DAY 2

Eco-Region Crosswalk Presentation 1
Criteria for acceptance of foreign pesticide field dissipation studies/ecoregion concept
By Raju Gangaraju (Canada-PMRA), Mah Shamim (US EPA) & Christopher Lythgo (EFSA)

Criteria for acceptance of foreign pesticide field studies/ecoregion concept
Raju Gangaraju, PMRA, Health Canada
Mah Shamim, US EPA
&
Christopher Lythgo, EFSA

OECD Workshop on pesticide TFD studies and ecoregion crosswalk
Ottawa, Canada, 9-11 March 2011

Ecoregion concept
• Fate and behaviour of a pesticide depend on environmental conditions
  – soil (pH, OC and texture) and
  – climate (temperature and rainfall)
• A terrestrial ecoregion delineated on the basis of these factors determines the behaviour of a chemical
• A pesticide is expected to behave similarly in similar ecoregions
Ecoregion concept (contd)

- Under global join reviews, studies conducted at foreign sites are submitted
- To consider foreign field studies, the study conditions must represent local conditions
- At present no methodology is available to assess the equivalency of European field studies to those of North American
- An ecoregion similarity model (ESM) is being developed to assess the equivalency of field studies conducted at EU and NA sites

OBJECTIVES

- Compare and identify similar ecoregions between NA and EU
- Develop a GIS-based ecoregion DSS to assist the pesticide industry in the selection of field sites
- Provide information on pesticide use areas (crop), soils and climate including location
NA ecoregions

- CANUS_GIPS

- Identifies similar ecoregions between Canada and USA
- DSS to assist in site selection based on user defined criteria
- North American Ecoregion Level II (developed by the Commission for Environmental Cooperation under NAFTA)
EU Regions

- A map with three regulatory zones is available for Europe
- No European map equivalent to North American ecoregion Level II is currently available
Ecoregion Similarity Model (ESM)

- To compare and identify similar ecoregions, an ESM similar to CANUS_GIPS is being developed

- PMRA, AAFC, EC JRC and US EPA

Methodology

DATABASES

- Soil: Harmonized World Soil Database v1.1 (EU and NA) and Soil Regions Map for Europe v2 (EU)
- Climate: MARS FOODSEC ERA-Interim Meteodata 2001-09 (EU and NA)
- Agricultural land use (pesticide use area):
  - Canada: Census of Agriculture 2008 SLC
  - USA: CENSTAT – Agricultural Census 2006
    - STATSGO (State Soil Geographic Data Base)
  - EU: CORINE (Coordination of Information on the Environment) Land Cover Database
Methodology

Method of comparison
- Ecoregion Similarity Model (ESM) uses mean and SD to compute similarity between multiple ecoregions
- Parametric test of input variables
- Model compares sum of the classed SDs of normal distribution of each input variable of the root ecoregion to that of all target ecoregions
- Sums classed differences in SDs to determine % similarity
- The threshold of percentage of similarity can be adjusted

Input variables
- **Soil**: pH, organic carbon and texture
  - Texture: WHSD classes
    - rocky or no data: 0, course: 1, medium: 2 and fine: 3
  - Means and SD of normal distribution of each input variable calculated and % similarity estimated
- **Climate**: Rainfall and temperature
Model Output

- **Similarity**: delineate areas in target continent with 80% similarity (default)

- **Similarity Report**: % similarity, areas matched, and comparison table for each input variable

ESM v1.02: Project Interface
Help Interface

Identify Tool

Using the Identify Tool, the user can select any ecoregion on the map to view its soil, climatic and location information.
User can use the Query Tool to select soil and climatic parameters, based on concerns identified from conceptual model (pesticide properties and lab fate studies).
Ecoregion Similarity Model (ESM)

1. The user selects the root ecoregion by using the Select Features tool, Query results or Identify tool.

2. The user then clicks the Run Tool button to run the ESM.

3. The Model Parameters box will pop-up to allow the user to select the percent similarity threshold.

Model Run

After the user has input the similarity threshold, the ESM model will begin processing.

Once the ESM has finished calculating, the number of matches will appear in the match result window and the matching ecoregions will be highlighted in green.
Once the ESM has calculated the match ecoregions, the soil and climatic information can be viewed in the Results Interface.
Another example

Site Selection Process

- **Step 1:** Select crop-growing (pesticide use) area(s)
- **Step 2:** Query to select soil and climatic parameters, based on concerns identified from conceptual model or a typical site
- **Step 3:** Identify equivalent ecoregions in the target continent
- **Step 4:** Examine the selected polygons and select the convenient site

- ESM SELECTS POLYGONS THAT MEET USER-DEFINED CRITERIA
Geographic Information

Provides information

- Soil (pH, OC, texture, CEC, slope, bulk density, taxonomic class, etc)
- Temperature and rainfall
- Crops and percent area
- Ecoregion and other information on location

BOG1 Questions

1. Field dissipation studies conducted at foreign sites are considered if the study sites represent similar environmental conditions, i.e., soil and climatic conditions represented by ecoregions. Is the ecoregion concept acceptable?

2. Are there any other criteria to be considered in accepting equivalent foreign pesticide field dissipation studies (other than study protocol)?

3. To identify similar ecoregions, soil parameters (pH, organic carbon and texture) and climate parameters (rainfall and temperature) are considered in the present model. Are there any additional parameters to be considered?

4. Should soil pH be excluded/included as a criterion for comparing and identifying similar ecoregions?

5. Should agronomic practices, microbial activity and soil moisture be included?
6. A GIS-based (ArcGIS 9.3) approach was used to compare and identify similar ecoregions. Is this the right software and approach?

7. Databases used for ESM/ERX:
   – Soil: Harmonized World Soil Database (IIASA)
   – Climate: MARS FOODSECERA-Interim Meteodata (JRC)
   – Agricultural Land Use/Land Cover:
     • STATSCAN Census of Agriculture 2008 (Canada)
     • CENSTAT and STATS90 (USA)
     • CORINE (EU)
   – Framework:
     – WWF Terrestrial Ecoregions of the World
     – Soil Regions map of Europe (published by ESBN, BGR and JRC)
     – Level II Terrestrial Ecoregions of North America (published by CBC)

Are these database acceptable?

8. Method of comparison:
   ESM uses mean and standard deviation to compute similarity between multiple ecoregions (parametric test) and estimates percent similarity

Is this methodology acceptable?
9. A similarity score of 80% is proposed to identify similar ecoregions, although the model allows selecting similarity score of 50-100%. Is 80% similarity threshold adequate to identify similar ecoregions?

10. The Model uses a query and filtering system based on user-defined criteria to select a field site. A site with a worst case scenario based on concerns identified by the conceptual model or a typical site can be selected. Is this methodology to select a site acceptable?

11. Do we prefer a site with a worst case scenario or a typical site or both?

12. The Model produces a map with similar ecoregions and comparison tables for soil pH, organic carbon, texture, taxonomic class, temperature and precipitation. What additional information is required in model output? (Taxonomic class, CEC, slope, bulk density, etc)
Eco-Region Crosswalk Presentation 2
Demonstration of GIS-based Model for Identification of Similar Ecoregions
By David Kroetsch (Canada-AAFC) & Raju Gangaraju (Canada-PMRA)

INTRODUCTION:

- OECD project to maximize the use of pesticide field dissipation studies by developing harmonized international guidance for conducting the studies and identifying comparable North American and European Ecoregions
- fate and behaviour of a pesticide in a region depends on factors such as soil (pH, OC, texture and classification), climate and vegetation
- geospatial model being developed to identify comparable North American and European Ecoregions
ECOREGION SIMILARITY MODEL (ESM):

- A mathematical model of similarity
- The mathematical model compares the sum of the classed standard deviations of the normal distribution of each comparison parameter for the source Ecoregion to that of all the Ecoregions of the target area and sums the classed differences in standard deviations to determine percent similarity
- The ESM is a parametric test of the input variables

\[

c_{S} > 0, c_{S} \leq \mu \leq \mu + 3\sigma
\]

ECOREGION CROSSWALK MODEL (ERX):

- Desktop based system
- Developed using ArcGIS 9.3 with Python 2.5 and Visual Basic 6.3 programming languages
- The geospatial model (ERX) is a regional similarity or decision support model incorporating a mathematical similarity model (ESM)
- This geospatial model utilizes the mathematical model output (for a defined % threshold) to display, identify, query and produce output reports and graphs at the ‘region’ level
**Demonstration of GIS-based Model for Identification of Similar Ecoregions**

**IDENTIFY TOOL:**

Using the Identify Tool, the user can select any Ecoregion on the map to view its soil, climatic and location information.

**QUERY INTERFACE:**

User can use the Query Interface Tool to select soil and climatic parameters, based on concerns identified from conceptual model (pesticide properties and fate studies).
Demonstration of GIS-based Model for Identification of Similar Ecoregions

QUERY RESULTS:

The Ecoregions that match the user-defined criteria entered into the query are highlighted in yellow.

ECOREGION CROSSWALK MODEL (ERX)

1. The user selects the root Ecoregion by using the Select Features tool. Query results or Identify tool
2. The user then clicks the Run Tool button to run the ESM
3. The Model Parameters box will pop-up to allow the user to select the percent similarity threshold
Demonstration of GIS-based Model for Identification of Similar Ecoregions

MODEL RUN:

After the user has input the similarity threshold, the ESM model will begin processing.

Once the ESM has finished calculating, the number of matches will appear in the match result window and the matching Ecoregions will be highlighted in green.

RESULTS INTERFACE:

Once the ESM has calculated the match Ecoregions, the soil and climatic information can be viewed in the Results Interface.
Demonstration of GIS-based Model for Identification of Similar Ecoregions

HELP INTERFACE:

[Image of a computer interface showing a map of Europe and a help window]
Comparison of North American and European soil data/databases

Eco-Region Crosswalk Presentation 3
Comparison of North American and European Soil Data/Databases

By Ciro Gardi (EU JRC) & Luca Montanarella (EU JRC)

Soil data at JRC

Land Management and Natural Hazards Unit

Soil

http://www.jrc.ec.europa.eu/
http://eusoils.jrc.ec.europa.eu/
The Action is the main repository of soil data and information in Europe, operating the European Soil Data Centre and providing high level analysis and assessments on the status and trends of soils in Europe and throughout the World.

- **European Soil Data Centre (ESDAC):** collection, management and distribution of data fully accomplishning INSPIRE Directive

- **Evaluation and Modelling of Soil Threats** as identified in the Thematic Strategy for Soil Protection

- **Soil Monitoring and Inventories** (e.g., Lucas soil, Biosoil, etc)

- **Research and development** (Digital Soil Mapping, advanced modelling and assessment)

- **Working Groups** (ESBN, Elonet, Soil Biodiversity, WRB, etc)
Need to collect and assess soil data and information → Establishment of ESDAC as one centre in the new system of European Data Centers for the environment, decided by “the group of four (Go4)” (DG ENV, ESTAT, JRC, EEA)

ESDAC is the single focal point for policy relevant soil data and information at EU level (one of the 10 Data Centers)

ESDAC is one node in a system consisting of distributed data nodes; as a soil data node, it will hold soil data at European level, while other soil data nodes at regional, national or global level will focus on data at different scales.

ESDAC will allow linking to data and information from National providers, fully complying with the INSPIRE principle of delocalized data systems in a networked approach (interoperability)

ESDAC is as ‘open’ as legally possible, meaning that if data and information resident in the ESDAC can legally be published, the system does. Even when a product is protected for access by only privileged users, efforts are made in order to present its metadata to the user.
EUROPEAN UNION

- Soil Geographical Database of Eurasia (SGDBE)
  (1:1,000,000, digitized European soil map and related attributes)

- PedoTransfer Rules Database (PTRDB)
  (holds a number of pedotransfer rules which can be applied to the SGDBE, producing new attributes)

- Soil Profile Analytical Database of Europa (SPADBE),
  (several databases, including measured and estimated soil profiles)

- Database of Hydraulic Properties of European Soils (HYPRES)

- Soil regions map for Europe
  (Map of European soil regions, together with data on climate and parent material)
**Thematic Datasets**

- Map of Top Soil Organic Carbon
- Maps of Soil Erosion Risk
- Maps of total heavy metal contents in European topsoils
- Map of natural soil susceptibility to compaction
- Map of Saline and Sodic Soils
- Map of Soil pH

**Detailed Soil Surveys**

Carried out by Member State at national and regional level. Scales varies (1:10,000 to 1:1,000,000). Coverage includes the territories of UE member states, and several regions within member states.

**European Soil Data Base 1:1 milion**

**MAIN FEATURE**

- vector geometry
- > 50 000 polygons
- 9 ha minimum area
- > 2 000 000 vertices (x,y)
- 73 Parameters

Full Database documentation includes: Metadata, Database Dictionaries, Attributes coding
Main components of the database

1. The Soil Geographical Database of Eurasia at scale 1:1,000,000 (SGDBE)
2. The Pedotransfer Rules Database (PTRDB)
3. The Soil Profile Analytical Database of Europa (SPADE)
4. The Database of Hydraulic Properties of European Soils (HYPRES)
SPADE 8

Is the results of quality control of estimated horizon parameters in Spade1

Three main activities:

- check the linkage between profile database and spatial database
- develop new links between profile database and spatial database
- verify the anałytica values within the horizons database

Spade 8 is being validated by member states and comments are currently been integrated

Future developments

- attach profile information to dominant STU in white area
- attach profile information to non-dominant STU
- merge Spade1, Spade 2, and Spade 8 in one coherent database

BIOSOIL demonstration study

Soil Information System

Soil observations

soilmap layers

Existing soil maps
Remote-sensed images
DEM
DTM
Climate
• The laboratory has been already selected and within next week the contract will be assigned
• Within the end of the year, we will send the first group of samples
• The parameters analysed will be:
Data for the Scenario Selection procedures

Soil:
- organic matter
- texture
- pH
- soil mapping units
- bulk density

Meteo
- temperature
- precipitation

Land use
- Corine Land Cover classes

U.S. Soil Data base

U.S. General Soil Map (STATSGO2)
- It consists of a broad-based inventory of soils and non-soil areas that occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped.
- Scale 1:250,000; the dataset was created by generalizing more detailed soil survey maps.
- Where more detailed soil survey maps were not available, data on geology, topography, vegetation, and climate were assembled, together with Land Remote Sensing Satellite (LANDSAT) images.
- Soils of like areas were studied, and the probable classification and extent of the soils were determined.
Soil Survey Geographic (SSURGO) Database

- Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database.

- Mapping scales generally range from 1:12,000 to 1:63,360; SSURGO is the most detailed level of soil mapping done by the Natural Resources Conservation Service (NRCS).

- SSURGO digitizing duplicates the original soil survey maps.

- This level of mapping is designed for use by landowners, townships, and county natural resource planning and management.

- The user should be knowledgeable of soils data and their characteristics.
SOIL LANDSCAPES OF CANADA (SLC)

• major characteristics of soil and land for the whole country

• SLC polygons are based on existing soil survey maps which have been recompiled at 1:1 million scale.

• Each area (or polygon) on the map is described by a standard set of attributes. The full array of attributes that describe a distinct type of soil and its associated landscape, such as surface form, slope, water table depth, permafrost and lakes, is called a soil landscape.

• SLC polygons may contain one or more distinct soil landscape components and may also contain small but highly contrasting inclusion components.

SOIL LANDSCAPES OF CANADA v3.1.1

• SLC v3.1.1 provides new soil information at a scale of 1:1 million for the major agricultural regions of Canada.

• The SLC v3.1.1 map series maintains the linkage to the national Ecological Stratification System for Canada.
NATIONAL ECOLOGICAL FRAMEWORK FOR CANADA

- The use of such a framework of standard ecological units provides for common communication and reporting between different jurisdictions and disciplines.
- Provide a common ground to report on the state of the environment and the sustainability of ecosystems in Canada.
- Ecological Land Classification incorporates all major components of ecosystems: air, water, land, and biota, including humans.
- It is holistic; "the sum is greater than the whole.
- The number and relative importance of factors helpful in delineating ecological units varies from one area to another, regardless of the level of generalization.
- It is based on a hierarchy with ecosystems nested within ecosystems.
- It involves integration of knowledge and is not simply an overlay process.
- It recognizes that ecosystems are interactive and that characteristics of one ecosystem blend with those of another.
- It recognizes that map lines generally depict the location of zones of transition.

Soil Data Bases

<table>
<thead>
<tr>
<th></th>
<th>EU ESDB</th>
<th>US STATSGO</th>
<th>Canada SLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale</td>
<td>1:1,000,000</td>
<td>1:250,000</td>
<td>1:1,000,000</td>
</tr>
</tbody>
</table>
### Soil Data Bases

#### EU | US | Canada
--- | --- | ---
Soil Classification | WRB and FAO-Unesco | US – Soil Taxonomy | Canadian System of Soil Classification 3rd Edition
Soil Mapping Units | SGDBE | STATSGO Polygons | SLC Polygons • Components • Soil Name • Soil Layer
Soil Typological Units | STU linked to SMU | | |

### Soil Data Bases

#### EU | US | Canada
--- | --- | ---
N. Parameters associated | 35 | | |
N. Parameters derived (PTR) | 38 | | |
Harmonized World Soil Database v 1.1

The Harmonized World Soil Database (HWSD) is a new comprehensive and updated (2009) source of information on soil worldwide.

The HWSD is a 30 arc-second raster database with over 16000 different soil mapping units that combines existing regional and national updates of soil information worldwide (SOTER, ESD, Soil Map of China, WISE) with the information contained within the 1:5 000 000 scale FAO-UNESCO Soil Map of the World.

The resulting raster database consists of 21600 rows and 43200 columns, which are linked to harmonized soil property data.

The use of a standardized structure allows for the linkage of the attribute data with the raster map to display or query the composition in terms of soil units and the characterization of selected soil parameters.
The Harmonized World Soil Database, have been selected as Soil Data Source for the Ecoregion-Crosswalk project, for the following reasons:

- harmonized and updated data base
- geographical coverage
- availability of soil parameters, relevant for the estimate of pesticides fate in soil:
  - organic Carbon
  - pH
  - water storage capacity
  - soil depth
  - cation exchange capacity
  - textural class
Comparison of North American and European climate data/databases

Ciro Gardi, David Kroestsch, Erin Carnegie

CLIMATE DATABASES

- MARS FOODSEC ERA-Interim Meteodata
  - European Commission
  - Joint Research Centre (JRC)
    - The Institute for the Protection and Security of the Citizen (IPSC)

- NOAA Global Summary of the Day
  - NOAA Satellite and Information Service
    - National Environmental Satellite, Data, and Information Service (NESDIS)
    - National Climatic Data Centre (NCDC)

- WorldClim Global Climate Data
  - Museum of Vertebrate Zoology, University of California, Berkeley
MARS FOODSEC ERA-INTERIM METEODATA

- The MARS FOODSEC ERA-Interim Meteodata is EC-IRC-MARS data produced by MeteoConsult (NI) and based on ECMWF (European Centre for Medium Range Weather Forecasts) model outputs.

- ERA Interim are resampled to 0.25 decimal degree grid cells in order to be comparable with the real time data.

- FOODSEC regularly receives 10-daily and monthly outputs of the ECMWF global circulation model.

- The original global data at a 0.25 degree resolution are preprocessed by Meteoconsult (NI) and additional parameters are calculated, such as global radiation and evapotranspiration.

- The data can be downloaded as point shapefiles for single countries or continents.

- The data aggregated for 10-day periods (dekads) can be downloaded from http://mars.jrc.it/mars/about-us/FOODSEC/Data-Distribution
Observed agro-climatological changes based on the MARS meteorological database 1975-2007

Lengthening of growing season
As a whole, it can be seen a lengthening of growing season is recorded over the whole area. This confirms the magnitude of increases noted, as an average 5°C in temperature has been noted across the sampled area from 1975 to 2007. However, in some regions, especially in the northeastern parts, the decrease in temperature is significant. The combination of increased temperature and decreased rainfall has resulted in a significant increase in the duration of growing season, especially in eastern regions.

Increased summer and seasonal rainfall
In eastern Europe, eastern China, Russia, and Australia, a significant increase in cumulative rainfall is noted during summer and autumn/winter/rainfall.

Reduction of summer rainfall
In the Mediterranean region, southern Europe, and southern Africa, there is a significant reduction in cumulative rainfall. This is particularly evident in southern regions, where the majority of annual rainfall is concentrated in the wettest months.

Increased precipitation demand
Increase in winter precipitation, mainly due to the reduction in rainfall during the growing season and weather, due to the combination of higher temperatures and decreased rainfall. This has resulted in increased precipitation demand for large parts of southern Europe, Asia, and southern Africa, especially in the dry season.

Shortening of crop growth cycle (agronomology)
The speed of crop development is mainly influenced by the increased temperature. Therefore, the increase of crops development speed lead to a shorter growing season over the last decades.
In general, most crops are ready for harvest earlier than in the past, particularly in the Mediterranean region. Winter crops were influenced more than summer crops.

Increased soil stress
In parallel to the increase of annual mean temperatures, maximum daily values were shifted upward and most frequent dew points are curves.

Widespread conditions were recorded in Spain (particularly southern areas, Italy and Black Sea area, mainly Turkey).
However, it must be noted that locally, along the Atlantic coasts, and in Greece a reduction of frequency stress was recorded.
NOAA GLOBAL SUMMARY OF THE DAY

- The global data summaries provided on the website are based on data exchanged under the World Meteorological Organization (WMO) World Weather Watch Program according to WMO Resolution 40 (Cg-XII).

- The input data used in building these daily summaries is derived from the synoptic/hourly observations contained in the Integrated Surface Data (ISD), which includes global data obtained from the USAF Climatology Center. This data is obtained from over 9000 stations.

- The latest daily summary data are normally available 1-2 days after the date/time of the observations used in the daily summaries.

- The online data files begin with 1929, and are now on Version 7.
Global Historical Climatology Network - Daily

Description - Source Data

Most nations operate at least one network of surface observing stations that collect data on a daily basis. Unfortunately, there is no central repository for all of the daily data collected from all observing systems worldwide. As a result, a major task in creating GHCN-Daily was to maximize spatial coverage by acquiring historical records for as many stations in as many national networks as possible. This was accomplished using three complementary data acquisition strategies. The first approach involved identifying relevant data sets that are already stored in NCDC’s archives. The second strategy entails leveraging off of international initiatives, such as the Global Climate Observing System (GCOS) Surface Network (GSN), that facilitate the free exchange of data. The third tactic is to exploit personal contacts, particularly those at national meteorological centers around the world.

NOAA GLOBAL SUMMARY OF THE DAY

Daily elements included in the dataset (as available from each station) are:

- Mean temperature (° Fahrenheit)
- Mean dew point (° Fahrenheit)
- Mean sea level pressure (mb)
- Mean station pressure (mb)
- Mean visibility (mi)
- Mean wind speed (knots)
- Maximum sustained wind speed (knots)
- Maximum wind gust (knots)
- Maximum temperature (° Fahrenheit)
- Minimum temperature (° Fahrenheit)
- Precipitation amount (inches)
- Snow depth (inches)

Indicator for occurrence of:
- Fog
- Rain or Drizzle
- Snow or Ice Pellets
- Hail
- Thunder
- Tornado/Thunderstorm Cloud
NOAA GLOBAL SUMMARY OF THE DAY

- The data are strictly ASCII, with a mixture of character data, real values, and integer values.

- Retrieve and download data for **certain stations only** by:
  - Worldwide scale
  - Geographic region (e.g., North America)
  - Country
  - Station Range (ID’s)

- The NOAA Global Summary of the Day data are appropriate for site specific summaries and not at the regional or global level without a significant amount of processing.

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NOAA GLOBAL SUMMARY OF THE DAY

The data is available via:

- World Wide Web

- FTP via web browser

- Command line ftp
WORLDCLIM

- Interpolated climate surfaces for global land areas (excluding Antarctica) at a spatial resolution of 30 arc seconds (~1 km spatial resolution).

- Input data such as monthly averages (measured at weather stations) were gathered from a variety of sources and, where possible, were restricted to records from the 1950–2000 period.

- The data was interpolated using the thin-plate smoothing spline algorithm implemented in ANUSPLIN (Hutchinson, 2004) and created global (land areas only, excluding Antarctica) climate surfaces for monthly total precipitation and monthly mean, minimum and maximum temperature.

WORLDCLIM

The WorldClim interpolated climate layers were made using:

- Major climate databases compiled by the Global Historical Climatology Network (GHCN), the FAO, the WMO, the International Center for Tropical Agriculture (CIAT), R-HydroNet, and a number of additional minor databases for Australia, New Zealand, the Nordic European Countries, Ecuador, Peru, Bolivia, among others.

- The Shuttle Radar Tomography Mission (SRTM) elevation database (aggregated to 30 arc-seconds, "1 km")

- The ANUSPLIN software. ANUSPLIN is a program for interpolating "noisy" multi-variate data using thin plate smoothing splines algorithms. Latitude, longitude, and elevation were used as independent variables.
WORLDCLIM

You can download climate data for:

- Current conditions (interpolations of observed data, representative of 1950-2000)
- Future conditions (downscaled from global climate model (GCM) output, IPCC 3rd assessment; 4th assessment coming soon)
- Past conditions (downscaled global climate model output)
  - Last inter-glacial (LIG; ~120,000 - 140,000 years BP)
  - Last glacial maximum (LGM; ~21,000 years BP)
  - Mid-Holocene (~6000 BP)

WORLDCLIM

- The coordinate system is GCS_WGS_1984 and the datum is D_WGS_1984.
- The original data were taken at a 30 arc-second spatial resolution, the other data have been derived through aggregation by calculating the mean of groups of cells.
- They are available at 4 different spatial resolutions
  - 30 arc-seconds (~1 km)
  - 2.5 arc-minutes
  - 5 arc-minutes
  - 10 arc-minutes (18.6 x 18.6 = 344 km² at the equator)
- Aggregation was done for monthly precipitation, minimum, mean and maximum temperature
- Data available for download in two raster formats:
  - Generic Grid
  - ESRI Grid
- Download data at http://www.worldclim.org
## CLIMATE DATABASES

<table>
<thead>
<tr>
<th>MARS FOODSEC ERA-Interim Metoclimate</th>
<th>NOAA GLOBAL SUMMARY OF THE DAY</th>
<th>WORLDCLIM</th>
</tr>
</thead>
<tbody>
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<td>0.25 decimal degrees</td>
<td>- 30 arc-seconds</td>
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<tr>
<td>- Global</td>
<td>- Global</td>
<td>- 2.5 arc-minutes</td>
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<td>- Geographic Region</td>
<td>- Geographic Region</td>
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<td>- Country</td>
<td>- 10 arc-minutes</td>
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<td>- NOAA Satellite and Information Service</td>
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<td>- Joint Research Centre (JRC)</td>
<td>- National Environmental Satellite, Data and Information Service (NESSDIS)</td>
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<td>- The Institute for the Protection and Security of the Citizen (IPSC)</td>
<td>- National Climatic Data Centre (NCDC)</td>
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<td>- Museum of Vertebrate Zoology, University of California, Berkeley</td>
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Eco-Region Crosswalk Presentation 4
Ecoregion Crosswalk Tool Delivery
By David Kroetsch (Canada-AAFC) & Raju Gangaraju (Canada-PMRA)

OECD WORKSHOP
The Development of Harmonized International Guidance for Pesticide Terrestrial Field Dissipation Studies and Crosswalk of North American and European Ecoregions

David Kroetsch

Ecoregion Crosswalk Tool Delivery

INTRODUCTION:

• OECD project to maximize the use of pesticide field dissipation studies by developing harmonized international guidance for conducting the studies and identifying comparable North American and European Ecoregions

• The geospatial model (ERX) utilizes the mathematical model output (for a defined % threshold) to display, identify, query and produce output reports and graphs at the ‘region’ level

• Require a delivery system accessible to all potential users that allows the selection of ‘similar’ regions between NA and EU
Ecoregion Crosswalk Tool Delivery

CHARACTERISTICS OF ECOREGION DECISION SUPPORT DELIVERY

- Able to display, identify, query and produce output reports and graphs at the ‘region’ level
- Available in a format that is accessible to working group members and industry representatives
- Able to be used across multiple OS
- Stable; repeatable results

HOW TO DELIVER?

DESKTOP BASED SYSTEMS

- Commercial Off the Shelf (COTS): (i.e. ERX)
  ArcGIS 9.3/Python/Visual Basic
  - All users require purchased and installed software
  - Operating system compatibility
  - Versioning issues

- OPEN SOURCE: MapWINDOW; GRASS; SAGA; JUMP; Quantum
  - Free and openly available
  - Compatible with multiple operating systems

Delivery of software and databases via:
- Digital media, FTP, Secure Website
Ecoregion Crosswalk Tool Delivery

HOW TO DELIVER?

WEB MAPPING SERVICES (WMS)

1. Proprietary Software
   - ArcGIS Server

2. Open Source
   - MapSERVER
   - GeoSERVER
   • Open Geospatial Consortium Standards OGC
   • INSPIRE - European GEO Standards and Interoperability Standards

Ecoregion Crosswalk Tool Delivery

ECOREGION CROSSWALK MODEL (ERX) DELIVERY
Development and Delivery:

1. Should the ERX be delivered via a Desk-top application or a Web Mapping Service (WMS)?
2. Should this model (ERX) be delivered with Commercial off the Shelf Software (COTS) or Open Source GIS software?
   a) Operating system issues i.e. Windows XP, Vista, Windows 7
   b) Installation issues
   c) GIS software versioning i.e. ArcGIS v9.3 -> v10.0
Ecoregion Crosswalk Tool Delivery

ECOREGION CROSSWALK MODEL (ERX) DELIVERY
Delivery and Availability:

3. If a WMS approach were used where would the ERX be hosted and served from?
4. Who should be allowed access to the ERX and databases?

Future Development and Delivery:

- Who has the responsibility for maintenance, updating and technical support for the ERX – Desk-top or WMS versions?
- Do you feel that a Working Group should be established to review, suggest improvements and manage the ERX
- How will the current and future versions of the ERX be resourced?
Eco-Region Crosswalk Presentation 5
When and How the Eco-Region Tool is to be used
By Mohammed Ruhman (US EPA) & David Kroetsch (Canada-AAFC)

When and How the Eco-region Tool Is to be Used

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Contents

• Example Run

• Suggested Use of The ER Tool:
  – When the ER Tool is to be Used
  – How the ER Tool is to be used

• What is needed for improvement
Example Run (1 of 3)

- Nine TFD studies were already executed for a chemical: Five in the USA and Two in Europe
- The ER tool was used to point out the importance of using the tool early in the planning stage for conducting these studies.

Example Run (1 of 3)

- The location of the nine studies were added as a layer to the tool
- For each of the nine locations:
  - Associated eco-region was selected as a “root eco-region”
  - The tool was launched and similar eco-region(s) were identified.
- Identified Matches were analyzed
### Example Run (1 of 5): locations

<table>
<thead>
<tr>
<th>Site</th>
<th>Eco-region (North America)</th>
<th>Site</th>
<th>Eco-region (Europe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA-1</td>
<td>Northern tall grassland</td>
<td>EU-1</td>
<td>English lowlands beech</td>
</tr>
<tr>
<td>NA-2</td>
<td>Southern Great Lakes forests</td>
<td>EU-2</td>
<td>Baltic mixed forests</td>
</tr>
<tr>
<td>NA-3</td>
<td>Southern conifer forests</td>
<td>EU-3</td>
<td>Western European</td>
</tr>
<tr>
<td>NA-4</td>
<td>California central valley grassland</td>
<td>EU-4</td>
<td>broadleaf forests</td>
</tr>
<tr>
<td>NA-5</td>
<td>Snake-Columbia shrub steppe</td>
<td></td>
<td>Atlantic mixed forests</td>
</tr>
</tbody>
</table>

### Example Run (2 of 5): Identification of Associated Eco-region “Root ER”

[Map showing eco-regions]
Example Run (3 of 5): Identification of Associated Eco-region “Root ER”

North America

Europe

Total Eco-regions (ERs) Matches = 15
60-69% Similarity = 8 ERs
70-79% Similarity = 6 ERs
≥ 80% Similarity = 2 ERs
NONE of the EU sites are located in these fifteen matches?

Example Run (4 of 5): Identification of Associated Eco-region “Root ER”

<table>
<thead>
<tr>
<th>Site</th>
<th>Site (ER Similarity %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA-1</td>
<td>None</td>
</tr>
<tr>
<td>NA-2</td>
<td>EU-1 (73%), EU-2 (69%), EU-3 (83%), and EU-4 (75%)</td>
</tr>
<tr>
<td>NA-3</td>
<td>None</td>
</tr>
<tr>
<td>NA-4</td>
<td>None</td>
</tr>
<tr>
<td>NA-5</td>
<td>EU-3 (63%)</td>
</tr>
</tbody>
</table>

| Number of Similar EU regions at varied similarity % |
|-----------------------------|-----------------|-----------------|-----------------|---------------|
| Site   | >=80% | 70-80% | 60-70% | Total |
| NA-1   | 0      | 0      | 7      | 7     |
| NA-2   | 2      | 8      | 13     | 23    |
| NA-3   | 0      | 0      | 0      | None  |
| NA-4   | 1      | 6      | 8      | 15    |
| NA-5   | 1      | 6      | 7      | 14    |
**Example Run (5 of 5): Conclusions**

- At least one North American site (NA-2) may have represented any of the EU sites (69-83% similarity)
- One of the EU sites (EU-3) might also be represented by one of the North American sites (NA-5)
- If this analysis is done before conducting the studies: May have excluded
  - At least one site (EU-3)
  - Other sites: if the location of the sites were chosen based on using the tool and associated analysis such as: Data on crops to be treated and associated soils

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**Suggested Use of The ER Tool: When the ER Tool is to be Used**

At the planning stage:

The objective is to use the tool early with further analysis to choose required sites in both NA and EU that represent areas where the pesticide is to be used (As per expected FINAL label)
Suggested Use of The ER Tool: How the ER Tool is to be used

- A layer of “crops to be treated” is displayed on the ER tool in both sides of the Atlantic
- Sites are chosen to represent the crops to be treated in one side of the Atlantic (i.e., North America)
- ER tool is used to identify a list of similar eco-regions in the EU
- Sites are chosen, in the EU, to be located within EU eco-regions that may represent other eco-regions in NA (other than the sites already chosen)
An Example: Other Steps

- Identify associated ER in North America
- Run the tool to identify similar ER in the EU
- May also do the process starting from the EU to identify areas where the pesticide is proposed to be used, associated EU ER and similar ER in North America.
- Use data to decide on the TFD locations with sites in the EU and North America

What is Needed for Improvement

- **Availability of:**
  - Separate shape files that may be used with the tool for soils (Harmonized World Soil Database). Soils (USDA soil orders/suborders & Canadian Soil Orders/suborders and FAO soil units), elevation, contour lines, Satellite data, and others.
  - Crops data for the EU that may be displayed on the map (linked with?).
- **Option for using other data bases, for example EFED uses the following:**
  - The Soil Survey Geographic (SSURGO) Database from the Natural Resources Conservation Service (NRCS) for soils
  - MARS FOODSEC Metedata (2000 to 2009) and NCDC Met Station data for climate
  - CANUS GISPS: CENSTATS – USA for crop data
  - Multi-Resolution Land Characteristics (MRLC) Consortium group's land cover dataset (the National Land Cover Dataset for land cover)