

Sen2Agri Workshop

Crop Type Identification in South Africa

Fanie Ferreira
2017-05-12



GEOTERRA
IMAGE

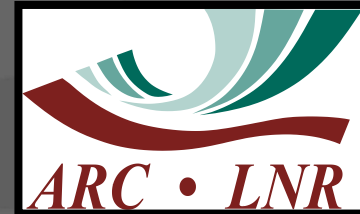
Unleashing the power of imagery, improving your business intelligence

Content

- Introduction
- CropType: Current Approach
- Comparison with Sen2Agri
- Future
- Benefits of the Sen2Agri

DAFF: Crop Estimates Committee (CEC)

- National Crop Statistics Consortium (NCSC)
- Agricultural Research Council
 - Institute Soil Climate & Water:
 - Agro-meteorology / Climatic conditions
 - Summer Grain Institute: objective yield – maize
 - Field measurements:
 - Small Grain Institute: objective yield – wheat
 - Field measurements
- SiQ
 - PICES aerial surveys & interviews
 - Statistical processing
- GeoTerraImage
 - Satellite image processing
 - Crop type classifications



Field Boundaries

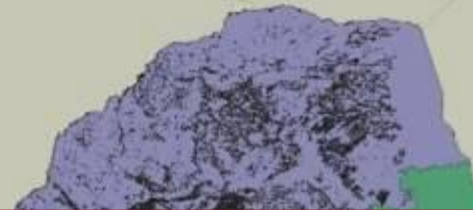
Stratification for PICES Surveys & CropTypes

- Centre Pivot Irrigation
- Irrigation (Non Pivot)
- Orchards: Fruit, Vineyards, Tea, Pineapples
- Strip Fields: Rooibos in Western Cape
- Groups of Small Scale / Subsistence Fields



SA coverage: 14 million ha

Digitised Field Crop Boundaries



		Area of Cultivated Fields per Province (Hectare) excl Sugar Cane				
Province	Province SqKm	Total FB	Dryland	Pivot	Orchards	Subsistence
Eastern Cape	168 948	1 619 559	512 649	22 627	3 951	1 080 332
Free State	129 771	3 813 118	3 635 161	147 270	1 853	28 834
Gauteng	18 170	376 690	349 003	22 194	2 354	3 139
KwaZulu-Natal	94 417	930 505	311 460	55 392	26 076	537 577
Limpopo	125 873	1 410 226	578 253	141 324	72 489	618 160
Mpumalanga	76 588	1 340 167	1 161 398	44 048	42 103	92 617
Northern Cape	372 950	266 390	169 347	86 220	7 178	3 645
North West	104 898	2 230 766	1 886 160	76 621	4 452	263 532
Western Cape	129 441	2 027 565	1 725 131	64 848	235 586	2 000
Total	1 221 056	14 014 985	10 328 562	660 544	396 044	2 629 835



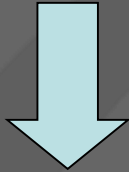
Mapped Fields



Use of satellite imagery

Range of sensors

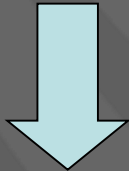
SPOT 5 / SPOT 6 & 7



Previous seasons
2006/7/8/9/10/11/12/13/14/15/?



Stratification: Update of Field
crop boundaries

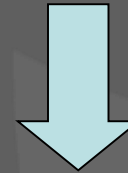


PICES Survey @ provincial level
to determine cropped area

LANDSAT 8 & Sentinel 2A / (2B)



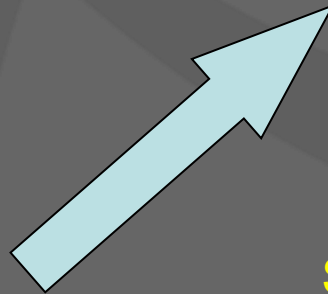
Winter 2016 / Summer 2017



Satellite image calibration to
identify crop types




Satellite image classification to
generate crop types



Crop Calendar

GeoTerraImage Crop Calendar© : Summer & Winter Grain Growth Stages

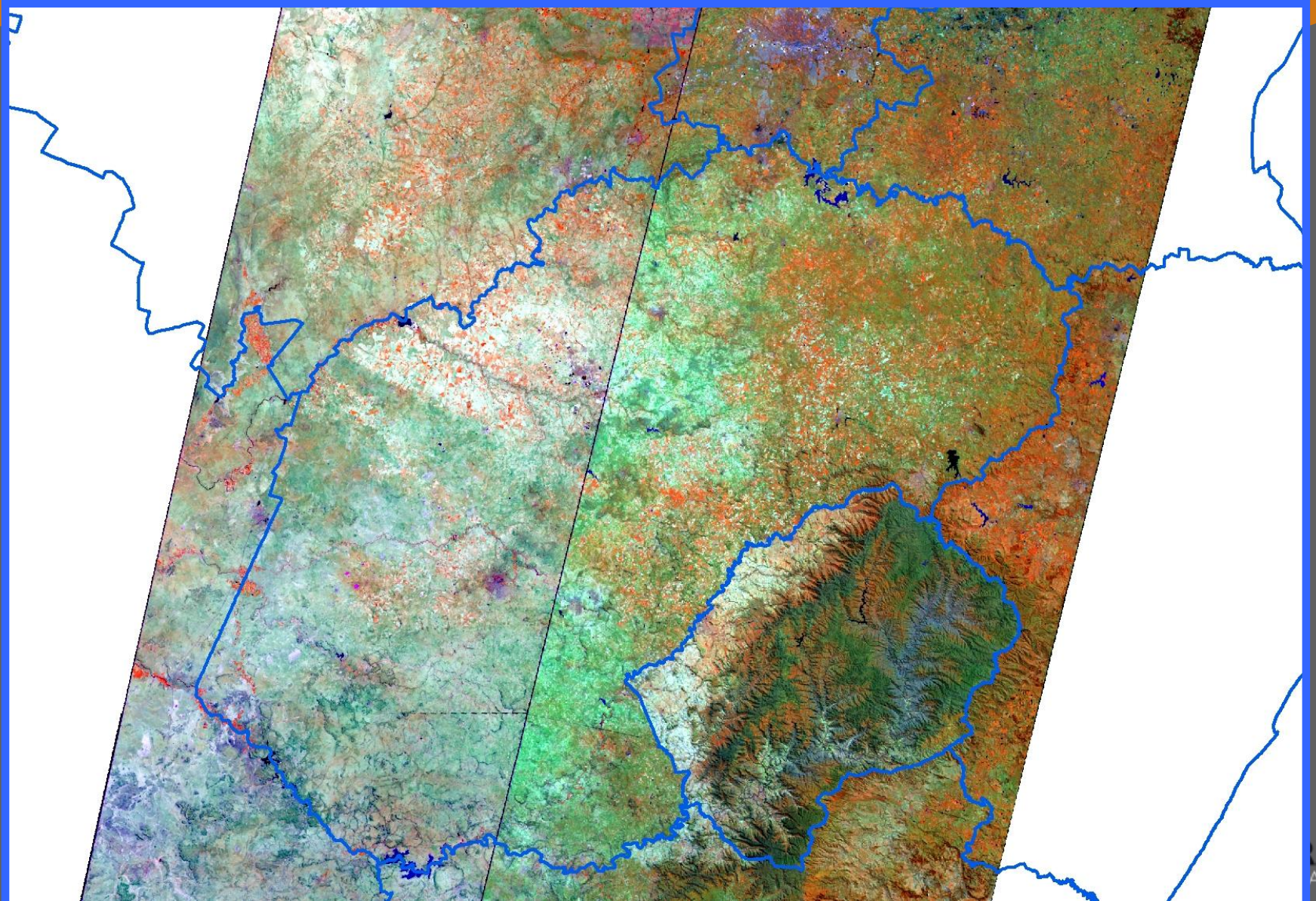
Crops	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Maize: (approx 4 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Fallow
Sunflower: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Fallow	Fallow
SoyaBeans: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Fallow	Fallow
Groundnuts: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Fallow	Fallow
Pasture (Natural Grass Summer)	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Growth	Growth	Growth	Growth	Growth	Senescence	Senescence	Fallow
Wheat	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Fallow
GeoTerraImage Legend			Re-Growth	Growth	Dry Matter	Senescence	Fallow					

Sentinel 2 Preparation

- Download for RSA Coverage
 - Amazon Cloud
 - Recording every 10 days
 - Annual size: 50 TerraByte
- Output: 3 Products
 - 4 Band Image @ 10m
 - 6 Band Image @ 20m
 - Landsat 8 equivalent: 10 Band Image @ 20m
 - Derive crop specific information



Satellites: Landsat8 vs Sentinel2



Crop Type Identification

- Results & Output
 - Provincial Crop Type
 - District Summaries for Each Crop Type
 - Track Farm Management & Crop Rotation Practices



Irrigation & Double Cropping

Wheat – Maize / Wheat - Soya

Jul 2010

Aug 2010

Oct 2010

Nov 2010

Double Cropping Area (Ha): Winter2013 - Summer 2014

Province	NorthWest	FreeState	Mpumalanga
WheatMaize	10,371	25,060	3,462
WheatSoya	14,093	1,939	2,712

Dec 2010

Double Cropping Area (Ha): Winter2014 - Summer 2015

Province	NorthWest	FreeState	Mpumalanga
WheatMaize		21,153	2,132
WheatSoya		8,446	3,099

Apr 2011

District Level Summary

Crop Type Area (Ha)

North West District CropType Breakdown Winter 2012 / Summer 2013: Area Planted (Hectares)

District	Maize	Pasture	SoyaBeans	Sunflower	Wheat	WheatMaize	WheatSoya	Fallow	Lucern	Total
BAFOKENG	1 679	1 102	0	0	0	0	0	0	0	2 781
BLOEMHOF	2 503	21 052	63	1 977	46	281	44	1 265	7	27 238
BRITS	14 174	13 428	2 808	2 142	263	3 621	2 502	14	145	39 097
CHRISTIANA	3 170	17 654	0	881	0	1 103	114	419	3	23 345
COLOGNY	52 883	20 305	632	4 161	0	113	144	479	0	78 718
DELAREYVILLE	86 292	71 185	616	43 734	0	581	73	7 065	0	209 546
DITSOBOTLA	20 912	20 987	4	8 144	0	0	0	4 098	0	54 145
GANYESA	80	284	0	0	0	0	0	911	0	1 275
KLERKSDORP	34 766	47 467	727	4 580	84	287	336	112	8	88 368
KOSTER	50 253	35 895	195	854	0	334	98	68	47	87 744
KUDUMANE	0	901	0	0	0	0	0	0	0	901
LEHURUTSHE	0	637	0	0	38	0	0	0	201	876
LICHTENBURG	157 575	74 745	1 577	28 771	267	2 900	922	4 378	75	271 211
MADIKWE	824	1 094	0	0	0	0	0	0	0	1 917
MANKWE	1 643	2 134	9	0	0	0	0	0	0	3 786
MARICO	6 646	44 123	163	227	175	987	285	1 038	236	53 880
MOLOPO	1 359	5 500	0	36	0	0	0	467	0	7 362
MORETELE	41	998	0	0	0	0	0	1 170	0	2 210
POTCHEFSTROOM	17 362	42 230	315	447	0	1 063	258	0	54	61 728
RUSTENBURG	10 502	13 688	121	20	53	96	111	5	35	24 631
SCHWEIZER-RENE	66 740	82 506	124	31 238	0	132	122	6 461	66	187 389
SWARTRUGGENS	2 769	10 813	82	5	0	161	31	58	49	13 969
TAUNG	1 631	662	63	60	1	1 792	119	6	0	4 333
VENTERSDORP	47 008	63 551	483	2 545	0	766	218	484	87	115 141
VRYBURG 1	70 491	284 559	841	47 138	1	816	325	45 533	249	449 954
WOLMARANSSTA	107 061	73 478	398	19 246	2	315	266	6 795	26	207 586
Total	758 363	950 977	9 222	196 207	931	15 350	5 968	80 826	1 287	2 019 130

Comparison

- Components : GeoTerraImage / Sen2Agric
 - Landsat 8 & Sentinel 2 Yes / Yes
 - Calibration/Training: PICES Survey Yes / Yes
 - Classifier: Random Forest Yes / Yes
 - Cropland Mask No / Yes
 - Leaf Area Index No / Yes
 - Crop Calendar Yes / No
 - Double Cropping Yes / No
 - Provincial / Local Crop Region Yes / No



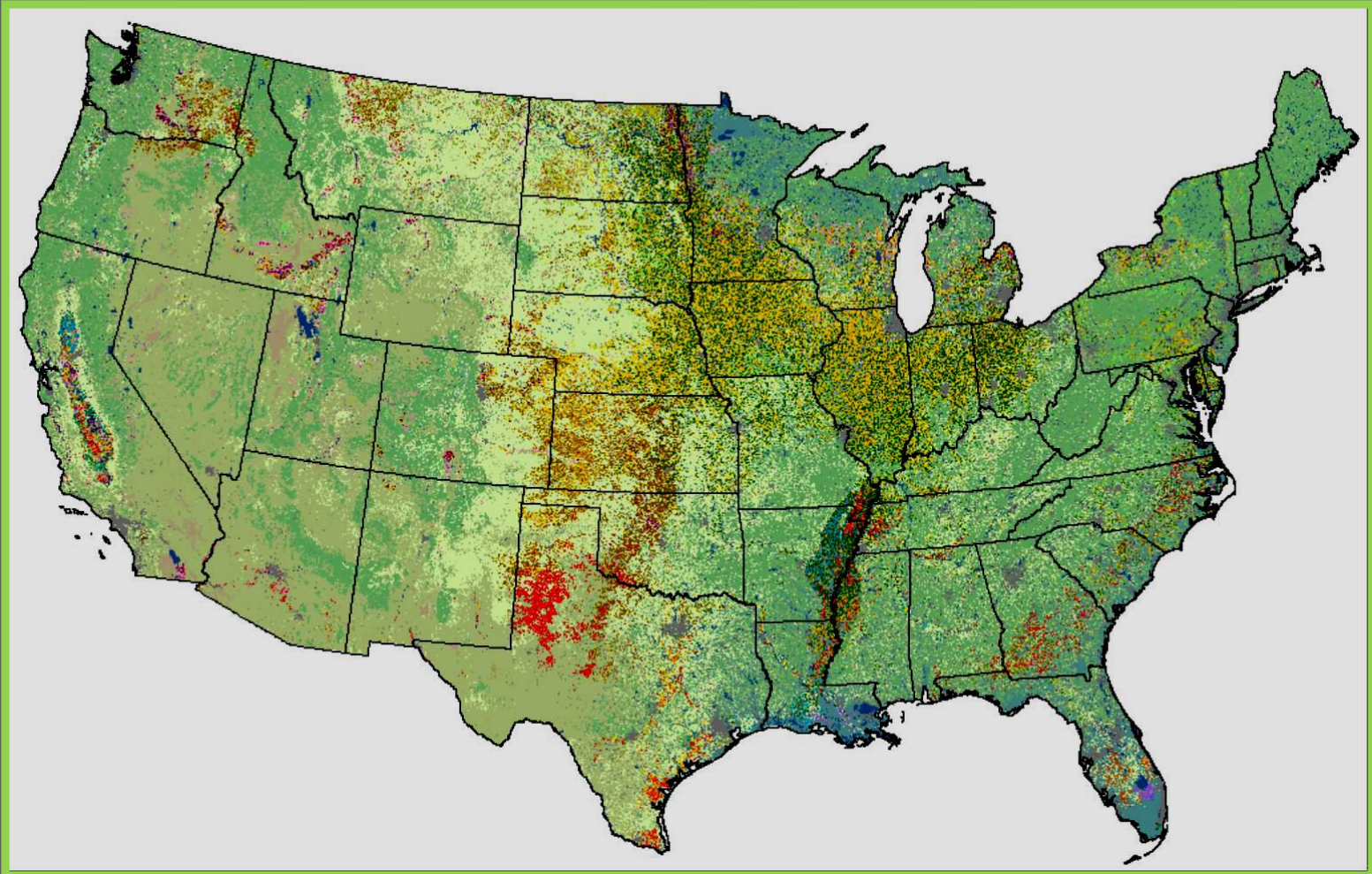
Comparison: F-Score

- Accuracy: GeoTerraImage / Sen2Agri
 - Maize: 85% / 94%
 - Sunflower: 77% / 80%
 - SoyaBeans: 79% / 82%
 - Planted Pasture: 86% / 89%
 - Fallow / Bare: 81% / N/A



Future

- USDA Cropland Data Layer (CDL)



Sen2Agri Benefits

- **Continuous Improvement**
 - Generate crop type inventory for all grain crop fields
 - Cropland mask can support intentions to plant
 - Increase accuracy
 - Earlier delivery
- **South African crop type inventory**
 - Sen2Agri System: improved accuracy
 - Cloud Computing: improved delivery time



Next Steps

- **Continuous Collaboration UCL**
 - Refine classification legend for South Africa
 - Incorporate local crop distribution regions
 - Training on Sen2Agri system
 - Test in neighbouring SADC countries

Conclusion

- **Sen2Agri Opportunity**
 - Further improvement RSA Crop Type
 - South African crop type inventory
 - Faster results
 - Higher accuracy



Thank
you

A stylized globe is centered in the background, rendered in a dark gray color with a grid of latitude and longitude lines. A bright red line curves across the bottom of the image, starting from the left and ending on the right, positioned below the text.