SYNTHETIC BIOLOGY = GENETIC ENGINEERING OF WILD SPECIES

Synthetic biology in the context of nature conservation is about genetically engineering wild species. As this is a profound paradigm shift for nature conservation there is a need for an inclusive debate within the IUCN (see Res 123).

FUNDAMENTAL PARADIGM SHIFT

Conservation and synthetic biology, though both grounded in biological science, are fundamentally divergent. Conservationists focus on understanding the complex interactions between nature and human activity, emphasising ecosystem protection. In contrast, synthetic biology is reductionist, often lacking insight into ecosystem dynamics, and seeks to engineer or create new life forms.

While conservation works to maintain or restore ecosystems, synthetic biology frequently introduces changes that conservationists strive to mitigate. As such, synthetic biology is not merely a tool for conservation but represents a paradigm shift that demands careful, thoughtful consideration before application.

Driven by molecular biologists and often funded by industrial or military interests, synthetic biology tends to focus on technological fixes rather than addressing the root causes of biodiversity loss. Its goals may conflict with the long-term preservation of biodiversity, necessitating a critical reassessment of its role in conservation efforts.

WHY IT MATTERS

Despite its proclaimed benefits, the application of synthetic biology in conservation contexts raises significant concerns:

- **LOSS OF GENETIC BIODIVERSITY AND RESILIENCE:** The resilience of ecosystems is a product of natural evolutionary processes. Interfering with the genetic diversity that forms one of the fundamental building blocks of this resilience not only puts ecosystems at risk, but also reduces their ability to adapt to environmental changes and recover from disturbances. Such disruptions could lead to cascading effects, destabilising entire ecosystems and threatening the species and human communities that depend on them.
- **IRREVERSIBLE DAMAGE OF ECOSYSTEMS/ FOOD WEBS:** Outcrossing and the unintended spread of genetically modified organisms beyond the target population can have unpredictable and far-reaching consequences. The potential adverse effects of synbio applications will emerge from these symbiotic interactions in unpredictable patterns. These biological systems cannot be assessed just by looking at single parts (one organism itself) and pieces in isolation, they all have to be considered as larger units. Moreover, the complex interdependencies within and among species in ecosystems are not yet fully understood, and unintended interactions could disrupt food webs, leading to irreversible damage. These disruptions may compromise ecosystem functions, potentially causing harm to both individual organisms and entire ecosystems, with consequences that could be difficult or impossible to reverse.

■ CREATING NEW "INVASIVE" SPECIES: Gene drives, which promote the rapid spread of engineered traits through populations, pose a significant risk of creating new «invasive» species. By altering inheritance patterns, gene drives are designed to introduce traits that allow organisms to outcompete native species.
■ PERSISTENCE OVER SPACE AND TIME: Genetically modified organisms may persist and spread across ecosystems over extended periods, often without effective means of control. This long-term persistence can give rise to next-generation effects that were not observed during laboratory testing. Such outcomes may lead to unintended consequences, as the organisms evolve and interact with their environment in ways that were unforeseen, potentially causing lasting impacts on ecosystems and biodiversity.
■ REGULATORY GAPS: Current legal frameworks are inadequately equipped to manage the novel and far-reaching implications of gene drives and other synthetic biology technologies. There is a notable absence of liability and redress mechanisms within international agreements, such as the UN Convention on Biological Diversity, to address potential cross-border ecological damages.

Due to significant unpredictability, insufficient knowledge and the potentially severe negative effects on biodiversity and ecosystems, including agroecosystems, we advise against any intentional environmental releases of gene edited organisms, especially gene drive applications, including experimental releases. Such actions should only be considered once there is complete knowledge and understanding that allows for reliable performance and adequate and reliable risk assessments, ensuring that no serious or irreversible negative impacts will result from the release.

THE POLICY, AS IT STANDS RIGHT NOW, IS NOT FIT FOR PURPOSE

Even though the policy has been going through some peer reviewing process it still has mayor shortcomings:

■ ASSUMPTIVE USE OF SYNTHETIC BIOLOGY: The policy prematurely assumes synthetic biology as a solution for biodiversity conservation, lacking thorough evaluation and contradicting the more cautious approach outlined in WCC-2020-Res-123.
■ INADEQUATE RISK ASSESSMENT: It fails to provide robust risk assessment frameworks for the application of genetic technologies, essential for managing the uncertainties and ethical concerns associated with gene drives and genetically engineered organisms.
■ SUPERFICIAL TERMINOLOGY: Key terms like «ecological knowledge» and «liability and redress» are used superficially without providing actionable guidance, undermining the policy's integrity and practical application in conservation efforts.

Abu Dhabi and the opportunity to join an NGO coalition The upcoming IUCN vote in Abu Dhabi is a key moment for the conservation community to take a stand on synthetic biology. A growing coalition of NGOs is already mobilising to push for strong regulations that prioritise ecological and ethical standards.

FOR MORE INFORMATION OR TO JOIN THE COALITION, PLEASE CONTACT:

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