

ABSTRACT

The FP7 ImagineS project continues the innovation and development activities to support the operations of the Copernicus Global Land service

The FP7 ImagineS project intends to continue the innovation and development activities to support the operations of the Copernicus Global Land service, preparing the use of the new Earth Observation data, in particular the processing lines for LAI, FAPAR and FCOVER products at 333 m based on PROBA-V data (i.e., GEOV3 products). Within the ImagineS a number of demonstration sites have been proposed for the validation and user evaluation of the GEOV3 products where field campaigns will be conducted with the support of local teams. One of the ImagineS demonstration sites is located at the "Río Colorado" basin, close to the "25 de Mayo" village, in La Pampa (Argentina), where INTA has permanent facilities and ground sensors for continuous monitoring of PAI and FAPAR over irrigated crops in the semi-arid environment of La Pampa.



People involved in the Field Campaign.

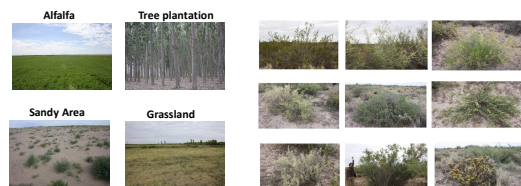
LOCATION

The experimental 25 de Mayo site is located in the La Pampa Region, situated in central Argentina, in the Section II of the Colorado River. (37°55'31.37"S, 67°48'13.86"W). The climate is semi-desertic, with average annual temperature of 14.6 °C and annual rainfall of 263 mm.



DESCRIPTION OF THE TEST SITE

The soils are sandy in texture. The dominant vegetation is shrubby type, where large irrigated plots are cultivated with alfalfa and corn. Furthermore, other areas dedicated to tree plantation (Populus Alba) or grassland/fallow were identified.



Examples of the different land cover types in 25 de Mayo site - La Pampa, Argentina.

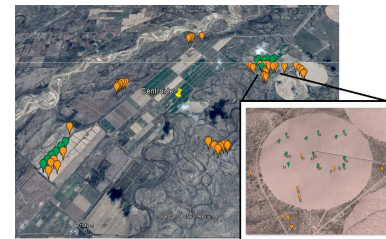
Typical shrub species in 25 de Mayo site - La Pampa, Argentina.

SHRUB - SPECIES	NAME	NUMBER	COVER m2	%	DENSITY (plants/ha)
Larrea divaricata	LD	616	1151.9	34.4	906
Bougainvillea spinosa	BS	420	525	15.7	617
Nitopis lampa	AL	383	305.6	9.1	563
Prosopis alata	PA	155	252.2	7.5	228
Bredemeyera myrtillophylla	BM	103	67	2	151
Acanthopis seriphoides	AS	82	28	0.8	121
Cyclolepis genistoides	CG	71	96	2.9	104
Larrea cuneifolia	LC	66	101.9	3	97
Lycium chilense	LCH	63	34.4	1	93
Monttea aphylla	MA	56	96.3	2.9	82
Verbena aspera	VA	44	25.4	0.8	65
Lycium gilliesianum	LG	33	15.5	0.5	49
Verbena seriphoides	VS	4	3.3	0.1	6
Chusquea erinacea	CHE	3	4.1	0.1	4
Atamisquea emarginata	AE	3	2.5	0.1	4

Summary of shrubland types in 25 de Mayo site.

SPATIAL SAMPLING SCHEME

A total of 43 ESUs of 6 different land cover types were characterized during the campaign



Distribution of the sampling units (ESU) over the study area. DHP sampling (in orange), PASTIS sampling (in green) over 25 de Mayo site, Argentina.

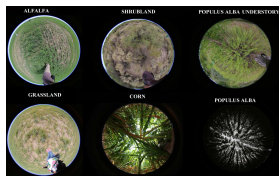
ESU internal code	Number of ESU's 9th of February, 2014
AL (Alfalfa)	9
SH (Shrubs)	14
G (Grassland)	5
C (Corn)	4
BS (Bare Soil)	1
TP (Populus Alba)	10
TOTAL	43

GROUND MEASUREMENTS

Several devices were used for estimating biophysical variables in the study area, including hemispherical digital photography (DHP), ceptometers and the PASTIS systems developed by INRA.

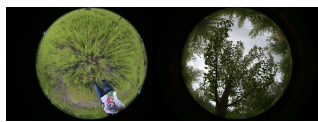
Digital Hemispherical Photographs (DHP) were acquired with a digital camera. Hemispherical photos allow the calculation of LAI, FAPAR and FCOVER measuring gap fraction through an extreme wide-angle camera lens (i.e. 180°) (Weiss et al., 2004).

The hemispherical photos acquired during the field campaign were processed with the CAN-EYE software to derive LAI, FAPAR and FCOVER.



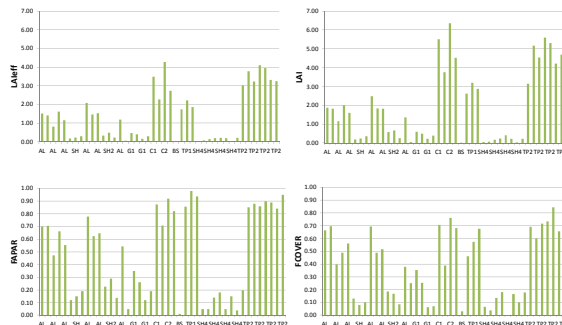
Digital Hemispherical Photographs acquired in 25 de Mayo, La Pampa, Argentina during the intensive campaign of 7-9 February 2014.

ESU 27, Tree plantation (Populus Alba)



DHP images for ESU 27, showing understory (left), and overstory (right), 25 de Mayo Field Campaign in La Pampa, Argentina.

LAIeff, LAI, FAPAR and FCOVER measurements acquired in 25 de Mayo site during the campaign of February 2014. Distribution by ESUS. (AL: Alfalfa, SH: Shrubland, G: Grassland, TP: Tree Plantation, BS: Bare Soil)



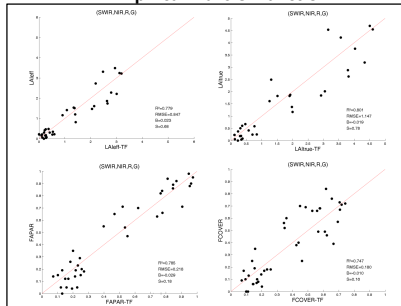
IMAGERY

The SPOT5 images were acquired the 9th February 2014. For the transfer function analysis, the input satellite data used is Top of Atmosphere (TOA) reflectance.

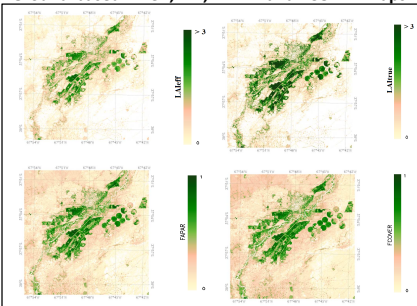
SPOT 5 METADATA	
Platform / Instrument	SP05 / HRG 1
Sensor	OPTICAL 10 m
Spectral Range	B1(green) : 0.5-0.59 µm
	B2(red) : 0.61-0.68 µm
	B3(NIR) : 0.78-0.89 µm
	B4(SWIR) : 1.58-1.75 µm
February 2014 campaign	
Acquisition date	2014-02-09
Incidence angle	13:39:54
Viewing angle	-26.146228°
Illumination	-22.818947°
Azimuth angle	73.507466°
Elevation angle	43.210963°

RESULTS

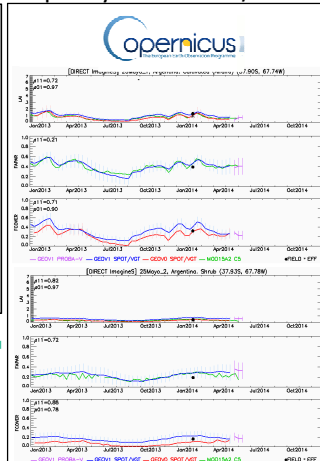
Empirical Transfer Function



Ground-based LAIeff, LAI, FAPAR and FCOVER maps



Temporal Dynamic from SPOT/VGT data



Mean values

NAME	COORDINATES		LAI _{eff}		LAI		FAPAR		FCOVER	
	LAT	LOE	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD
Alfalfa	-37.907	-67.746	0.93	0.74	1.3	1.08	0.39	0.24	0.32	0.19
Shrub	-37.939	-67.789	0.31	0.41	0.42	0.59	0.19	0.13	0.16	0.1

Mean values and standard deviation (STD) of the HR biophysical maps for the selected 3 x 3 km² areas

NAME	COORDINATES		LAI _{eff}			LAI		FAPAR		FCOVER	
	LAT	LOE	MEAN	STD	MEAN	STD	MEAN	STD	MEAN	STD	
Shrub	-37.939	-67.789	0.2	0.2	0.25	0.29	0.17	0.07	0.15	0.05	
Corn	-37.94	-67.833	1.71	0.82	2.43	1.19	0.62	0.22	0.48	0.15	
Tree plantation	-37.928	-67.833	2.27	0.78	3.25	1.14	0.75	0.23	0.55	0.17	
Alfalfa	-37.915	-67.771	1.23	0.59	1.74	0.86	0.5	0.19	0.4	0.15	

Mean values and standard deviation (STD) of the HR biophysical maps for the selected 1 x 1 km² areas

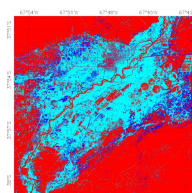
CONCLUSIONS

The spectral bands combination of empirical transfer function applied to spot5 input data were band 1 (green), band 2 (red) band 3 (Near Infrared) and band 4 (Short Wave Infrared) showing low RMSE errors and unbiased distribution.

High quality biophysical maps were derived from transfer function. The quality flag map based on the convex-hull analysis shows very good reliability around the center of the image (75 % at 10x10 km² around the Centrum), with a large area in the contours of the image corresponding to bare areas and shrublands areas far away from the sampled area, where the transfer function behaves as extrapolator, however the results obtained in the maps seem to be reliable.

Future work include the characterization of the study area with the probaV at 333 meters. This HR maps will be used for validation of medium resolution satellite products.

Special Thanks to the INTA - 25 de Mayo for the support and the organization of the Field Campaign, and the facilities which allow us to characterize the site.



Convex Hull test over 20x20km² area centered at the test site: clear and dark blue correspond to the pixels belonging to the 'strict' and 'large' convex hulls. Red corresponds to the pixels for which the transfer function is extrapolating

