Exploring the challenges with soil data in regional land use analysis

Chantal Hendriks

Jetse Stoorvogel, Lieven Claessens

WAGENINGEN UNIVERSITY
WAGENINGEN UR

ICRISAT
Science with a human face

Introduction

- GYGA project used as case study
- Challenges were faced by the GYGA project
- Pragmatic decisions on data usage
- Available versus required data

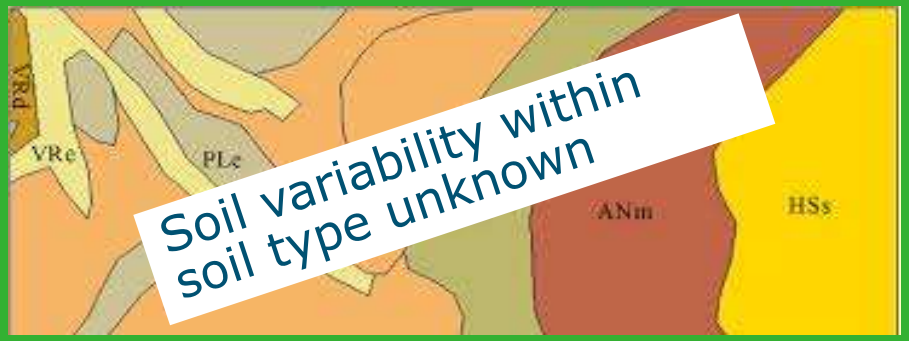
Quality and availability of data required for yield gap analysis in three study regions.

Data input	Region		
	Nebraska, USA	Argentina	Kenya
Soils			
Source	USDA-NRCS	INTA-GeoINTA, INTA-Soil division	ISRIC-WISE
Spatial resolution	High	Intermediate	Coarse
Availability of required variables	All	All	All, except rootable depth

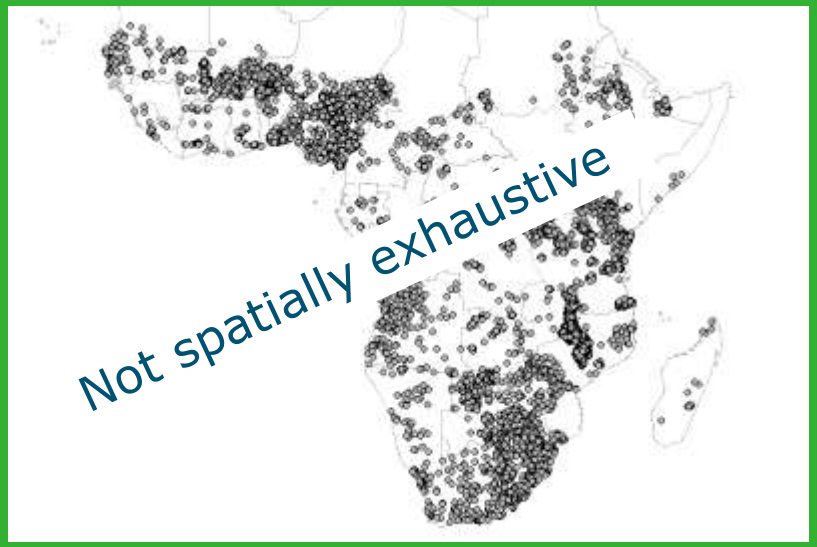
(Grassini et al., 2015)

Available soil data

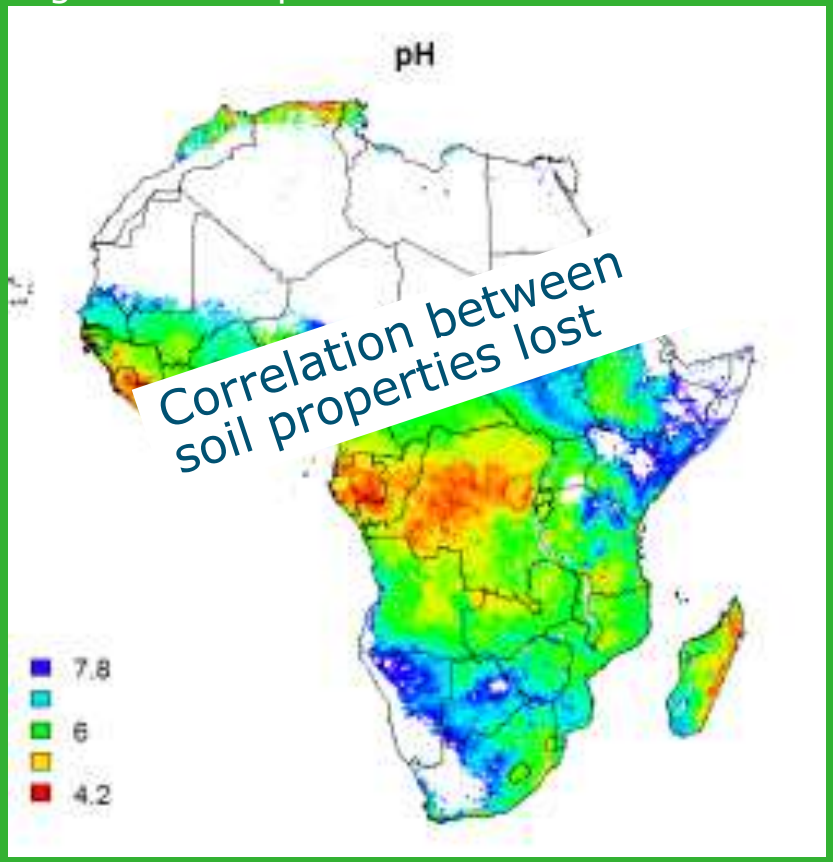
Conventional soil survey



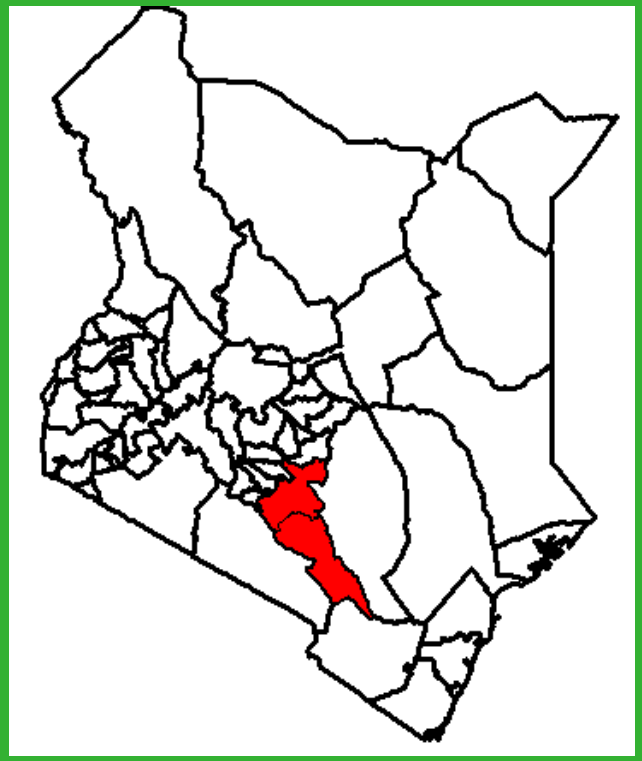
Point dataset



Digital soil map



Study area: Machakos and Makueni county



- Maize cropping area
- Semi-arid
- 400 and 2100m ASL
- Actual yield: 1.6 ton/ha
- 500 to 1300 mm precipitation
- 15 and 25 °C

WAGENINGEN UNIVERSITY
WAGENINGEN UR

ICRISAT
Science with a human face

Explore the challenges with soil data

- Compare six soil datasets available for the study area
- Test assumptions that were made in the procedures to establish soil datasets
- Analyse the effect different datasets have on:
  - Area selection
  - Water-limited maize yields

Results: compare six soil datasets

Dataset	Carbon (%)	Sand (%)	Clay (%)	pH
ISRIC-WISE	0.6 (0.1)	43.5 (6.5)	37.7 (4.1)	6.2 (0.7)
S-World	1.5 (1.2)	45.1 (16.5)	36.9 (13.4)	6.2 (0.4)
AfSIS	0.1 (0.1)	10.7 (4.9)	11.7 (4.0)	4.8 (0.7)
Local DSM	0.8 (0.2)	71.7 (17.6)	23.6 (8.8)	n.a.
KenSOTER	1.0 (0.6)	48.0 (21.0)	31.8 (16.7)	6.1 (1.1)
FURP	0.3 (0.0)	36.2 (5.0)	44.4 (7.2)	5.1 (0.7)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

ICRISAT
Science with a human face

Results: test assumptions

- Soil types are homogeneous

Soil type	Average			Coefficient of variance	
	Sand (%)	Clay (%)	pH (-)	Sand (%)	Clay
Chromic Cambisol	35	40	5.0	7	
Ferralic Arenosol	81	7	5.8		9

- Mapping units can be ... without considering land use and ... ent

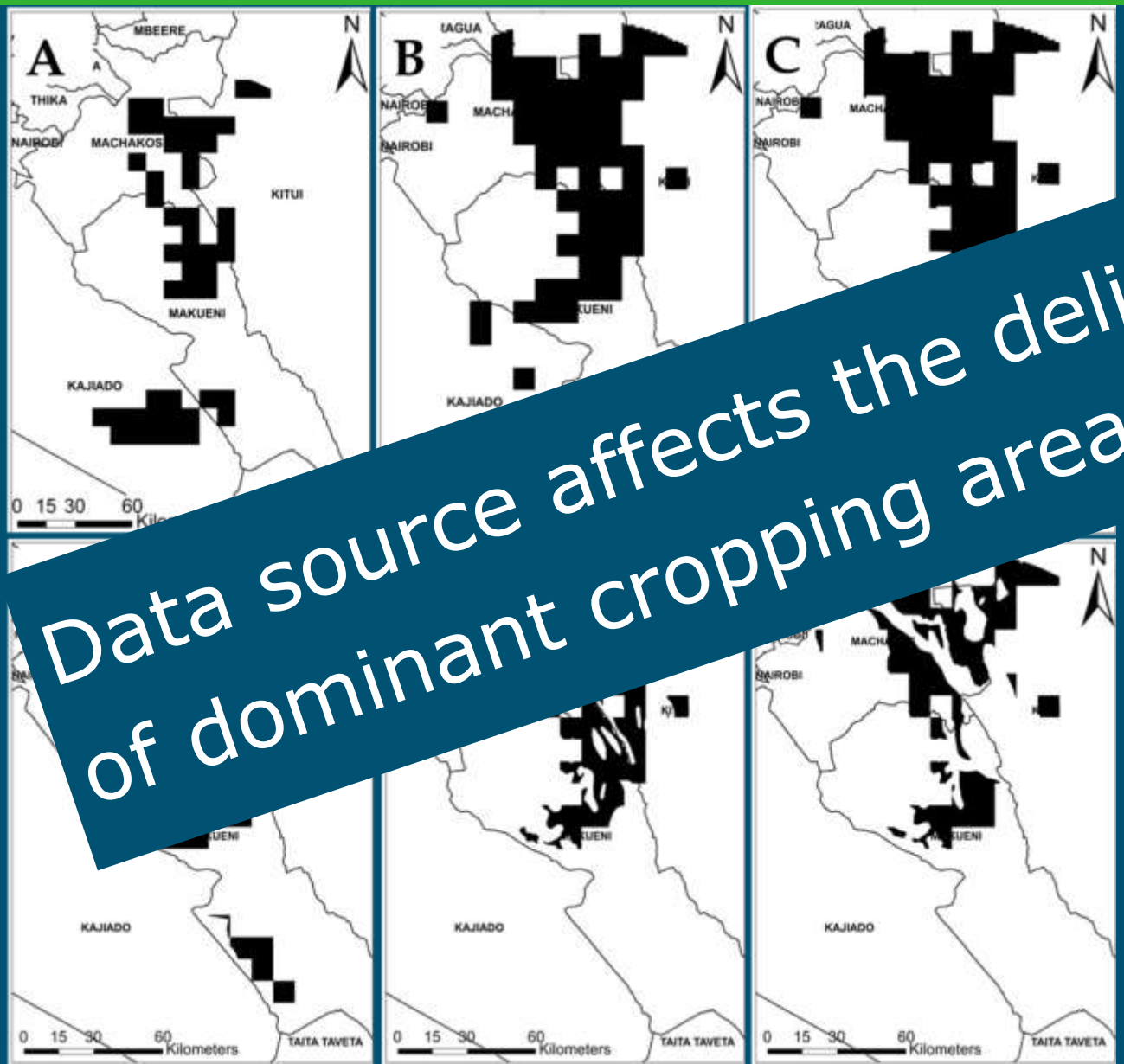
Assumptions affect the data

	P-value carbon	P-value soil moisture
...e vs agriculture	**0.02**	**0.09**
Terraced vs non-terraced	0.23	**0.03**
Mono-cropping vs intercropping	**0.07**	0.18

WAGENINGEN UNIVERSITY
WAGENINGEN UR

ICRISAT
Science with a human face

Results: area selection



Data source affects the delineation of dominant cropping areas

A = ISRIC-WISE

B = S-world

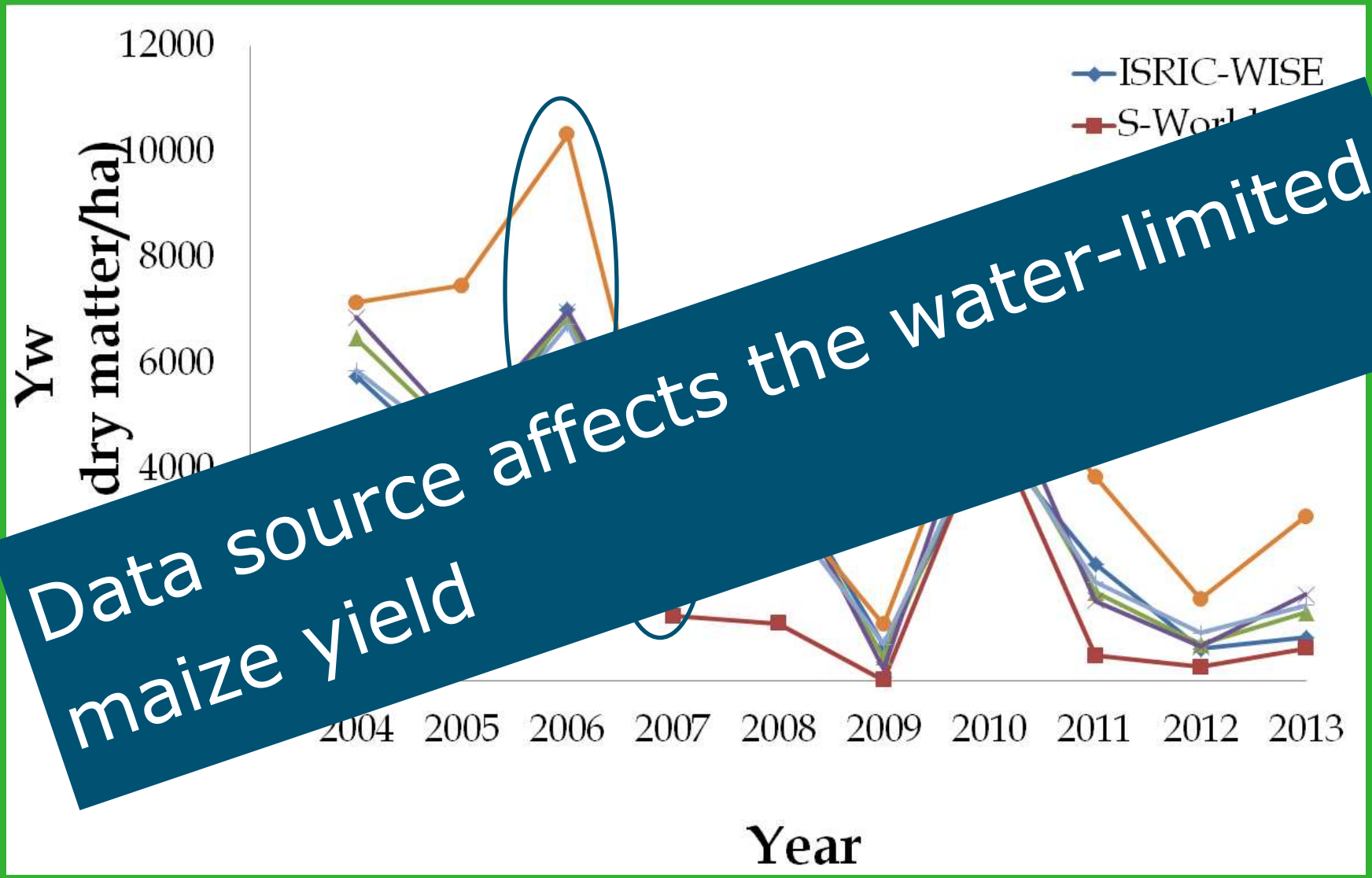
C = AfSIS

D = Local DSM

E = KenSOTER

F = FURP

Results: water-limited maize yield



Data source affects the water-limited maize yield

Challenges for soil data users

- Avoid to choose the soil dataset based on pragmatic decisions
- Possibilities/limitations of soil datasets unknown
- Scale of dataset ≠ scale of analysis
- Unknown quality of soil dataset

Recommendations to GYGA

GYGA focusses on agricultural areas. Choose soil datasets that were established for agricultural areas.

Validate soil datasets, to get an idea of the quality of the datasets.

Validation not possible, use multiple datasets using ensemble runs.

Questions?

"*The choice of which datasets to use for your analysis needs to be tailored to the aim of the analysis.*"
(Hendriks et al., in prep.)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

ICRISAT
Science with a human face