# ES2013 Introduction to Environmental Sciences I: Human Populations & Environmental Health (Unit 4)

## **\*\*DRAFT\*\*\***

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| **Learning Objectives** | **Discussion(s)** | **Assignment(s)** | **Learning Resources + Media + Datasets** |
| After this lesson, you will be able to …   * Describe Ecotoxicology * Evaluate how Data Science can contribute to understanding hazard risk assessment | The term “Ecotoxicology” was introduced by Truhaut in 1969. Prior to that, Rachel Carson’s book, Silent Spring (1962), made the world aware of the dangers of pesticides (DDT) in the environment.  Ecotoxicology is related to environmental toxicology, and both rely on understanding how chemicals can affect individuals, populations, communities, and ecosystems. Ecotoxicology considers all levels of stressors – from molecular to entire ecological systems – and their effects on whole communities in terms of population growth, diversity, and species interactions.  The ability to measure chemical transport and fate and exposure of organisms in ecotoxicological testing is critical to the ultimate development of an **ecologic risk assessment**.  **To Prepare for this Discussion:**   * View **(e)** on DDT * Read **(a), (b), (c), (d)** on the basics of Ecotoxicology and ecological risk assessment. **Focus on** methods for risk assessment and how data is collected.   Three hazard endpoints:   * Human Health * Ecological Toxicity * Environmental Fate (persistence & bioaccumulation)   **Discussion**   1. Eco question 1 2. Eco question 2 | Many researchers in Ecotoxicology need to be proficient with assessing, interpreting, and communicating information about chemical hazards.  In this assignment, you will produce a hazard report to a target Texas community that host one or more of the 69 identified Superfund sites per EPA. Your report should include inferences on data visualizations from modeling life expectancy and give guidance for risk assessment from both environmental and human health endpoints.  **To prepare for this Assignment**:  Producing high-quality visualizations (charts, graphs) from these models is necessary to help data interpretation and answer hypotheses posed to solve ecotoxicology problems.  Explore the **linear regression** model visualizations summarizing and predicting Life Expectancy (LE):   1. Is age, gender, or population density a predictor of LE? 2. Does living near an EPA Superfund site affect LE? 3. How does LE vary with the level of TRI-reported carcinogens?   **Assignment**  Report on one of the counties where EPA has identified a **Superfund** site.   * What are the top 5 highest production of chemicals for that county? * What data can you use from IRIS to profile the chemical hazard? * If you model by **Carcinogens**, then how does that affect your interpretation? * Who is your target audience?   One Model, Multiple Datasets  Your report relies on a model that uses data from state and federal agencies. What risks are inherent in making predictions using multi-sourced datasets?   * Merge datasets by features of common interest into one synthesized dataset (union) * Adjust, if necessary, timeframes: May need to create a summary statistic for TRI data to match that of LE data * Consider such factors as dataset versions/updates, missing data, and data cleaning issues such as outliers and missingness * Model after dataset merge & cleaning   Submit your report – two pages and cite the methods used and data sources. | **Articles**   1. How Environmental Toxins Reduce Life Expectancy in Many American Neighborhoods   <https://scholars.org/contribution/how-environmental-toxins-reduce-life-expectancy-many-american-neighborhoods>   1. Risk Assessment for Toxic Air Pollutants: A Citizen's Guide   <https://www3.epa.gov/airtoxics/3_90_024.html>   1. Assessing ecological risk on a regional scale <https://link.springer.com/article/10.1007/BF02394200> 2. TRI and Estimating Potential Risk <https://www.epa.gov/toxics-release-inventory-tri-program/tri-and-estimating-potential-risk>   **Videos**  e. Pesticides - DDT - Rachel Carson - Silent Spring (10:58) <https://youtu.be/Ipbc-6IvMQI>  **Source datasets**  Codebook for ZIP Code and county datasets  Texas 2005 to 2014 \*\*SUMARY STATS ONLY for LE data  <https://www.texashealthmaps.com/lfex>.  Superfund at EPA  <https://www.epa.gov/superfund>  Contaminants at Superfund Sites  <https://www.epa.gov/superfund/contaminants-superfund-sites>  Toxic Release inventory (TRI) at EPA  <https://www.epa.gov/toxics-release-inventory-tri-program>  IRIS human health hazard risk assessments (CDC) by chemical name  <https://cfpub.epa.gov/ncea/iris_drafts/AtoZ.cfm>  **Additional Sites of Interest**  Agency for Toxic Substances and Disease Registry (ATSDR) at CDC  <https://www.atsdr.cdc.gov/>  ToxTown at NIH  <https://toxtown.nlm.nih.gov/>    **Visualizations:** via Jupyter or R Notebook + PPT Slides  **Tox Hazard Communications Presentation Rubric**      From: <https://www.epa.gov/toxics-release-inventory-tri-program/tri-and-estimating-potential-risk>    From: <https://www.sciencedirect.com/science/article/pii/S2352847817300515> |