Strategies for assessing risk and benefit for gene drive field release: Prepared remarks

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Overarching questions/topics

Asked to address the following questions in 10 minutes

- **What strategies exist for risk and benefit assessments for gene drives or research with similar issues?**

- **What challenges exist for conducting environmental risk assessments for gene drive field release?**

- **What additional knowledge would be useful for conducting such assessments?**

- What broader domains beyond environmental considerations should be considered when conducting a risk and benefit assessment for field release of gene drives?

- How can decision-makers be better prepared to assess risks and benefits across environmental, economic, and social domains as gene drives come closer to release?

- Are there areas of expertise and/or lived experience that should be considered in the conduct of risk and benefit assessments that are currently missing?

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Risk assessment strategies in complex novel situations

OIE-IUCN (2014).

- "Generally an insufficient amount or quality of data is available on wildlife to make meaningful quantitative risk assessments...the application of a structured qualitative approach is usually preferred..."
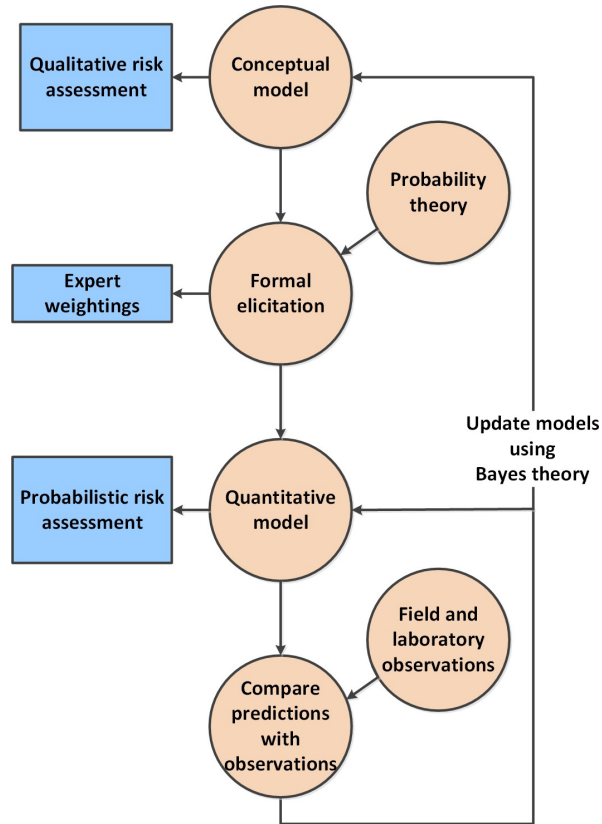
Kaplan and Garrick (1981)

- "With insufficient data there is nothing else one can do but use probability..."

Rasmussen (1981)

- "The use of Probabilistic Risk Assessment in large accidents of low probability must employ the logic of the Bayesian approach..."

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Risk assessment strategies in complex novel situations

What challenges exist for conducting ERA for gene drive field release

Advection-diffusion-reaction model will form the core of RA for a field release of a GDMO

- Parametrisation and inference will be technically challenging
- Significant uncertainty associated with: carrying capacity, advection, competition...

Simulation will not be enough for an "adequate" RA

- Key parameters will need empirical basis
- Otherwise complex sensitivity analysis

Monitoring will be necessary at large spatio-temporal scales
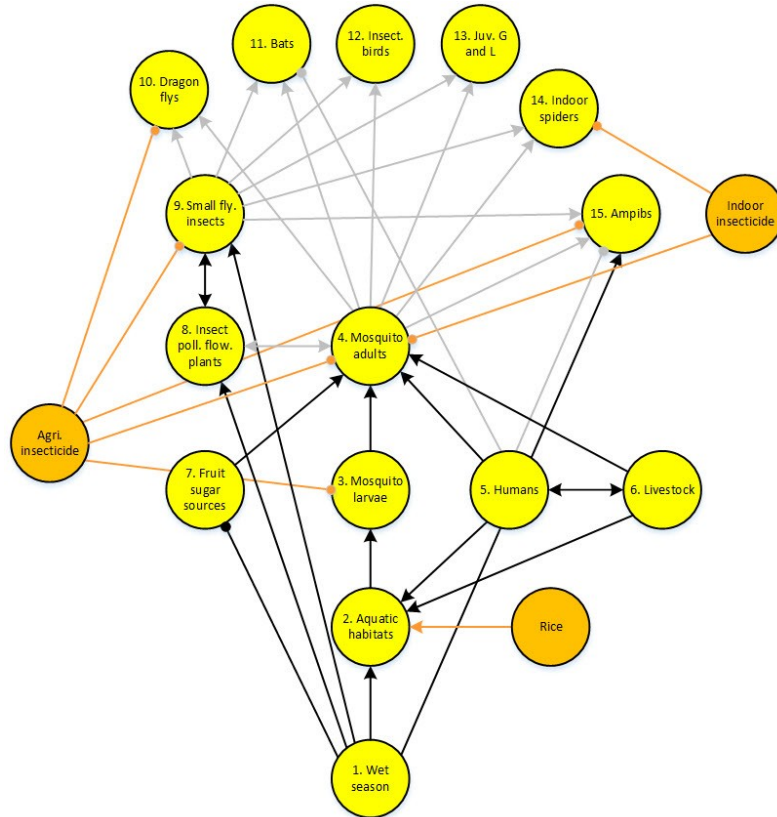
- Rare events will be hard to detect (see: https://vimeo.com/169701041)
- Logistically difficult and costly

What additional knowledge would be useful

Source: https://www.vectorbase.org/popbio/map/
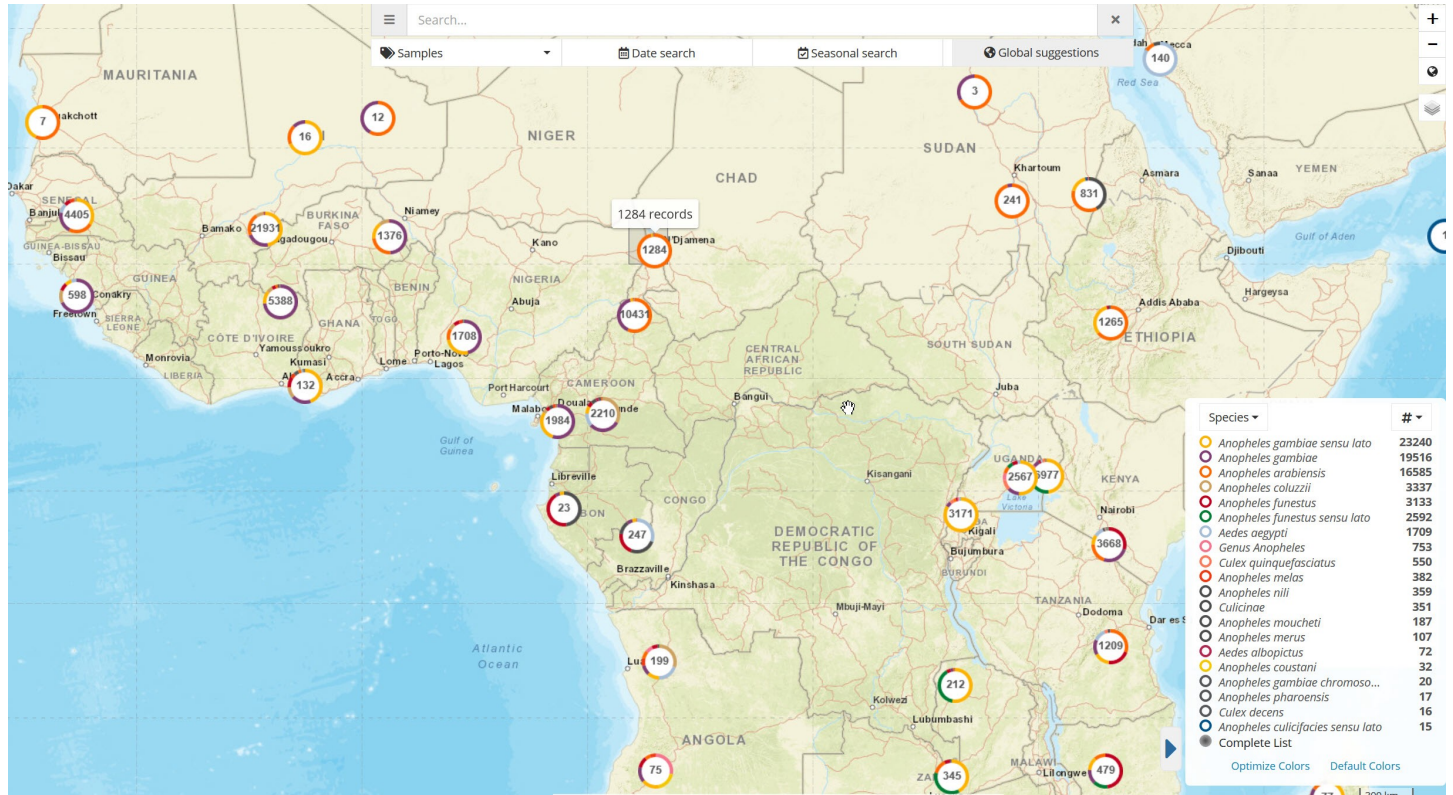
What additional knowledge would be useful

References

Kaplan, S. and Garrick, J. B. (1981). On the quantitative definition of risk. *Risk Analysis*, 1(1):11–27.

OIE-IUCN (2014). Guidelines for wildlife disease risk analysis. Technical report, World Organisation for Animal Health (OIE) and International Union for Conservation of Nature (IUCN), Paris, 24 pp.

Rasmussen, N. C. (1981). The application of probabilistic risk assessment techniques to energy technologies. *Annual Reviews in Energy*, 6:123–138.

Thank You

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