



About Accuracy

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June, 5th 2018

Kadaster Netherlands

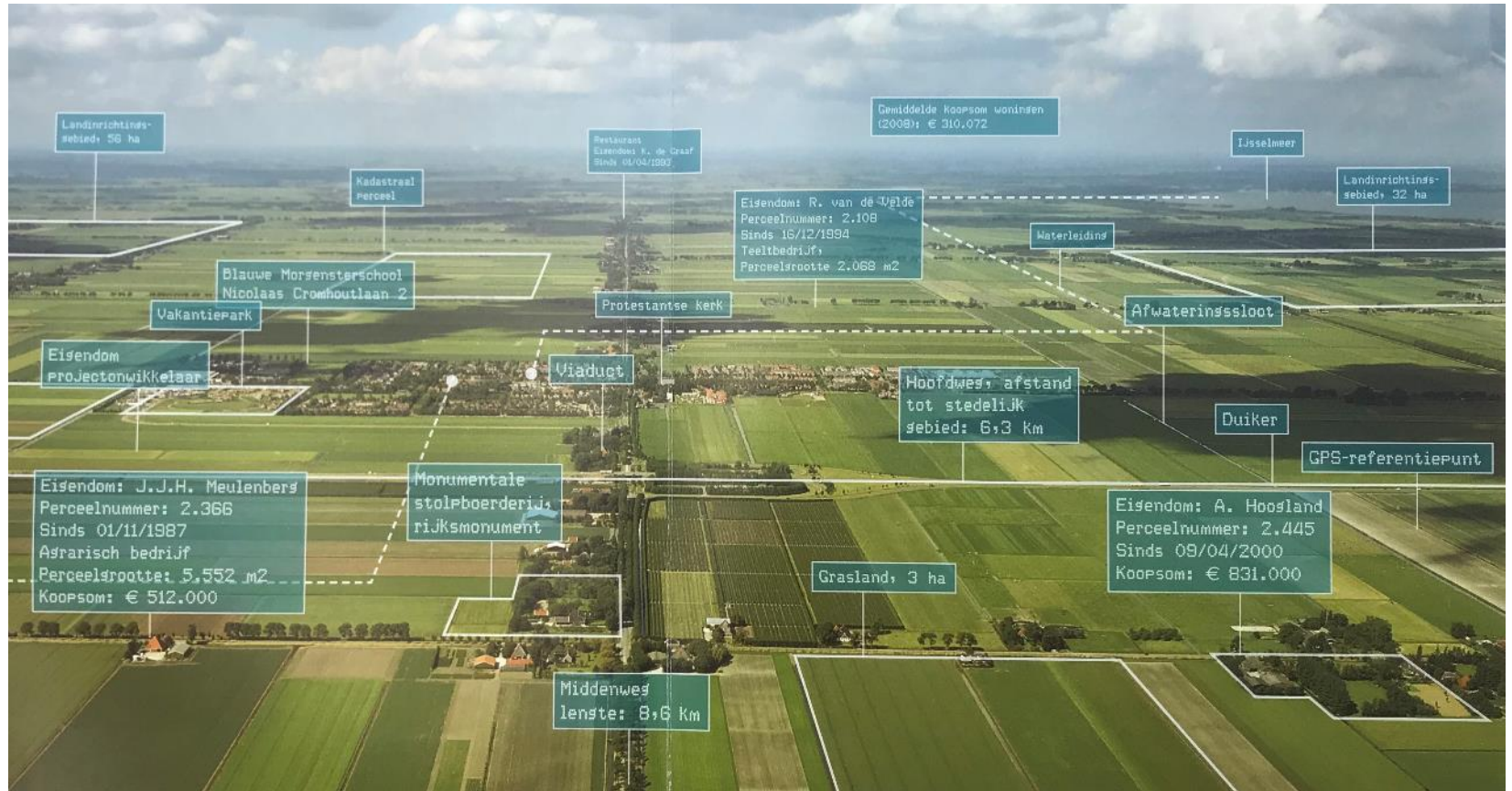
**NetPos
Continuously Operating
Reference Station**



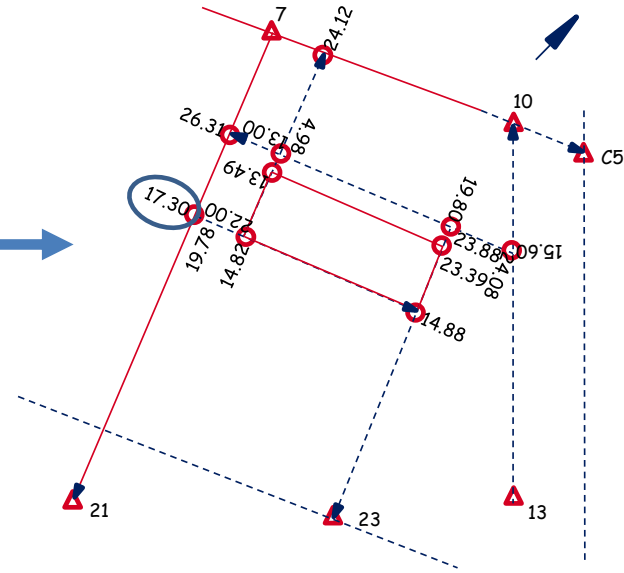
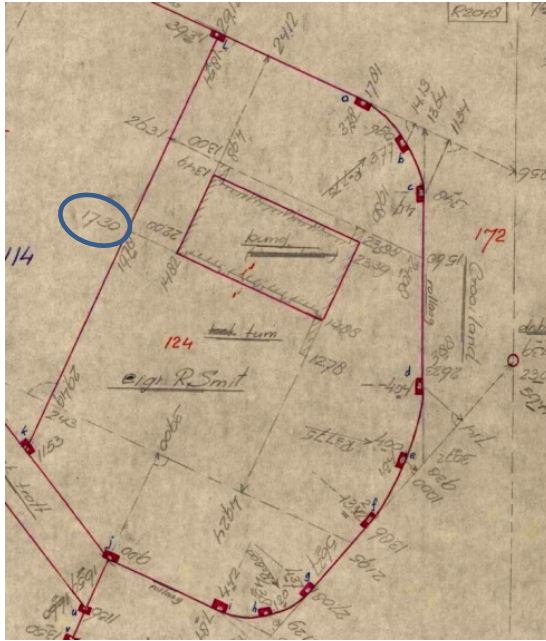
CORS and sub-decimeter precision



Fit for our purpose



Fieldsketch as base for cadastral mapping



Land administration in the world



Quality Principles

Completeness

Logical Consistency

Topological Consistency

Positional Accuracy

Temporal Accuracy

Thematic Accuracy

ISO 19113 Geographic information -- Quality principles
ISO 19157 Geographic information -- Data quality



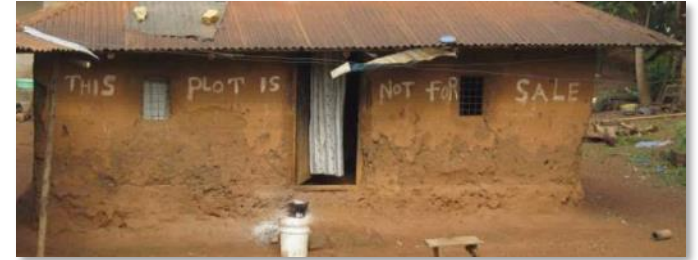
Undocumented Land Rights



Slums



Customary rights



Private property

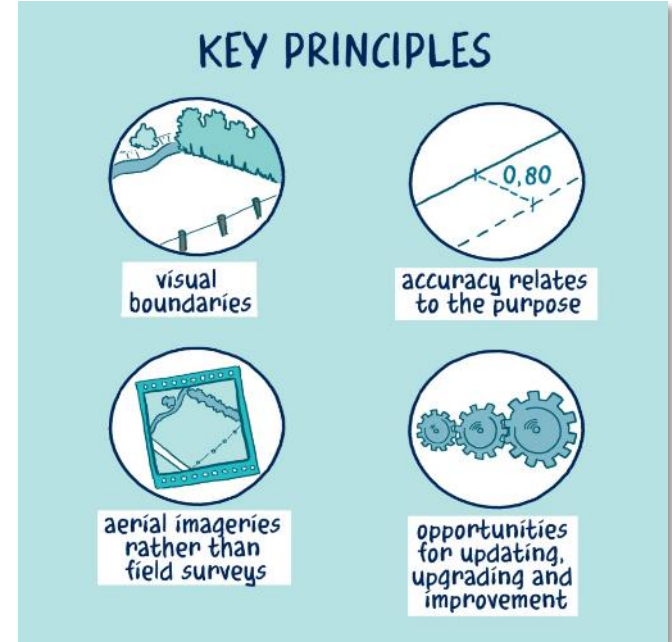
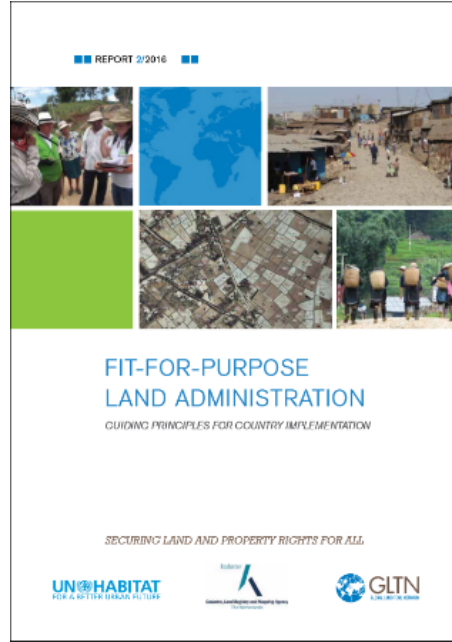
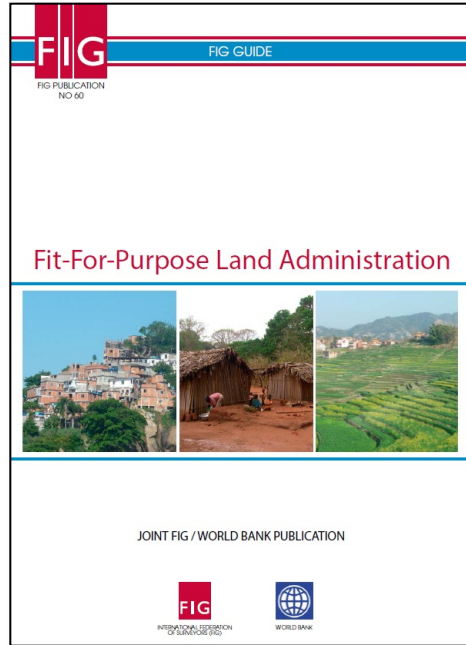


Common lands

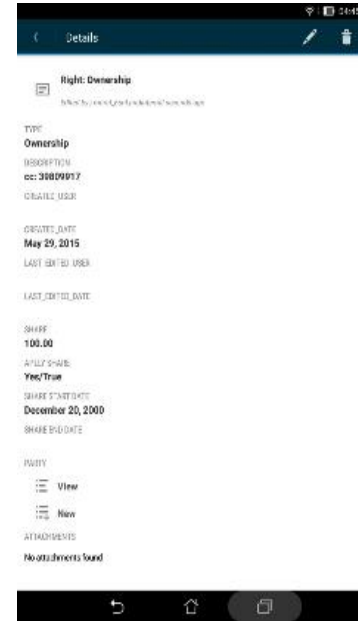
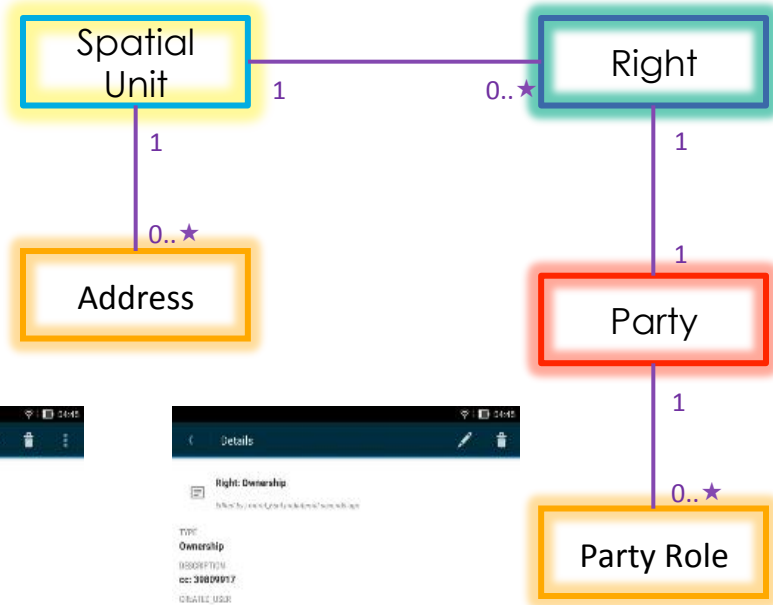


State lands

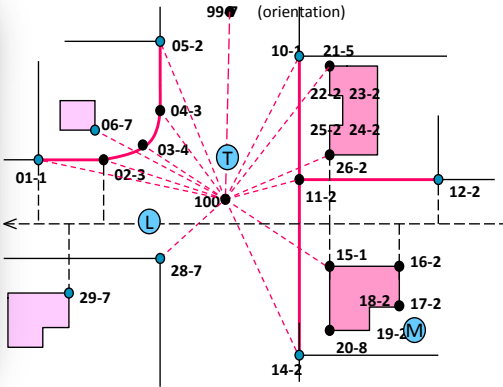
Fit For Purpose Land Administration



Integrated Approach



The need for geo-referencing



Boundaries

Visual boundaries



Fixed boundaries



Even sharply defined
rural parcel boundaries
are at least 0,5 m wide ...





The boundary between private land and public land

- Is it the road side?
- Is it the river side?
- Is it the middle of the river?

These uncertainties are much larger than the uncertainty from even the worst precision measurement

Courtesy: Ernst-Peter Oosterbroek
Kadaster



The boundary between private land and public land

- Straight?
- Is it recognised as public land?

Process – Initial Data Acquisition

- Fast – light equipment: Mobile, GPS Antenna and Cloud Service
- Reliable – collect attributes once: minimise number of attributes
- Cheap – grassroot (local) surveyors: boys and girls from the village
- Transparent – check with community: online and public inspection

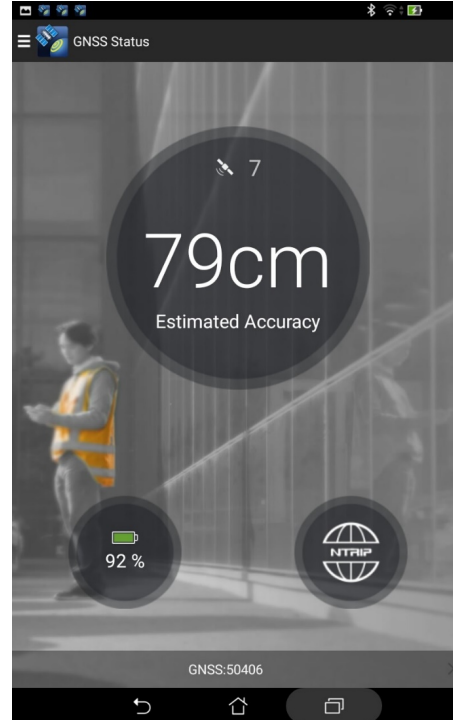


Identification of Landobject



Accuracy

- Value of the land
- Accuracy of the boundary
- Accuracy of the measurement
- Accuracy of the mapping process



Topology

- Evidence from the field
- Based on polygons collected in the field by the rightholders themselves
- Disputes
- Agreement



Identification of Person



Results – Shown Immediately after Acquisition




Results in the Cloud


HOME ▾ LADM_Colombia_v3-Tenjo NEW MAP Mathilde ▾

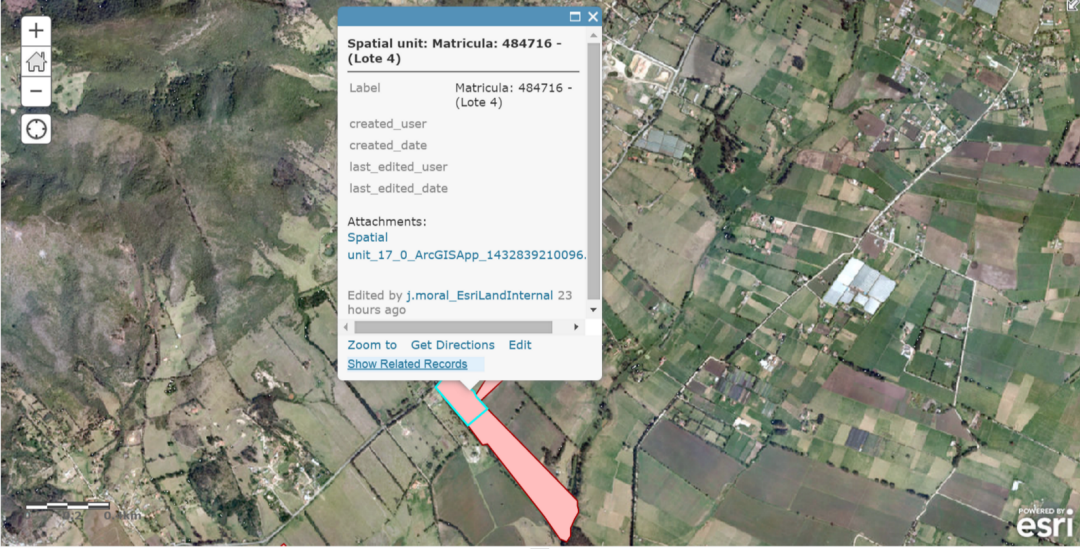
Details Add Edit Basemap Save Share Print Directions Measure Bookmarks Find address or place 🔍

About Content Legend

Legend

Spatial unit 

Spatial source 



Spatial unit: Matricula: 484716 - (Lote 4)

Label Matricula: 484716 - (Lote 4)

created_user
created_date
last_edited_user
last_edited_date

Attachments:
Spatial
unit_17_0_ArcGISApp_1432839210096.

Edited by J.moral_EsriLandInternal 23 hours ago

[Zoom to](#) [Get Directions](#) [Edit](#)
[Show Related Records](#)

Right (2 features)										Table Options ▾
Type	Description	created_user	created_date	last_edited_user	last_edited_date	Share	Apply share	Share start date	Share end date	
Ownership	cc: 2929545		May 29, 2015			50.00	Yes/True	December 20, 2000		
Ownership	cc: 24287907		May 29, 2015			50.00	Yes/True	November 20, 2000		

Esri.com ArcGIS Marketplace Help Terms of Use

Results – Integrated Spatial - Administrative Data

DEPARTAMENTO DEL META
MUNICIPIO DE VISTA HERMOSA
VEREDA TERMALES

Nombre o identificación del Predio: LAS CAMELIAS



Área (aproximada): 28 ha



Pag. 2/4

DEPARTAMENTO DEL META
MUNICIPIO DE VISTA HERMOSA
VEREDA TERMALES

Nombre o identificación del predio: LAS CAMELIAS

Identificación de los propietarios / poseedores

Número Identificación Nombre Completo

C. C. 17290430	SERGIO ANTONIO GUERRERO
C. C. 40275828	LUZ ENIA VALENCIA OSPINA

Fotos de los documentos y los propietarios / poseedores



Pag. 3/4

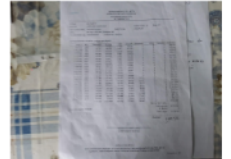
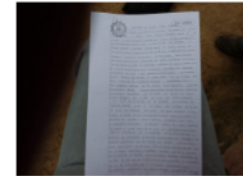
DEPARTAMENTO DEL META
MUNICIPIO DE VISTA HERMOSA
VEREDA TERMALES

Nombre o identificación del predio: LAS CAMELIAS

Documentos que asocian el terreno con los propietarios / poseedores

Tipo de documento:

Propiedad

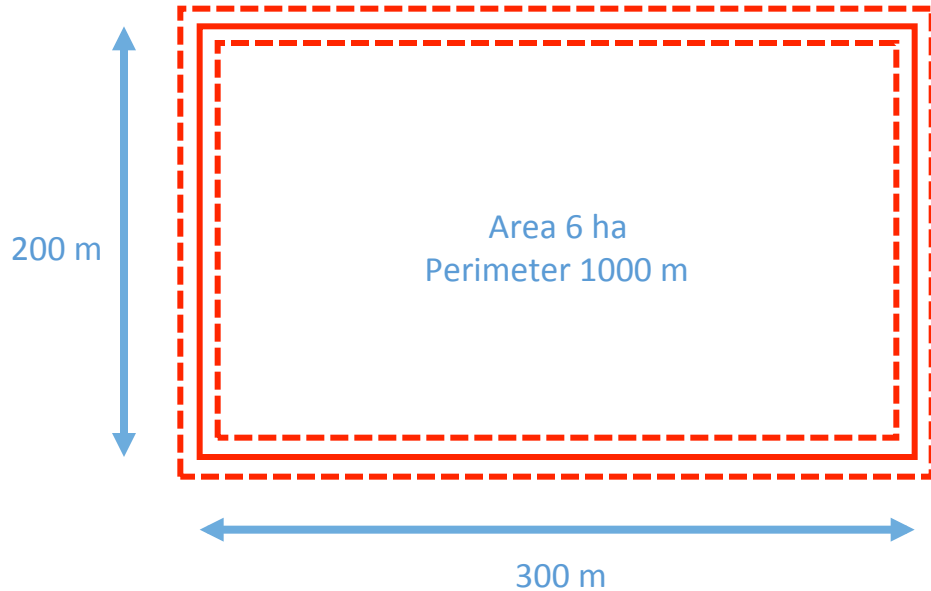


Pag. 4/4

Paper based is possible and proven



Natural boundaries and effect on parcel area



If margin from measuring and identification = 2 m
then margin area = $2000 \text{ m}^2 = 0,2 \text{ ha}$

If margin from measuring and identification = 0,5 m
then margin area = $500 \text{ m}^2 = 0,05 \text{ ha}$

This is about the ultimate precision that can be reached
in rural area, only through expensive measuring methods

So, it's useless to express areas of rural parcels in dm^2

DECLARAÇÃO DE AQUISIÇÃO DE DIREITO DE USO E APROVEITAMENTO DE TERRA POR OCUPAÇÃO

(B) TITULARES

NOME	GENERO	DATA NASC	TIPO IDENTIFICAÇÃO	# IDENTIFICAÇÃO	DATA EMISSÃO
Luis Muneia Cororo	Masculino	02-02-1979	Cartão de Eleitor	9755489	23-03-2014

(C) DATA DELIMITAÇÃO

11-04-2017

(D) TESTEMUNHAS

Martinho Alves Intarima

Carlitos Paulo Paulo

(E) DATA EDITAL

15-08-2017

(F) PRAZO EDITAL

30 Dias

Assinatura e Data

04-05-2018

Januário Juia Musso
ReguloBernardo Cuaria Mphola
Presidente da Associação
Ohau Omale

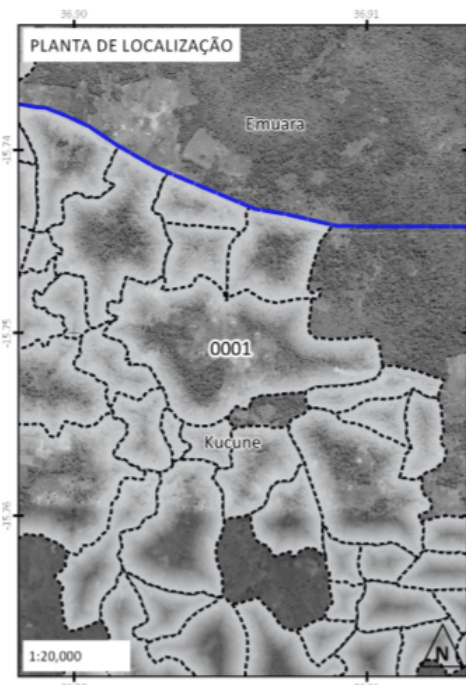
(G) Parcela # AS040001-13-0001

Distrito de NAMARROI

Posto de NAMARROI

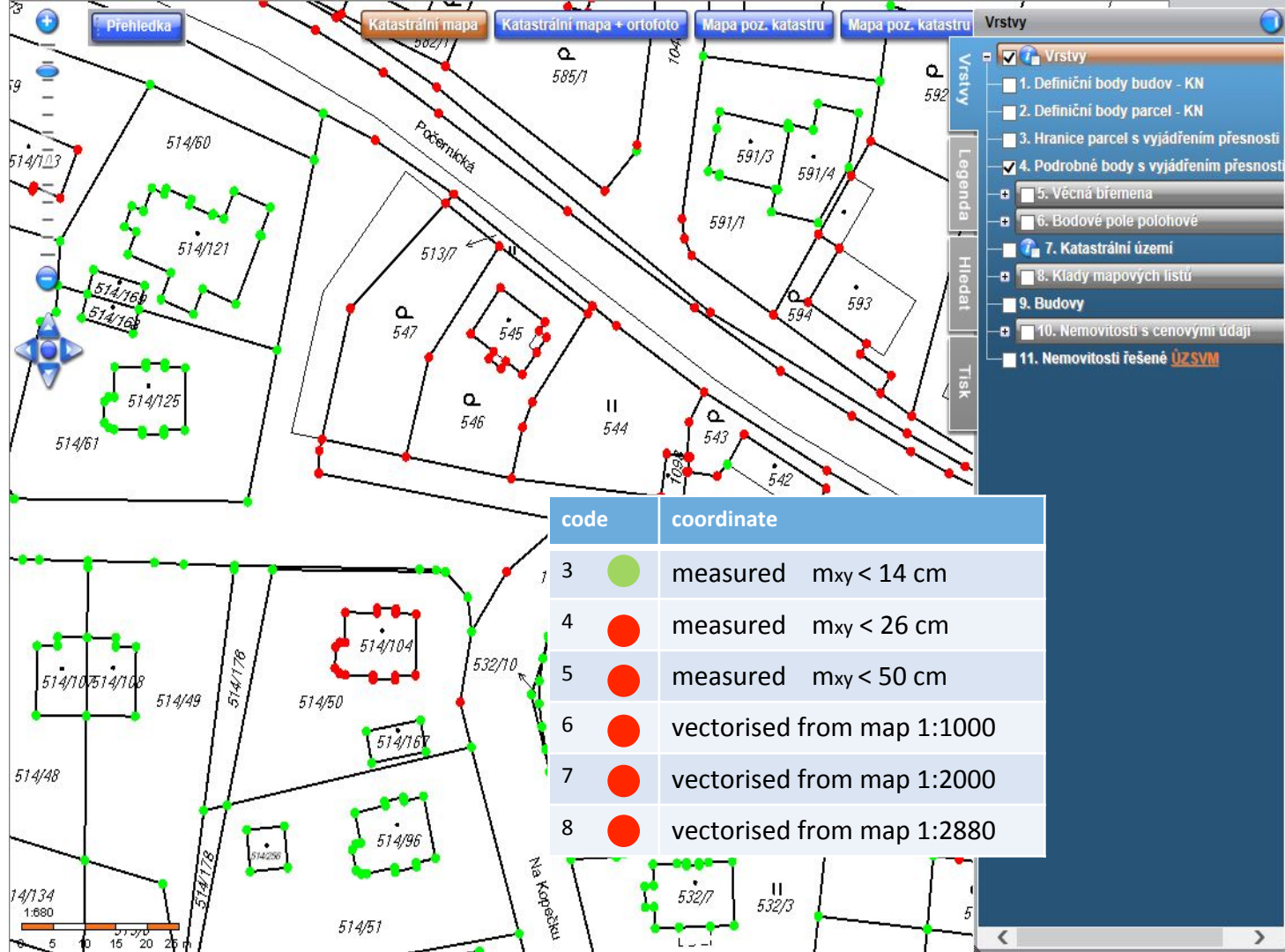
Bloco Cadastral de KUCUNE

Área aproximada 48 Hectares





Courtesy:
Libor Tomandl
Czech Office for
Surveying, Mapping
and Cadastre



Position Technology and Accuracies

	Mobile Phone	Handheld GPS Simple	Handheld Advanced	Handheld Sophisticated	Precision Survey
Example	Android, iPhone, iPad	Garmin Glo, Bad Elf GPS Pro, Cedar Tree CT4, CT7	Bad Elf Surveyor, Eos Arrow Lite, DT Research 307	Trimble R1, R2, SX Blue ii, EOS Arrow 100, CHC X20i, Geo 7X	Trimble R8, R10, SX Blue iii, EOS Arrow 200, CHC X20i w/RTK Spatial
Approximate Cost	USD 200 - 400	USD 100 - 250	USD 600	USD 1000 - 3000	USD 5000+
Horizontal Absolute Position Accuracy	± 5 Metres	± 2-3 Metres	±1 Metre	±Sub-metre	± Centimeter

Adapted from: WorldBank Group: The State of Play for Land Administration, February 2018

...Emlid Reach RS+ USD 799: Base and Rover

For survey and navigation
with centimeter accuracy

Point collection Point stakeout Machinery guidance **Base station** Network rover



Stream corrections

Use Reach RS to set up your own base station. Stream corrections over the network via NTRIP/ICP or LoRa radio. Record base logs for post-processing.

Correction and log formats

RTCM3, RINEX.

For survey and navigation
with centimeter accuracy

Point collection Point stakeout Machinery guidance Base station Network rover



Collect points

With Reach RS you can create survey projects to manage data collection. When working in the field each point is assigned a custom name and offset. Results can be downloaded from the project list.

Exporting formats

DXF, CSV, GeoJSON and ESRI Shapefile.

Boundaries still inaccurate

Accuracy

- It is time to stop thinking of parcel corner accuracy in terms of centimeter accuracy
- It is impossible to calculate any parcel area with 100% precision



Jack McKenna

Director, Business Development in Africa and the Caribbean, Trimble Land, Administration Solutions

Compare

Alternative 1

- 100 years
- High Costs
- Technology driven
- By Government
- Rigid

Alternative 2

- 10 years
- Low Costs
- Demand driven
- By Citizens
- Transparent

Time



Money



Quality



Conclusions

- Land rights for all
- Fit for Purpose Land Administration
- Need for innovation in geo-referencing



70% Undocumented - State of play

	Total	SSA	ECA	LAC	MNA	OECD	SAS	EAP
Private plots in city registered	0.22	0.04	0.32	0.03	0.14	0.68	0.25	0.24
Private plots in city mapped	0.46	0.13	0.60	0.31	0.48	0.97	0.25	0.52
Private plots in country registered	0.22	0.04	0.32	0.03	0.14	0.68	0.13	0.24
Private plots in country mapped	0.24	0.02	0.40	0.03	0.14	0.71	0.13	0.28
No. of countries	189	47	25	32	21	31	8	25

Source: K. Deininger – World Bank (2017)

SSA – Sub-Sahara Africa

ECA – Europe and Central Asia

LAC – Latin America and the Caribbean

MNA – Middle East and North-Africa

SAS – South Asia

EAP – East Asia and the Pacific