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# Ecotoxicological Assessment & Modeling Research Area

*It's not just humans that are exposed to environmental chemicals. Chemicals have the potential to impact ecological systems that are essential for human health and well-being. EPA's Chemical Safety for Sustainability Research Program provides information and methods to better understand how these systems may be impacted by exposure to environmental chemicals.*

## EPA's Chemical Safety for Sustainability Research Program

The goal of EPA's Chemical Safety for Sustainability (CSS) National Research Program is to provide information and methods to make better-informed, more timely decisions about the safety of chemicals, many of which have not been thoroughly evaluated for potential risks to human health and the environment.

## About Ecotoxicological Assessment and Modeling Research

The **Ecotoxicological Assessment and Modeling (ETAM)** research area develops, integrates, and evaluates models to predict effects of pesticides and other chemicals on at-risk species and wildlife populations. This research:

- Facilitates better assessment of risk when limited data are available for chemicals,

- Supports refined, targeted decision-making for data-rich chemicals and scenarios, and

- Integrates existing and new models into frameworks that combine

## Why Is Ecotoxicological Assessment and Modeling Research Important?

Ecological modeling is a key component of EPA's process for chemical evaluation and regulation. Chemical evaluation includes a tiered ecological risk assessment (ERA). High-level assessments include quantitative estimates of ecologically-relevant risk and identification of risk mitigation options. The majority of chemicals, however, have little or no data on which to base these decisions. For these chemicals, ERAs rely on ecological models to estimate exposure and subsequent effects. CSS Ecotoxicological Assessment and Modeling research provides these models and data.
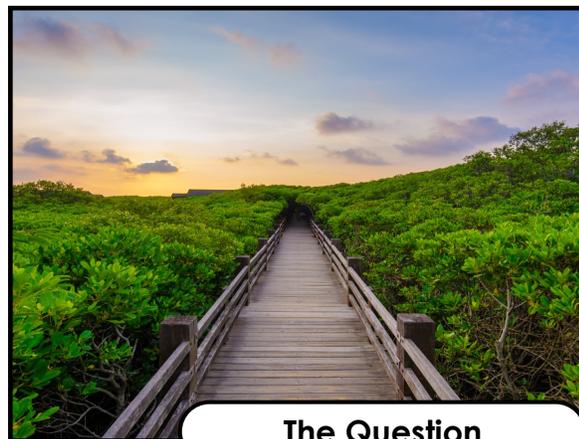
## Interested In Learning More?

**EPA's Chemical Safety Research Program:** epa.gov/chemical-research

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### The Question

**What is that chemical doing to our wildlife and ecosystems?**

### Our ETAM Tools

***ECOTOX:*** application providing information on adverse effects of single chemicals on ecologically relevant aquatic and terrestrial species

***HexSim:*** multi-species, life history simulator ideal for building models of animal and plant population viability, interactions, and responses to disturbances

***TIM:*** model use to derive quantitative estimates of the probability and magnitude or mortality to birds exposed to pesticides

***McNEST:*** model to quantitatively estimate impacts pesticide-use scenarios on the annual reproductive success of bird populations

***Web-ICE:*** application to estimate acute toxicity to aquatic and terrestrial organisms

**Visit these and our other Ecotoxicological Assessment and Modeling tools on our webpage:**
epa.gov/chemical-research/research-evaluating-risk-across-life-cycle-manufactured-chemicals-materials

# Ecotoxicological Assessment & Modeling Research Area Up Close

## Visualizing the CSS Program



*Our **Ecotoxicological Assessment and Modeling** research is included under the **Complex Systems Science** research topic. This topic is dedicated to building the scientific foundation to predict adverse outcomes resulting from chemical exposures in various contexts.*

### How Ecotoxicological Assessment and Modeling Fits In

CSS is organized around three research topics that address specific science challenges in assessing the safety of chemicals: Chemical Evaluation, Complex Systems Science, and Knowledge Translation & Delivery.

Included in our *Complex Systems Science* research topic, our **Ecotoxicological Assessment and Modeling** research is focused on developing ways to model ecological impacts of chemicals across broad scales. This research addresses the need to examine the complex chemical-biological interactions that occur in real-world settings.

## Examples of Research and Products

### An Integrated Modeling Framework for Spatially Explicit Avian Risk Assessment Using 3 Ecological Models (TIM, MCnest, and HexSim)

⇒ **Description:** This modeling framework allows individuals to use data from current pesticide toxicity tests to assess the risk of adverse population-level outcomes to birds exposed to products under specific proposed labeled uses.

⇒ **Impact:** This model provides risk assessors with a way to interpret the results of toxicity tests for the potential impacts on natural populations.

⇒ **Who Can Use It?:** researchers, US EPA offices, the regulatory community, and risk assessors interested in understanding population-level impacts of pesticides on birds

⇒ **Learn More:** epa.gov/chemical-research/markov-chain-nest-productivity-model

### ECOTOX Knowledgebase, Version 5.0

⇒ **Description:** The ECOTOX Knowledgebase is a comprehensive, publicly available application providing chemical environmental toxicity data on aquatic life, terrestrial plants and wildlife. ECOTOX has toxicity effects data on over 11,000 chemicals and 12,000 species, curated from scientific literature after an exhaustive search protocol.

⇒ **Impact:** The ECOTOX Knowledgebase addresses the challenge in obtaining, curating and effectively disseminating high-quality data on the potential effects of chemicals on ecological species. Updates to ECOTOX include graphs and visualization tools to improve data accessibility and interpretation.

⇒ **Who Can Use It?:** researchers, risk assessors, or decision makers looking for a faster way to gather more information on the effects of chemicals on ecological species

⇒ **Learn More:** epa.gov/ecotox

### Web-based Interspecies Correlation Estimation Application (Web-ICE)

⇒ **Description:** Web-ICE is a publicly available tool to extrapolate toxicity from standard test organisms to endangered species and other taxa with limited data.

⇒ **Impact:** This tool allows users to determine if a species could be at risk from exposure to a chemical even without test data, and the predictive capability to a wide range of species helps to limit the need to animal testing.

⇒ **Who Can Use It?:** decision makers, researchers, and risk assessors interested in chemical toxicity predictions for ecological species with limited data available

⇒ **Learn More:** www3.epa.gov/webice

### Learn More

**EPA's Chemical Safety Research Program:** epa.gov/chemical-research