

REFERENCES & RESOURCES

Resources on science, innovation and public engagement

Below are a selection of resources and references that users of this toolkit may find useful. In no way do these links constitute the entirety of important and useful scholarship and resources out there, but we hope they give a slice of relevant information.

For recommended general reading on collaborative problem solving and facilitation strategies applicable to a wide variety of science-policy issues, check out the common higher ground resource guide available for free download at [Common Higher Ground Workshop - Keystone Policy Center](#).

PUBLICATIONS AND ARTICLES

[Genome-edited crops for improved food security of smallholder farmers](#) (Nature Genetics, 2022)

Perspectives on genome-edited crops and their potential benefits to smallholder farmers, as well as possible risks – technical and societal – of edited crops. Includes an assessment of the EU's policy on gene-edited crops.

[Gene editing and agrifood systems](#) (FAO, 2022)

Summary of the state-of-the-field of gene-editing in agriculture and food systems by the Food and Agriculture Organization of the United Nations. Outlines several scenarios in which gene-editing could be beneficial for improving food security globally.

[Designing Participatory Technology Assessments: A Reflexive Method for Advancing the Public Role in Science Policy Decision-making](#) (Technological Forecasting and Social Change, 2021)

A framework for bringing public participation into science policy decisions, called participatory technology assessment (pTA) developed by the Consortium for Science, Policy & Outcomes.

[Public and Stakeholder Engagement in Developing Human Heritable Genome Editing Policies: What Does it Mean and What Should it Mean?](#) (Frontiers in Political Science, 2021)

A deep dive on effective public and stakeholder engagement strategies for crafting effective policy around heritable human gene editing. Authors conduct a critical review of engagement campaigns undertaken by a few agencies and evaluate them based on five ideals: comprehensiveness, transparency, inclusivity, sound methodology, and accountability.

[Responsible governance of gene editing in agriculture and the environment](#) (Nature Biotechnology, 2021)

An article that lays out potential governance principles for the responsible and effective use of gene-editing technology in products. Outlines the pitfalls of genetically-modified foods and ways in which they could be avoided in the case of gene-edited foods.

[Societal Debates About Emerging Genetic Technologies: Toward a Science of Public Engagement](#)

(Environmental Communication, 2020)

Perspectives on how to best engage with the public on the “wicked problem” of gene-editing, including specific recommendations for bench scientists as well as social scientists. Argues the need for more meaningful and intentional engagement as early as possible.

[Emerging Technologies for Invasive Insects: The Role of Engagement](#) (Annals of the Entomological Society of America, 2020)

A detailed assessment of engagement in the field of invasive insect management. The authors outline best practices for engagement in three main steps: 1) pursue engagement across decision phases and sectors; 2) select context-appropriate participants and methods; and 3) recognize and navigate engagement-related tensions. They use a specific case of an invasive fruit fly as an example of effective ongoing and future engagement.

[Online Representations of “Genome Editing” Uncover Opportunities for Encouraging Engagement: A Semantic Network Analysis](#) (Science Communication, 2019)

A semantic analysis of representations of genome-editing in two online networks, Google and Wikipedia. The findings show that, thus far, most of the information related to the technology focus on technical information rather than social or moral debates.

[Mice Against Ticks: an experimental community-guided effort to prevent tick-borne disease by altering the shared environment](#) (Philosophical Transactions of the Royal Society B, 2019)

An experiment to prevent tick-borne disease transmitted by mice in Nantucket and Martha’s Vineyard, two island-based communities in eastern North America. The study aims to release mice engineered to be immune to pathogens that infect ticks on the island, thereby significantly lowering the affected tick population. The study employed community engagement campaigns from the outset to determine the ideal strategy, which is detailed in the paper, and serves as a good example of how community engagement can be incorporated into the research design.

[Genetic frontiers for conservation: An assessment of synthetic biology and biodiversity conservation: technical assessment](#) (IUCN, 2019)

This report is published by the International Union for Conservation of Nature (IUCN) Task Force on Synthetic Biology and Biodiversity Conservation, and offers an extensive and highly detailed analysis of using synthetic biology tools in conservation and genetic diversity. The report is a critical assessment of the range of issues surrounding this approach, including current technologies, risk/benefits, governance, societal impact, and long-term implications. A shorter summary of the report can be found [here](#).

[CRISPR versus GMOs: Public acceptance and valuation](#) (Global Food Security, 2018)

A study of public acceptance of gene-edited rice vs GMO rice. The study has many interesting findings, such as respondents were more willing to eat CRISPR food over GM food, but without detailed information respondents' valuation of CRISPR and GM food overall was similar. Furthermore, the study assesses how respondents reacted to different labeling policies, pricing, and contexts.

[Rethink public engagement for gene editing](#) (Nature, 2018)

Offers a new structured approach to gene-editing engagement, namely creating a consortium of interested parties, including scientists, policymakers, activists, private companies, etc. from all perspectives that can address concerns and inform the public.

[A framework for enhancing ethical genomic research with Indigenous communities](#)

(Nature Communications, 2018)

Details a framework for how to engage with Indigenous communities regarding genomics research, using six principles: (1) understand existing regulations, (2) foster collaboration, (3) build cultural competency, (4) improve transparency, (5) support capacity, and (6) disseminate research findings.

[CRISPR for Crop Improvement: An Update Review](#) (Frontiers in Plant Science, 2018)

A very thorough review of CRISPR use-cases in several crop plants, such as rice, wheat, maize, cotton, soybean, tomato, potato, grape, and citrus. Mostly technical breakthroughs and updates.

[Biotechnology, the American Chestnut Tree, and Public Engagement Workshop Report](#) (Genetic Engineering and Society Center, North Carolina State University, 2018)

A detailed report of the public engagement workshop for the restoration of the American Chestnut using genetically-engineered varieties. Includes engagement strategies, participant opinions, summary of findings, and recommendations.

[Communicating through vulnerability: knowledge politics, inclusion and responsiveness in responsible research and innovation](#) (Journal of Responsible Innovation, 2016)

An article that uses three case studies to argue that idealized rational decision-making is not sufficient for responsible innovation, but rather needs, vulnerabilities, identity, and agency are entangled within society and must be factored into scientific innovation.

[Responsible innovation and the reshaping of existing technological trajectories: the hard case of genetically modified crops](#) (Journal of Responsible Innovation, 2016)

An article that argues the need to move away from a "risk assessment" discussion of genetically-modified crops and into one that encompasses historical, cultural, societal perspectives. Also refutes the information deficit model of public acceptance of GM crops as being far too simplistic, despite being prevalent.

[Rewriting the Code of Life](#) (New Yorker, 2016)

A long-form essay that features a gene-drive scientist, Dr Kevin Esvelt, as a vehicle to discuss bioethics, the academic community, and public engagement.

[Developing a framework for responsible innovation](#) (Research Policy, 2013)

This article describes the original framework of responsible research and innovation. The authors synthesize previous findings and perspectives on public governance of research into four main pillars: anticipation, reflexivity, inclusion, and responsiveness. This framework is the basis for a lot of thinking for best practices in linking engagement with innovation, and continues to be relevant.

[Public Engagement with Biotechnologies Offers Lessons for the Governance of Geoengineering Research and Beyond](#) (PLOS Biology, 2013)

A case study that employs the framework described in the paper above, involving a geoengineering experiment to manipulate the level of sunlight received in an area. Describes the engagement process in detail.

ORGANIZATIONS AND TOOLKITS

[Association for Responsible Research and Innovation in Genome Editing](#)

ARRIGE is an international organization based in France that seeks to bring together all stakeholders to promote a global governance strategy for genome-editing, and its responsible and ethical use. They have published statements on [regulation of gene-edited crops, gene drive technology, and edited human embryos](#).

[Boston Museum of Science Public Engagement with Science Guide](#)

The Boston Museum of Science has compiled a guide for public engagement with science after many years of work in this field. As described on the website, “This guide is designed to help staff at informal science education organizations and others who are interested to develop, implement, and evaluate activities and events that incorporate the multi-directional dialogue and mutual learning at the heart of public engagement with science.”

[Consortium for Science, Policy & Outcomes](#)

The Consortium for Science, Policy & Outcomes (CSPO) is an organization that develops projects, practices, and knowledge bases to enable the scientific enterprise to interact more effectively with the public and society. CSPO has several active projects on their website, including [public engagement on human genome editing and carbon dioxide removal technologies](#). They have also developed a framework for bringing public participation into science policy decisions, called [participatory technology assessment \(pTA\)](#).

[Global Citizens’ Assembly on Genome Editing](#)

The Global Citizens’ Assembly is an international project to bring together representative stakeholders from multiple countries to inform, deliberate, and recommend governing principles for gene-editing. The product of the deliberations will be presented to the UN, WHO, FAO, and national leaders, and will also be featured in a [documentary film](#) recording the process.

[Genetic Engineering and Society Center](#)

The GES is a center based at North Carolina State University dedicated to interdisciplinary research in genetic engineering and its societal impact. Part of the core mission is to engage with the public, identify problem areas, perform risk-assessment for research, and facilitate dialogue between scientists and stakeholders. Some of their projects include [collecting an oral history of agricultural genetic engineering practices](#), [assessing the institutional and regulatory frameworks surrounding CRISPR gene editing in Latin America and the Caribbean](#), and a [workshop on gene drives in agriculture exploring the risks and benefits](#).

[Keystone Policy Center](#)

Keystone Policy Center is a non-profit, non-advocacy organization with a mission to inspire leaders to rise above entrenched positions to reach common higher ground. Keystone is recognized by public, private, and civic-sector leaders for independent, collaborative problem-solving approaches on a variety of science-policy issues in agriculture, natural resources, health, Tribal and Indigenous engagement, and education. Keystone offers [capacity building, engagement and collaboration training](#) and also leads work in incorporating diverse societal perspectives into responsible governance approaches for [emerging genomic technologies](#) and their applications in food, agriculture, the environment, public health and personal medicine.

[International Association for Public Participation, USA](#)

IAP2 is an organization that advocates for public participation in decision making. They provide tools for practitioners (researchers, policymakers, community leaders) to effectively include, collaborate with, and empower stakeholders. IAP2 has developed three Public Participation Pillars that outline a plan for social engagement.

[Involve UK](#)

Involve UK is a UK-based organization founded to facilitate public engagement in policy decision-making. They have an extensive catalog of projects and resources available on their website, including a descriptive list of various methods of public engagement at different levels.

[Responsible Research and Innovation](#)

RRI is a set of guiding principles that are meant to be employed “upstream” of any research enterprise, to incorporate societal values and impacts into the design, in order to align research goals with the goals of society at large. The RRI website has an extensive database of resources, including trainings, examples, and community forums to integrate RRI into any research environment or plan.