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Global-Detector: GIS and Knowledge-based Tool for a Global Detection of the Potential for Production, Supply and Demand

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Background

There is a growing trend towards internationalisation of the agri-food sector in order to find new markets and reduce costs. Entrepreneurs who want to expand their production or market possibilities abroad are often faced with inadequate and dispersed information about promising locations in the world. To assemble and harmonise all the relevant data for the best decisions may become very costly and time-consuming.

Objective

Our objective is to develop a generic tool for knowledge-based spatial analysis. A large set of indicators is readily available for use without any GIS processing. The model builder together with an expert can start instantaneously, so the result should be reached considerably faster and more efficiently compared to a customary approach where often tedious and time-consuming data tracing, collection and GIS processing have to take place before actual spatial analyses can start.

Indicators of Global-Detector

The raw data for most indicators of Global-Detector are downloaded open-source data from the Web with various formats: gridded GIS files (rasters), shapefiles, tabular csv. Using GIS procedures these are converted to more than 200 uniform 5'x5' indicators for: climate, land use, infrastructure, geography, population density in various circles, country aspects (e.g. fragility, GDP), etc.

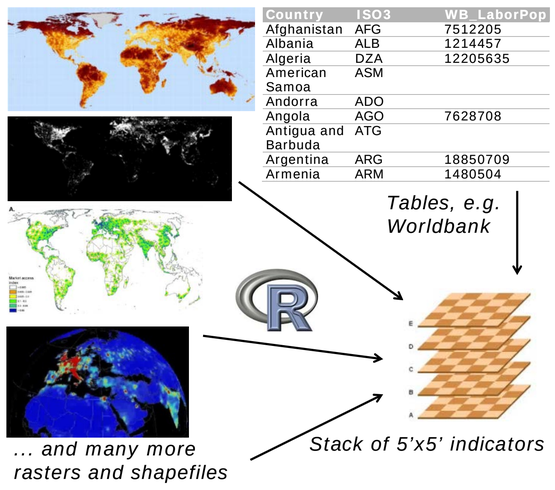


Figure 1. Creation of a stack of uniform 5'x5' indicators from downloaded freely available open-source data (GIS, tabular).

Role of the expert and knowledge engineer

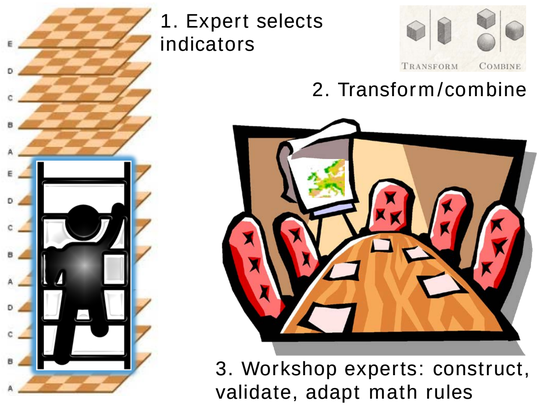


Figure 2. Experts select relevant indicators, express ways to transform and combine using math functions (e.g. optimum) and discuss and validate intermediate and final maps.

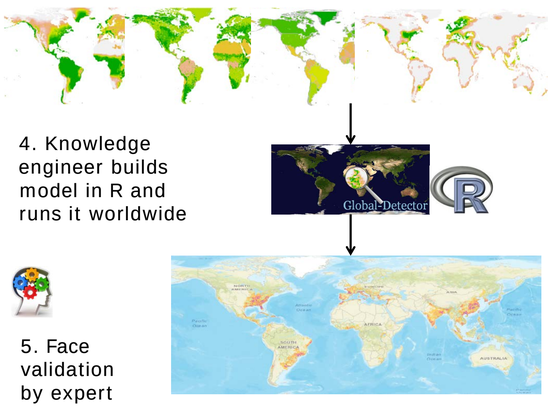
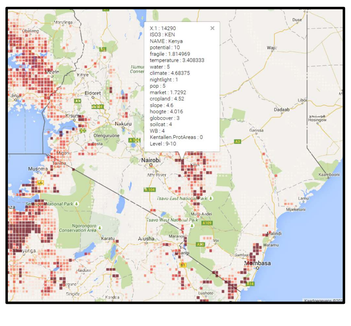


Figure 3. The knowledge engineer works in close cooperation with the expert to make a knowledge base that transforms relevant indicators to a map of production potential.

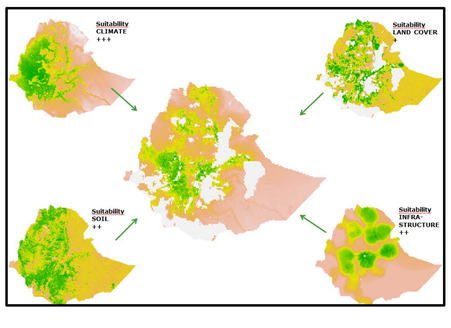
Figures 2 and 3 show the process of creating a knowledge base and a map of production potential. Following these steps, the first results can be achieved within a few hours. Experts select the indicators, express knowledge, and validate; knowledge engineers facilitate the experts, build knowledge bases and are responsible for the display.

Case studies with Global-Detector

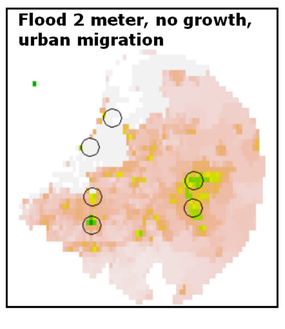
- Detection of the potential for production, e.g. tilapia in ponds, ornamental horticulture, pig production.
- Expected demand for a product, e.g. cherry tomatoes.
- Metropolitan assignments, e.g. urban food and recreation.
- Scenarios that have an effect on production/demand (e.g. floods).



Potential for tilapia in Kenya and surrounding countries.



Potential for avocado production in Ethiopia based on four aspects.



Scenario calculations with effects of floods on supply and demand of food.

Final result on world map (e.g. fruit vegetables)

The final result is a world map or several detailed maps of regions. For this 'fruit vegetables' example about 40 indicators of Global-Detector have been chosen and applied. In a workshop with 8 experts, these indicators have been transformed (e.g. mean temperature to optimal temperature and combined). Results can be aggregated to country or province level.

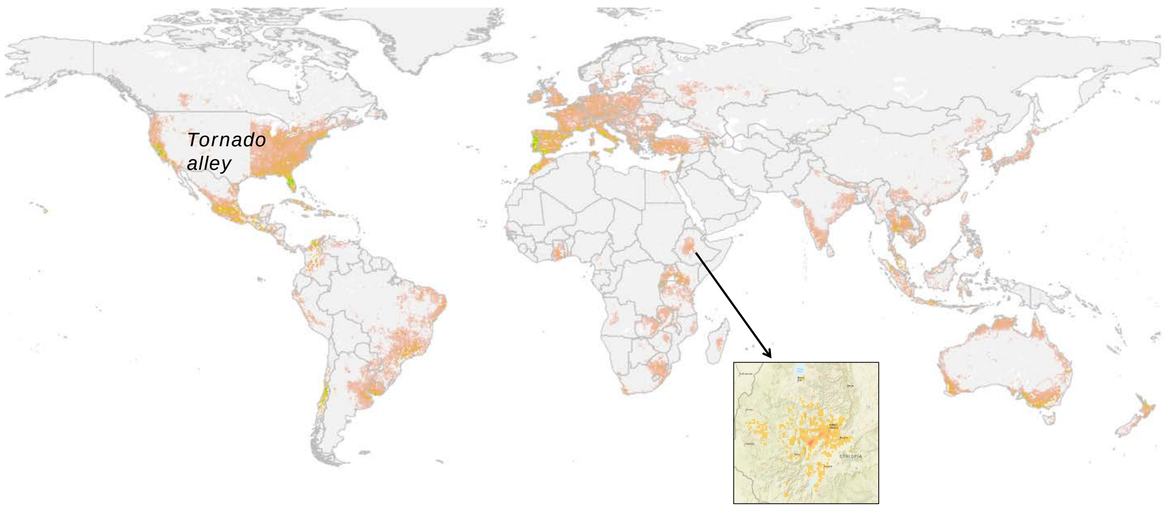


Figure 4. Final result of the case 'Potential for fruit vegetables'. Data from a world map can be combined with Google Maps for a clear presentation: detail shows 'Potential for flowering and beddings plants in Ethiopia'.

Conclusions and future potential

- Global-Detector is a generic tool for knowledge-based spatial analysis in a fast and straightforward way, applicable in various cases.
- The expert is crucial (selection, face validation, 'tacit knowledge').
- The instrument is helpful for entrepreneurs to gain information from target countries and to locate promising locations in the world.
- Global-Detector is valuable when applied in conjunction with existing models, e.g. with the general equilibrium tool MAGNET which covers the entire global economy. Global-Detector's can be made to downscale results, and so increase the value of both models.
- Intention to make the Global-Detector more dynamic and accessible with a web-based presentation version.
- Augment possibilities for market demand.

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