



Inter-Calibration of the RapidEye Sensors with Landsat 8, Sentinel and SPOT

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Content

- About Planet
- Project Context (Purpose and why do we need this?)
- Influences on different response
- Cross Calibration
- Results



An aerial photograph showing a coastal area with a city on the right and mountains on the left. The mountains are covered in dense green forest, with some areas appearing brown, possibly due to fire or deforestation. The city is densely packed with buildings and roads. The ocean is visible in the bottom left corner, with a sandy beach and waves. A large, semi-transparent 'p' logo is overlaid on the bottom left corner of the image.

About Planet

Muir Woods & Mt. Tamalpais, California, USA DEC 23, 2015



To image the whole world
every day, making change
visible, accessible and
actionable.

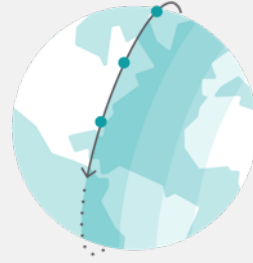


OUR PRODUCTS



Monitoring Programs

Our subscription program of continuous imaging of places you care about.



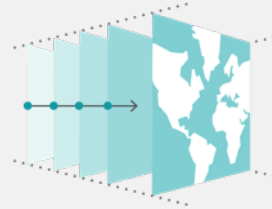
Imagery à la Carte

À la carte imagery that is tailored for one-time purchase of satellite data.



Global Basemaps

Seamless, color-balanced, cloud-free mosaics – ready for immediate use.



Imagery Archive

Explore one of the largest archives online today – dating back to 2009.



Planet operates the largest fleet of earth observation satellites available

- 5 Satellite RapidEye constellation (launched 2009, expected live at least until 2020 and beyond)
- Fast growing number of cubesats (doves in flocks)





Intercalibration is Essential for:

- Detection of changes
- Quantification of changes
- Weather forecasting
- Understand climate processes
- Monitor land cover changes



An aerial photograph showing a coastal area with a city on the right and mountains on the left. The mountains are covered in dense green forest, with some areas appearing more brownish, possibly due to fire or deforestation. The city is densely packed with buildings and roads. The ocean is visible on the left side, with a sandy beach and a breakwater. The text "Project Context" is overlaid in the center of the image.

Project Context

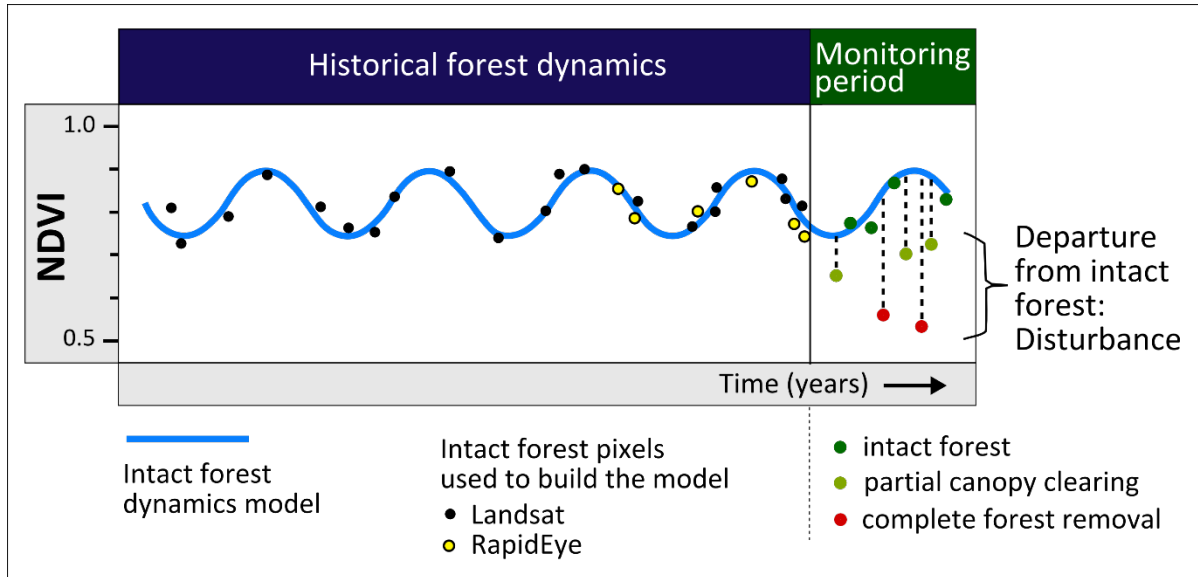
A large, semi-transparent, light blue stylized letter 'p' logo is positioned in the bottom left corner of the slide.

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Forest Degradation Monitoring with Satellite Data (ForMoSa)

- ForMoSa project (03/2015 – 02/2017) is funded by ESA Innovator II and carried out with and for FAO
- focuses on the development of methods for mapping and quantifying deforestation and forest degradation, based on the integrated use of available remote sensing satellites, such as Landsat 7 and 8, RapidEye, Sentinel-2 and SPOT-5.

ForMoSa Approach



forest natural variability and dynamics are modelled on a per-pixel basis, to detect departures from normal conditions as potential indicators of different degrees of forest canopy disturbance.

Sensor Interoperability in ForMoSa

- An interoperability solution allows the joint use of multi-source optical satellite imagery, thus increasing the density of historical time series and improving the forest dynamics model
- Landsat (2006 -2011), RapidEye (2009 – 2010), SPOT-5 imagery are used as historical observations
- Landsat (2012 -2016), RapidEye (2011 – 2016), SPOT-5 and Sentinel-2 imagery are included for current status mapping



An aerial photograph showing a coastal area with a city on the right and mountains on the left. The city is densely packed with buildings and roads. The mountains are covered in dense green forest. The ocean is visible on the left side of the image. The text "Background and Method" is overlaid in the center of the image.

Background and Method

A large, semi-transparent, light blue stylized letter 'p' logo is positioned in the bottom left corner of the slide.

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Differences in the Satellite Response over an Area with the same Reflectance is caused by

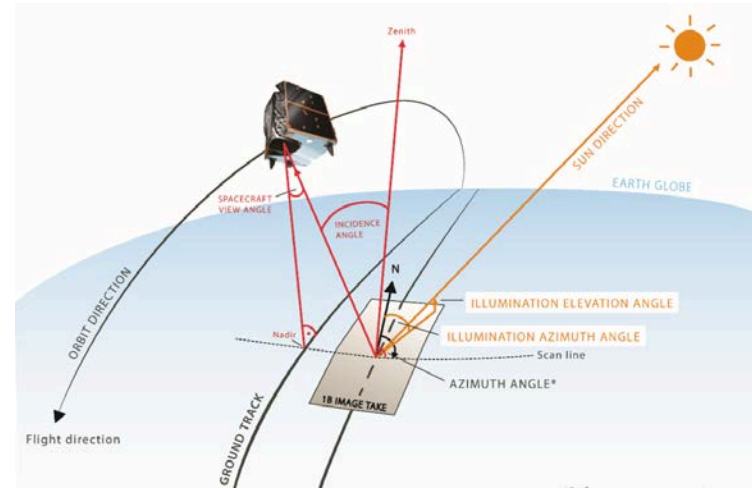
- Sensor Dependent Factors
- Sensor Independent Factors





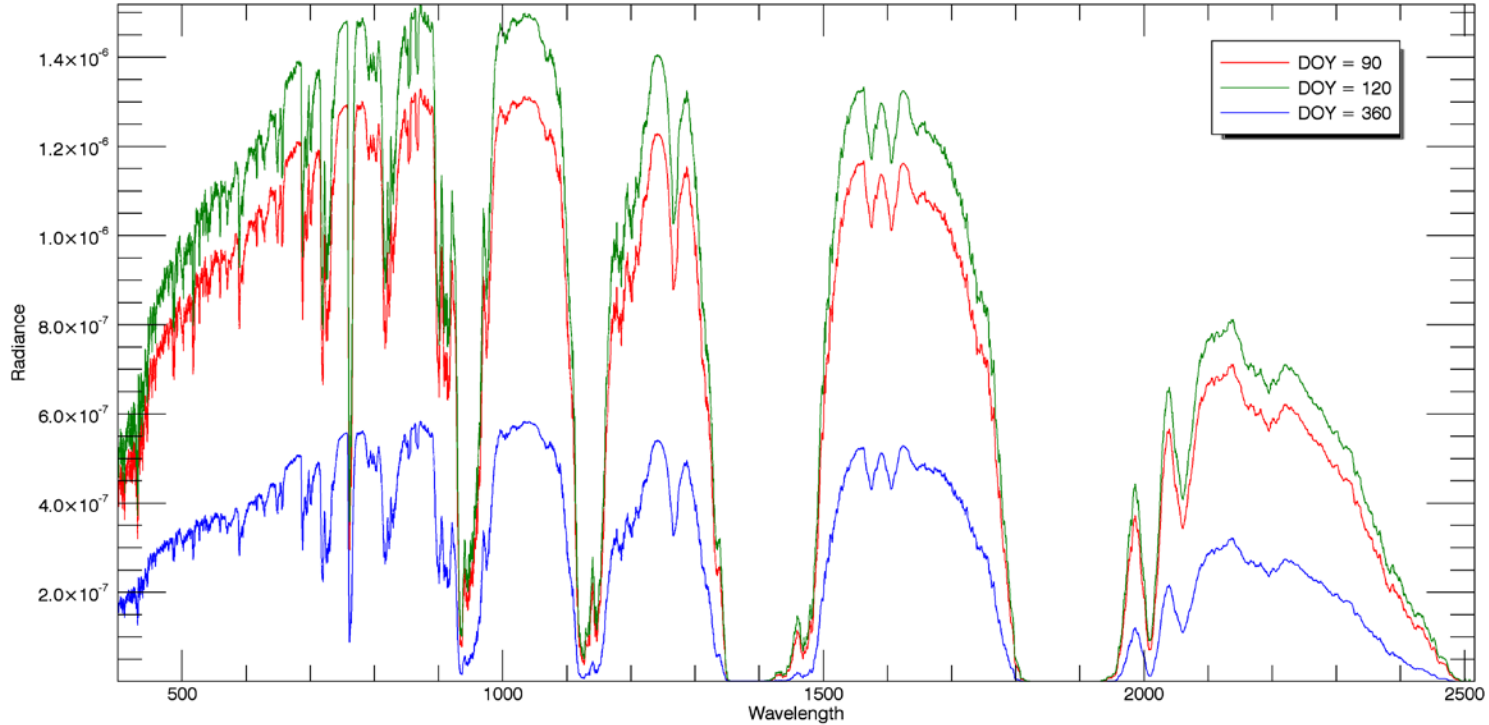
Sensor independent:

- Illumination / Imaging Geometry
- Solar Irradiance
- Atmosphere

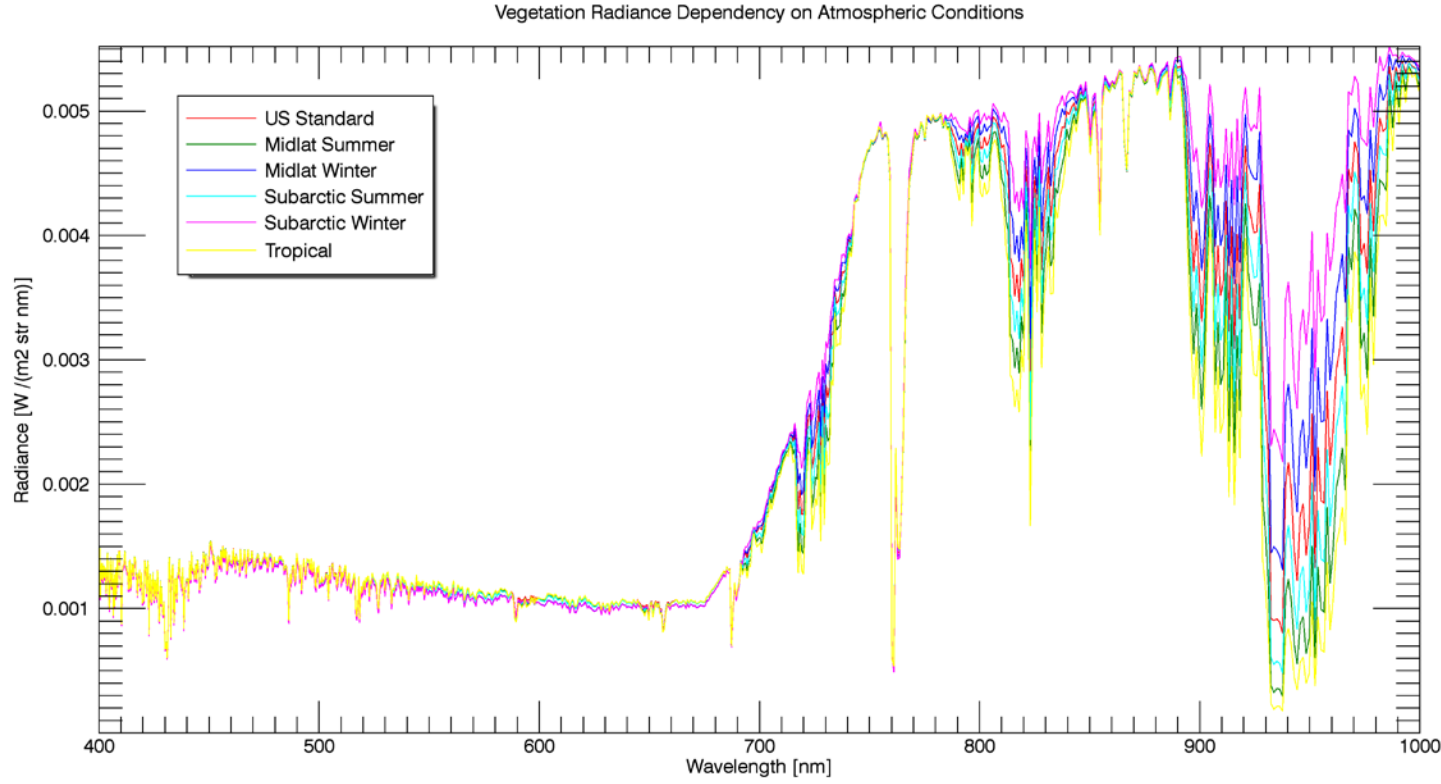


Dependency on Solar Irradiation

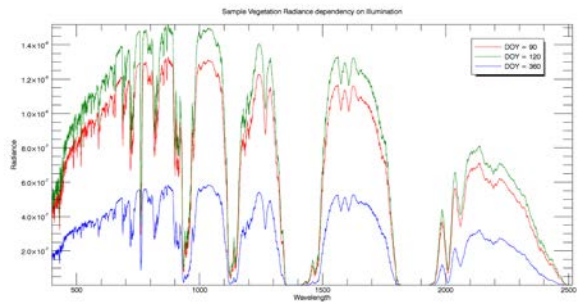
Sample Vegetation Radiance dependency on Illumination



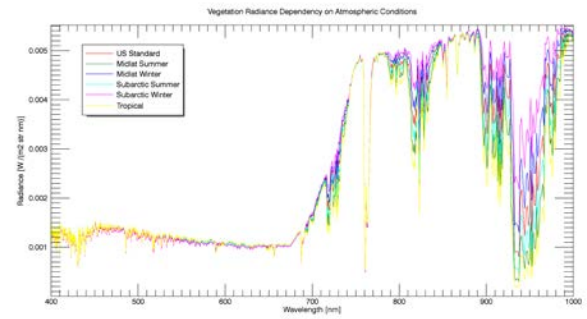
Dependency on Atmospheric Conditions



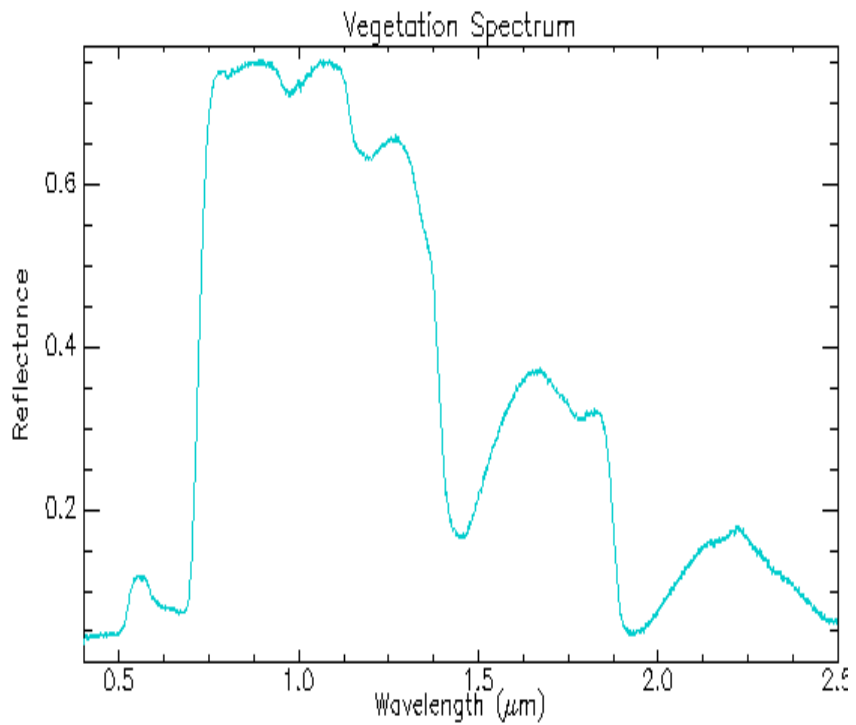
Atmospheric Correction



+



ATCOR





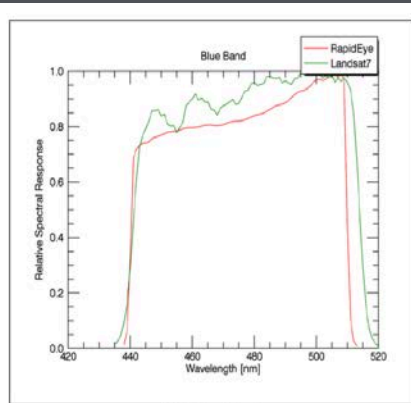
Sensor dependent

- Spectral Response characteristics of the different sensors

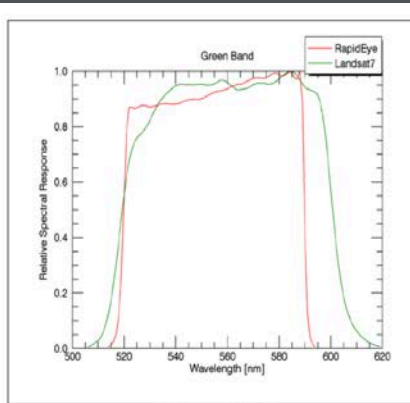




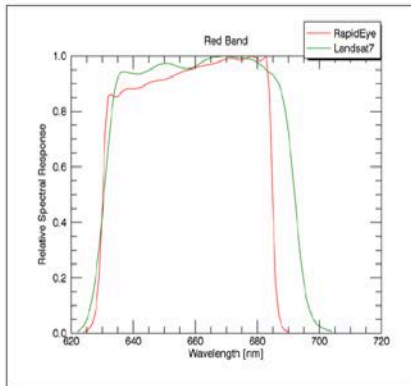
Spectral Response Curves



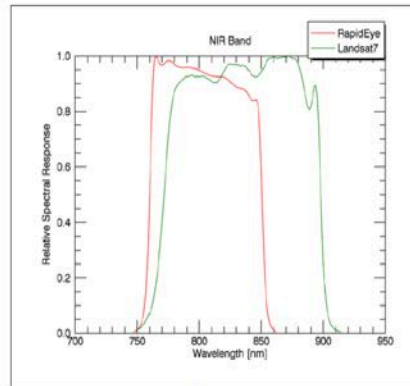
(a) Blue Band



(b) Green Band



(c) Red Band



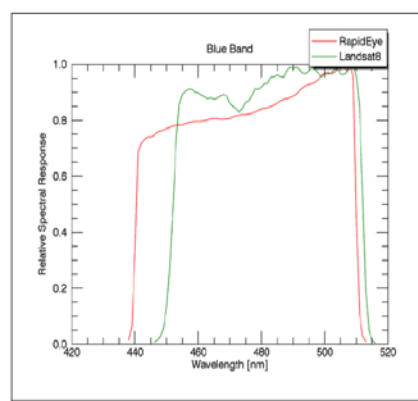
(d) NIR Band

Overlapping
Bands
between
RapidEye
and
Landsat 7

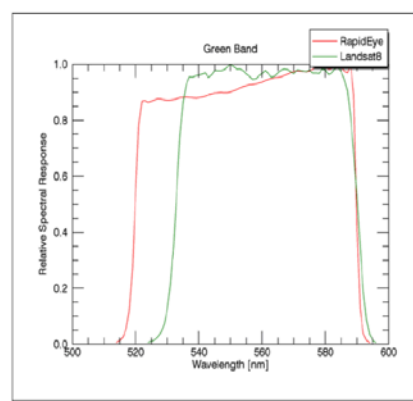




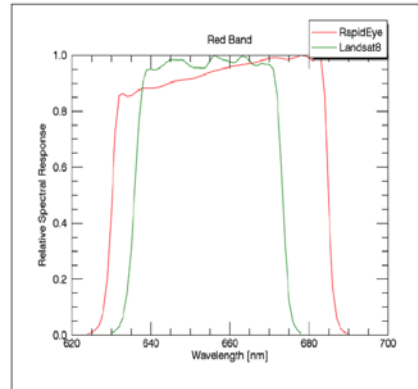
Spectral Response Curves



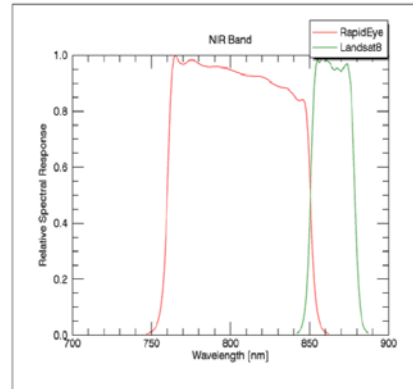
(a) Blue Band



(b) Green Band



(c) Red Band



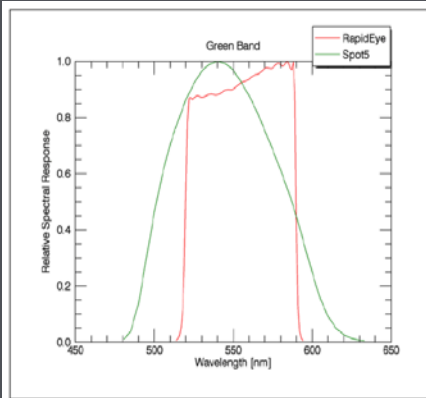
(d) NIR Band

Overlapping
Bands
between
RapidEye
and
Landsat 8

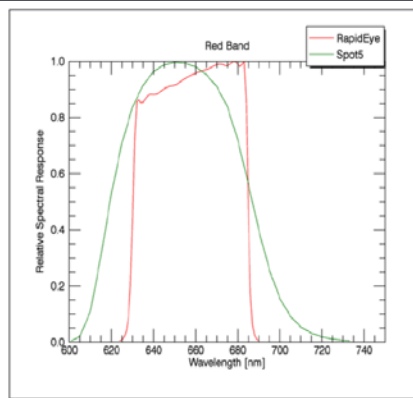




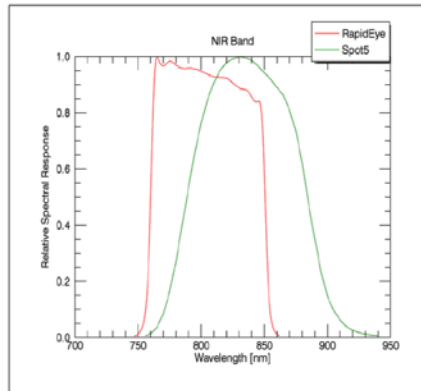
Spectral Response Curves



(a) Blue Band



(b) Green Band

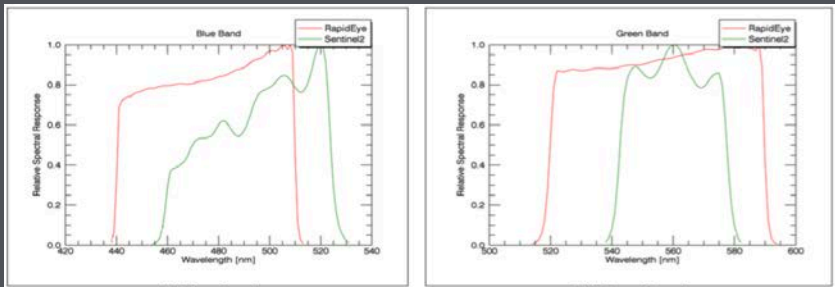


(c) Red Band

Overlapping
Bands
between
RapidEye
and
Spot 5

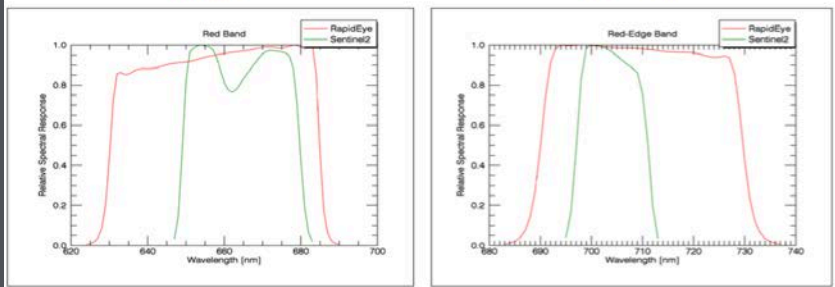


Spectral Response Curves



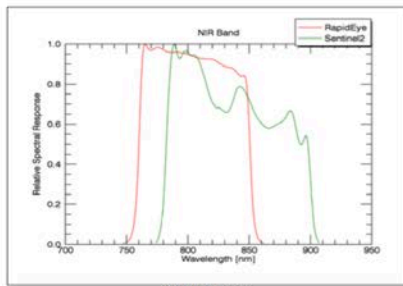
(a) Blue Band

(b) Green Band



(c) Red Band

(d) Red-Edge Band

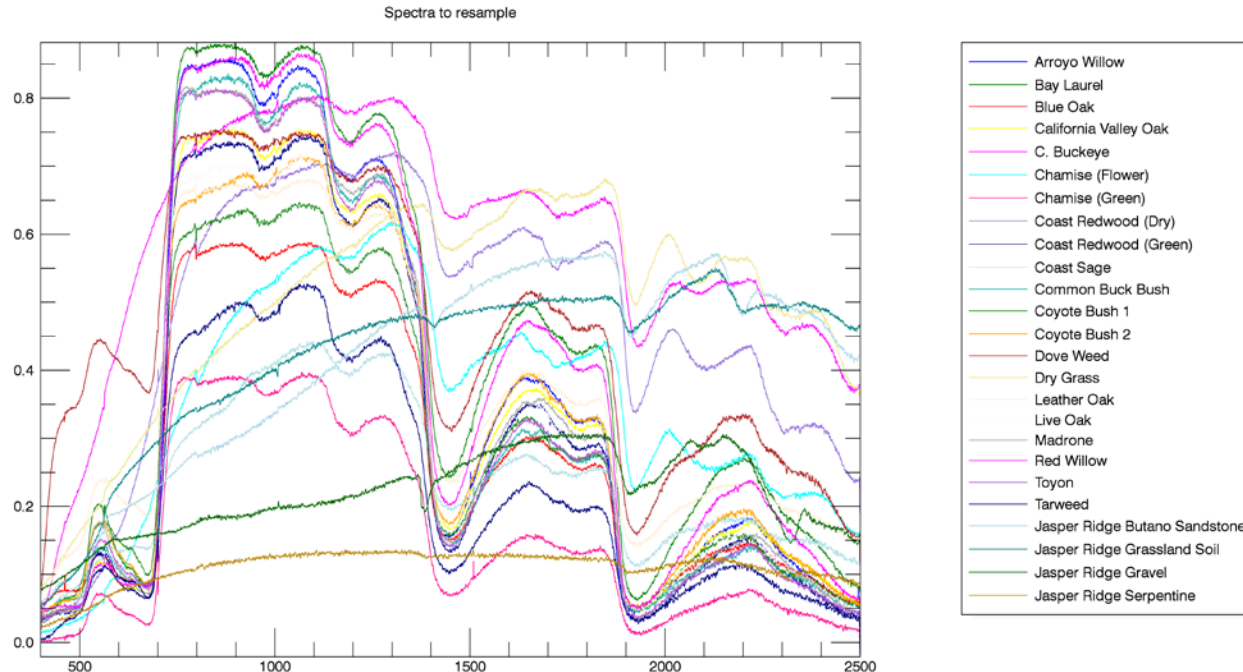


(e) NIR Band

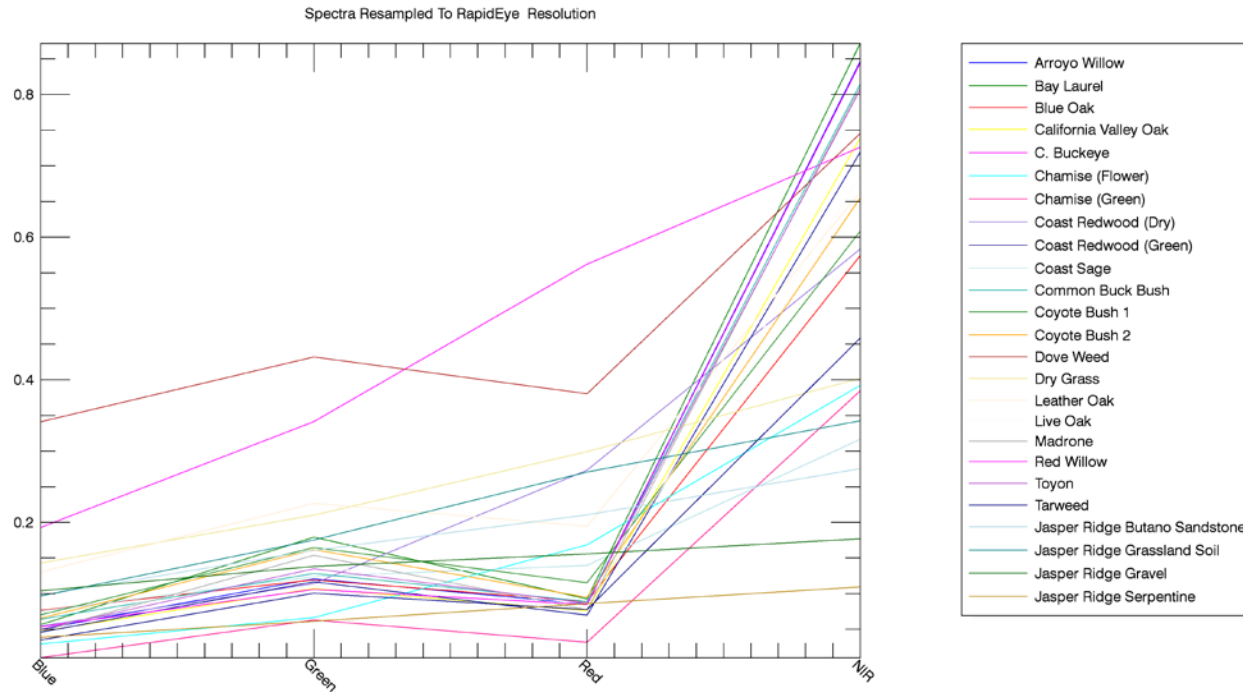
Overlapping
Bands
between
RapidEye
and
Sentinel 2



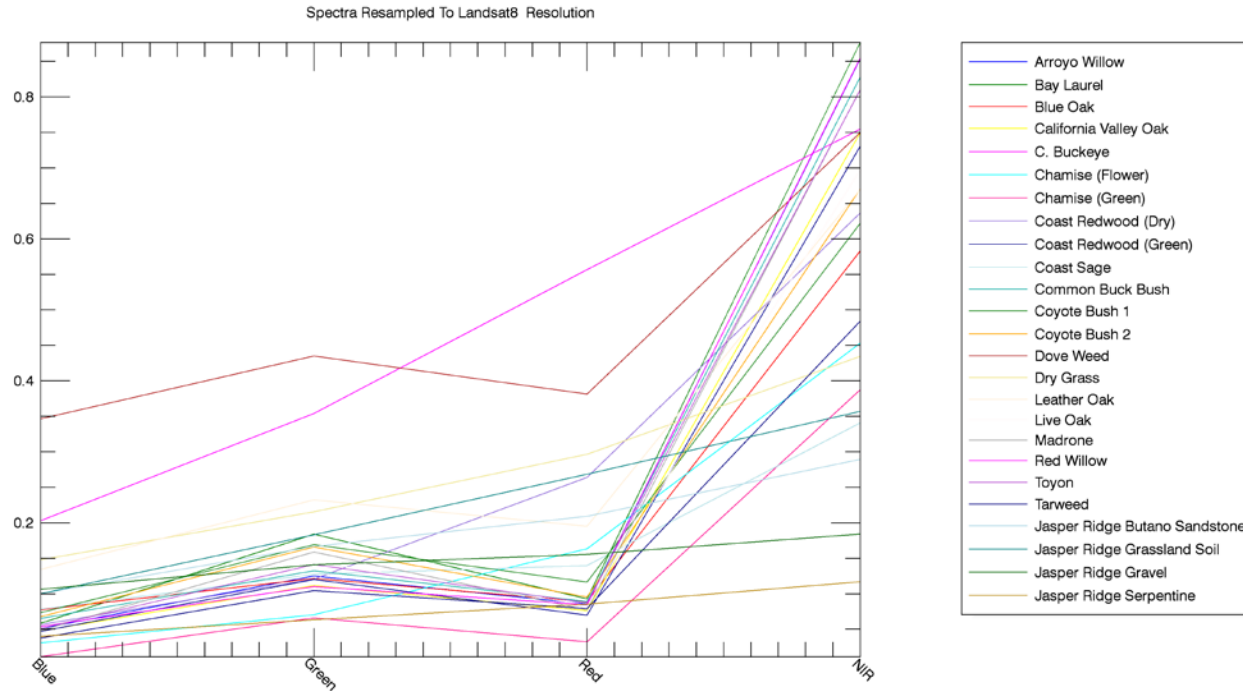
Resample High Res Reflectance Spectra to the different Spectral Response of the Cameras



Resample High Res Reflectance Spectra to the different Spectral Response of the Cameras



Resample High Res Reflectance Spectra to the different Spectral Response of the Cameras





Creation of Spectral Band Adjustment Factors (SBAFs)

SBAFs to adjust forest spectra of the different Sensors to RapidEye spectral resolution

	Blue	Green	Red	Red-Edge	NIR
Sentinel2	0.8805	0.9807	0.9782	1.0156	0.9265
Landsat 7	0.8858	0.9798	0.9767	-	1.0181
Landsat 8	0.9141	0.9865	0.9868	-	1.0112
Spot 5	-	0.9408	1.0393	-	1.4868

Different forest spectra are treated the same (difference < 0.5%)

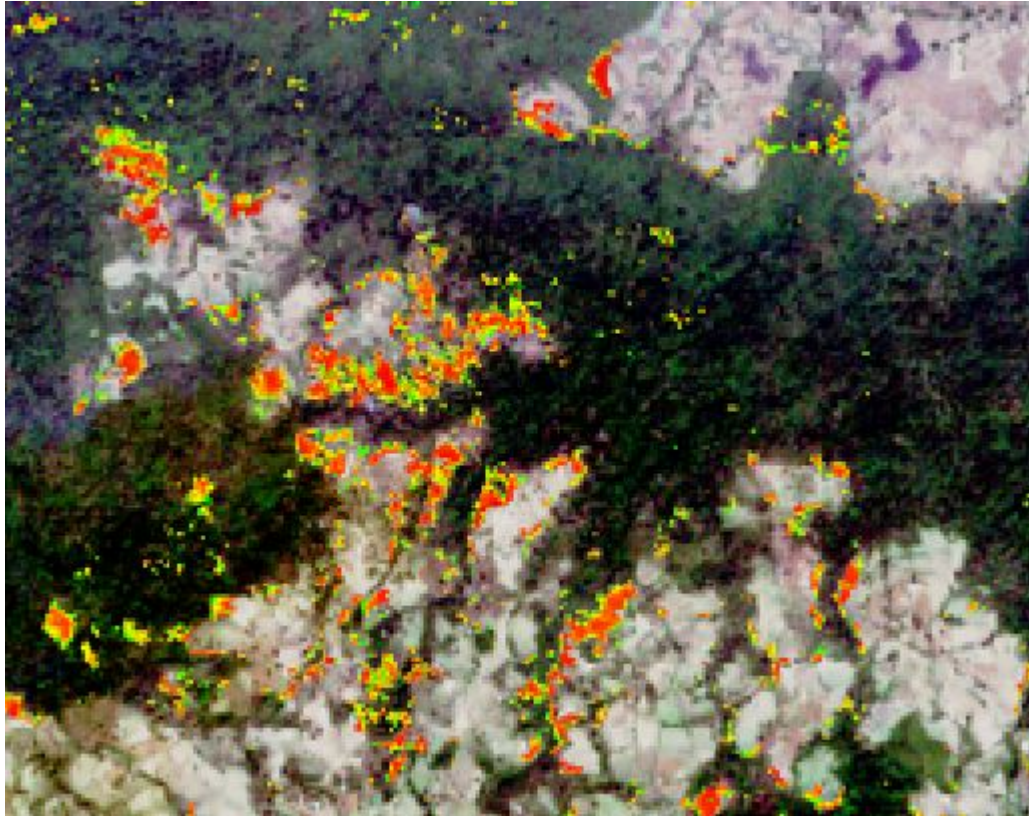


An aerial photograph showing a coastal area with a city on the right and mountains on the left. The word "Results" is centered in white text. A large, semi-transparent "p" logo is in the bottom left corner.

Results

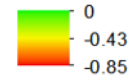
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First ForMoSa Results



A Prototype workflow for the image pre-processing for long, consistent data series and production of **forest cover and forest cover change maps** was developed and is now used for demonstration in 3 selected test areas

Disturbance intensity





Thank You!
Questions?

<http://www.formosa.global/>

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