

RSA Crop Estimate System

Earth Observation Technology

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GEOTERRA
IMAGE

Unleashing the power of imagery, improving your business intelligence

Content

- Why Crop Estimates is Important
- Satellite Technology
- Stratification: RSA Field Boundaries
- Irrigation & Double Cropping
- Harvest Progress
- Crop Type Statistics
- Conclusion



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



Why Crop Estimates

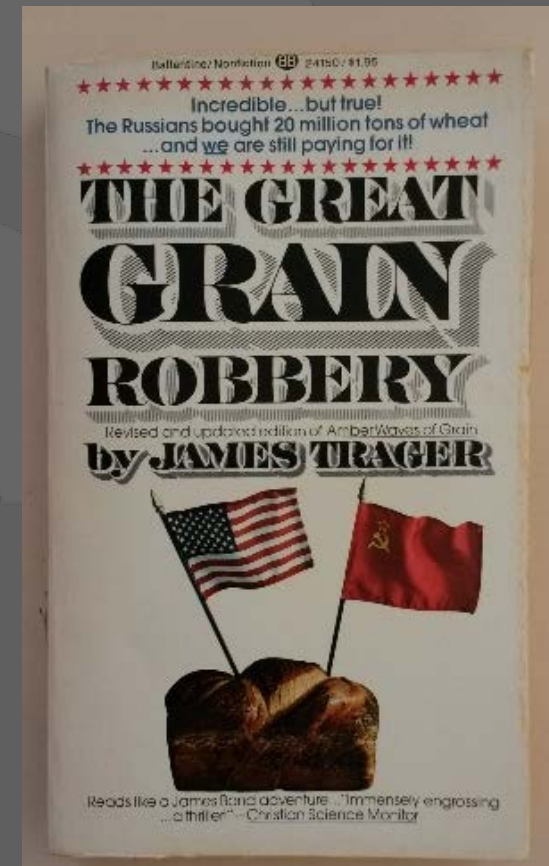
Accurate information reduce price volatility

- **Income Transfer Ratio**

- Maize trading on SAFEX
 - Year 2000 approx 20 x
 - Currently between 10 -15 x
- Article by Jannie de Villiers & Andre Jooste
- Uncertainty results in price volatility
- Millers buy more to reduce risk

- **Great Grain Robbery: Wheat**

- USSR purchased large quantities
- During Cold War
- Russia had wheat crop failure
- Transaction on 4 th July 1972
- Book published 12 Jan 1975



Satellite Technology

Types of Satellites

- **Navigation**

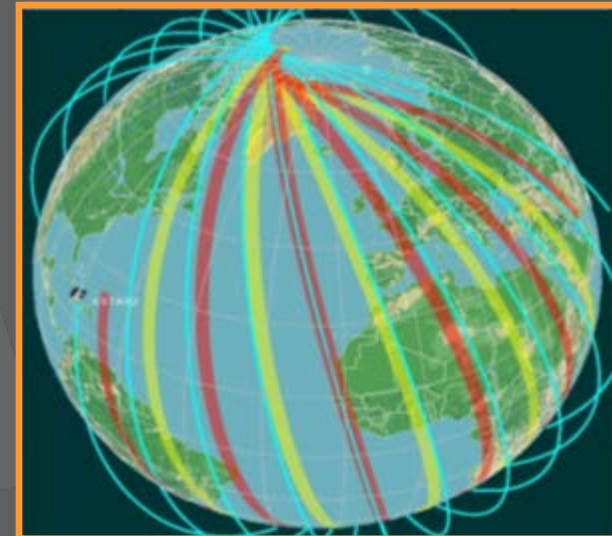
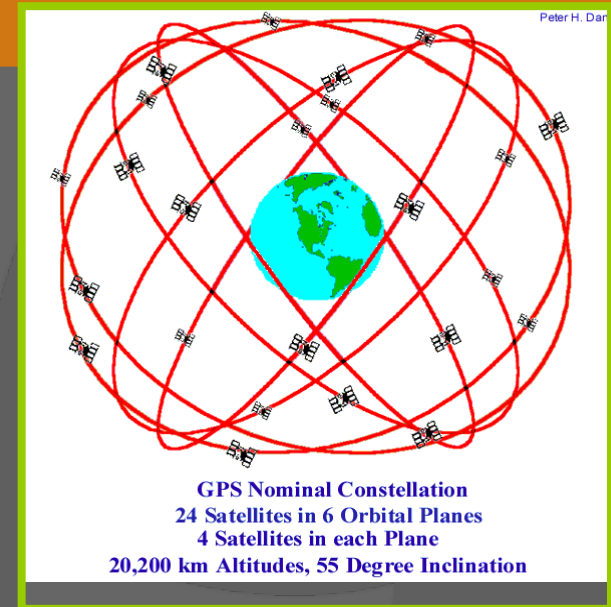
- Precision Farming & Vehicle Tracking
- 6 Orbital planes
- Live feed

- **Communication**

- Dstv links
- Geostationary & fixed dish
- Live feed

- **Earth Observation**

- Satellite images
- Sun-synchronous orbits
- Scheduled recordings
- Downloaded: recording stations



Satellite Technology

Recording Sun Reflectance

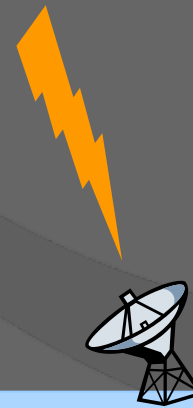
Satellite sensor measures canopy reflectance



Canopy absorbs & reflects light



Reflectance intensity based on different types of vegetation



Ground Receiving Station



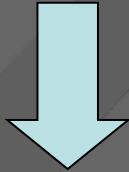
Processing and preparation for field boundaries and crop type analysis



Use of satellite imagery

Range of sensors

SPOT5 / SPOT6 & 7



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

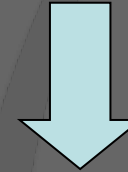


Stratification: Update of Field
crop boundaries



PICES Survey @ provincial level
to determine cropped area

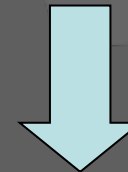
LANDSAT 7/8 & Sentinel 2A



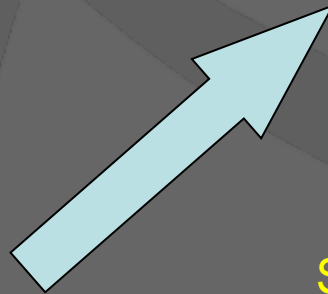
Winter 2015 / Summer 2016



Satellite image calibration to
identify crop types



Satellite image analysis @ field
level to identify crop types



Field Boundaries

Stratification for Crop Estimates Surveys

- Reduce area for PICES survey by almost two thirds
- Sub-stratification
 - Centre Pivot Irrigation
 - Orchards: Fruit, Coffee, Tea, Pineapples
 - Strip Fields: Rooibos in Western Cape
 - Groups of Small Scale / Subsistence Fields
 - New stratum: Irrigation (Non Pivot)
 - Irrigation schemes: Eg Vaalharts, Oranje-Riet & Crocodile
 - Along rivers : Eg Flood irrigation of Lucern in Eastern Cape
 - WRC Project: Collaboration with Univ Stellenbosch

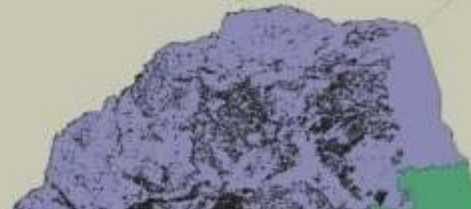


Mapped Fields



SA coverage: 14 million ha

Digitised Field Crop Boundaries

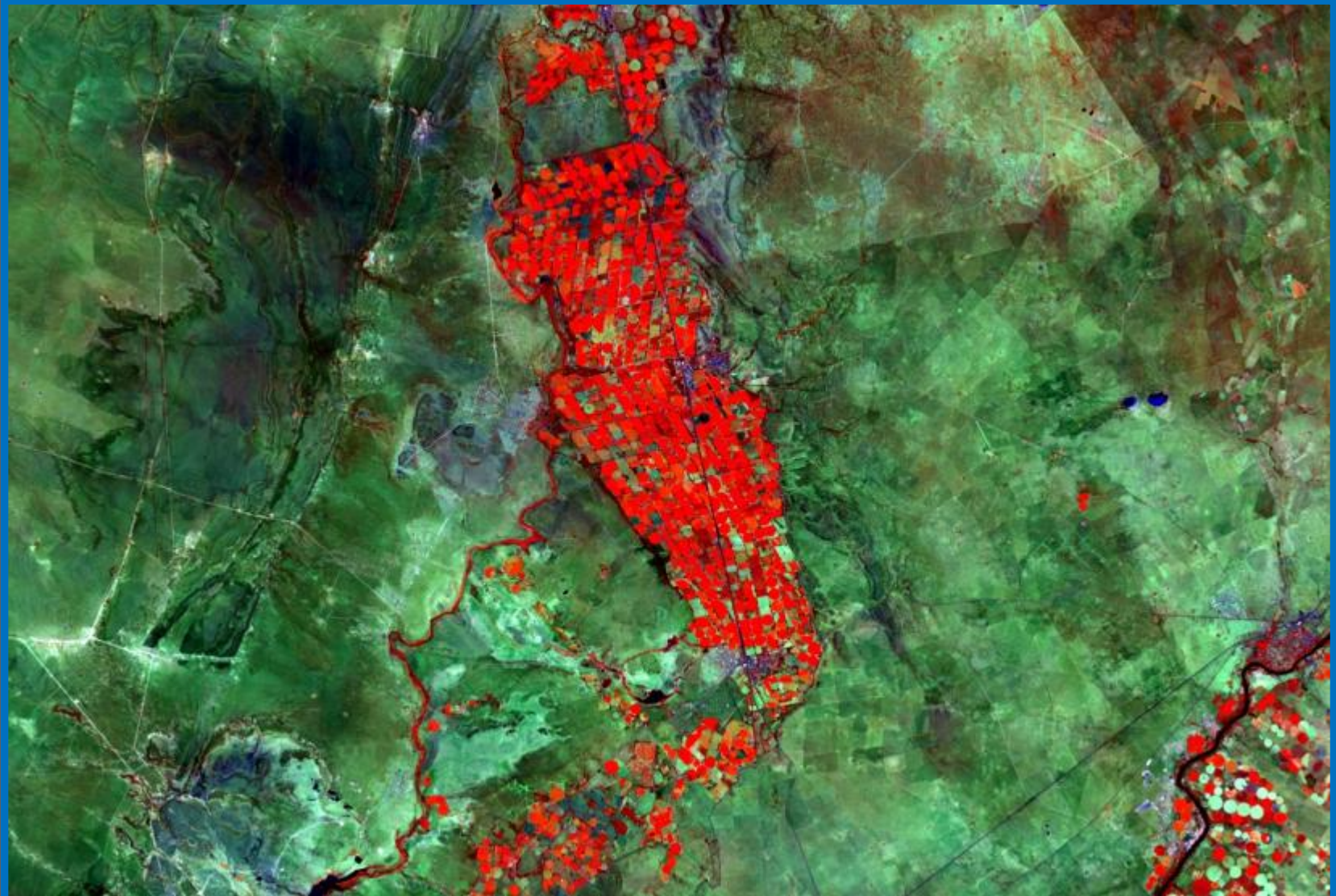


		Area of Cultivated Fields per Province (Hectare) excl Sugar Cane				
Province	Province SqKm	Total FB	Dryland	Pivot	Orchards	Subsistence
Eastern Cape	168 948	1 619 559	512 649	22 627	3 951	1 080 332
Free State	129 771	3 813 118	3 635 161	147 270	1 853	28 834
Gauteng	18 170	376 690	349 003	22 194	2 354	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



Vaalharts Irrigation

Approx 40 000 Ha



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

Crop Type Identification

- **Components**
 - Landsat 8 & Sentinel 2
 - Calibration: PICES Survey
 - Crop Calendar
 - Statistical Classifier: Maximum Likelihood
 - Crop Field Boundaries
- **Results & Output**
 - Field Boundaries with Crop Type
 - District Summaries for Each Crop Type
 - Farm Management & Crop Rotation Practices



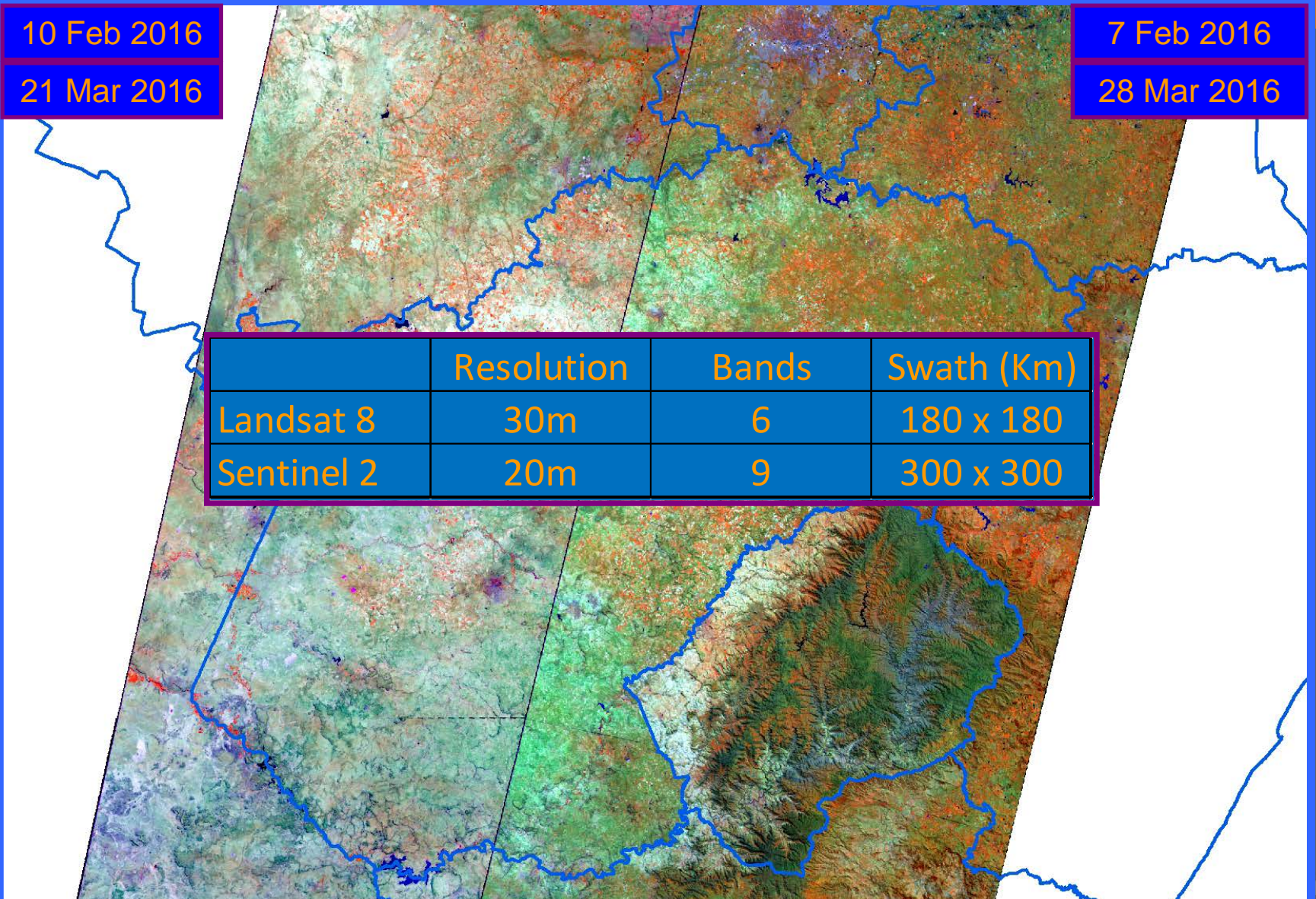
Satellites: Landsat8 vs Sentinel2

10 Feb 2016

21 Mar 2016

7 Feb 2016


28 Mar 2016



	Resolution	Bands	Swath (Km)
Landsat 8	30m	6	180 x 180
Sentinel 2	20m	9	300 x 300

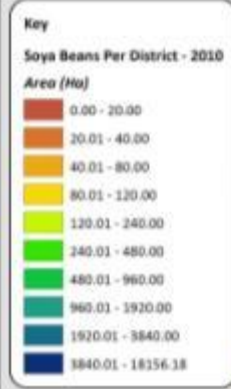
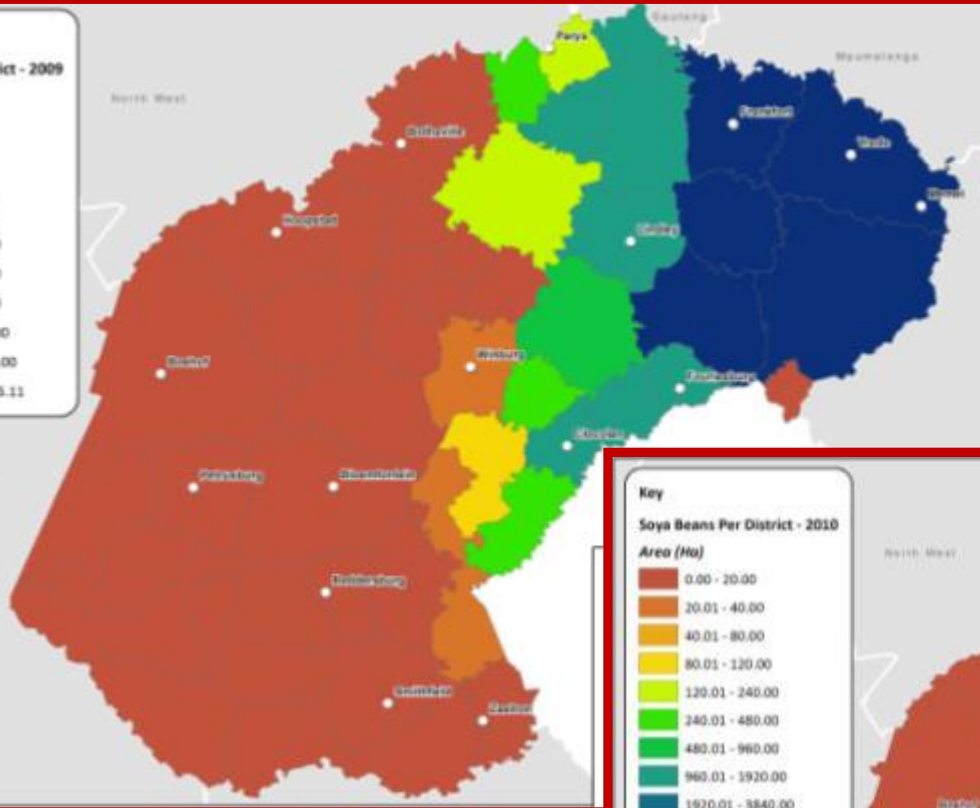
Crop Calendar

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	Senescence
Sunflower: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Senescence
SoyaBeans: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Senescence
Groundnuts: (approx 3 months)	Re-Growth	Growth	Growth	Growth	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Dry Matter	Senescence	Senescence	Senescence
Pasture (Natural Grass Summer)	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth
Wheat	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth	Re-Growth
GeoTerraImage Legend			Re-Growth	Growth	Dry Matter	Senescence	Fallow					

SoyaBean Comparison: 2009 vs 2010

- Spatial Distribution
- Cultivated area
- Crop types



District level comparison:
✓ Soya area / district

District Level Summary

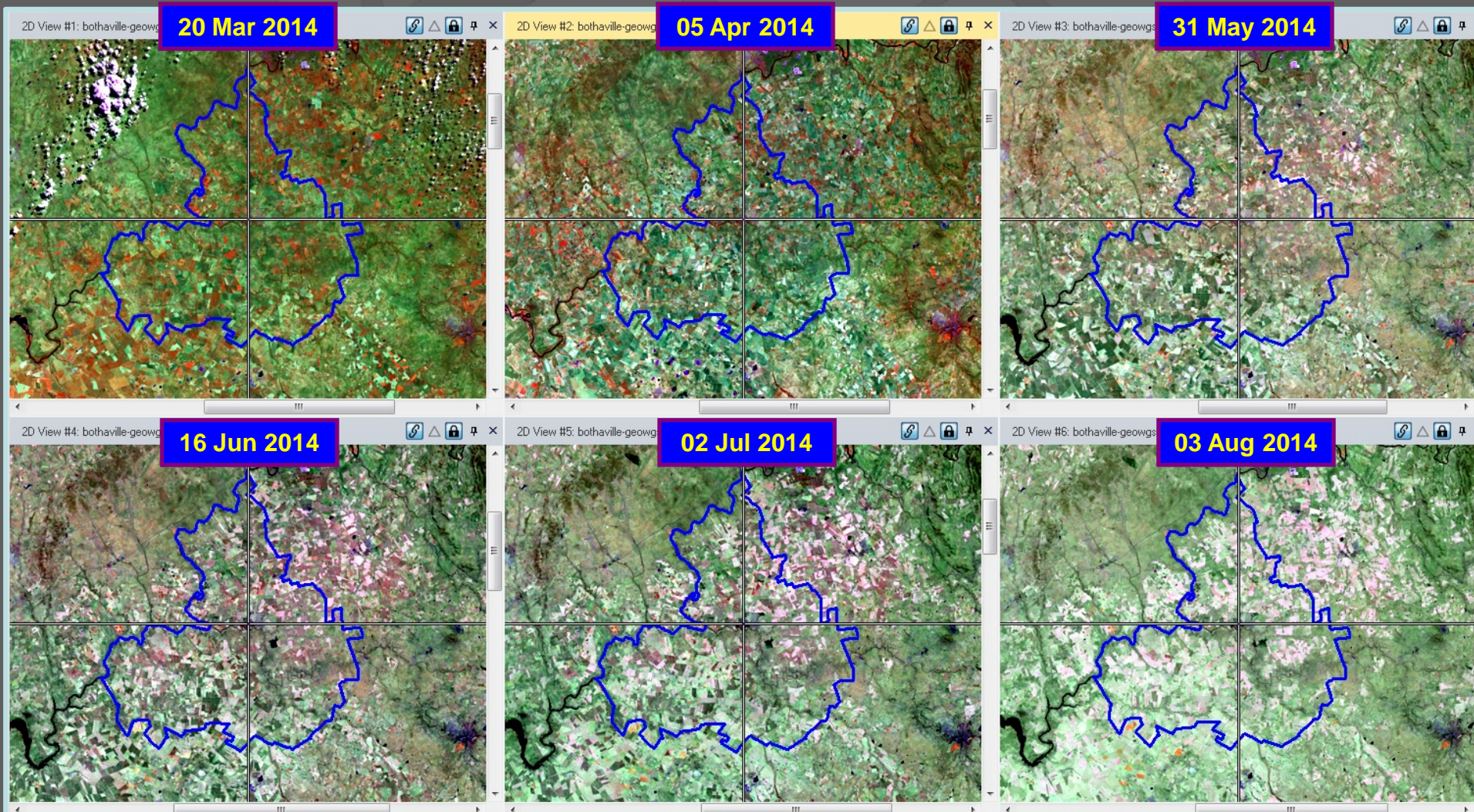
Crop Type Area (Ha)

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

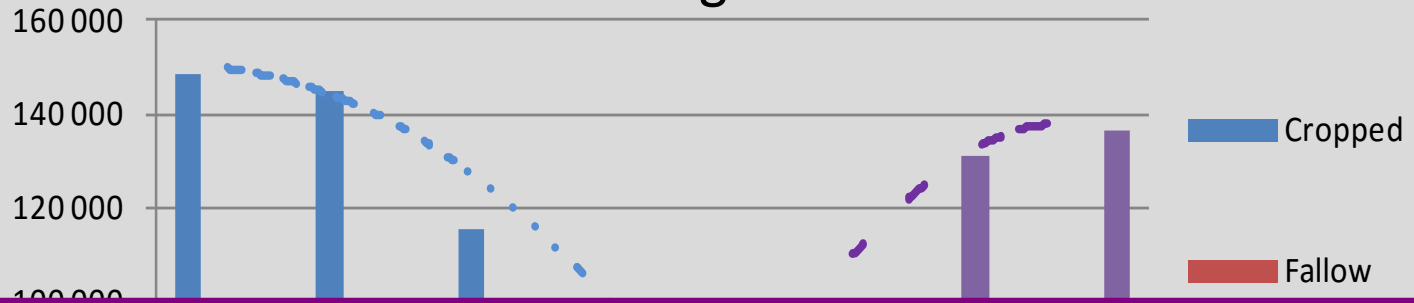
Tracking Harvest Progress

From Forecast (May) to Final Deliveries (Sept)

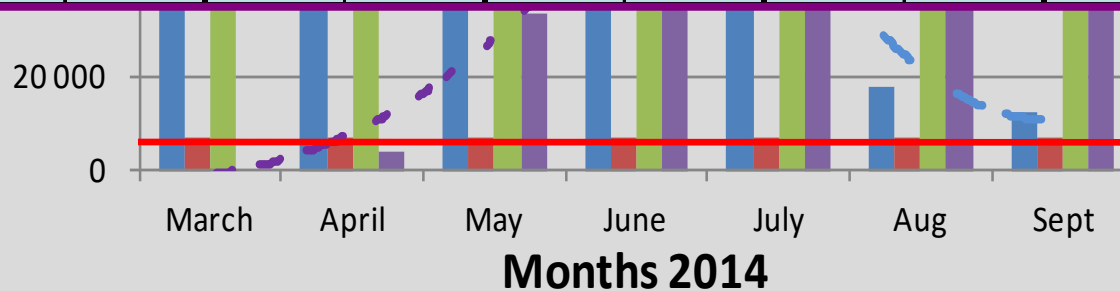


Area Harvested

Bothaville Harvest Progress Winter 2014



	20-March-2014		05-April-2014		31-May-2014		16-June-2014		02-July-2014		03-August-2014	
CropType	Fields	AreaHa	Fields	AreaHa	Fields	AreaHa	Fields	AreaHa	Fields	AreaHa	Fields	AreaHa
Cropped	3934	148 717	3813	145 060	2919	115 074	2308	89 390	1640	58 307	860	17 475
Fallow	262	6 943	262	6 943	262	6 943	262	6 943	262	6 943	262	6 943
Pasture	1980	45 771	1980	45 771	1980	45 771	1980	45 771	1980	45 771	1980	45 771
Harvested	0	0	121	3 657	1015	33 644	1626	59 327	2294	90 411	3074	131 242
Total Fields	6176	201 431	6176	201 431	6176	201 431	6176	201 431	6176	201 431	6176	201 431



Conclusion

- **Aim: Continuous Improvement**
 - Evaluate new technology as it becomes available
 - Use applicable technology
 - Improve efficiency and accuracy
- **Crop Estimate Approach / System**
 - Allow the inclusion of new technology
 - Any new relevant satellite sensor
 - Any new software / programming





Thank
you
