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Stakeholder Engagement and Governance of Emerging Biotechnologies

Center for Science and Technology Policy Research
University of Colorado, Boulder| January 29, 2020

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Integrating scientific knowledge and public values in shaping the futures of biotechnology

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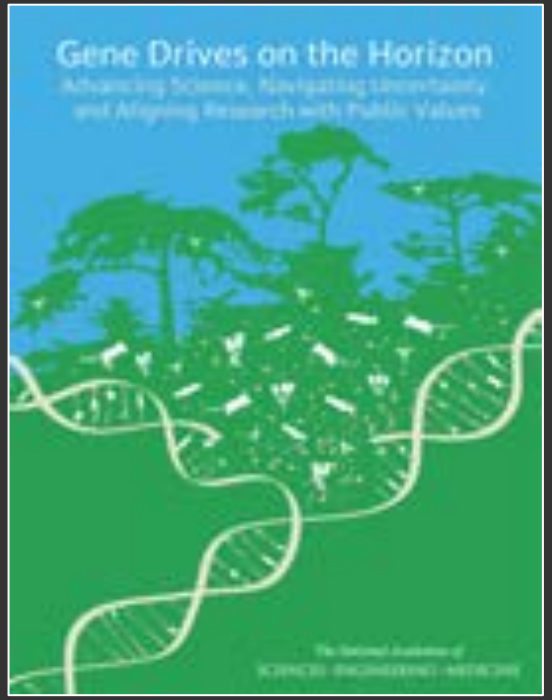
Farooque, M. (ecastnetwork.org)

The National Academies of SCIENCES ENGINEERING MEDICINE

nas-sites.org/gene-drives

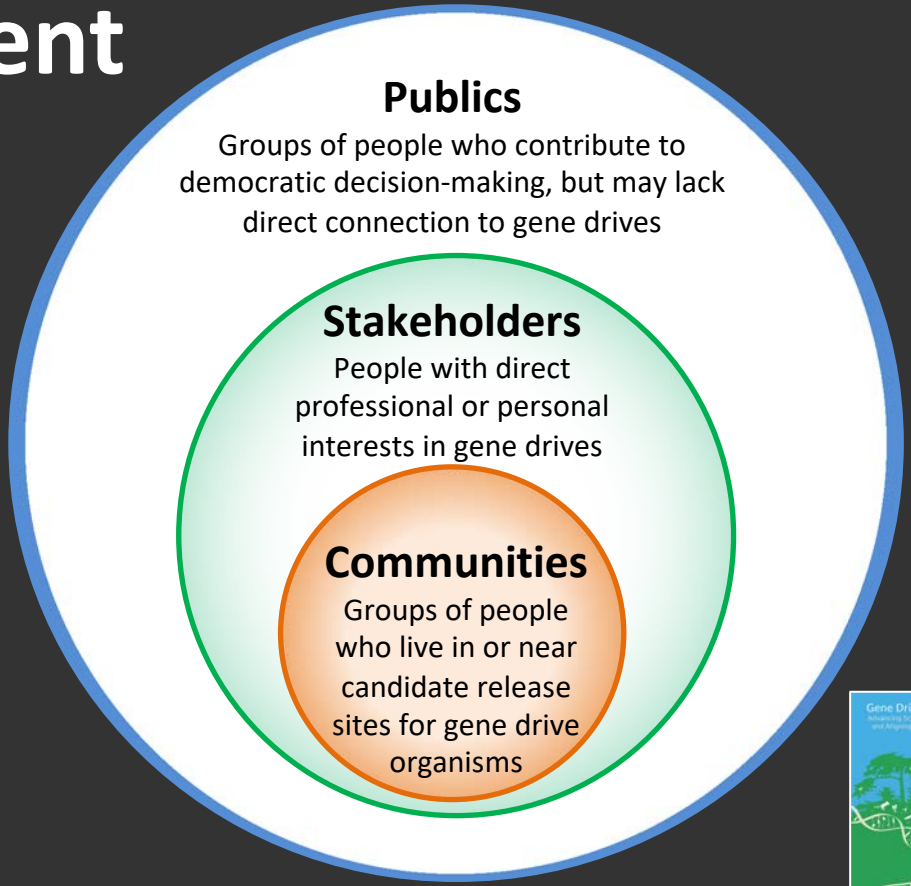
"Public engagement cannot be an afterthought."

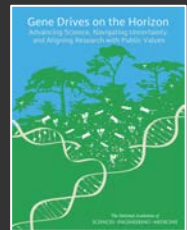


"The outcomes of engagement may be **as crucial as the scientific outcomes** to decisions about whether to release a gene-drive modified organism into the environment."

Defining Engagement

"Seeking and facilitating the sharing and exchange of knowledge, perspectives, and preferences between or among groups who often have differences in expertise, power, and values"

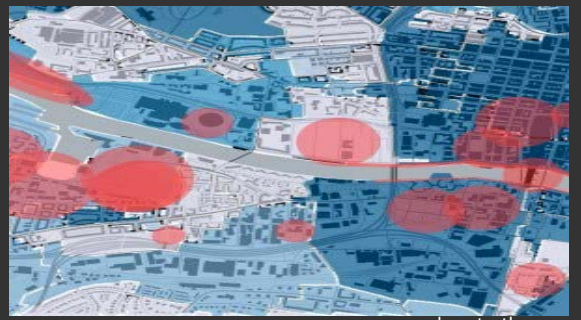




Motivations for Engagement

- Local knowledge
- Principles of justice
  - Transparency
  - Informed consent
- Opportunities for mutual learning
- Building of trust

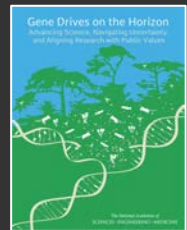
Keymind.com.br



udsu-strath.com

Dps.mn.gov/divisions/ojp

Globoforce.com



Challenges of Engagement

- **Who** should be engaged?
- What are the **goals** of engagement?
- **When** should engagement occur?
- How can **cultural differences** among those involved in engagement be recognized and respected in ways that enhance deliberation?
- What are potential triggers for **polarization**?
- How should the results of engagement feed into practical and formal **decision making** about research and technological deployment?

(NASEM, 2016)

Typology of Public Engagement

Type of Engagement	Information Flow		
Public Communication	Sponsor	→	Public Representative
Public Consultation	Sponsor	←	Public Representative
Public Participation	Sponsor	← →	Public Representative

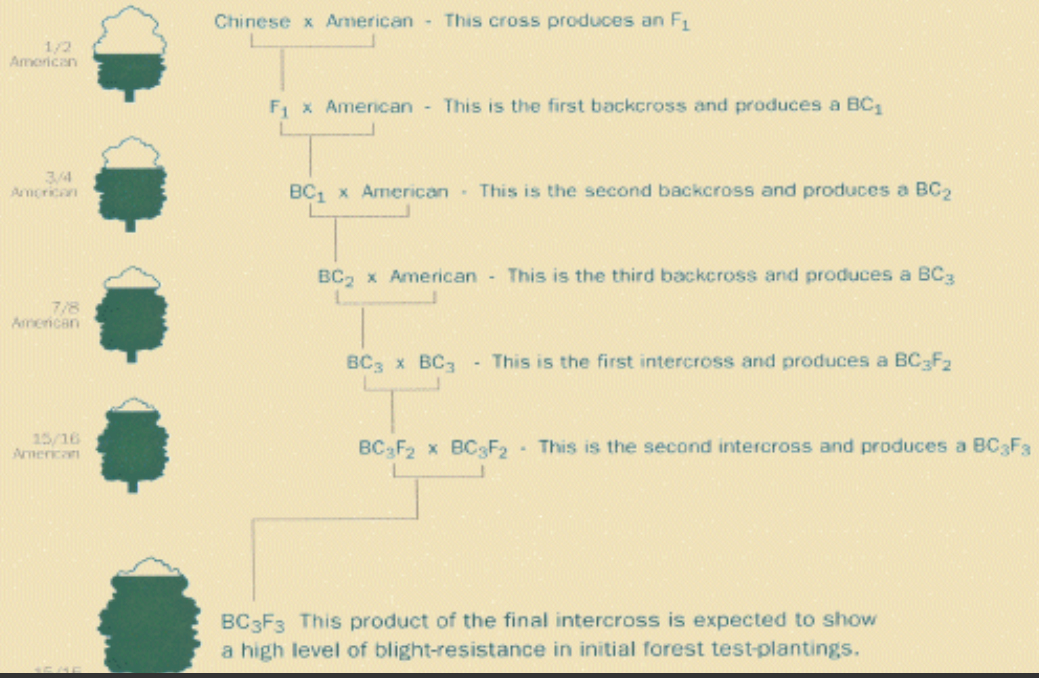
Rowe, G., & Frewer, L. J. (2005). A Typology of Public Engagement Mechanisms. *Science, Technology and Human Values*, 30(2), p. 255.

(Jacobsen, 2019)


ONTARIO
WISCONSIN
MICHIGAN
NEW YORK
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
RHODE ISLAND
CONNECTICUT
NEW JERSEY
PENNSYLVANIA
DELAWARE
OHIO
INDIANA
ILLINOIS
WEST VIRGINIA
VIRGINIA
KENTUCKY
TENNESSEE
SOUTH CAROLINA
GEORGIA
ALABAMA
LOUISIANA
FLORIDA

Backcross Breeding Program

With each cross, additional American chestnut characteristics are regained. Only at the final cross, however, does blight resistance approach that of the Chinese parent.



THE AMERICAN CHESTNUT FOUNDATION®

Center for Native Peoples and the Environment

GJEP GLOBAL JUSTICE ECOLOGY PROJECT

ESF
State University of New York
College of Environmental Science and Forestry

ARBORGEN®

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

The Nature Conservancy

Chestnut Growers of America

NSF (SES-1632670)
"Responsible Innovation with Genetically Modified American Chestnut Trees."

Motivations

- Stakeholders + innovators
- Expand beyond "upstream"

Innovations

- Interests and values
- Decision phases:
  - Research and development
  - Regulatory review
  - Deployment, management, and monitoring
- Engagement scenarios

Biotechnology, the American Chestnut Tree, and Public Engagement
Workshop Report

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Research Team
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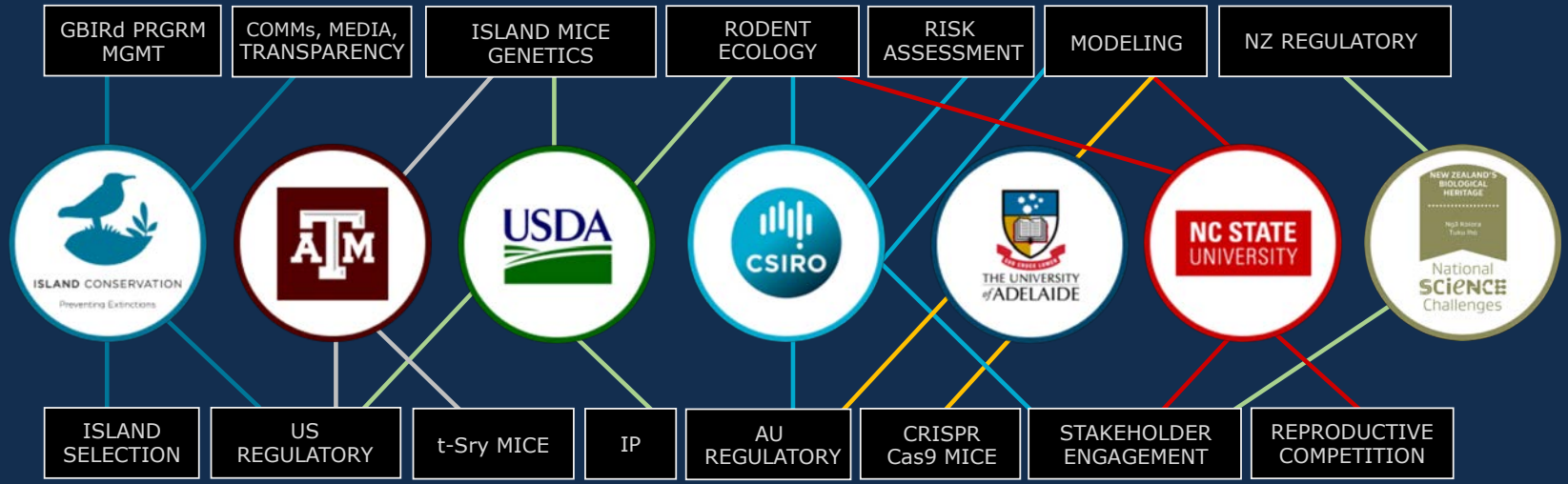
Jayce Sudweeks, M.S.

go.ncsu.edu/ges-chestnut-report


GBIRd
GENETIC BIOCONTROL
OF INVASIVE RODENTS
https://www.geneticbiocontrol.org/

GBIRd

Genetic Biocontrol of Invasive Rodents



BIOSAFETY/CONTAINMENT/ LOCALIZATION

ETHICS ADVISORY COMMITTEE

SUSTAINABILITY/ FUNDRAISING

https://research.ncsu.edu/ges/2019/02/report-gene-drive-landscape/

Exploring Stakeholder Perspectives on the Development of a Gene Drive Mouse for Biodiversity Protection on Islands

Summary Report of Stakeholder Interviews

GES CENTER | NC STATE UNIVERSITY | KEYSTONE POLICY CENTER | Consortium for Science, Policy & Outcomes at Arizona State University

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DARPA DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Defense Advanced Research Projects Agency > Program Information

Safe Genes

Exploring Stakeholder Perspectives on the Development of a Gene Drive Mouse for Biodiversity Protection on Islands

Stakeholder Workshop | March 7-8, 2019

North Carolina State University | Hunt Library | Raleigh, NC

DARPA DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Defense Advanced Research Projects Agency > Program Information

Safe Genes

Consortium for Science, Policy & Outcomes at Arizona State University

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KEYSTONE POLICY CENTER

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Participants

- Evolutionary biologists
- Invasive species experts
- Ethicists
- Mouse biologists
- Conservation NGOs
- Animal welfare experts
- Wildlife biologists
- Biotech policy experts
- Population geneticists
- Population modelers

Discussions across scales of research

- Laboratory
  - Gene drive mechanisms
  - Control methods
- Simulated natural environments
- Field trial risk assessment
- Island selection
- Community engagement

Island Selection Criteria	Island A	Island B	Island C	Island D
Size	5 ha	10 ha	100 ha	400 ha
Distance from mainland	10 km	1000 km	1 km	100 km
Presence of native mice	No	Yes	No	Yes
Human activity on island	Small-scale Eco-tourism	Lighthouse	Research Station	Indigenous agriculture
Geography	Sandy beaches		Steep Cliffs	
Accessibility - Public	Yes	Yes	No	No
Accessibility - Research team	1 hr boat ride	flight to landing strip	10 min boat ride, with crane access	1 day boat ride
Regulatory Oversight	U.S.	AU	US	AU
Number of land managers involved	Wealthy Conservationist	Petrochemical Company	Government (Fish & Wildlife)	Tribal government, Federal government
Knowledge of invasive mouse population (behavior, genetics, ecology)	N/A	1 sampling event	20 years of studies	1 year of study
Livestock & other animals	None	feral goats	None	llamas, pigs, chickens
Prior eradication efforts	Succeeded in 2009	historical baiting around barracks	None	None
Non-targets of concern	None	native mouse	endangered raptor	None
Presence of mus musculus	No, would be introduced	Yes	Yes	Yes
Feasibility of eradication with toxicants	Highly feasible	Feasible	Unclear	Difficult
Organisms threatened by mice	bat spp that is rebounding	an extirpated lizard that could be reintroduced	several endangered birds	Mice spread human disease as a vector for tick-borne illness

Lessons for engagement

- Enthusiasm for “upstream” engagement
- Appreciation for dialogue with “uncommitted developers”
- Scenarios: integration of facts and values, tradeoffs, priorities
- Concerns:
  - discussions of technical options without safety studies
  - focus on new tools may undermine existing strategies
  - working for public acceptance vs. being an “honest broker”


M. Farooque

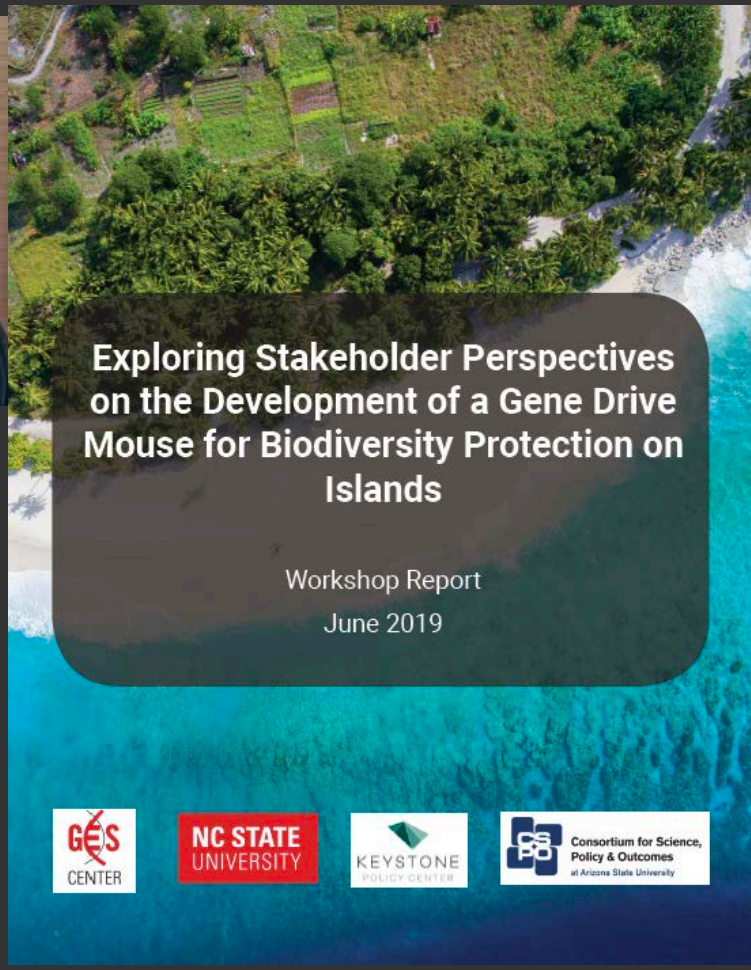

S.K. Barnhill-Dilling


J. Shapiro


J. Delborne

Report available at the GES Center Website

https://research.ncsu.edu/ges/research/biodiversity-and-gene-drive-mice/



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