Disaggregation of Land Types in South Africa

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Pieter le Roux
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Introduction

- Optimizing land use needs soil maps
  - Expensive and time consuming

Explosion

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Introduction

- Soils are not randomly distributed

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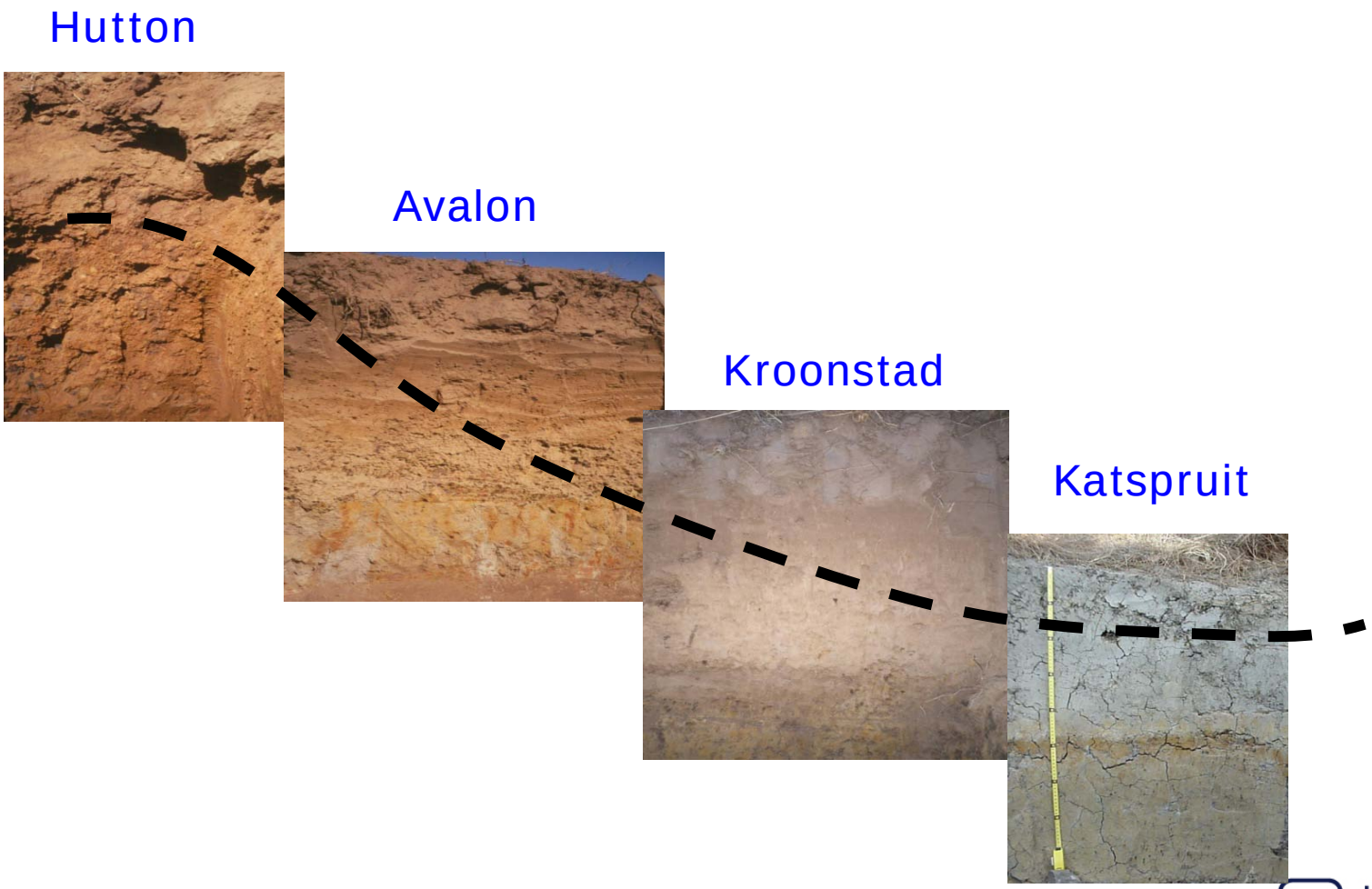
Introduction

- Soils are not randomly distributed



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Introduction

- Land types (LT) = soil distribution patterns + terrain + climate
- Terrain analysis (TA)
- LT + TA = Soil distribution

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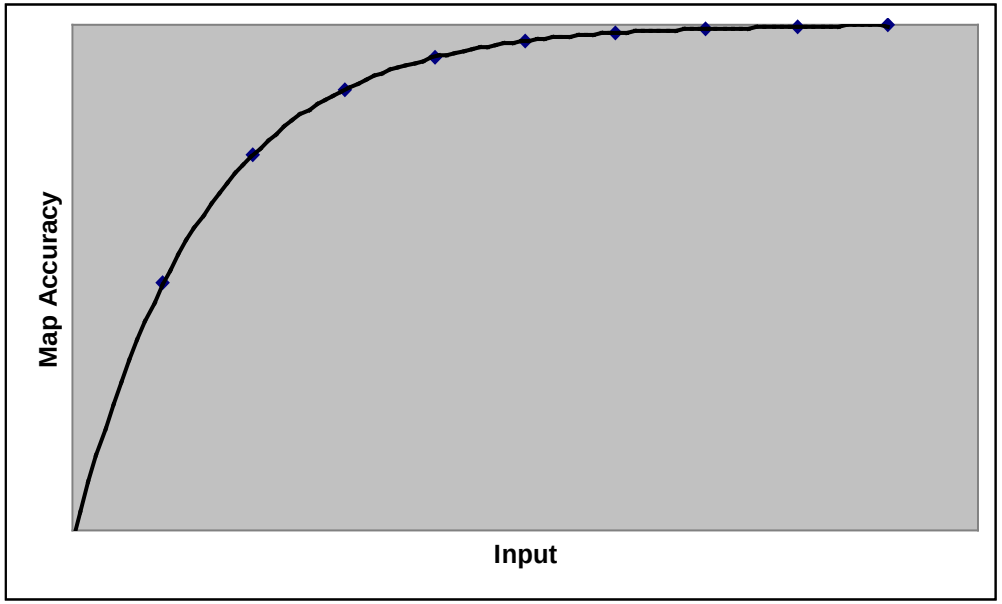
Hypothesis

- DSM can disaggregate land type inventories into soil maps



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Aim

- To use land type attributes to create soil maps by disaggregation

- Optimise field work
  - Limit field work, optimise impact

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Land Type Inventory

- 1: 250 000 scale
- Covers whole of SA
- Link soils to Terrain Morphological Units
- Field estimated attributes

- http://www.agis.agric.za/agisweb/landtypes.html

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Land Type Inventory

LAND TYPE / *LANDTIPE* ..... : Ea34

CLIMATE ZONE / *KLIMAATSONE* ..... : 266S

Area / *Oppervlakte* ..... : 28529 ha

Estimated area unavailable for agriculture

Beraamde oppervlakte onbeskikbaar vir landbou : 60 ha

Occurrence (maps) and areas / *Voorkoms (kaarte) en oppervlakte* :

2728 Penkfoet (22649 ha) 2730 Vryheid (5880 ha)

Inventory by / *Inventaris deur* :

D P Turner

Model Profiles / *Modale profiele* :

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4395 4398

Terrain unit / *Terreineenheid* ..... :	1	2	3	5
% of land type / *% van landtipe* ..... :	30	2	63	5
Area / *Oppervlakte (ha)* ..... :	8559	571	17973	1426
Slope / *Helling (%)* ..... :	2 - 4	>100	6 - 15	6 - 15
Slope length / *Hellingslengte (m)* ..... :	60 - 600	10 - 20	600 - 1200	20 - 50
Slope shape / *Hellingsvorm* ..... :	Y	Z	Y-X	Y-X
MB0, MB1 (ha) ..... :	3423	0	6111	0
MB2 - MB4 (ha) ..... :	5135	571	11862	1426

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Rock / Rots		4 :	1712	20	457	80	3595	20			5763	20.2						
Glendale Sd21, Shortlands Sd22, Argent Sd11, Richmond Sd12	300-1200	2 :	2140	25			5392	30			7532	26.4	45-60		45-60	B	SaCl-Cl	so,H
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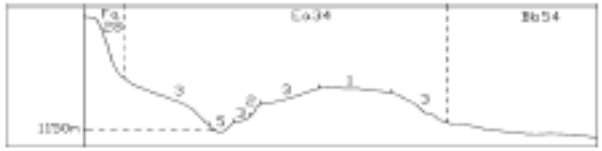
Katspruit Ka10	300-400	2 :							285	20	285	1.0	20-35			A	SaClLm	gc
Stream beds/Stroombeddings		4 :							570	40	571	2.0						

Terrain type / *Terreintipe* : C4

Terrain form sketch / *Terreinvormskets*



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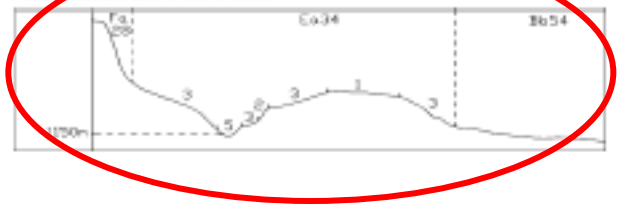

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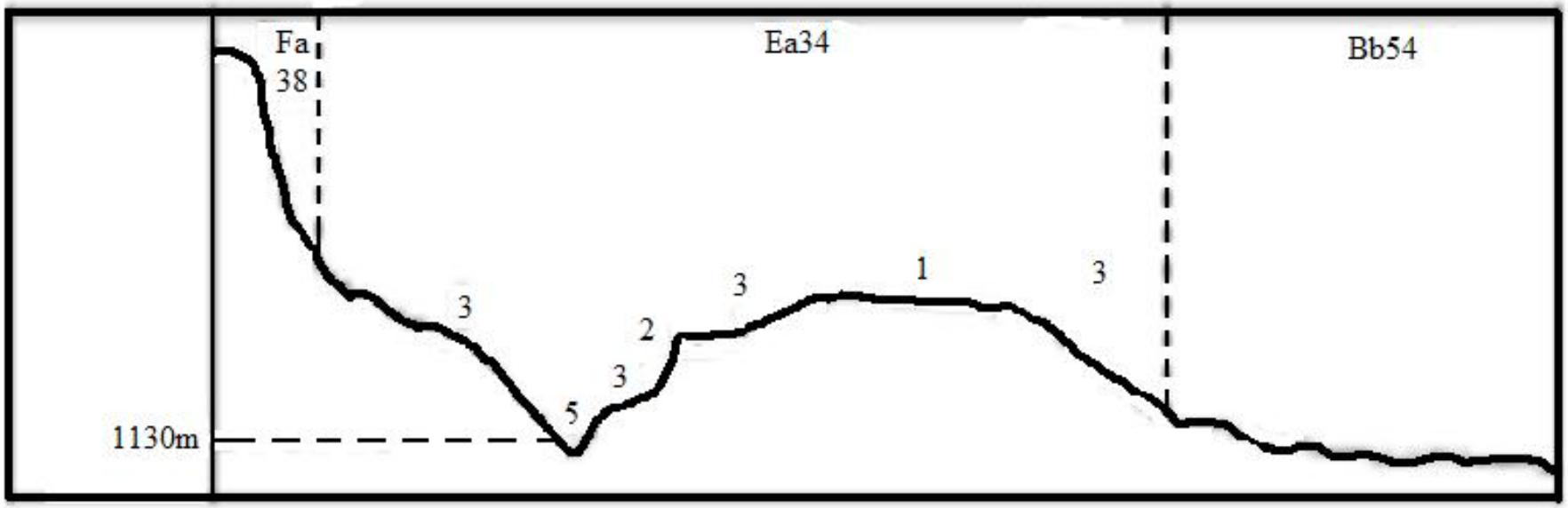
Terrainsketch/Terreinskets



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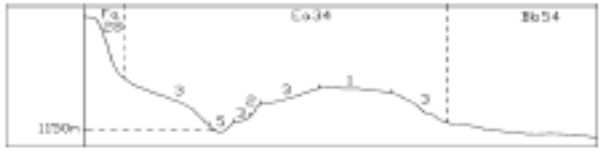
Terrain form sketch / *Terreinvormskets*



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Shemodo Hu36, Mainga Hu26	300-1200	0	:					539	3		
Heidelberg Av34, Soetmelk Av35	300-900	0	:	257	3			180	1		
Stanger Bo11, Rudeni Bo21	300-900	2	:					359	2		
Willowbrook Wo11, Chinyika Wo21	200-400	2	:							285	20
Katzpruit Ka10	300-400	2	:							285	20
Stream beds/Stroombeddings		4	:							570	40

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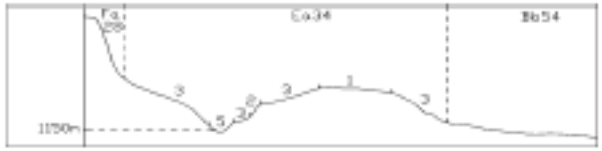

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Clay content % *Klei-inhoud %*				Texture *Tekstuur*
A	E	B21	Hor	Class / *Klas*
45-60		45-60	B	SaCl-Cl
45-60		45-60	B	SaCl-Cl
45-60		45-60	B	SaCl
35-55		35-55	B	SaCl
15-30			A	fi/meSaLm-SaClLm
45-60		45-60	A	SaCl-Cl
15-35		15-35	B	fiSaLm-SaClLm
10-25		10-25	B	Lmfi/meSa-SaClLm
45-60		45-60	A	SaCl-Cl
35-45			A	SaCl
20-35			A	SaClLm

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Study Site

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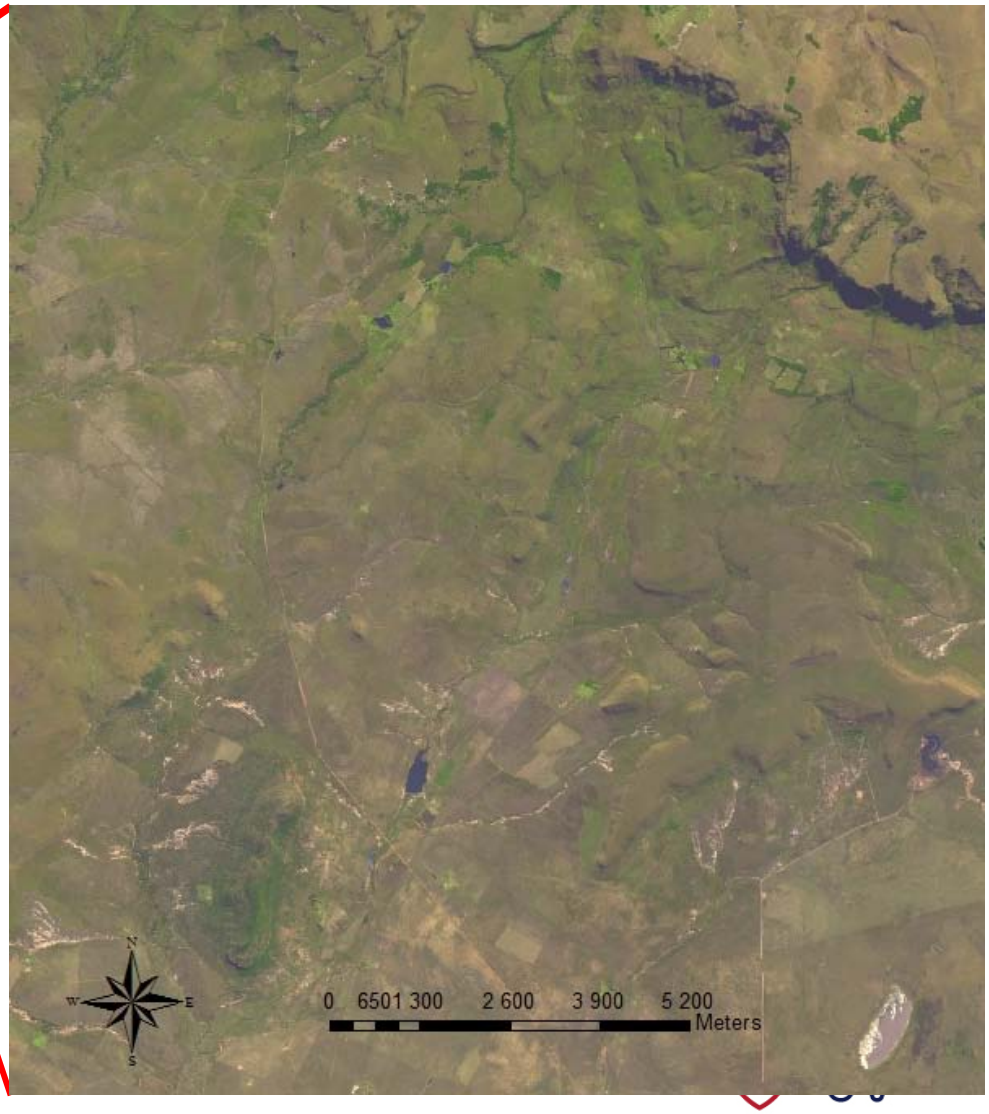

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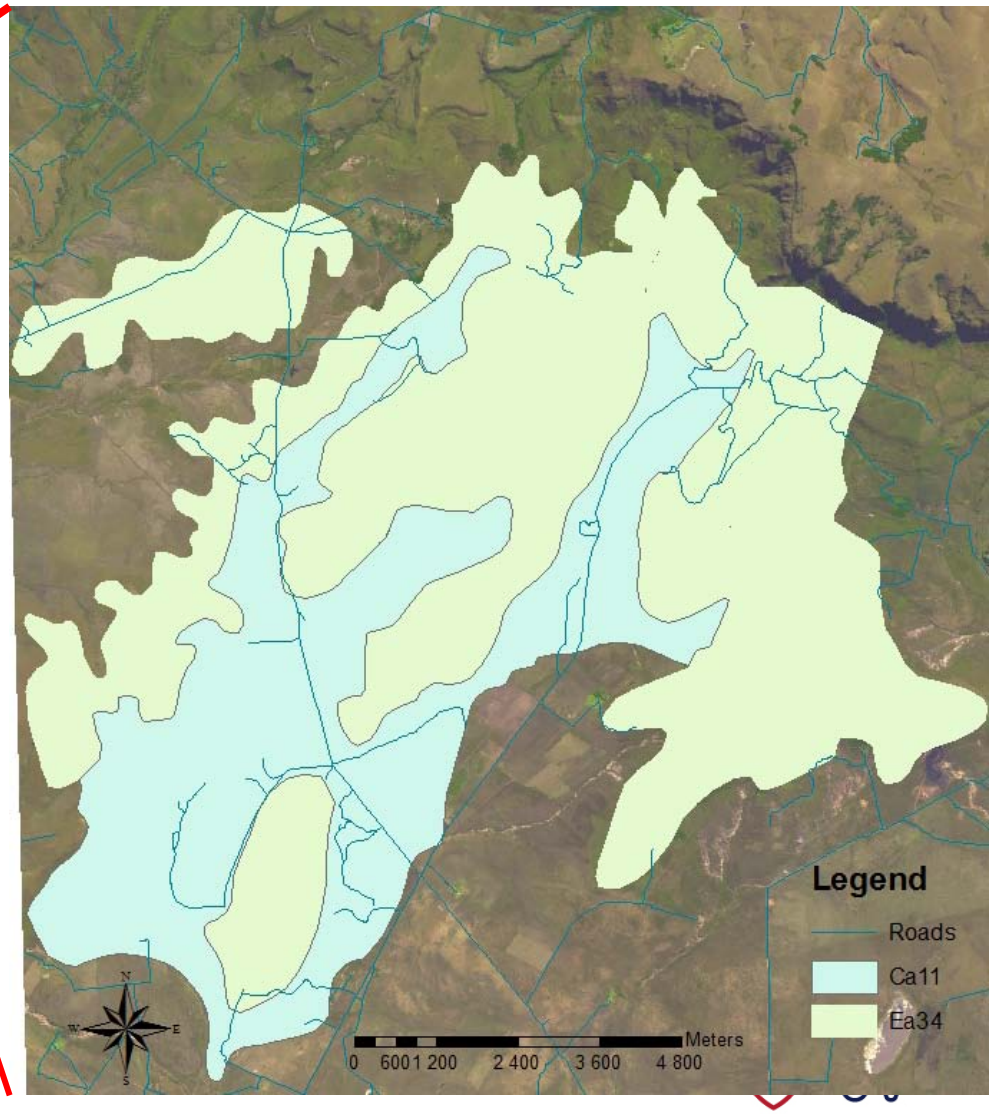

- Approx 10 000 ha
  - Ea34 = 6500ha
  - Ca11 = 3500ha

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Methodology

- Sites: Land Types Ea34 and Ca11
- Terrain analysis, expert knowledge and GIS

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AfSIS

- Africa soil information system
  - www.africasoils.net
- Aims:
  - Provide up to date soil information for Africa
  - Long Term ecological survey sites

- 60 Sentinel sites across Sub-Sahara Africa

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Methodology

- 4 Soil maps drawn of the area
  - First in office
  - Second after recce field visit with land type surveyor
  - Third after doing field work, using 30% of data points
  - Fourth after field work, using 60% of data points

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First Map

- Divided area into TMU's
- Divided soils in Land Type inventory into three classes
  - Shallow
  - Intermediate
  - Wet
- Drew map using 3dMapper, Solim and ArcGIS
  - Zhu and Burt
  - Esri

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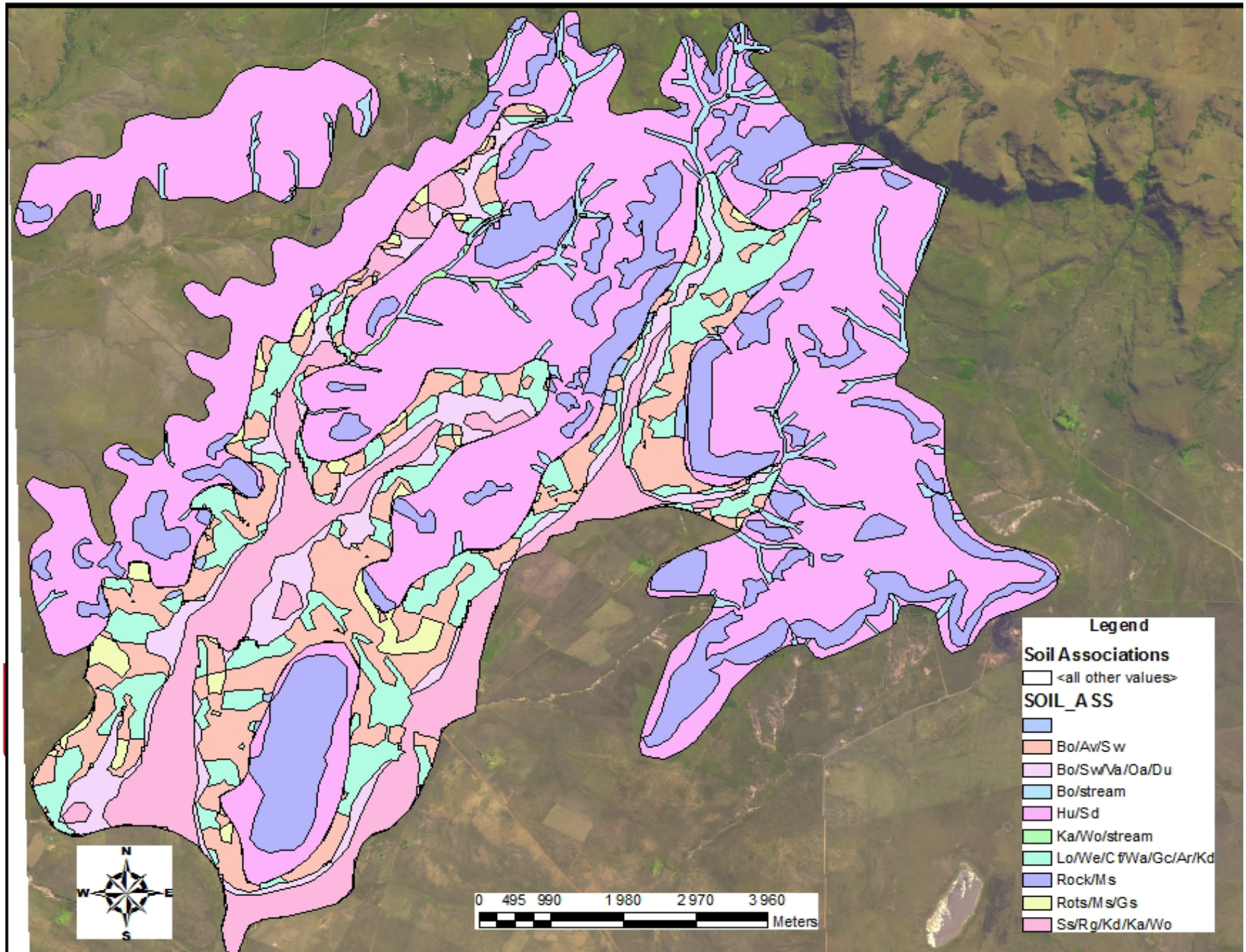
Legend
Soil Associations
<all other values>
SOIL_ASS
Bo/Aw/Sw
Bo/Sw/Va/Oa/Du
Bo/stream
Hu/Sd
Ka/Wo/stream
Lo/We/Cf/Wa/Gc/Ar/Kd
Rock/Ms
Rots/Ms/Gs
Ss/Rg/Kd/Ka/Wo
0 495 990 1 980 2 970 3 960
Meters
N
W
E
S

Second Map

- After recce field visit
- Soilscapes
- Drew soil associations map by hand on ArcGIS

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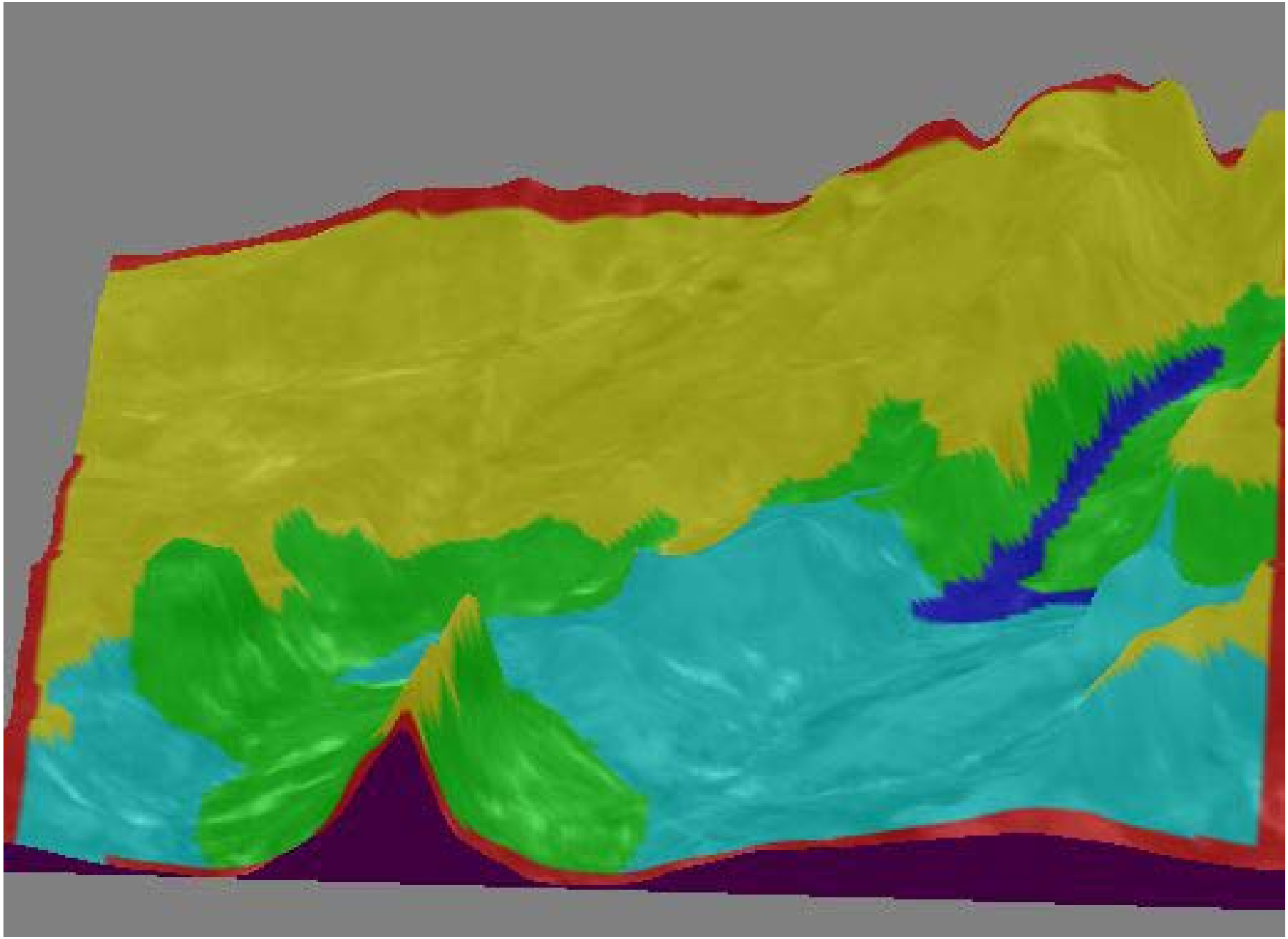

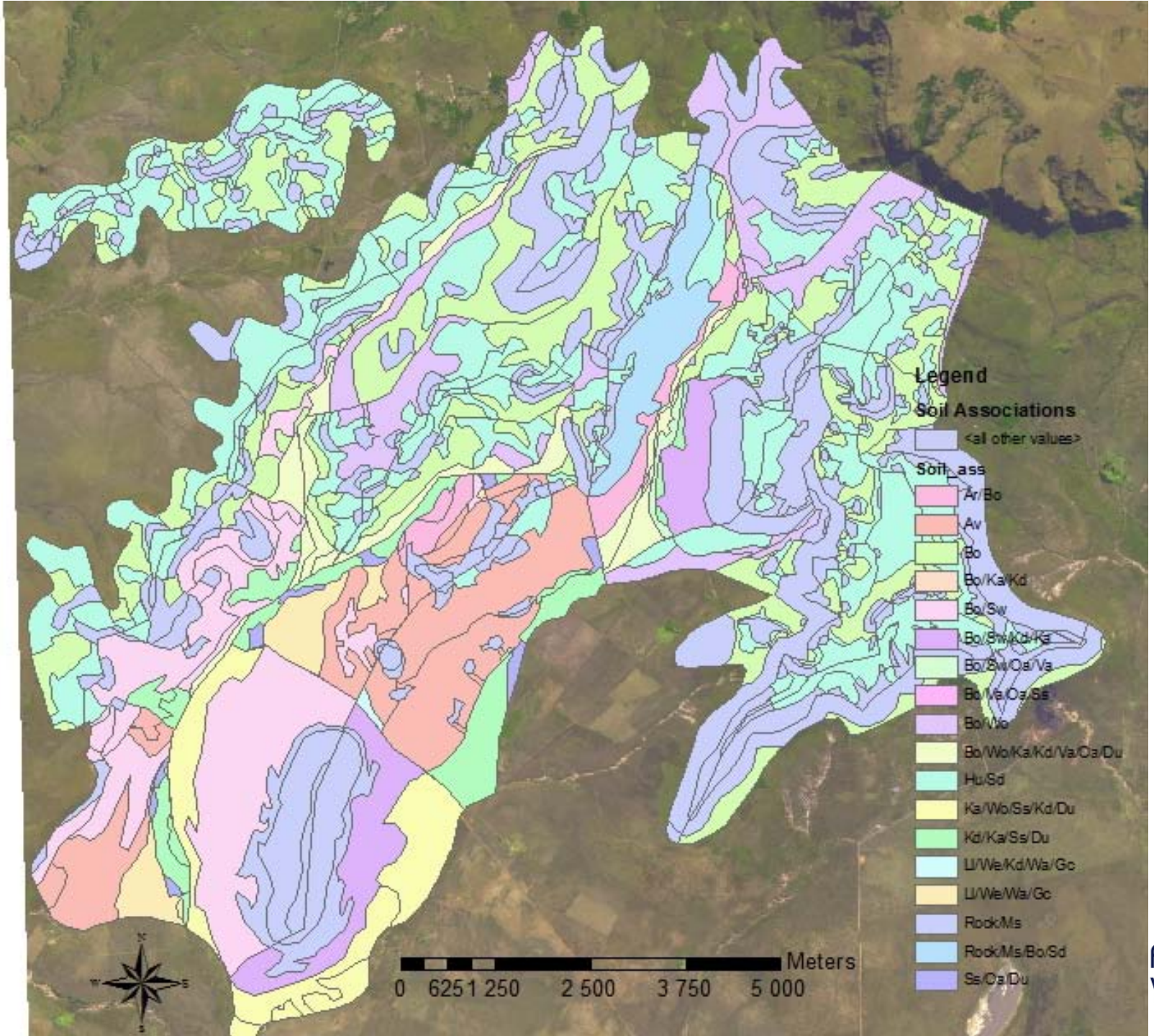
Legend
Soil Associations
<all other values>
Soil_ass
Ar/Bo
Av
Bo
Bo/Ka/Kd
Bo/Sw
Bo/Sw/Kd/Ka
Bo/Sw/Oa/Va
Bo/Va/Oa/Ss
Bo/Wo
Bo/Wo/Ka/Kd/Va/Oa/Du
Hu/Sd
Ka/Wo/Ss/Kd/Du
Kd/Ka/Ss/Du
Ll/We/Kd/Wa/Gc
Ll/We/Wa/Gc
Rock/Ms
Rock/Ms/Bo/Sd
Ss/Oa/Du
Meters
0 625 1 250 2 500 3 750 5 000

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FS
V

Third and Fourth Map

- Drawn after extensive surveying
- Training data
  - Third using 30% of data points
  - Fourth using 60% of data points
- Divided soils into general groups
- Inference system
  - Solim (http://solim.geography.wisc.edu)

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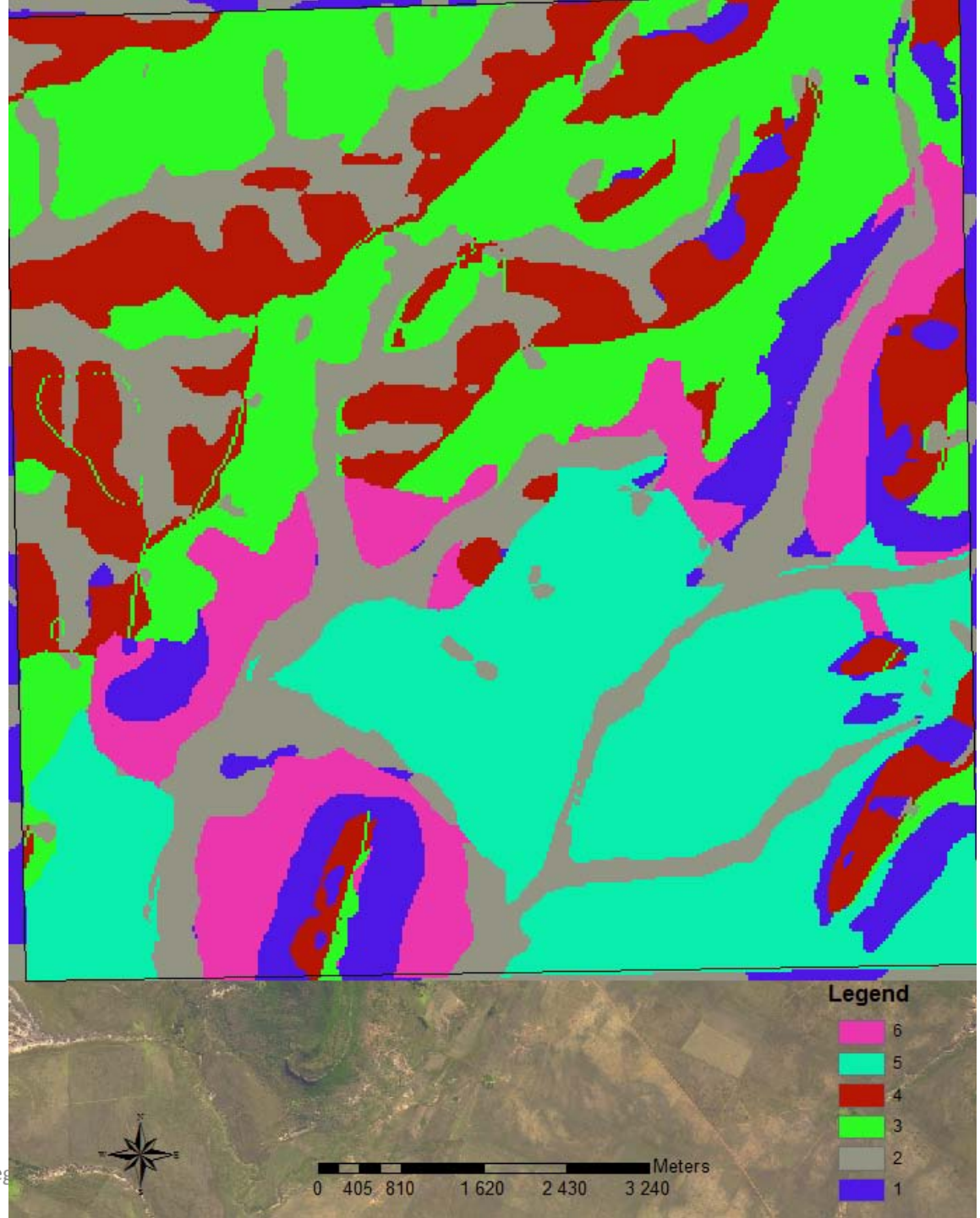

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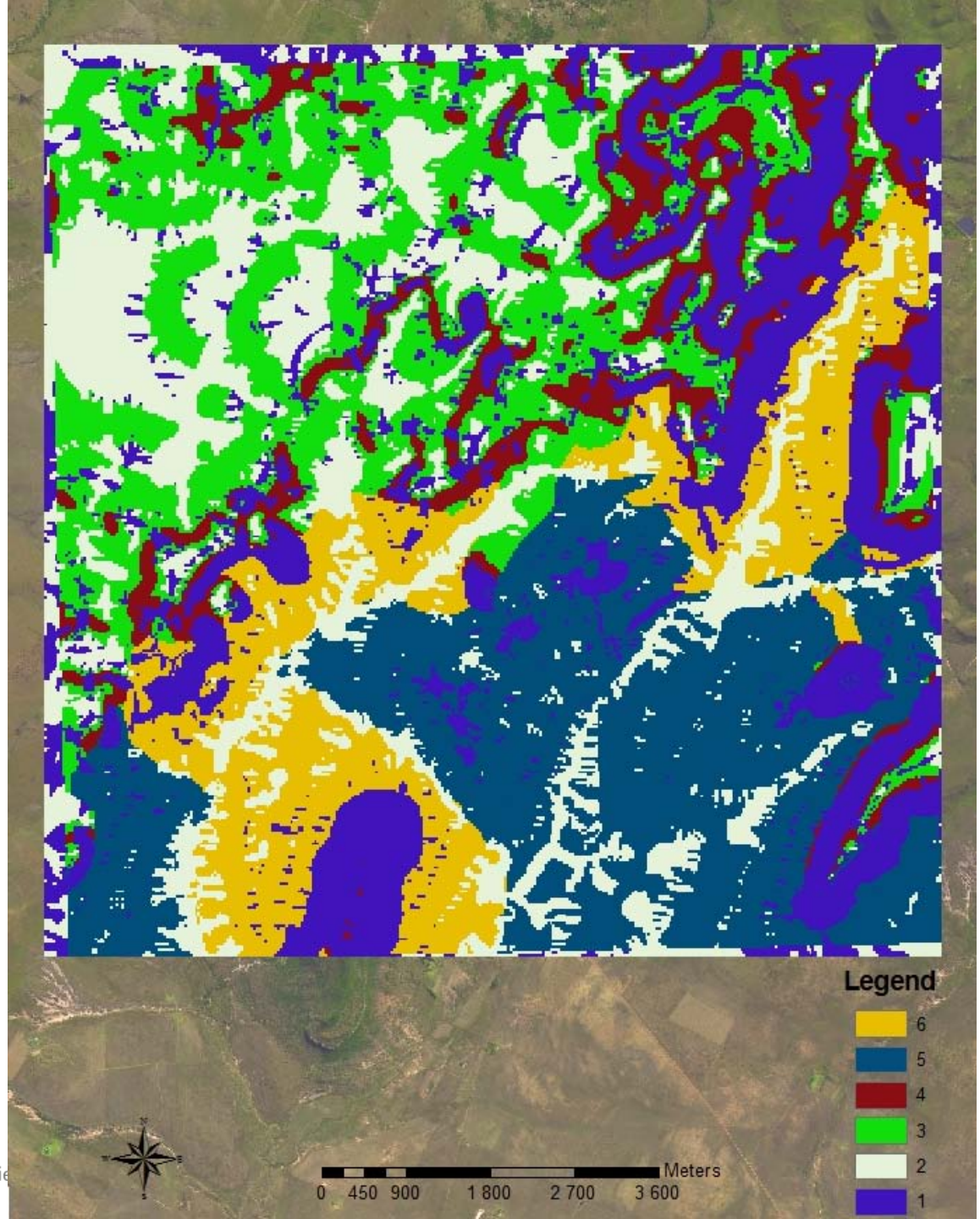
UFS UV



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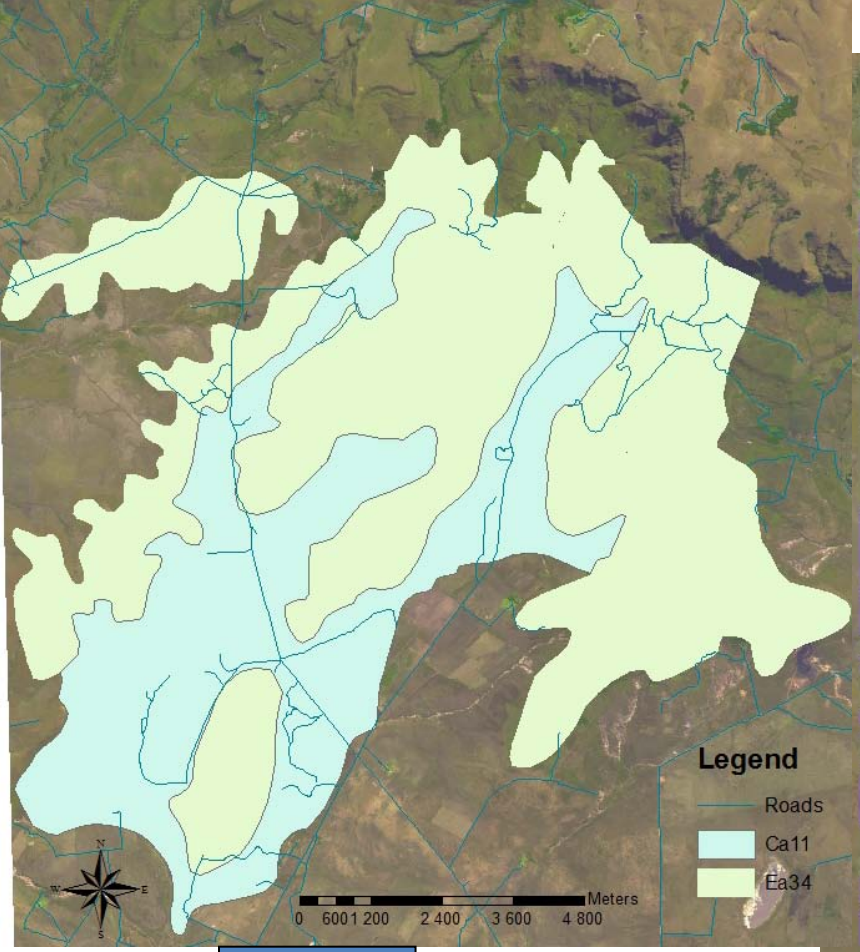
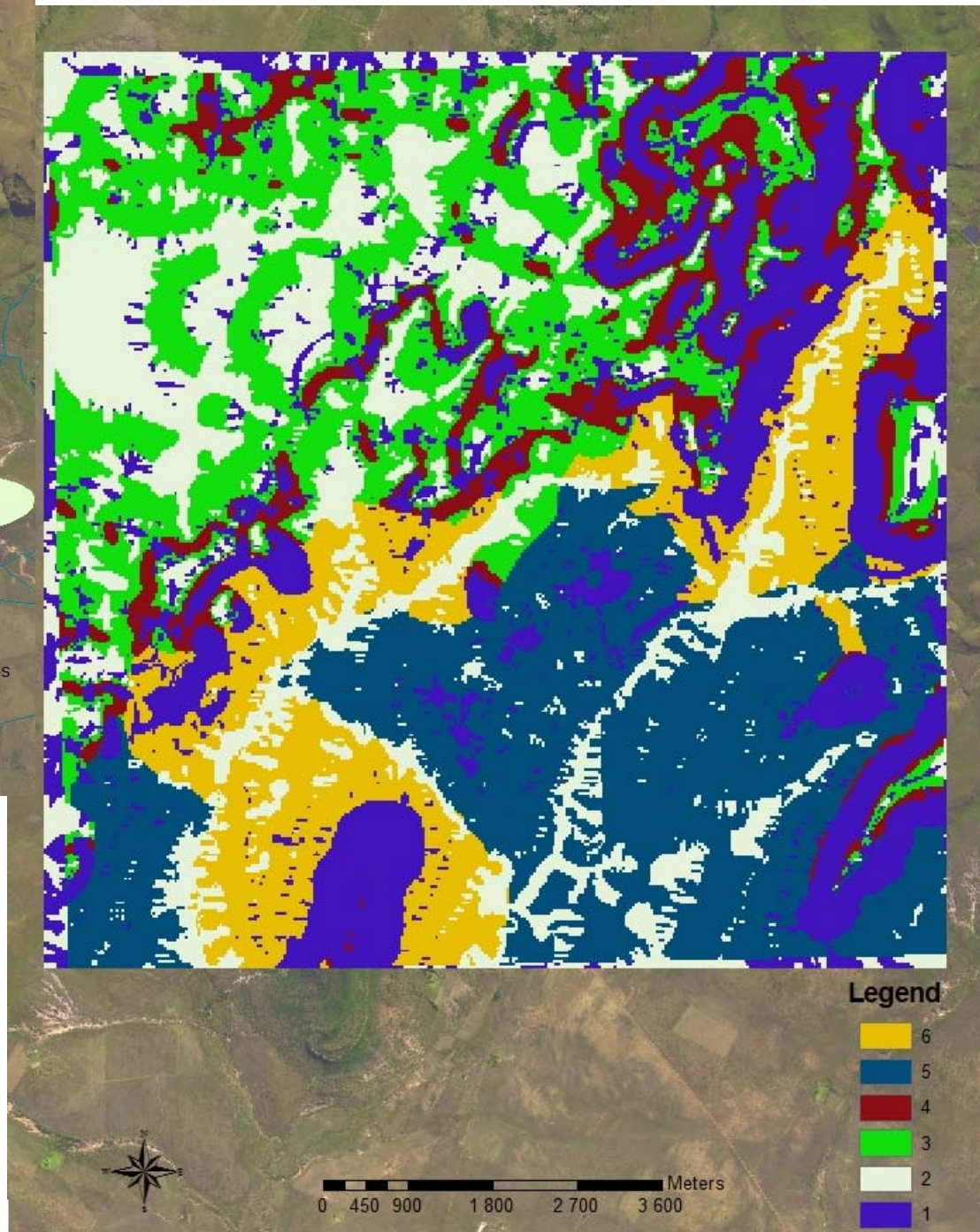
UFS UV





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Results

Map	% Accuracy
1	35
2	36
3	49
4	60

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Conclusions

- DSM can make a difference
- Land types can be disaggregated into generalised soil maps
- Higher input, better map
  - More tacit knowledge
- Field work essential
  - Can be optimised with DSM

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The next step…

- Land type → Soil Property maps
- Different locations
- Optimising use of Software
  - Sampling positions
  - Validation

- User friendly methodology

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  - Academic Cluster 4: University of the Free State

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