en/Promega-Commits-3-Million-Revive-Restore-Science>

of the task force and technical subgroup have previously collaborated with Revive and Restore, either as co-authors or panelists and participants in the organization's workshops.

GBIRd consortium (Genetic Biocontrol of Invasive Rodents project) is a consortium of organizations and academics funded by the US Defense Advanced Research Projects Agency¹⁰ (DARPA) which is working to develop, test and deploy gene drive systems in mice. Initially, GBIRd representatives publicly discussed aiming to be ready for deployment by 2020, but have since cooled their hurry.¹¹ Three current and past GBIRd members have considerable presence in the report group: Jason Delbourne, Todd Kuiken and Dan Tompkins. Kuiken and Tompkins serve on both the task force and technical subgroup. All three are identified as authors of multiple sections. Additionally, Adam Kokotovich, a postdoctoral researcher working for Jason Delbourne, was also tapped to write two sections of the report as was a further North Carolina based associate of Jason Delbourne who works on transgenic insects, Johanna E. Elsensohn. Two of the box and case study authors are GBIRd consortium members.

Target Malaria is a UK-based research project with over \$100 million USD in funding, working to develop and deploy gene drive mosquitoes in Africa.¹² Target Malaria's policy lead Delphine Thizzy is a core group member of the report, serving on both the task force and technical subgroup and also as a case study author. Another technical subgroup member appears to have links to Target Malaria, Daniel Masiga, while another two contributors have informal scientific collaborations with Target Malaria scientists: Luke Alphey (technical subgroup) and Phil Leftwich (box/case study author) of Pirbright Institute. Target Malaria also employs public relations outfit Emerging Ag Inc.– a boutique consulting firm that serves biotech and agribusiness clients. In 2017, Emerging Ag coordinated a covert attempt to influence an online expert forum of the UN Convention on Biological diversity to prevent a moratorium on gene drives. Documents disclosed under the Freedom of Information Act reveal that about a dozen members of the task force, subgroup

or case study authors were either part of that effort or were listed to be recruited into the covert expert forum push. This includes the chair Kent Redford, who appears to have actively participated (see Annex).¹³

A number of individuals in the group hold patents or have commercial interests in the area of synthetic biology or associated high tech work.¹⁴ Several also receive research funds expressly in order to develop synthetic biology, gene drive or other genetic engineering applications. Revive and Restore additionally grants research funds in this area.

IUCN chose not to balance these interests with even a single appointment of an expert or representative known for their critical views of synthetic biology and gene drives

Lack of balance and outreach

Despite the proliferation of biotechnology industry representatives, gene drive developers, genetic engineering proponents and those with a demonstrated bias and interest in favor of promoting synthetic biology and gene drives, IUCN chose not to balance these interests with even a single appointment of an expert or representative known for their critical views of synthetic biology and gene drives. Such experts would have been easy to find. For example, over 30 leading conservation and environmental leaders wrote to IUCN in 2016 at the time of Resolution 086 expressing a call for no use of gene drives in conservation.¹⁵ There have been several open letters and reports authored by critical voices. Resolution 086 itself referenced both “The Principles for the Oversight of Synthetic Biology,”

10 <http://genedrivefiles.synbiowatch.org/2017/12/01/us-military-gene-drive-development/>

11 <https://www.audubon.org/magazine/summer-2017/how-genetically-modified-mice-could-one-day-save>

12 <https://www.cnbc.com/2018/09/25/gene-tweak-kills-whole-population-of-malaria-carrying-mosquitoes.html>

13 <https://www.etcgroup.org/content/gene-drive-files>

14 Individuals in the group who hold patents or have commercial interests in the area of synthetic biology or associated high tech work include Kevin Esvelt, Luke Alphey, Drew Endy, Edward Perello, Bart Kolodziejczyk.

15 http://www.synbiowatch.org/wp-content/uploads/2016/09/letter_vs_genedrives.pdf

authored by 111 organizations and also referenced The International Civil Society Working Group on Synthetic Biology. No attempt was made by IUCN to reach out to either to participate.

At a soft launch of the ‘Genes for Nature’ draft of the report held as a side event to the 14th COP to the UN Convention on Biological Diversity, IUCN chief scientist Thomas M Brooks expressed that it had been difficult to find appropriate experts willing to serve on the committees. Besides those mentioned above, one parallel committee on the topic with a very similar mandate whose membership IUCN could have approached for balance and better regional representation is the UN’s Ad Hoc Technical Expert Group (AHTEG) on synthetic biology, which is constituted as a regionally balanced group with additional observer members from Indigenous communities, civil society and the private sector.¹⁶ Surprisingly given the similarity of mandates, the IUCN Synthetic Biology group originally included only one expert drawn from the CBD AHTEG (Todd Kuiken). The AHTEG also recently reconstituted itself to include GBIRD participant Dan Tompkins as IUCN’s representative.

It is not clear how broadly, thoroughly or by what means the chair or IUCN secretariat reached out to recruit experts and seek diverse forms of expertise. IUCN guidelines for Independent Scientific or Technical Advisory Processes (ISTAP) require panel positions to be advertised.¹⁷ This task force does not count as an ISTAP, but no similar open expert recruitment process appears to have been undertaken. IUCN does have rules regarding conflict of interest and task force chairs are expected to exercise judgement in selection of task force members. Chairs are, for example, advised to ask members to declare conflicts of interest and for this task force, conflict of interest papers were received and, following requests, were published with the final report.¹⁸ Troublingly, several participants who filled in these forms did not acknowledge apparent conflicts of interest (see analysis in Annex A below). It is unclear if there is a procedure by which failure to declare interests can be addressed or by which IUCN members may hold either the chair

or IUCN secretariat accountable for their judgement in appointing so many members with clear biases or conflicts of interest.¹⁹

Annex A: Further details on members of the taskforce, technical subgroup or authors regarding possible bias or conflicts of interest (listed alphabetically).

Dr. Luke Alphey

Position: On the task force

Concern: Bias and conflict of interest (Formerly Oxitec; also receives synthetic biology research funds)

Dr. Luke Alphey, Currently based at UK Pirbright Institute, is the founder and former research director of Oxitec Ltd, a company producing transgenic insects including transgenic mosquitoes. Alphey sold Oxitec to Synthetic Biology leader Intrexon for \$160 million USD. Alphey has been a forthright commercial advocate for the use of synthetic biology and gene drives. He is undertaking research on developing gene drive systems in insects and is also a recipient of \$2.66 million USD from the US Military (DARPA) under the “safe genes” project on gene drives. Alphey was one of the scientists recruited by Emerging Ag to participate in a covert attempt to sway an online forum of the CBD to head off a moratorium on gene drives and appears to have been active in that effort.²⁰ Alphey acknowledges these conflicts of interests in his conflict of interest statement to IUCN.

Dr. Karl Campbell,

Position: Box/case study author

Concern: Bias and conflict of interest (GBIRD)

Dr. Karl Campbell is a program director for Island Conservation, an international NGO that is part of the GBIRD consortium, which received \$6.4 million USD to develop gene drives in mice for use in island eradication programs. Campbell is widely reported as an advocate for gene drive experimentation and use. Documents received under FOIA request show that Campbell was involved in an effort led by Emerging Ag to covertly recruit experts to sway an online forum of

¹⁶ <https://bch.cbd.int/synbio/AHTEG/listparticipants.shtml>

¹⁷ Section 4.3.5: <https://www.iucn.org/es/node/26323>

¹⁸ Conflict of Interest declarations are available at https://www.iucn.org/sites/dev/files/syntheticbiology_conflictintereststatements_final.pdf

¹⁹ See https://www.iucn.org/sites/dev/files/iucn_ssc_leader_guidelines_final_0.pdf for IUCN guidelines to SSC leaders on avoiding conflicts of interest.

²⁰ <http://genedrivefiles.synbiowatch.org/2017/12/01/us-military-gene-drive-development/#14>

the UN CBD.²¹ Dr. Campbell acknowledges his role in GBIRD as a conflict of interest.

Dr. Jason Delborne

Position: On the task force

Concern: conflict of interest (GBIRD)

Dr. Jason Delborne is a key member of the GBIRD (Genetic Biocontrol of Rodents) project that received \$6.4 million dollars from DARPA to develop mouse gene drives. He also received funds from the U.S. Army Corps of Engineers (ACE) to convene closed-door meetings on gene drives on their behalf. Delborne was also part of a group of experts who were recruited by PR Firm Emerging Ag Inc. to attempt to sway the outcome of a CBD online expert group to forestall a moratorium on gene drives. Emails released under the Gene Drive Files show that Delborne was also part of the coordinating group for this lobby effort.²² Dr. Delborne's Conflict of Interest statement acknowledges some of these conflicts and lists funds he is receiving from the US Government to explore issues in genetically modified chestnut trees.

Dr. Drew Endy

Position: On the task force

Concern: Bias and conflict of interest (Gen 9, Antheia, Gingko, Templa Nucleics and receives synthetic biology research funds)

Dr. Drew Endy is one of the most high-profile figures in, and proselytizers of, the development of synthetic biology as a field. He is founder of the IGEN competition, which recruits and trains young synthetic biologists and also President and founder of the Biobricks Foundation, which acts as an interest group for synthetic biology as a field. Endy is currently Professor of Bioengineering at Stanford University. He has founded or served on the board of two synthetic biology startups: Codon Devices (now defunct) and Gen9.

His wife, Dr. Christina Smolke, is CEO and founder of Antheia, a private synthetic biology company which manufactures opioids. Endy acknowledges several potential conflicts of interest on his Conflict of Interest declaration, including holding stock or stock options in Gingko Bioworks Inc, Antheia and Templa Nucleics Inc.

21 <http://genedrivefiles.synbiowatch.org/?s=Campbell+%22emerging+ag%22> and https://www.iucn.org/sites/dev/files/iucn_ssc_leader_guidelines_final_0.pdf

22 <http://genedrivefiles.synbiowatch.org/?s=Delborne+%22emerging+ag%22>

Dr. Kevin Esvelt

Position: On the technical subgroup

Concern: Bias and conflict of interest (receives synthetic biology research funds)

Dr. Kevin Esvelt is a bioengineer who leads the "Sculpting Evolution" team at MIT's Media Lab. He is probably the best-known developer and proponent of CRISPR Gene drives. Esvelt is the named inventor on a key patent²³ on RNA Guided CRISPR gene drives with extremely wide claims to the use of gene drives.

His team is developing a range of gene drive applications in mice, nematodes, yeast and mosquitoes, including a theoretical "daisy drive" to limit the spread of gene drives. Esvelt is a recipient of funds from the US military (DARPA) Safe Genes project as well as other sources to develop working gene drive systems. Esvelt acknowledges the conflict of Interest of holding key patents in the field but does not acknowledge his receipt of military funds to work on these topics.

Dr. Nick Holmes,

Position: Box/case study author

Concern: Conflict of interest (GBIRD)

Dr. Nick Holmes is Science director for Island Conservation, an international NGO that is part of the GBIRD consortium, which received \$6.4 million USD to develop gene drives in mice for use on island eradication programs. Documents received under the Freedom of Information Act show that Holmes was involved in an effort led by Emerging Ag to covertly recruit experts to sway an online forum of the UN CBD.²⁴ Dr. Holmes has declared his involvement with GBIRD as a conflict of interest.

Dr. Bart Kolodziejczyk

Position: On the task force

Concern: Possible industrial conflict of interest (undisclosed patents/biotech startups)

Dr. Bart Kolodziejczyk describes himself as "Nanoscientist and Entrepreneur" and comes from a technology industry background. He claims to have a "portfolio of three tech startups" and has elsewhere claimed that two of these are "biotech startups." He is chief technology officer with H2SG Energy (Australia). Kolodziejczyk also claims to hold "a number of original patents" although only one appears to be published (and is not directly applicable to synthetic

23 <https://patents.justia.com/inventor/kevin-m-esvelt>

24 <http://genedrivefiles.synbiowatch.org/?s=Holmes+%22emerging+ag%22>

biology). He is associated with the World Economic Forum.²⁵ Despite his commercial interest in biotechnology startups, Kolodziejczyk's Conflict of Interest form self-declares that he has no conflict of interest that might be perceived to influence the assessment.

Dr. Todd Kuiken

Position: On both task forces

Concern: Bias and conflict of interest (GBIRD)

Dr. Todd Kuiken is a well-known public policy expert on the topics of synthetic biology and gene drives who is also closely involved with the synthetic biology research community. As a scholar at North Carolina State University, Kuiken was a member of the GBIRD (Genetic Biocontrol of Rodents) project that received \$6.4 million USD from DARPA to develop mouse gene drives.²⁶ He subsequently left that project due to disagreements over military funding.²⁷ He was, however, a key organizer of the effort by Emerging Ag to covertly recruit and direct expert participation in an online open forum to fight against a potential gene drive moratorium at the CBD.²⁸ Kuiken is also known for his advocacy for the synthetic biology "DIY Bio" community of practice, commonly known as biohackers. He serves on the organizing committee for the annual IGEM Synthetic Biology competition, which recruits and trains young synthetic biologists. He is also a host/facilitator for the SynBio LEAP project (Synthetic Biology Leadership Excellence Accelerator Program) which aims to build a cadre of young professionals taking leadership roles to develop the field of synthetic biology. Kuiken's form acknowledges conflicts of interest.

Dr. Phil Leftwich,

Position: Box/case study author

Concern: Bias and conflict of interest (receives biotech research funds)

Dr. Phil Leftwich is based at the Pirbright Institute in the UK, where he works in Luke Alphey's research group, primarily investigating the molecular biology of mosquitoes in order to develop novel gene drive mechanisms. This work has received \$2.66 million USD from the US Department of

Defense (DARPA) as part of the "safe genes" project on gene drives.²⁹ Leftwich formerly worked for Alphey-founded biotechnology firm Oxitec, where he genetically engineered Mediterranean fruit flies. In his conflict of interest declaration, Leftwich does not acknowledge receipt of US military funds or his former commercial role with Oxitec.

Dr. Tom Maloney

Position: Box/case study author

Concern: Bias and conflict of interest (funder of synthetic biology research)

Dr. Tom Maloney is Director of Conservation Science for Revive and Restore, a California-based NGO that advocates for the use of genetic engineering in conservation and also funds genetic engineering and synthetic biology research for conservation applications via the "Science Catalyst Fund," established by biotech company Promega. His Conflict of Interest statement acknowledges his role with Revive and Restore but not the link between Revive and Restore and Promega.

Dr. Daniel Masiga

Position: On the technical subgroup

Concern: Bias and possible conflict of interest (Target Malaria)

Dr. Daniel Masiga is a bioinformatics researcher working on insect vectors of disease at the International Centre of Insect Physiology and Ecology (ICIPE). He is also a collaborator with the Target Malaria Gene Drive project, in which capacity he has received funds to undertake scientific research on mosquitoes³⁰. Masiga is a signatory to two letters organised by Target Malaria calling for support for gene drive research and a block on any moratorium.³¹ Dr. Masiga was also one of the scientists recruited by Emerging Ag to participate in a covert attempt to sway an online forum of the UN CBD with a view to heading off a moratorium on gene drives.³² Masiga, in his Conflict of Interest statement, does not declare his receipt of funds from Target Malaria.

25 <https://www.weforum.org/agenda/authors/bart-kolodziejczyk>

26 <https://www.geneticbiocontrol.org/could-genetic-testing-synthetic-mice-end-mice/>

27 <https://slate.com/technology/2017/05/what-happens-if-darpa-uses-synthetic-biology-to-manipulate-mother-nature.html>

28 <http://genedrivefiles.synbiowatch.org/?s=Kuiken+%22emerging+ag%22>

29 <https://cen.acs.org/biological-chemistry/biotechnology/New-CRISPR-inhibitors-found-help/96/web/2018/09>

30 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5606012/>

31 2016: <https://targetmalaria.org/open-letter/>, 2018: <https://genedrivework.org/open-letter>

32 <http://genedrivefiles.synbiowatch.org/cbd-synthbio-ahteg-online-forum-outreach-tracking-sheet-2/>

Andrew E. Newhouse,

Position: Box/case study author

Concern: Bias and conflict of interest (recipient of biotech research funds)

Andy Newhouse is a PhD student at the University of New York at Syracuse. He is developing genetically modified chestnut trees for release into the wild as part of the American Chestnut Research & Restoration Project, supported by donors including Monsanto (now Bayer) and GMO tree company Arborgen.³³

Despite this, in his Conflict of Interest forms he declares that he has no conflict of interest that may be seen to influence the assessment.

Newhouse has written in US media and appeared on panels promoting the idea of genetic engineering as a tool for conservation.

Dr. Ben Novak

Position: Box/case study author

Concern: Bias and conflict of interest (funder of synthetic biology research)

Dr. Ben Novak is Lead Scientist for Revive and Restore, a California-based NGO that advocates for the use of genetic engineering in conservation. It also funds genetic engineering and synthetic biology research for conservation applications via the “Science Catalyst Fund” established by biotech company Promega.

Novak leads the work of the organization in trying to “de-extinct” the passenger pigeon using synthetic biology approaches. Despite being employed by a genetic engineering funder (Revive and Restore) Ben Novak’s Conflict of Interest statement declares that he has no conflict of interest that could be perceived to influence the assessment.

Edward Perello

Position: On the task force

Concern: Bias and conflict of interest (Desktop Genetics, Revive and Restore)

Edward Perello is a principal at Arkurity, a biotechnology consulting firm and also Chief Business Officer and co-founder of Desktop Genetics, a private synthetic biology company that provides CRISPR genome editing libraries for functional genomics and drug discovery. Desktop Genetics has raised \$6.9 million USD in equity funding, led by biotech tools

company Illumina.³⁴ It is in a joint venture with Twist Biosciences, one of the hottest gene synthesis firms in the synthetic biology field. Desktop Genetics also works with Editas Medicine, Horizon Discovery, Transcriptic, and enEvolv. Perello is also a SynBio LEAP fellow. In his Conflict of Interest form, Edward Perello additionally acknowledges that he has received funds as a consultant to Revive and Restore.

Dr. William A. Powell,

Position: Box/case study author

Concern: Bias and conflict of interest (recipient of biotech research funds)

Dr. William A. Powell is director of the Council on Biotechnology in Forestry and a high-profile advocate for the use of genetic engineering approaches in forestry. He has worked for over 20 years developing transgenic trees. In 2013 he was named Forest Biotechnologist of the Year. Powell claims that he and his colleagues have planted more than 500 transgenic American chestnut trees at 10 locations in the U.S., including the New York Botanical Garden in the Bronx. He also directs the American Chestnut Research & Restoration Project at the State University of New York at Syracuse, supported by donors including Monsanto (now Bayer) and GMO tree company Arborgen. Despite this, Powell self-declares that he has “no conflicts of interest that would affect the perception of the assessment.”

Ryan Phelan

Position: On the technical subgroup

Concern: Bias and possible conflict of interest (funder of synthetic biology research)

Ryan Phelan is the co-founder and Executive Director of Revive and Restore, a California-based NGO that advocates for the use of genetic engineering in conservation. Revive and Restore also sponsors genetic engineering and synthetic biology research, managing the “Science Catalyst Fund” which was established with a gift from biotech firm Promega to develop genetic engineering applications. She is one of the leading advocates for the use of synthetic biology and gene drives in the conservation world. Phelan has organized several workshops, strategy discussions and public events designed to move forward the agenda of what her organization terms “genetic rescue,” promoting biotechnology-based conservation applications. Ryan describes herself as a serial entrepreneur and was formerly the founder and CEO of medical biotech firm DNA Direct, which was acquired by Medco Health

33 <https://www.wbur.org/onpoint/2019/04/29/gmos-genetics-ethics-chestnut-tree>

34 <https://www.crunchbase.com/organization/desktop-genetics#section-funding-rounds>

Solutions. She currently also serves on the board of directors of the Personal Genome Project run by high-profile synthetic biologist Dr. George Church. Phelan was also one of the individuals recruited onto the effort by gene drive lobby firm Emerging Ag to influence a UN CBD online forum to prevent support for moratorium on gene drives.³⁵ Ryan Phelan's conflict of Interest statement acknowledges her role with Revive and Restore but not the links with Promega, the personal genome project or her former commercial directorship.

Dr. Kent Redford

Position: Chair, author, on both task forces
Concern: Bias and possible conflict of interest (DuPont, Target Malaria)

Dr. Kent Redford runs a private consulting firm, Archipelago Consulting. He is well known in the field as a true believer in the promise of biotechnology and is identified with a partisan position of enthusiastic promotion of synthetic biology as a "positive" tool for conservation practice.

Since 2012, Kent has convened several conferences, workshops, and strategic group meetings, and authored reports and papers – all aimed at building support for synthetic biology in the conservation community.

Kent has been closely identified with Revive and Restore, a pro-biotech lobby group that argues for, and funds, research into synthetic biology conservation measures. Their website features a testimonial by Kent and in spring 2015, he was the co-organizer of a three-day workshop hosted for Revive and Restore on "New Genomic Solutions for Conservation Problems." The goal of the workshop, as reported, was "To begin to create a future in which new genomic technologies can be considered thoughtfully and eventually deployed safely and effectively to help conserve the Earth's biodiversity."³⁶

Freedom of Information Act documents show that in 2017, Redford was part of a group of experts coordinated by lobbying firm Emerging Ag for a covert attempt to influence a UN CBD expert forum to prevent a moratorium on gene drives.³⁷ Redford's

35 <http://genedrivefiles.synbiowatch.org/?s=Phelan+%22Emerging+Ag%22>

36 <https://reviverestore.org/about-the-workshop/>

37 <http://genedrivefiles.synbiowatch.org/?s=Redford+%22Emerging+Ag%22>

online resume lists one of his clients as biotechnology company DuPont, which has extensive interests in synthetic biology and genome editing. However, the nature of work he has undertaken for them is unclear.³⁸ He also sits on the ethics committee for Target Malaria. The Conflict of Interest statement submitted by Redford to IUCN only partially acknowledges his conflict of interests. For example, it does not acknowledge any consulting with DuPont or Revive and Restore.

Dr. Gernot Segelbacher

Position: On technical subgroup
Concern: Evidence of possible bias

Dr. Gernot Segelbacher holds the chair in Wildlife Ecology and Management at the University of Freiburg. According to Freedom of Information Act documents, he was listed by Emerging Ag as one of the scientists that were to be recruited to participate in a covert attempt to sway an online forum of the UN CBD to head off a moratorium on gene drives.³⁹ It is unclear whether he agreed to participate in the effort.

Lydia Slobodian

Position: On technical subgroup
Concern: Evidence of possible bias

Lydia Slobodian is a legal officer with IUCN. According to FOIA documents, she was amongst those recruited by Emerging Ag to participate in a covert attempt to sway an online forum of the UN CBD to head off a moratorium on gene drives.⁴⁰ This would be a direct contravention of decision 086 in which IUCN was bound by a decision not to promote gene drives. Although she is listed on emails as part of the group, she does not appear to have participated in the online forum itself.

Delphine Thizzy

Position: On both task forces and box/case study author
Concern: Bias and conflict of interest (Target Malaria)

Delphine Thizzy is stakeholder engagement manager for Target Malaria, a high-profile project with over \$100 million USD in funding to develop and

38 <https://archipelagoconsulting.com/clients-and-projects/>

39 See <http://genedrivefiles.synbiowatch.org/cbd-synthbio-ahteg-online-forum-outreach-tracking-sheet-2/>

40 <http://genedrivefiles.synbiowatch.org/?s=Slobodian+%22Emerging+Ag%22>

release gene drive mosquitoes in West and Central Africa, funded by the Gates Foundation, the Open Philanthropy Project And DARPA (US military). Thizzy is the most visible lobbyist for gene drives at international negotiations and was the principal organizer of the effort by Emerging Ag to covertly recruit and direct expert participation in an online open forum to fight against a potential gene drive moratorium at the CBD. Thizzy leads lobby strategies and public relations efforts on behalf of the Gene Drive Outreach Information Network, a group which lobbies for the interests of gene drive developers at international fora. Members of the Target Malaria team that Thizzy represents hold key patents in the field of gene drives and are probably currently the best-funded research team in the field. Delphine Thizzy does acknowledge her conflicts of interest on her signed Conflict of Interest statement.

Dr. Dan Tompkins

Position: On both task forces

Concern: Bias and conflict of interest (GBIRD)

Dr. Dan Tompkins is Science Manager for Predator Free 2050 and was formerly team leader for LandCare, a New Zealand Crown Research Institute. Landcare is one of the 7 partners in the GBIRD consortium developing gene drive mice that received a \$6.2 million USD grant from the US military (DARPA) and Dan Tompkins was responsible for the New Zealand activities of the GBIRD partnership. Emails published under a Freedom of Information Act request show that Tompkins has been closely involved with attempts by GBIRD to favourably manage public perception of gene drives in New Zealand, by lobbying the New Zealand government.

Tompkins was also one of the scientists recruited into the effort by gene drive lobby firm Emerging Ag to influence a CBD online forum to prevent support for moratorium on gene drives.⁴¹ Dr. Tompkins does not declare any of this (receipt of military funds or involvement in GBIRD) in his signed Conflict of Interest statement.

Dr. Madeleine Van Oppen

Position: On the technical subgroup and box/case study author

Concern: Bias and possible conflict of interest (receives synthetic biology research funds)

Dr. Madeleine Van Oppen is a research scientist with the Australian Institute of Marine Science. She is engaged in developing genetically modified coral using synthetic biology approaches. Her team has been sequencing coral and symbiont genomes with an eye towards potential genetic modification and introduction of genes for resistance, to make corals able to withstand temperature change. She is co-recipient of a \$4 million USD, five-year grant from Microsoft co-founder Paul Allen to, “Develop a biological toolbox for creating a stockpile of corals with improved environmental stress resilience, which can then be used to stabilise and restore reefs.”⁴² Dr. Van Oppen does not acknowledge any conflict of interest in her signed statement to IUCN.

Annex B:

Tracking the postings of the Emerging Ag “Volunteers” on The CBD Open Online Forum on Synthetic Biology, July 2017

As noted above, a number of those associated with IUCN’s synthetic biology report were also on the list of those targeted for recruitment by lobbying firm Emerging Ag to promote the views of biotechnology industry in the UN CBD online forum on synthetic biology. Below are two examples of how Emerging Ag attempted to direct responses to the online forum.

Example 1: Luke Alphey

7:27 EST 04-07-2017 Taye Birhanu (a representative of Ethiopia) writes about “horizontal gene transfer” on the CBD online forum.

11:46pm EST 04-07-2017 Barbara Livoreil (a representative of France) posts to the CBD online forum about “off target effects.”

10:41am 05 -07-2017 Ben of Emerging Ag sends an email to the list of recruited “volunteers” pointing out that they may wish to address the questions of off-target effects and horizontal gene transfer: “On off target effects,” he points out, “This point in particular may be picked up by NGOs with regards to CRISPR and other gene editing techniques, so it would be good to think about arguments or publications which could be used as a response. (See Doc: 20170705-CBD Online Forum Update-373.pdf)

11:10am EST 05-07-2017 (i.e. half an hour after the request by Emerging Ag) one of the “volunteers”, Anthony James answers on the online forum about off-

41 <http://genedrivefiles.synbiowatch.org/page/2/?s=tompkins+%22New+Zealand%22>

42 https://www.aims.gov.au/docs/media/latest-releases/-/asset_publisher/8Kfw/content/04-august-paul-g-allen-supports-coral-reef-research-to-reverse-rapid-decline

target effects (message #8398]) and five minutes later (11:15am) answers about “horizontal gene transfer” (message #8399).

10:03am EST 07-06-2017 Another volunteer, Luke Alphey of the Pirbright Institute (and IUCN panel member), also posts at length about horizontal gene transfer, reinforcing the post by Anthony James [#8415]

1.40pm 07-07-2017 Luke Alphey additionally posts at length about off-target effects [#8454]

Both Alphey and James were on the “To” list for the request by Ben of Emerging Ag inc

Example 2: Kent Redford

11:39am EST 07-07-2017 A further email is sent from Ben@emergingag.com. It requests: “it may be good for those working in conservation (particularly those affiliated with Island Conservation) to provide some comments related to the moderator’s request to “capture positive impacts of synbio organisms on biodiversity.”

12:22pm EST 07-07-2017 (43 minutes later) Paul Freemont posts: “In terms of biodiversity there are views within the professional conservation community which are suggesting that genomic technologies like genome editing and assembly could provide solutions to current conservation problems (see reference above).”

13:04pm 07-07-2017 (1hr 25 mins later) Mr. Kent Redford of Archipelago Consulting writes a post entitled “**Pluses and minuses of synbio for conservation - and an argument for counter-factuals**” [#8456] *talking about positive impacts of synbio for conservation*: “Considering positive impacts, direct positive impacts could include controlling invasive disease threatening endangered species whereas indirect positive impacts could be through increased food production allowing for less land under agriculture and therefore available for restoration of natural habitat.”

Both Redford and Freemont were on the “To” list for the request by Ben of Emerging Ag Inc.