

A RISK-BASED TOOL FOR THE REGIONAL RANKING OF ENVIRONMENTAL CHEMICAL STRESSORS

Elisa Giubilato¹, Alex Zabeo², Silvio Giove³, Andrea Critto¹, Antonio Marcomini¹

¹ University Ca' Foscari Venice, Interdepartmental Centre I.D.E.A.S., Cannaregio 2978, Venezia, Italy

² University Ca' Foscari Venice, Dept. of Environmental Sciences, Informatics and Statistics, Dorsoduro 2137, Venezia, Italy

³ University Ca' Foscari Venice, Dept. of Economics, Cannaregio 873, Venezia, Italy

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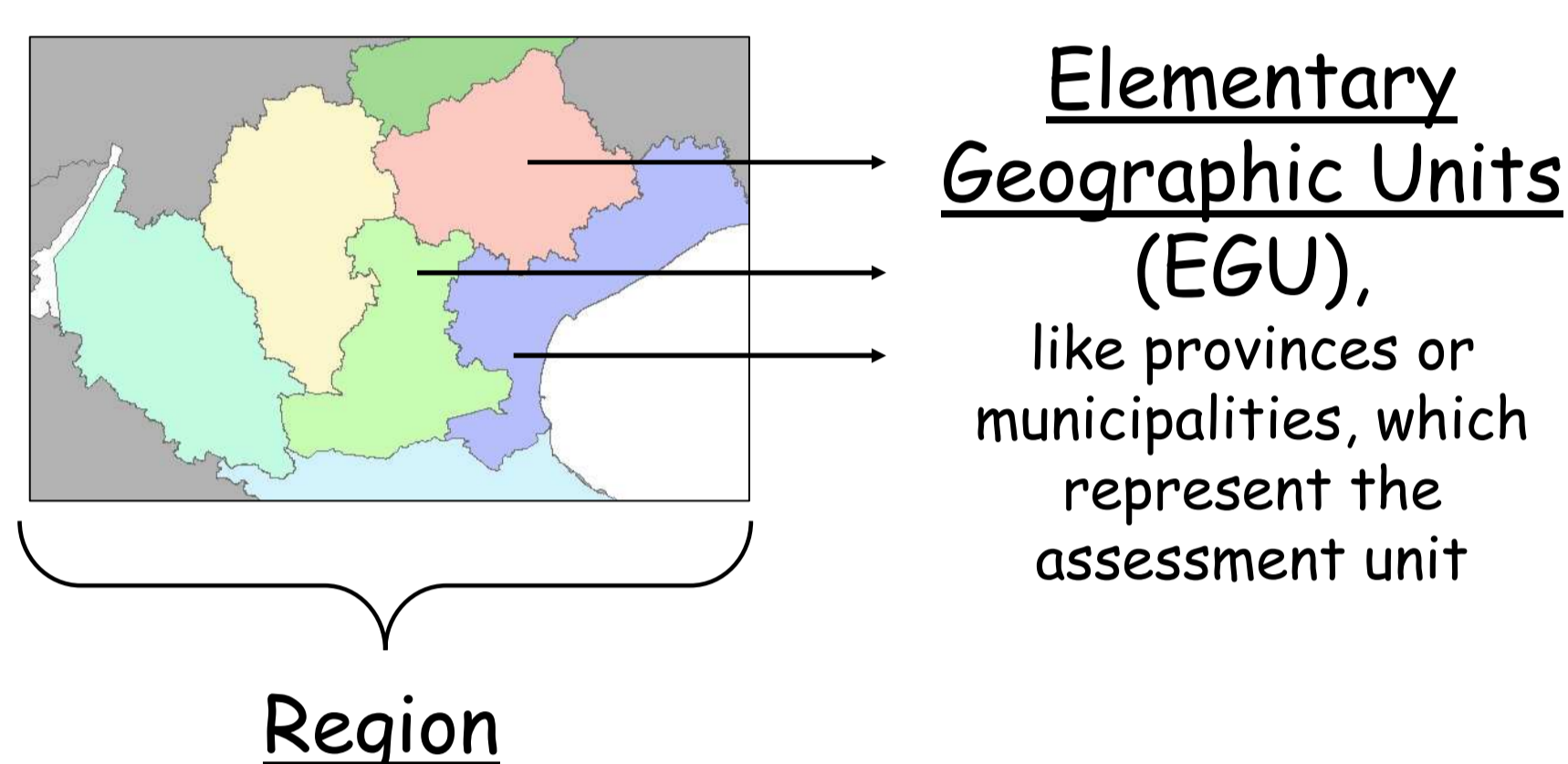
In complex systems, where multiple health stressors interact, many targets are contemporary involved and different health outcomes may be observed in the population, initial assessment efforts have to be addressed towards the most relevant scenarios, with the aim of focusing further risk assessment on the most critical situations (Menzie et al., 2007). This is a "focusing exercise" aimed at guiding assessment efforts and resources towards those scenarios which could correspond to the most significant potential effects on human health.

OBJECTIVES

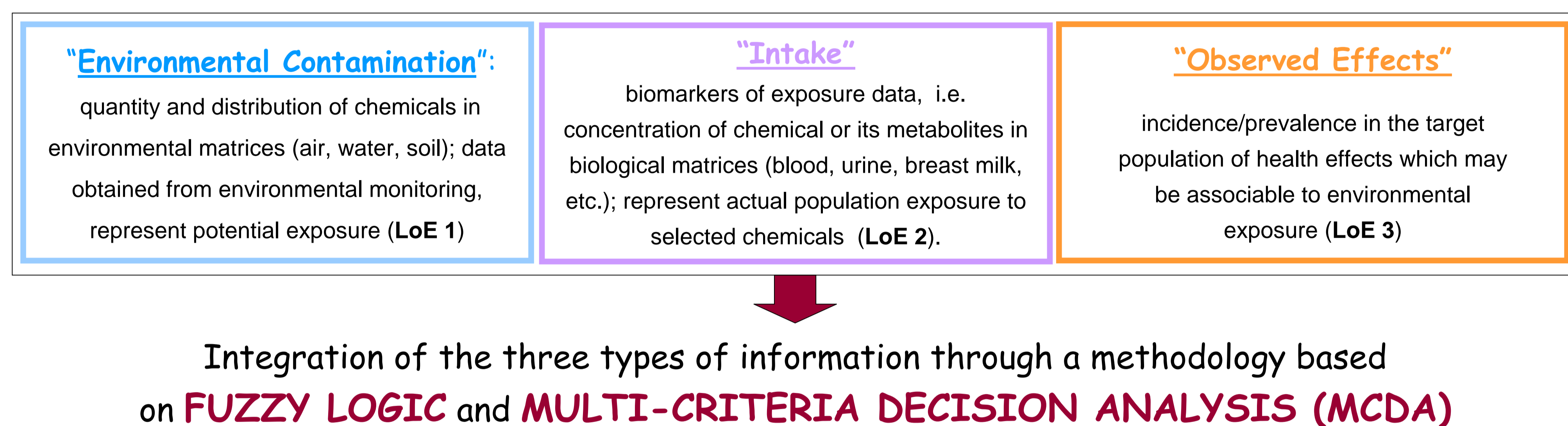
The main objective was to develop a screening methodology for defining a ranking of environmental chemical stressors at the regional scale. A "Risk-based Tool for the Ranking of Environmental Chemical Stressors" has been developed, aimed at supporting decision-makers in the evaluation of the existing information on environmental contamination and population health status in the region of interest, to identify which pairs of "chemical-related health effect" should be investigated more urgently. Moreover, the tool should allow the identification of priority areas within the considered region, where further assessment should be focused.

METHODOLOGICAL APPROACH

SPATIAL DIMENSION



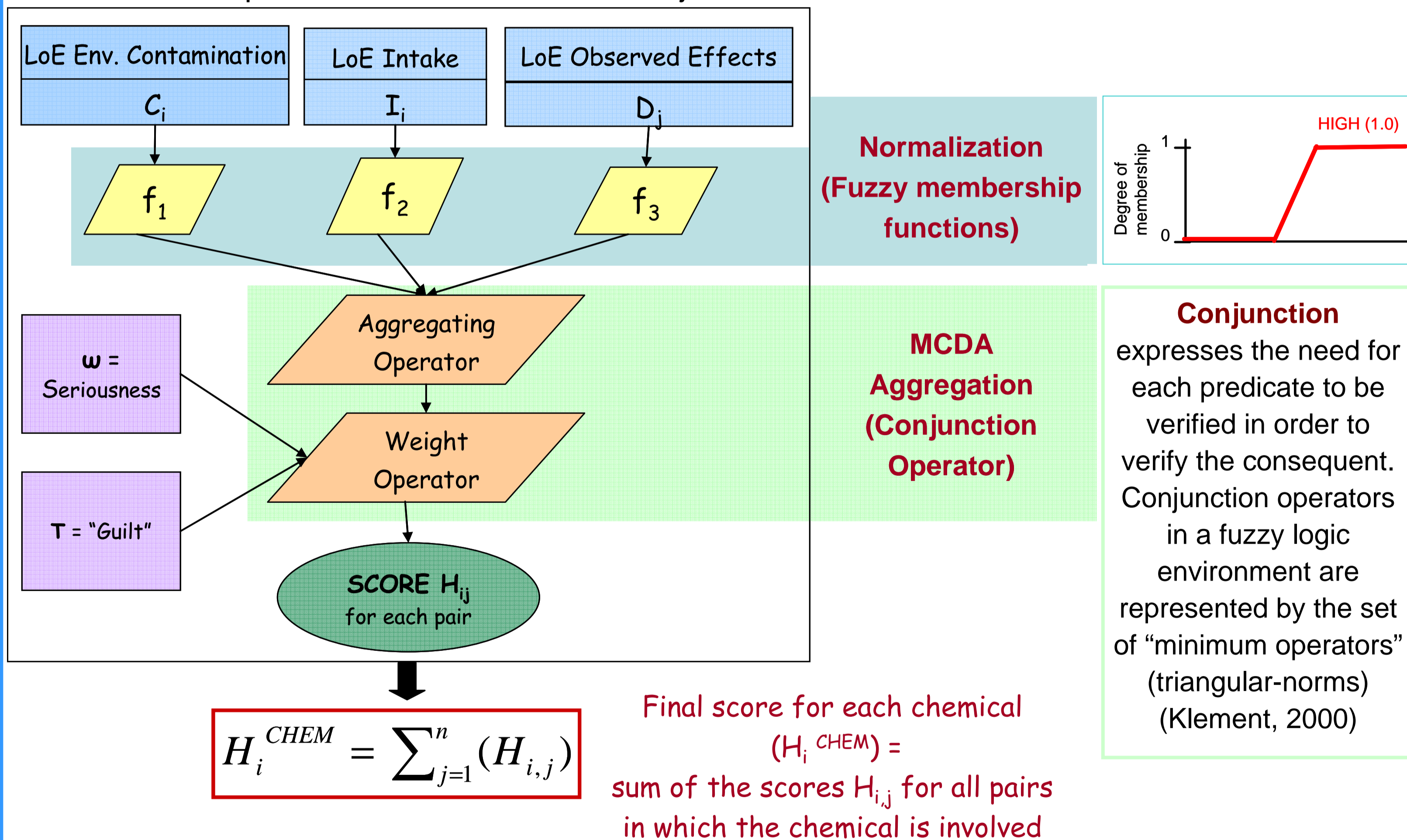
WEIGHT-OF-EVIDENCE APPROACH



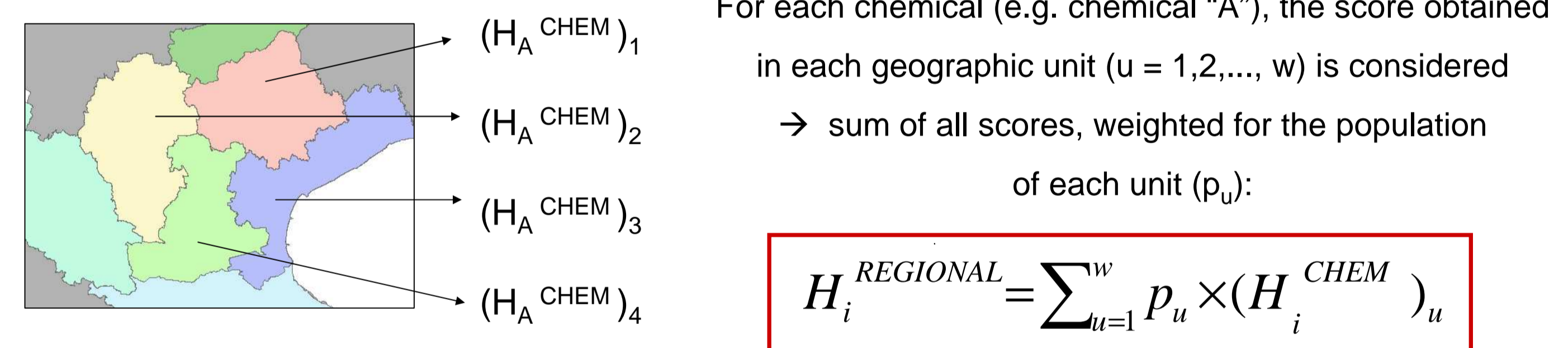
3 STEPS OF THE METHODOLOGY

1 - RANKING OF CHEMICALS WITHIN EACH ELEMENTARY GEOGRAPHIC UNIT

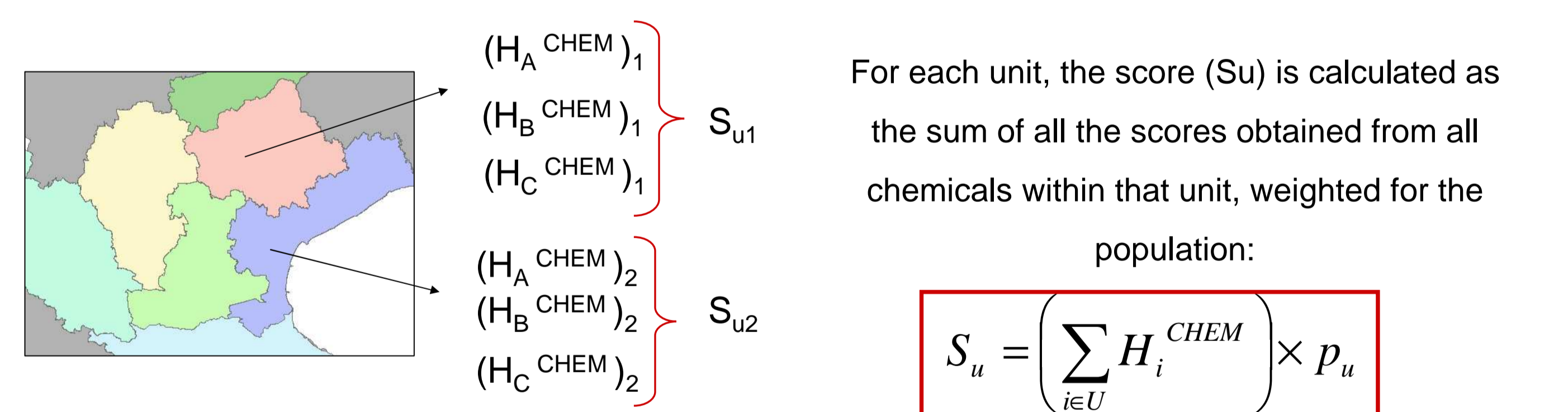
For each pair "chemical i^{th} / health effect j^{th} ":



2 - RANKING OF CHEMICALS AT THE REGIONAL SCALE



3 - RANKING OF THE ELEMENTARY GEOGRAPHIC UNITS



CASE-STUDY FOR A TESTING APPLICATION

The tool is being applied to a Belgian case-study, focusing on the region of Flanders, using soil contamination data and data on exposure and effect biomarkers measured in adolescents in the frame of the Flemish Biomonitoring Programme 2002-2006 (Schroijen et al., 2008).

Types of data chosen for the application

Chemicals: Lead, Cadmium, PAHs, Benzene

LoE Environmental Contamination: soil contamination data

LoE Intake: data on biomarkers of exposure (Pb in blood, Cd in blood, 1-OH-pyrene in urine, t,t'-muconic acid in urine)

LoE Observed Effects: data on effect biomarkers and other effects (sex and thyroid hormones, pubertal stages, asthma and allergies)

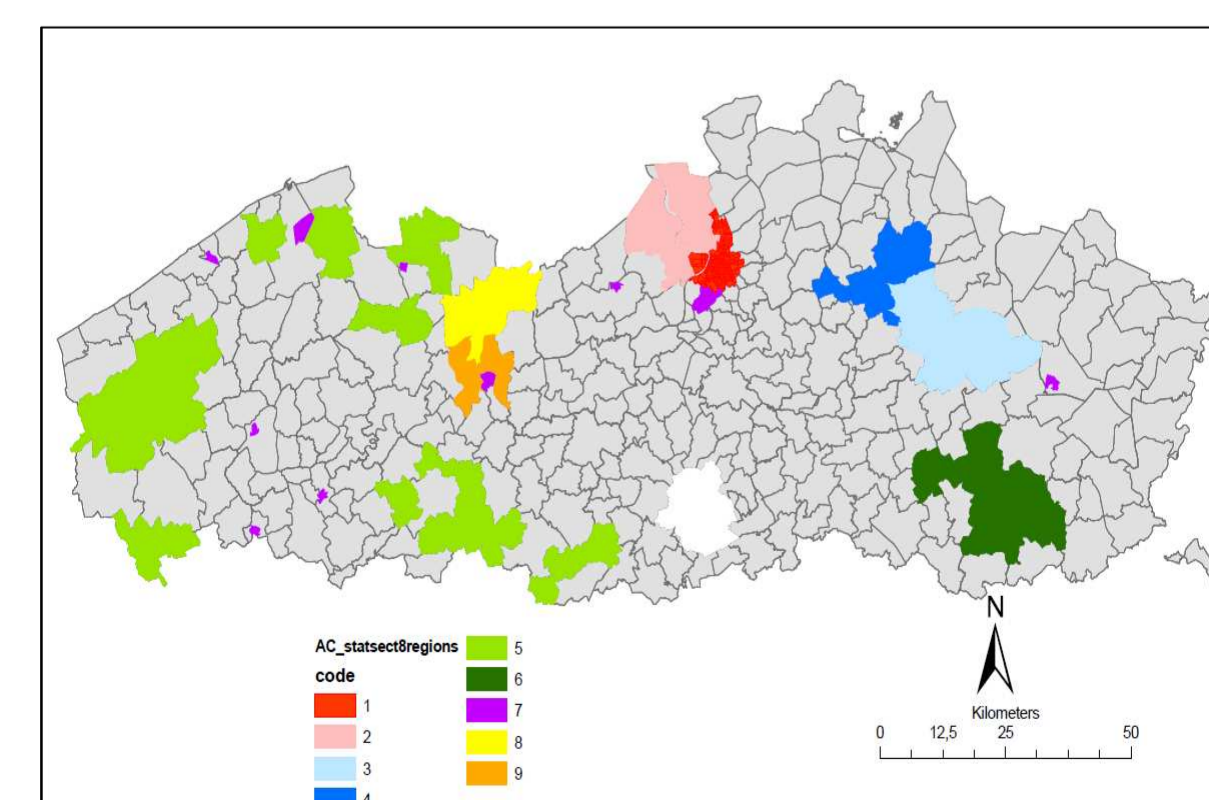


Figure 1. Areas where exposure and effects biomarkers on adolescents have been monitored in the frame of the Flemish Biomonitoring Programme 2002-2006 (from VITO)

Acknowledgement: VITO (Flemish Institute for Technological Research) and OVAM (Public Waste Agency of Flanders) for their kind support in providing soil contamination and biomarkers data

PROTOTYPE

The Risk-based Tool for the Regional Ranking of Environmental Chemical Stressors is a prototype software allowing data storage (based on a Microsoft Access database), application of the different methodological steps and delivery of results. The tool includes a geo-database linked to a Geographic Information System framework for the spatial visualization of results.

SENSITIVITY ANALYSIS

An application for sensitivity analysis has been included in the prototype tool. The methodology is based on Monte Carlo simulation and allows to analyse the effects of end-user's choices about model parameters (e.g. weights assigned to LoEs). Since the output of the tool is a RANKING of chemicals, and not a single value, each Monte Carlo simulation provides a SET OF RANKINGS.

Measures of SIMILARITY AMONG RANKINGS (Nardo et al., 2005) are thus used to analyse the results of sensitivity analysis.

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