CAST WEBINAR SERIES ON
FIFRA AND ESA **#3**

CAST
The Science Source for Food,
Agricultural, and Environmental Issues

Improving the science behind the process: Implementing better data and tools to streamline the FIFRA/ESA process

Valery Forbes
Richard Brain

CAST Quick Facts

- 501(c)3 membership-supported nonprofit

- Formed in 1972 as a result of 1970 National Academy of Sciences Report

- Nonpartisan and apolitical

- Membership includes 27 scientific societies; 20 universities; 19 libraries; 45 nonprofits; 21 companies; and over 500 individuals from 46 states and 7 countries

- Celebrated its 50th anniversary in 2022

Mission

CAST convenes and coordinates networks of experts to assemble, interpret, and communicate credible, unbiased, science-based information to policymakers, the media, the private sector, and the public.
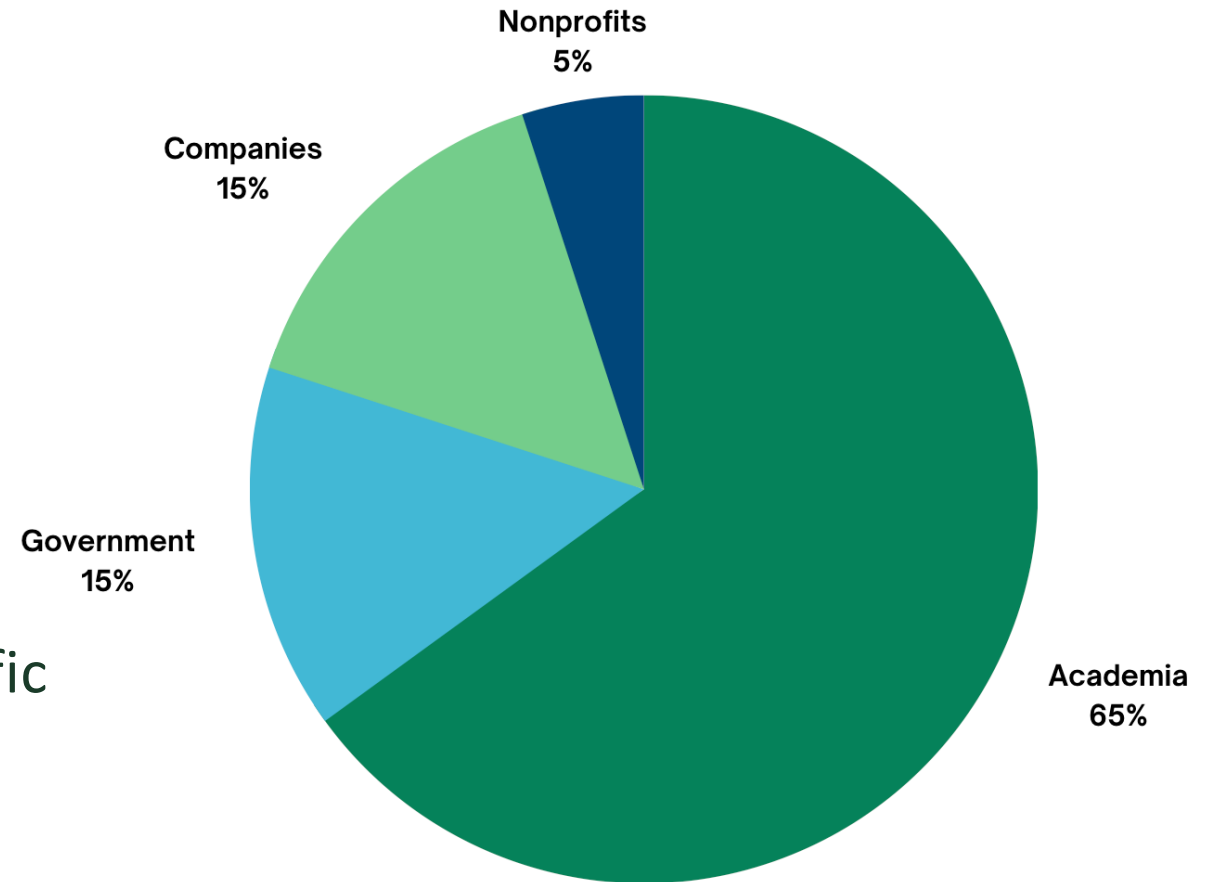
Vision

A world where decision making related to agriculture, food, and natural resources is based on credible information developed through reason, science, and consensus building.

CAST

The Science Source for Food, Agricultural, and Environmental Issues

How CAST Accomplishes Its Mission

With the help of many volunteer contributors:

- 65 Board Members representing scientific societies, companies, nonprofits, and universities
- Nearly 200 active task force members working on CAST reports yet to be released
- Volunteer scientific experts as authors and reviewers—more than 1800 volunteers since 2008

Nonprofits
5%

Companies
15%

Government
15%

Academia
65%

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Section 7 Consultation Process

FEDERAL INSECTICIDE, FUNGICIDE, AND
RODENTICIDE ACT

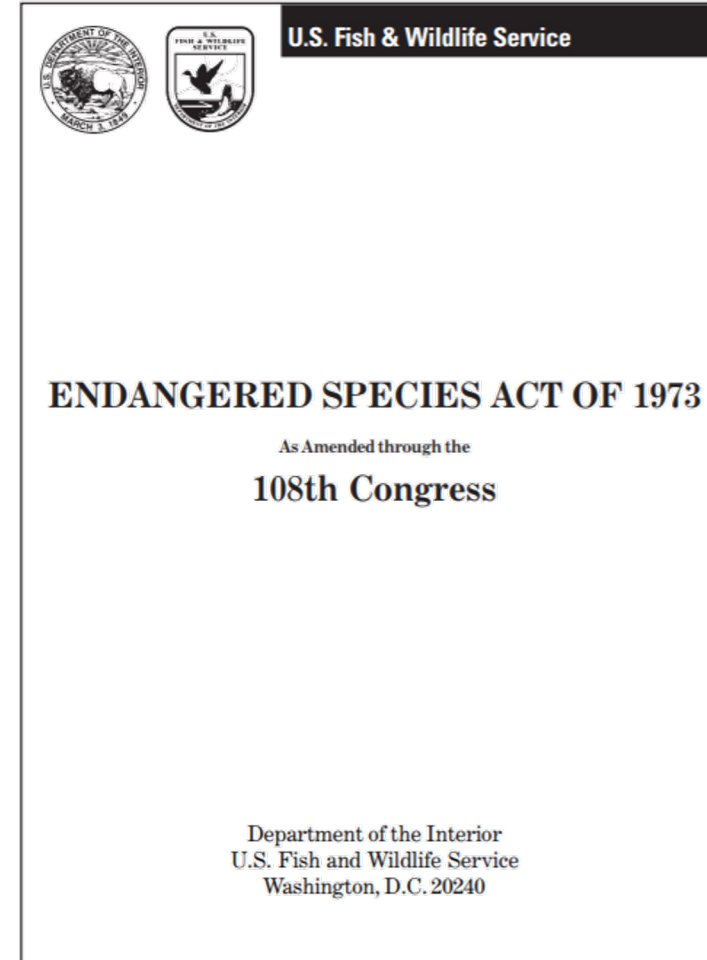[As Amended Through P.L. 112–177, Effective Sept. 28, 2012]

AN ACT

To regulate the marketing of economic poisons and devices, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

[1]–[1] This table of contents is not part of the Act but is included for user convenience. The numbers in brackets refer to section numbers in title 7, United States Code.

1

September 28, 2012

U.S. Fish & Wildlife Service

ENDANGERED SPECIES ACT OF 1973

As Amended through the

108th Congress

Department of the Interior
U.S. Fish and Wildlife Service
Washington, D.C. 20240

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Herbicide (ESA) Strategy

Draft Herbicide Strategy Framework
to Reduce Exposure of Federally Listed Endangered and
Threatened Species and Designated Critical Habitats from
the Use of Conventional Agricultural Herbicides

July 2023

Office of Pesticide Programs
Office of Chemical Safety and Pollution Prevention
U.S. Environmental Protection Agency
Washington, DC

1. Identify Population-Level Impacts	Rely on current risk assessment methodology Identify whether mitigation practices would apply Reflects fate and toxicity profile
2. Identify Type and Level of Mitigation	Identify runoff, erosion, and drift mitigation measures for each use pattern and application parameters
3. Identify the Geographic Extent of Mitigation	Identify mitigation that would apply across the entire use area to include on the label Identify mitigation that would apply in a specific geographic area to implement via Bulletins Live Two!; select applicable grouped species Pesticide Use Limitation Areas (PULAs)

Three Step ESA Process

All Federally Listed Species
within the conterminous United States
- 2021 CDL – Cultivated lands (~ 345 million acres)
- All FWS Listed Species Range – August 2022

USFWS Range (8/8/2022)
https://ecos.fws.gov/ecp/report/current-range-all

Cropland Data Layer (CDL) Cultivated
https://www.nass.usda.gov/Research_and_Science/Cropland/Release/

0   250   500   1,000 Kilometers

Ecological Risk Assessment

Planning ↔ **Problem Formulation** ↔ Gather Data, Iterate, & Monitor

Analysis of Exposure & Effects

Risk Characterization

Communicate Results

Risk Management

Increasing Complexity/Resource Requirements Characterization of Variability and/or Uncertainty

Refined

Tier 3
- Probabilistic exposure assumptions
- Detailed site-specific modeling
- High cost

Evaluate and refine

Tier 2
- More realistic exposure assumptions
- More detailed modeling
- Moderate cost

Evaluate and refine

Screening-Level

Tier 1
- Conservative exposure assumptions
- Simple modeling
- Low cost

Adapted from Figure 31-1, ATRA, Volume 1

Topic	Step 1	Step 2	Step 3
Assessment	Biological Evaluation	Biological Evaluation	Biological Opinion
Scale	Individual and field	Individual and field/landscape/watershed[1]	Population and landscape/watershed
Determination	No Effect/May Affect	Not Likely to Adversely Affect/Likely to Adversely Affect	No Jeopardy/Jeopardy[2]

Tiered Risk Assessment Framework

Realistic/Refined

Conservative/Screening-Level
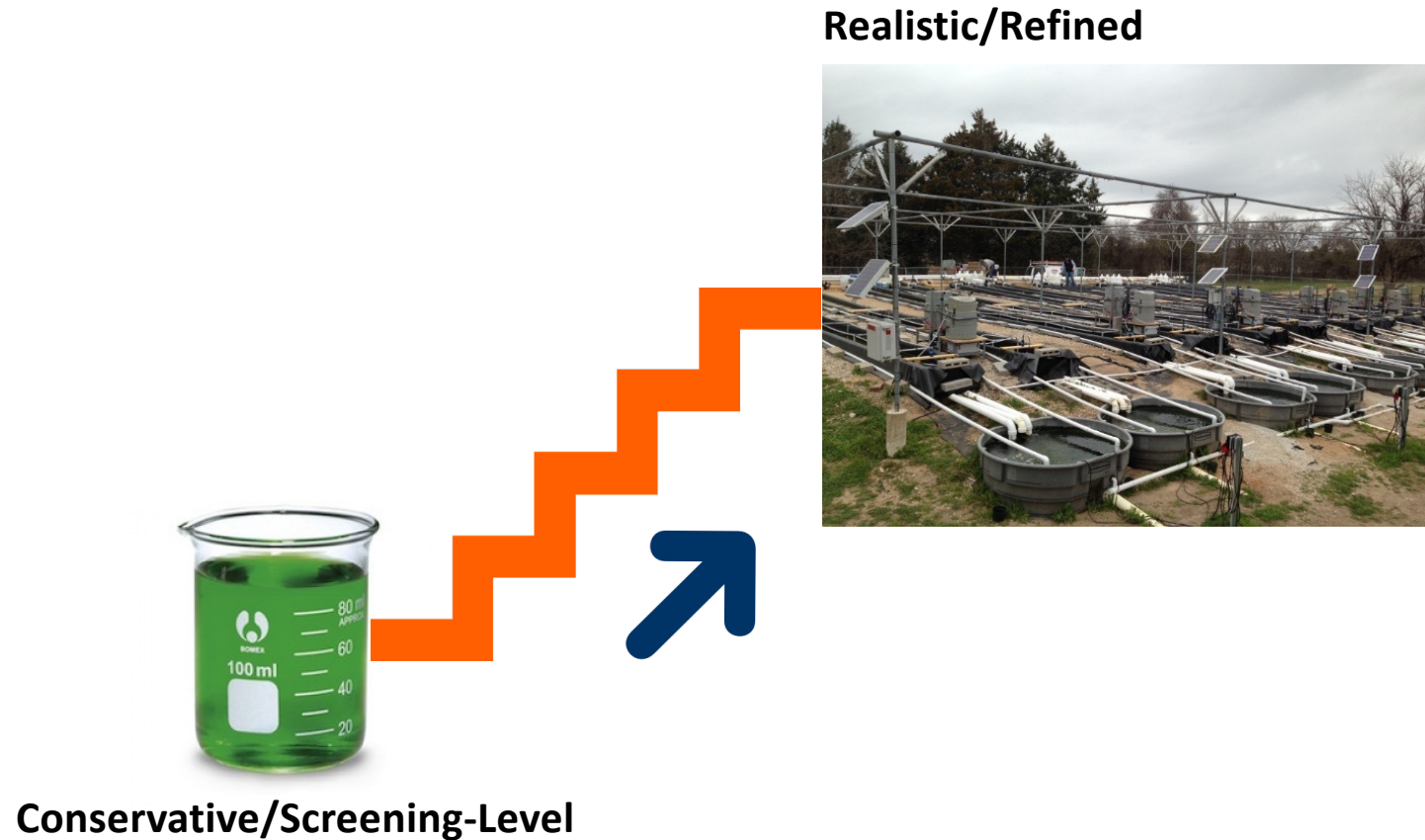
Obstacles to Progress

Lack of resources has forced a reliance on screening-level risk assessments in Steps 1 and 2

Litigation as the driver of the FIFRA/ESA consultation process forces action

The objectives (i.e., protection goals) of FIFRA (i.e., ensuring no adverse effects to nontarget species or critical habitat from registering a pesticide) and ESA (i.e., ensuring that listed species are not further impacted from any human-related cause) are very different
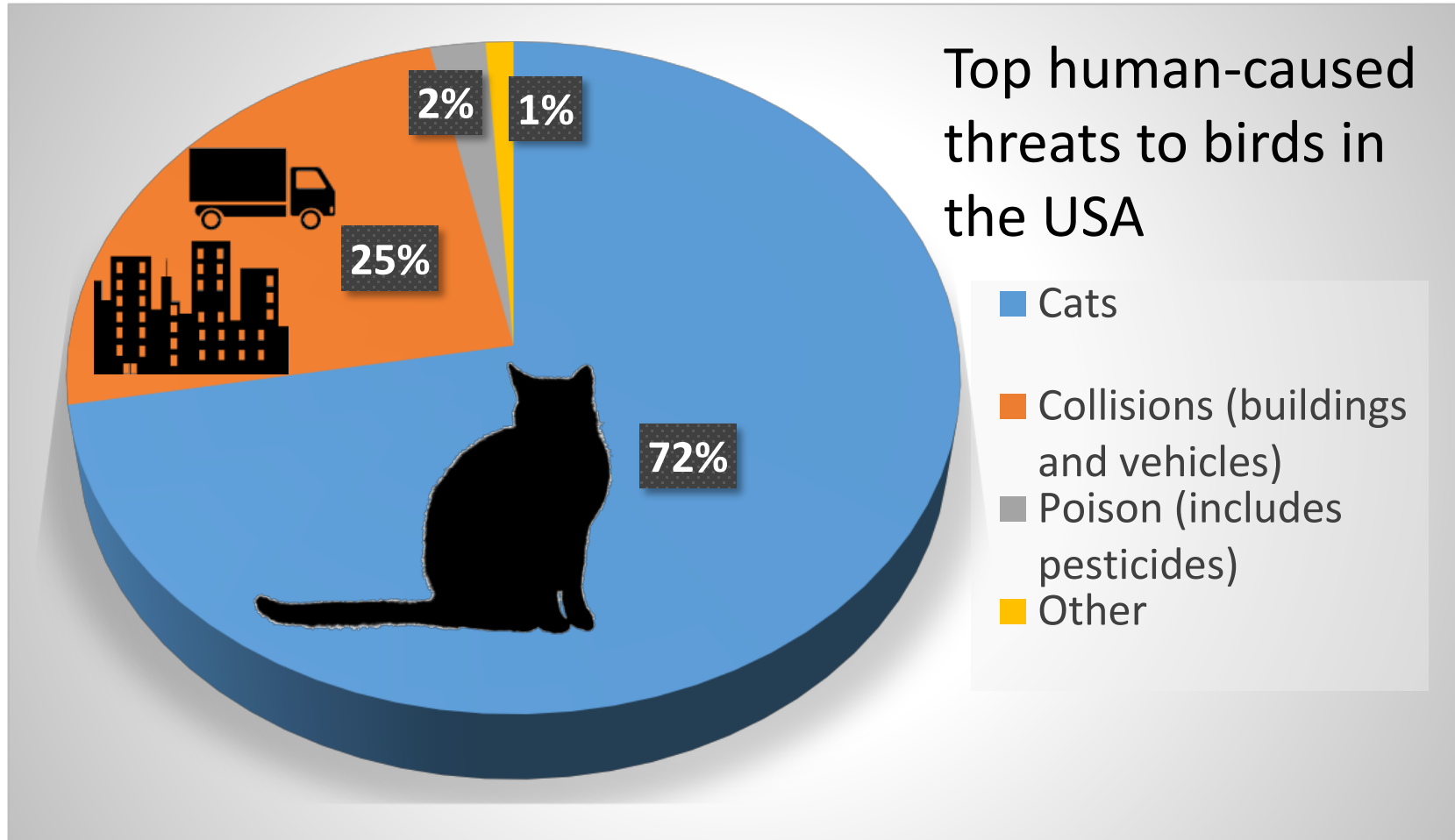
Credit: https://phantasmicmindtripwordpresscom.wordpress.com/2016/01/29/individual-vs-community/
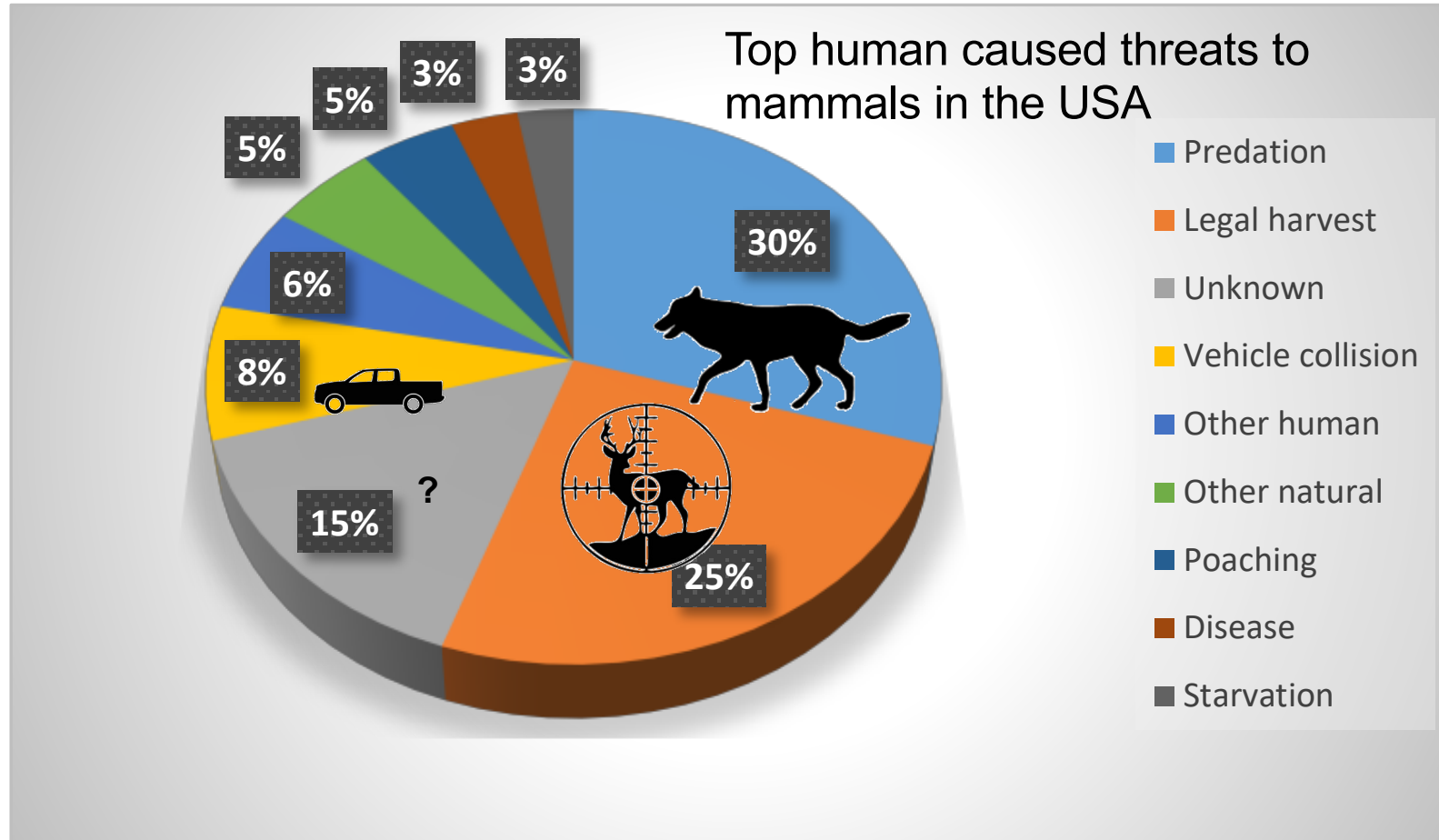
Obstacles to Progress

- What are the primary drivers of species decline?

- Where do pesticides rank?

- Are we addressing a micro-scale contributor to a macro-scale problem?

- Not within the purview of Section 7 Consultation, but important to consider

- Brain R, Anderson J. 2019. The Agro-Enabled Urban Revolution, Pesticides, Politics, and Popular Culture: A Case Study of Land Use, Birds, and Insecticides in the United States. Environmental Science and Pollution Research 26(21):21717-21735. DOI: 10.1007/s11356-019-05305-9.

- Brain RA, Anderson JC. 2020. Anthropogenic factors affecting wildlife species status outcomes: Why the fixation on pesticides? Environmental Science and Pollution Research https://doi.org/10.1007/s11356-020-08980-1.

- Brain RA, Prosser R. 2022. Human induced fish declines in North America, how do agricultural pesticides compare to other drivers? Environmental Science and Pollution Research https://doi.org/10.1007/s11356-022-22102-z.

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Context: Birds

Top human-caused threats to birds in the USA

- Cats — 72%
- Collisions (buildings and vehicles) — 25%
- Poison (includes pesticides) — 2%
- Other — 1%

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Context: Mammals

Top human caused threats to mammals in the USA

Legend:
- Predation
- Legal harvest
- Unknown
- Vehicle collision
- Other human
- Other natural
- Poaching
- Disease
- Starvation

30%
25%
15% ?
8%
6%
5%
5%
3%
3%
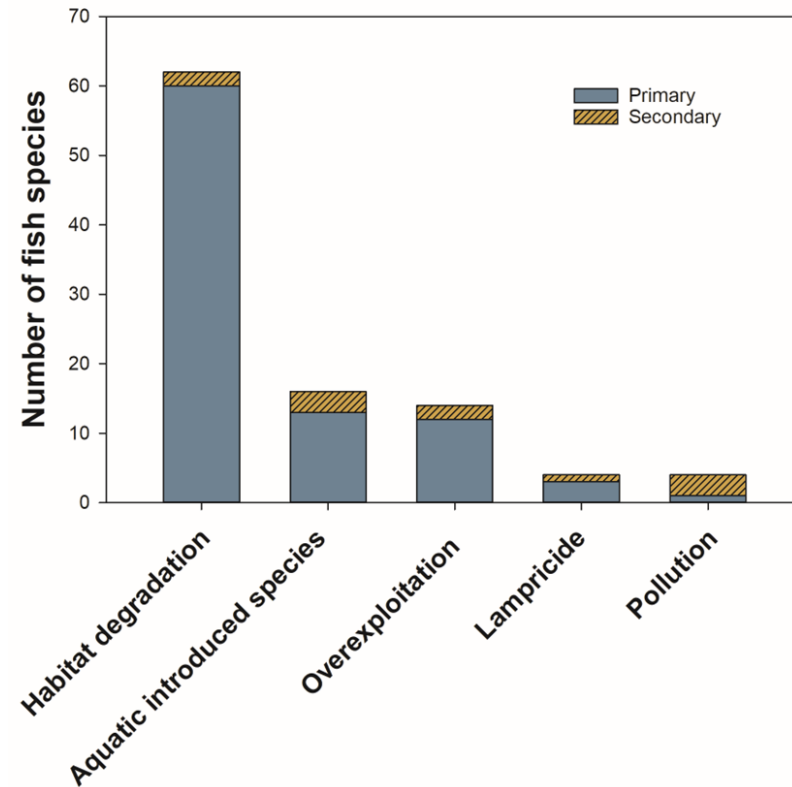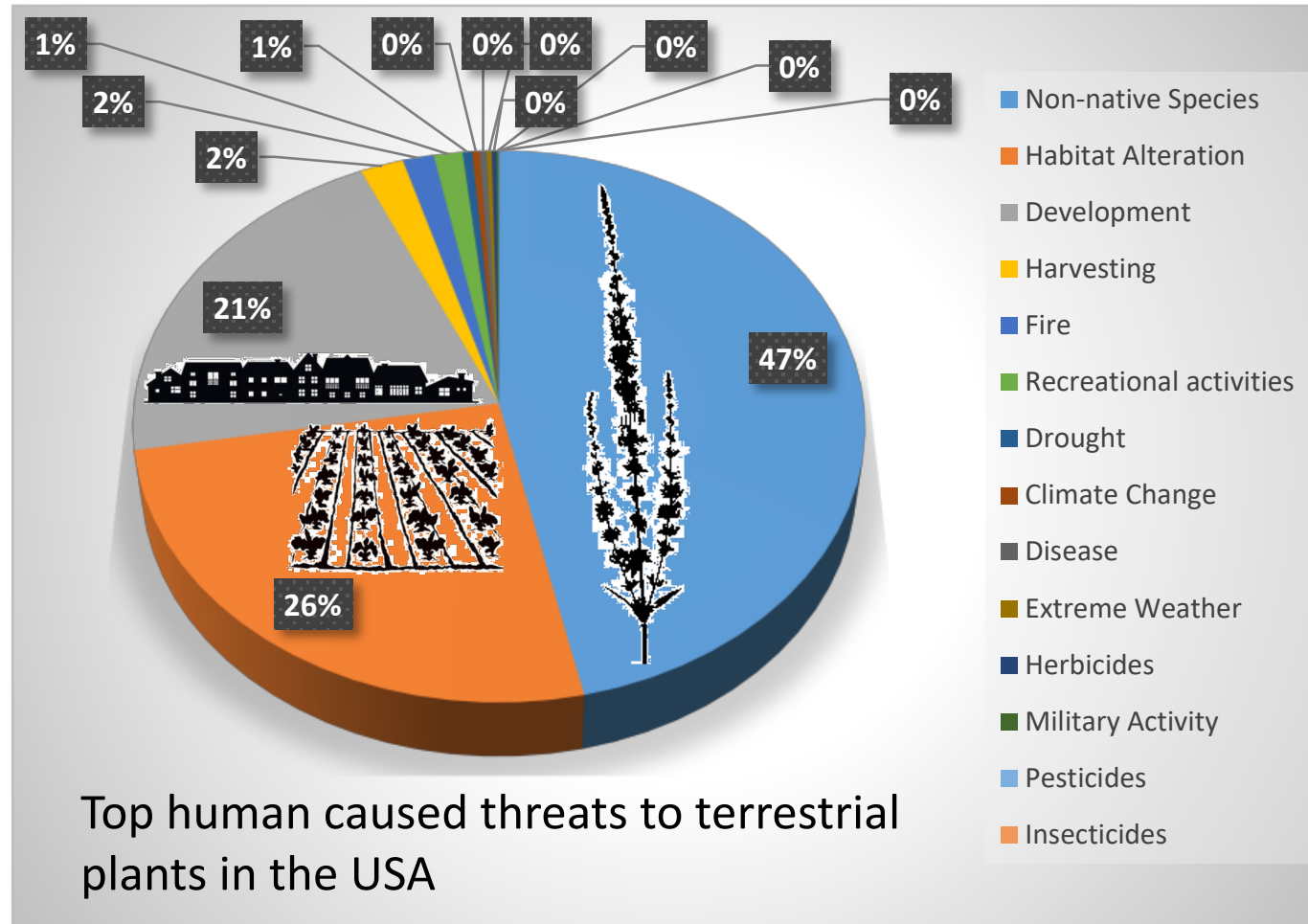
Context: Fish

Primary and secondary threats to freshwater fish species identified as at risk of extinction in the Laurentian Great Lakes according to Mandrak and Cudmore (2010).

Context: Terrestrial Plants

Top human caused threats to terrestrial plants in the USA

1%	
2%	
2%	
1%	
0% 0% 0%	0%
0%	0%
21%	
47%	
26%	

- Non-native Species
- Habitat Alteration
- Development
- Harvesting
- Fire
- Recreational activities
- Drought
- Climate Change
- Disease
- Extreme Weather
- Herbicides
- Military Activity
- Pesticides
- Insecticides

Best available data & need for regulatory process to keep pace with the science
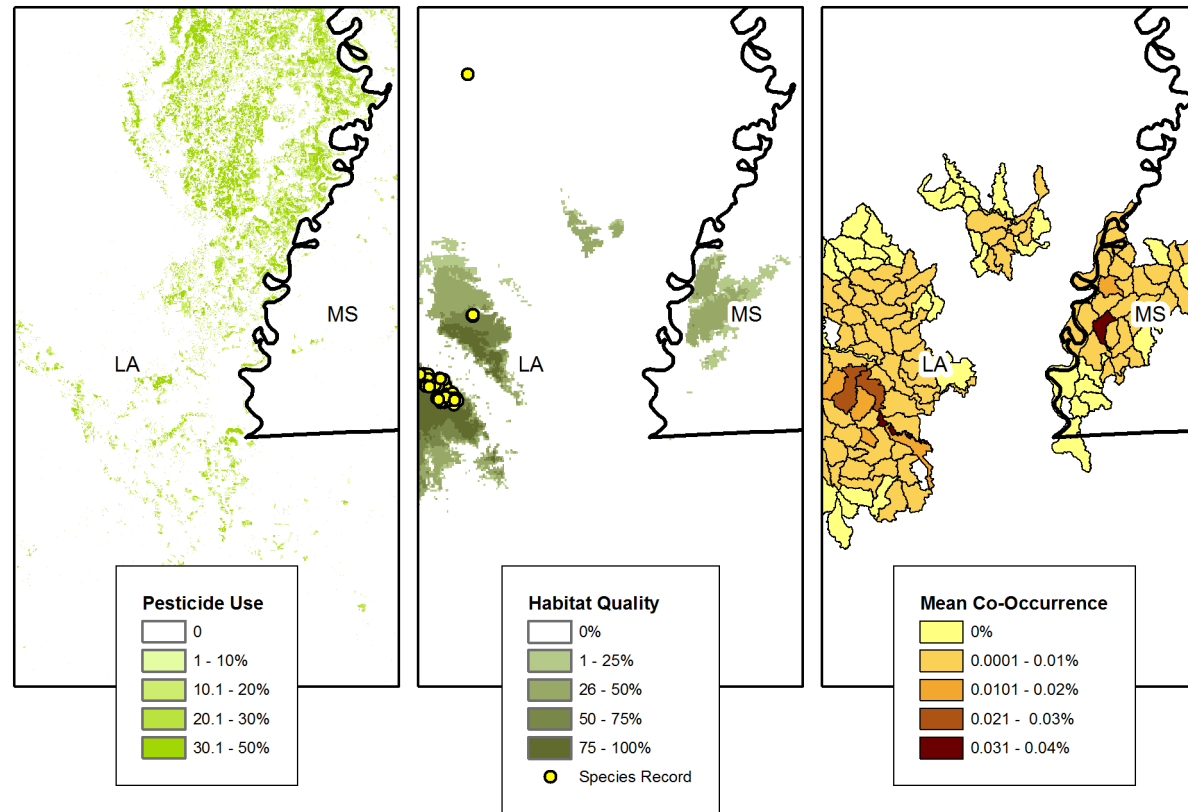
- What constitutes "best available"?

- Fundamentally, the ecological risk assessment process that underpins FIFRA and ESA has not evolved consequentially in decades, despite significant technical advances, why?

- Is there a better, more collaborative, path forward to address the inherent obstacles currently present?

- How do we ensure optimal species status outcomes relative to variably contributing anthropogenic stressors?
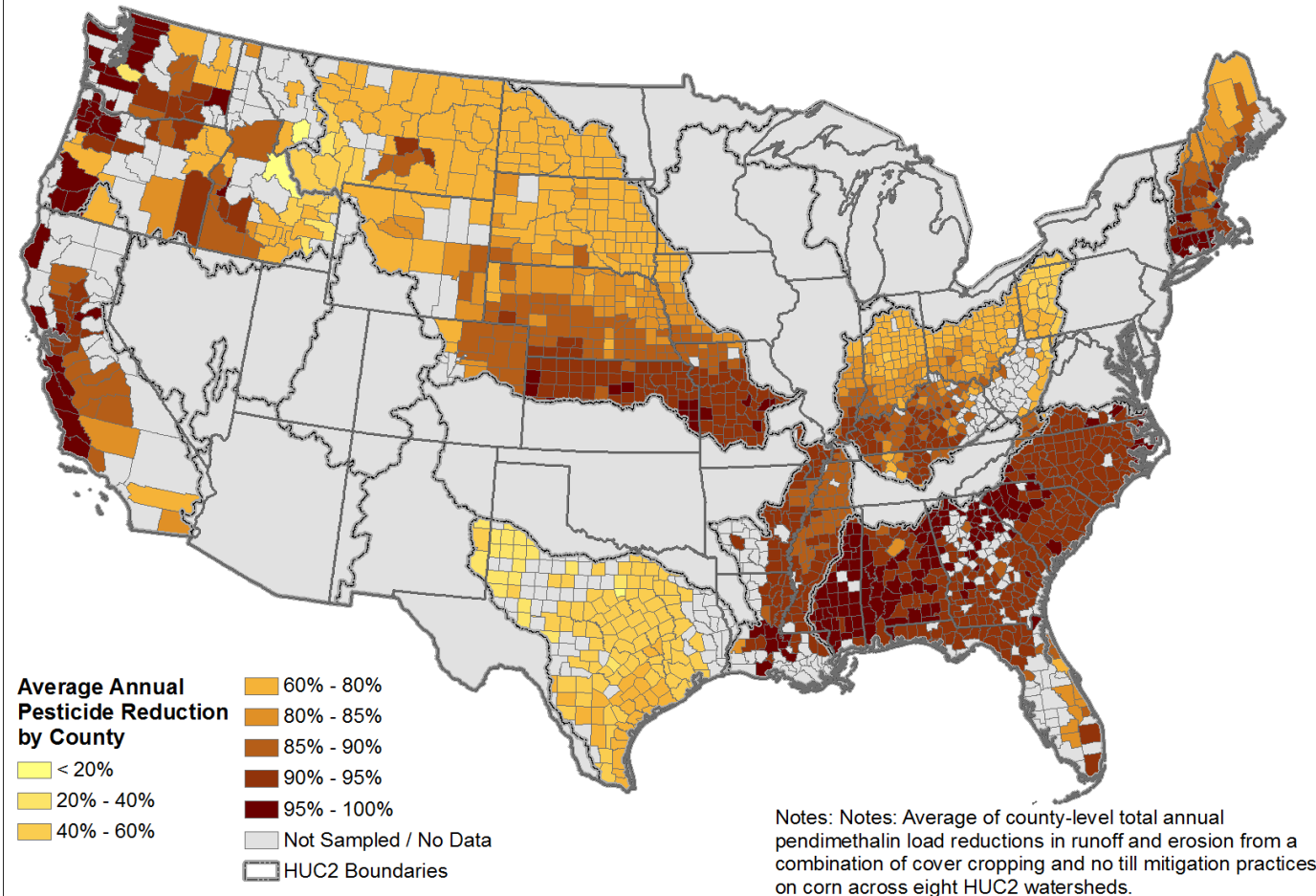
Some Notable Scientific Advances

- APCOAT (Automated Probabilistic Co-Occurrence Assessment Tool)

- APEX (Exposure Mitigation Effectiveness Tool; Agricultural Policy/Environmental Extender model)

- Higher-Tier Field Studies (e.g., field drift bioassays, etc.)

- Ecological (i.e., Population) Modeling
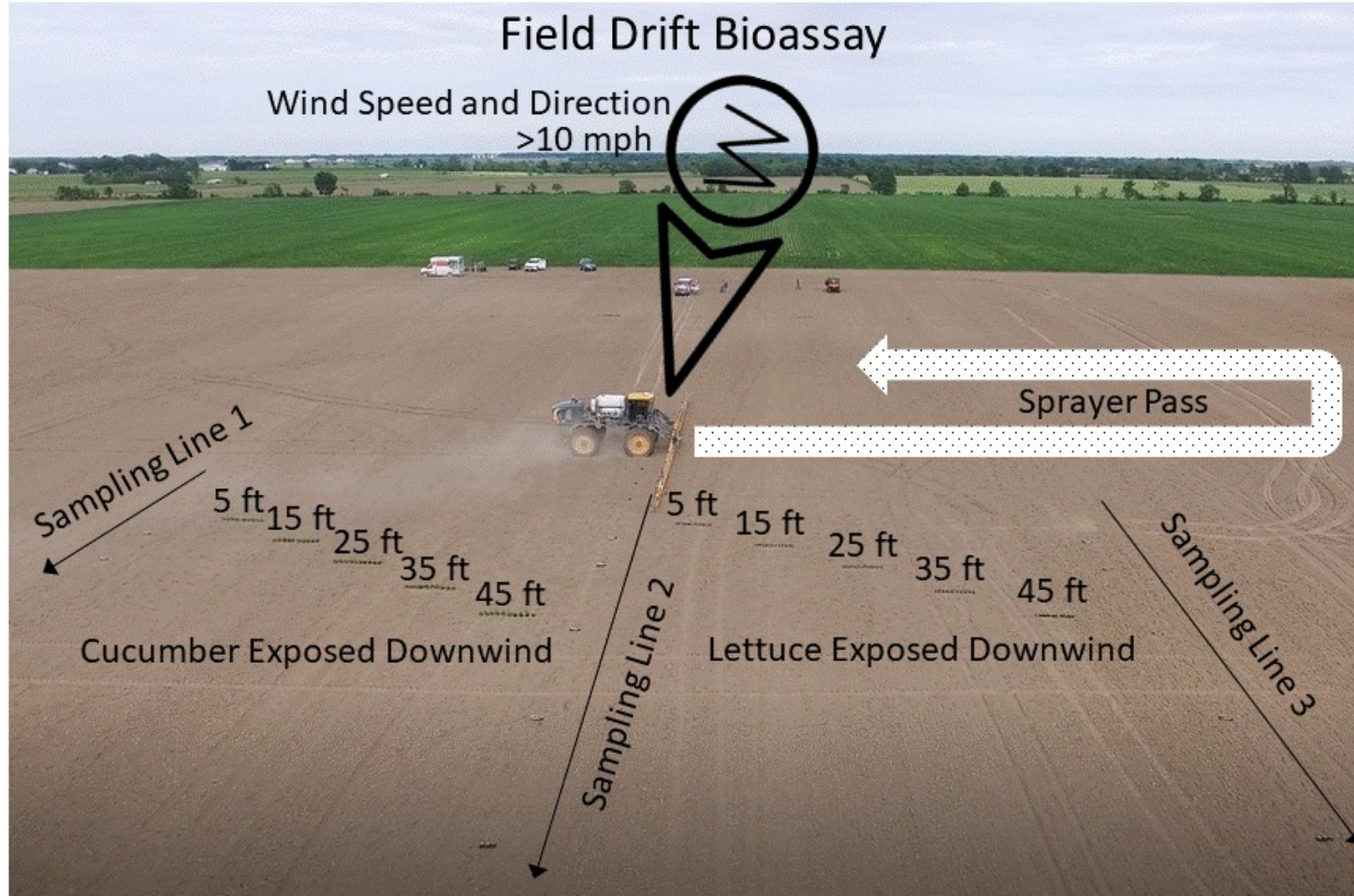
- Traits-Based Approaches

Probabilistic Geospatial Proximity Analysis (APCOAT)

Pesticide Mitigation Effectiveness (APEX)

Average Annual Pesticide Reduction by County

- < 20%
- 20% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 85%
- 85% - 90%
- 90% - 95%
- 95% - 100%
- Not Sampled / No Data
- HUC2 Boundaries

Notes: Notes: Average of county-level total annual pendimethalin load reductions in runoff and erosion from a combination of cover cropping and no till mitigation practices on corn across eight HUC2 watersheds.

Higher-Tier Field Studies

Field Drift Bioassay

Population models offer many advantages for ERA to improve decision support.

➢ Can be developed for any species for which we have data

➢ Incorporate life history & ecology

➢ Can integrate spatially & temporally variable exposures

➢ Once the model is developed, can explore many scenarios quickly & cheaply

➢ Model outputs = things we care about protecting

So, why aren't they being used as much as they should be?

Challenges in expanding use of population modeling in ERA

➢ Resistance in Regulatory Agencies to move away from individual-level effect endpoints & traditional methods.

➢ Lack of guidance and standardization of population models.

➢ Lack of case studies demonstrating use of models in practice.

➢ Lack of basic biological data for many species, especially T&E species.

Both extensive guidance & case studies now exist

- Today, guidance exists for population models in terms of:
  - **Documentation** – Overview, Design Concepts, Details (ODD; Grimm, et al. 2006, 2010, 2020); TRAnsparent and Comprehensive Ecological modeling documentation (TRACE; Grimm et al. 2014)
  - **Evaluation** – Pattern-Oriented Modeling (POM; Grimm et al. 2005, 2012)
  - **Development** – Pop-GUIDE (Raimondo et al. 2021)
  - **Visualization** – Conceptual Model Diagrams (Forbes et al. 2023)

- There is also a large and growing number of case studies to demonstrate how population models can add value to ERA and ESA
  - **CREAM** - Grimm et al. 2009; Grimm & Thorbek 2014
  - **MODELINK** – Hommen et al. 2015
  - **NIMBioS** - Forbes et al. 2019; Galic et al. 2019
  - *Ecologies* **Special Issue** – Raimondo & Forbes 2022
 - **And many more…**

Traits-Based Approaches Can Help Fill Data Gaps

➢ Provide a functional & species-independent way to characterize organisms of concern, compare listed vs. non-listed species, and identify "representatives".

➢ Go beyond simple measures of toxicity to include factors important for species vulnerability to stressors (e.g., life-history, physiology, spatial behavior).

➢ Easily transferrable across regions and geographies.

➢ Can reduce large numbers of individual species into a few functional types to simplify analyses.

➢ Can be helpful in determining the relative importance of data gaps and in filling them.

Reproduction

Survival

Life History

Growth
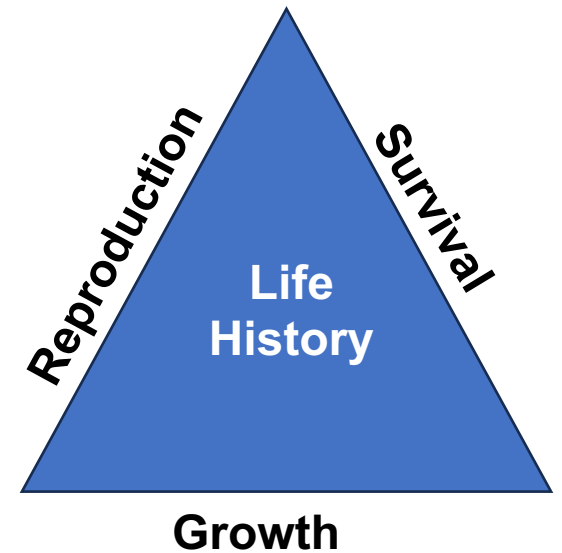
Some lessons from traits-based analyses to date

➢ There appears to be substantial overlap in life-history traits of listed and non-listed species.

➢ This means that population models developed for data-rich, non-listed species may be useful for assessing risks to listed species for which little/no data are available.

➢ Trait-based analyses may be useful for guiding the choice of representative and/or vulnerable species for ecological risk assessment.

➢ One model may be used to represent multiple species by changing only model parameters (e.g., DEB).

➢ Application of traits-based approaches combined with population models has the potential to make the FIFRA/ESA process more efficient.
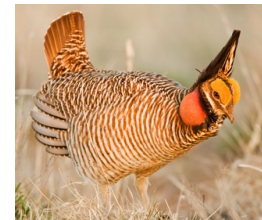
Conclusions

By focusing only on pesticides, the FIFRA/ESA consultation process is missing other important drivers of listed species decline.

Mitigations that are not sufficiently informed by science risk being infeasible, ineffective, or both.

As the science continues to advance, this should be reflected in improvements to the consultation process.

Engaging multiple stakeholders in a collaborative effort to develop and implement better data, methods, and guidance is needed to balance the need for food production while ensuring species protection.

Some Immediate Next Steps

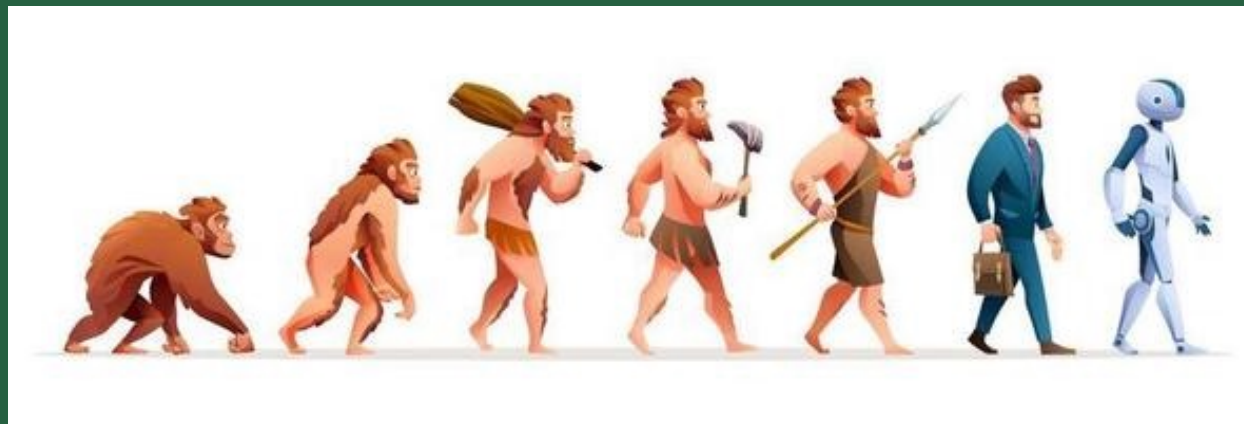Consider the risks of pesticides in the context of other threats to listed species and mitigate accordingly.

Re-evaluate steps in the process to ensure that screening-level assessments effectively screen out low-risk scenarios and incorporate higher-tier tools based on best available science.

Engage multi-stakeholder collaboration to integrate better science, increase transparency, improve efficiency, and reduce litigation.

Allow registrants to provide data, methods, and tools that have been evaluated by transparent criteria to reduce the burden on EPA and the Services.

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Questions?

Credit: https://www.vecteezy.com/free-vector/evolution

Upcoming Webinars

January 30	Developing and Adopting Economically Effective Mitigation Strategies: Critical to the Survival of Agriculture and Endangered Species
February 20	FIFRA, ESA and Pesticide Consultation: Understanding and Addressing the Complexities
March 12	The topic of this webinar is the role of states in the implementation and regulation of FIFRA. Exact content will be announced later.

New CAST Paper

RNA Interference in Agriculture: Methods, Applications, and Governance

Chairs:

Ana María Vélez Arango (Assistant Professor, University of Nebraska-Lincoln)
Kenneth Narva (Head of Entomology, GreenLight Biosciences, Inc.)

What: Paper Rollout of "RNAi Technology in Agriculture: Methods, Applications and Governance"

When: Thursday, Jan. 11, from 10:30 a.m. to 1:30 p.m. EST

Where: North Carolina State University Plant Sciences Building, 840 Oval Drive - Raleigh, NC
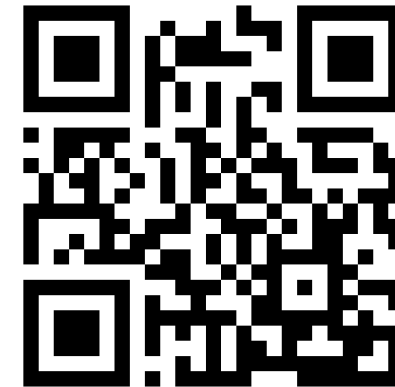
Webinar release on Wednesday, Jan. 17, noon-1 p.m.

Register Now!

RNA Interference in Agriculture: Methods, Applications, and Governance

Paper Rollout

Webinar Release

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