MAXIMIZING USE OF DATA FROM TERRESTRIAL FIELD DISSIPATION STUDIES CONDUCTED IN NORTH AMERICA AND EUROPE VIA ECOREGION CROSSWALKS

Virginia Houck, Bei Chu (Arcadis) and Timothy Negley (The Intelligence Group)

INTRODUCTION

Regulatory agencies in Europe and North America are increasingly evaluating data from terrestrial field dissipation (TFD) studies conducted on foreign soils. The acceptability of studies conducted on foreign soils has largely increased as a result of the OECD Ecoregion Crosswalk project which established guidance and tools to assess the geographic representativeness of TFD studies conducted in North America and Europe. This acceptance of data from studies conducted on foreign soils can significantly reduce the number of TFD studies that are required globally, which reduces costs for both industry and regulatory agencies.

To evaluate the acceptability of study data a crosswalk must be performed to ensure the soils and climate of the TFD study are representative of soil and climate conditions where the pesticide is intended to be used. The OECD crosswalk project developed ENASGIPS ("Europe – North America Soil Geographic Information for Pesticide Studies"), a GIS-based model that includes a database of soil, climate, and crop information for North America and Europe. This model identifies ecoregions in North America and Europe with similar climate and soils. In addition, TFD site selection is facilitated through user defined soil, climate, and crop criteria. ENASGIPS is available online at www.enasgips3.org.

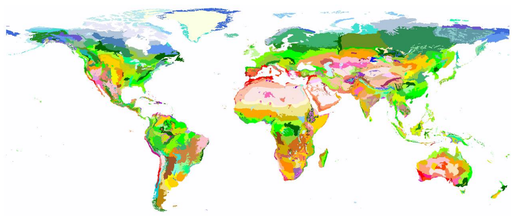
ENASGIPS: SOFTWARE AND DATABASE

ENASGIPS software is an add-In for ESRI's ArcGIS with data stored in a geodatabase. It includes a GIS-based similarity model and includes a standardized database of soil, climate, and crop information for North America and Europe. Core capabilities include:

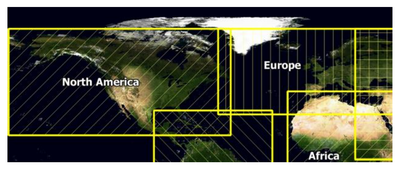
- **Ecoregion Crosswalk.** Identifies ecoregions in North America with similar climate and soils from a selected ecoregion in Europe using the Ecoregion Similarity Model, and vice versa.
- **Site Selection.** Facilitates TFD site selection based on user defined soil, climate, and crop criteria.
- **Other Uses.** Crop density mapping and soil taxonomy mapping for USEPA Guidance for acceptability of studies on foreign soils. Experienced GIS users can mine and utilize the geodatabase.

ENASGIPS DATA SOURCES

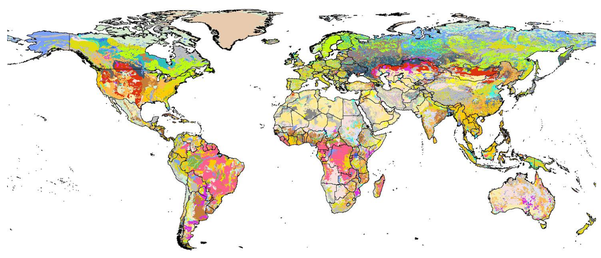
Ecoregions: WWF Terrestrial Ecoregions



Climate: EC-JRC MARS, 1978-2011 (temperature and precipitation)



Soil: Harmonized World Soil Database 2009 pH, OC, texture, bulk density, CEC

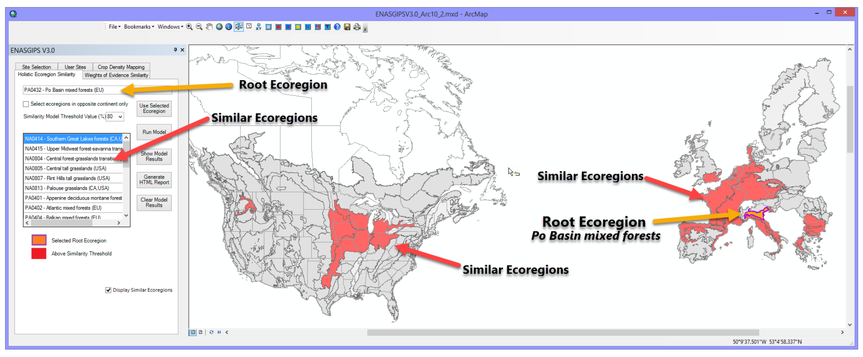


Crops: Europe: CAPRI Crop Dataset 2000
Canada: Interpolated Census of Agriculture to Soil Landscapes of Canada 2008
USA: AgCensus (NASS) 2007

Slope: Shuttle Radar Topography Mission (SRTM)

HOLISTIC ECOREGION SIMILARITY CROSSWALK APPROACH

ENASGIPS includes a graphical user interface (GUI) that is easy to use. To run the similarity model, the user selects an ecoregion and clicks "Run the Model". Maps of similar ecoregions are displayed.



Select a Root Ecoregion and run the model to identify similar ecoregions.

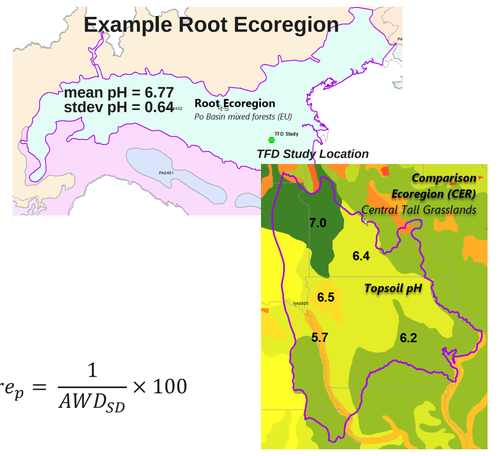
ESM SCORES

The overall holistic similarity score is calculated using all five soil and climate parameters. Options are available to select fewer than five parameters for a weights of evidence similarity modeling approach. Similarity scores are shown below for ecoregions similar to the Po Basin in Italy, shown in the example above.

Root Ecoregion Name: **Po Basin mixed forests**	Similarity Scores					
	Overall Holistic Score	Temp	Precip	Organic Carbon	pH	Texture Class Ranking
NA0414 - Southern Great Lakes Forests (CA,USA)	83	65	66	100	82	100
NA0415 - Upper Midwest Forest-Savanna Transition (USA)	85	32	100	100	100	94
NA0804 - Central Forest-Grasslands Transition (USA)	90	57	100	100	91	100
NA0805 - Central Tall Grasslands (USA)	88	43	96	100	100	100
NA0807 - Flint Hills Tall Grasslands (USA)	99	95	100	100	100	100
NA0813 - Palouse Grasslands (CA,USA)	80	50	52	100	100	100

ECOREGION SIMILARITY MODEL (ESM)

For each parameter, the mean and standard deviation of the entire Root Ecoregion is compared to each detailed polygon of an ecoregion, and area weighted to calculate a similarity score. The overall ecoregion similarity is the mean of the individual parameter similarity scores. Comparison ecoregion scores ≥ 80% are considered to be similar.



$$AWD_{SD} = \frac{\sum_{n}^{i=1} ABS\left[\frac{X_{CERi} - \overline{X}_{Root}}{SD_{Root}}\right] * Area_{CERi}}{Area_{CER}}$$

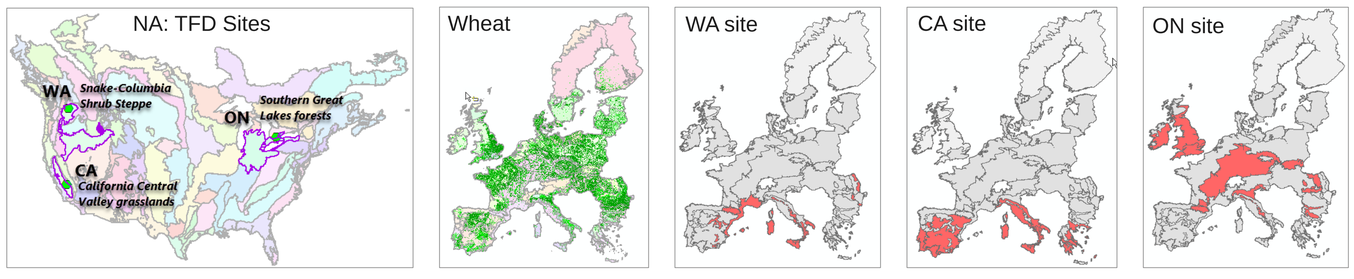
$$Similarity\ Score_{p} = \frac{1}{AWD_{SD}} \times 100$$

$$Ecoregion\ Similarity = Mean\ of\ Similarity\ Scores\ for\ soil\ and\ climate\ parameters$$
(topsoil pH, OC, texture, temp, precip)

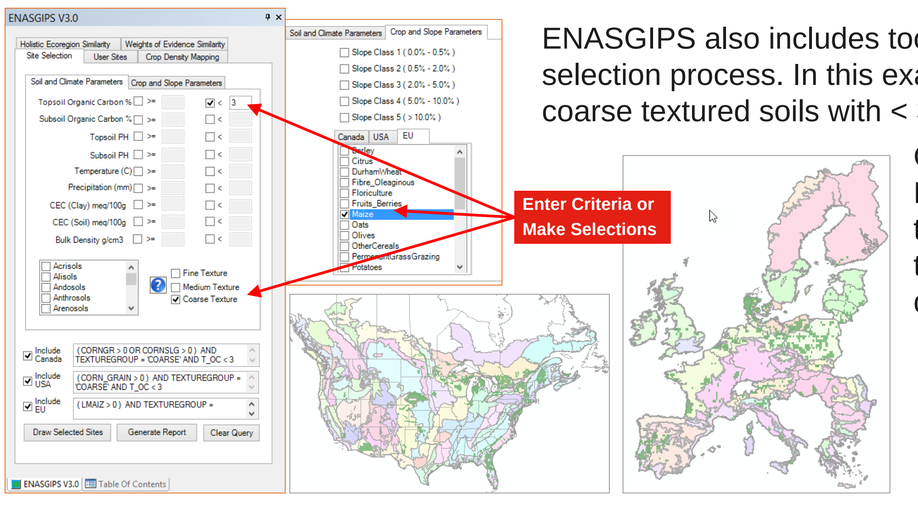
- AWD_{SD} = Area Weighted Distance in SDs
- $\overline{X}_{Root}, SD_{Root}$ = mean, standard deviation of parameter in root ecoregion
- X_{CERi} = value of parameter in comparison ecoregion detailed polygon

ECOREGION CROSSWALK EXAMPLE

A TFD study of a product used on wheat was conducted at three sites in North America (Washington, California, and Ontario, Canada). The ecoregions of each of the of the sites have similar ecoregions in the EU, and together provide good coverage in Europe where wheat is grown. This example demonstrates that the soils and climate conditions of the TFD study are representative of soil and climate conditions where the pesticide is intended to be used in the EU.



ENASGIPS SITE SELECTION EXAMPLE



Enter Criteria or Make Selections

ENASGIPS also includes tools to assist in the site selection process. In this example the user has selected coarse textured soils with < 3% organic carbon in areas Of corn/maize cultivation. Maps in North America and the EU of areas that meet this criteria are instantly displayed.

SUMMARY OF ENASGIPS CROSSWALK APPROACH

With the harmonization of TFDs, regulatory agencies in Europe and North America can accept data from TFD studies conducted on foreign soils. The crosswalk should ensure geographic representativeness of the TFDs; the soils and climate of the TFD should be representative of soil and climate conditions where the pesticide is intended to be used. The ENASGIPS tool was developed to standardize and simplify the crosswalk process as well as to assist in the site selection process. This software is an add-in for ArcGIS with geodatabase of soil and climate parameters used for similarity modeling (pH, OC, texture, temperature and precipitation) as wells as crop cultivation data. The software also includes a graphical interface that is easy to use.