

Recovery Observatory Haiti

Session 2 : Milieu naturel

Retour d'expérience : le suivi du Parc Macaya

Atelier techniques – retour d'expérience des utilisateurs
PàP/Zoom, Haiti, 19 Janvier 2020

Stanley Paulin

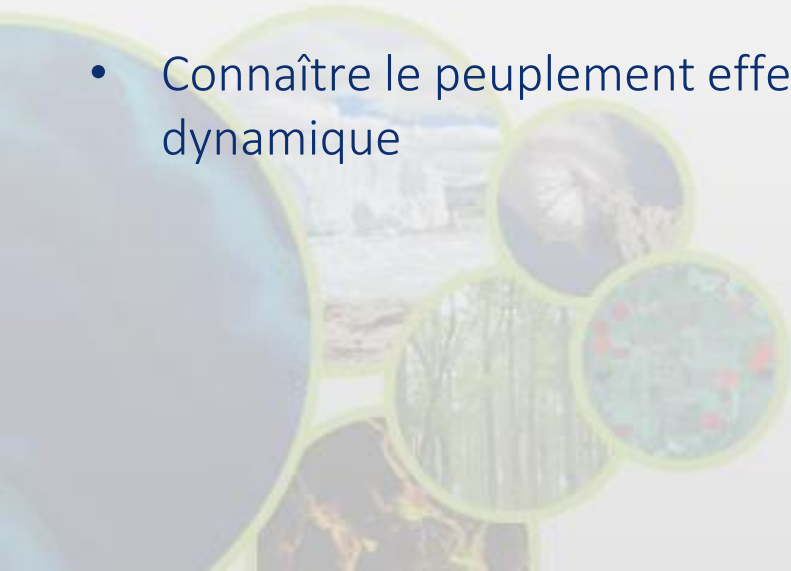
Robin Faivre





Objectifs et problématiques de la thématique

- Connaître l'impact du cyclone Matthieu sur la forêt située au sein du Parc Macaya.
- Suivre l'évolution de la forêt endommagée
- Connaître le peuplement effectif dans le secteur du Parc et comprendre sa dynamique



- Classification de la végétation pré-Matthieu (2016)
- Evaluation des dégâts et suivi de la reprise végétale (2017)
- Classification de la végétation post-Matthieu (2019)
- Evolution du couvert forestier entre 2016 et 2019
- Suivi de l'habitat entre 2014 et 2018
- Etude pour la cartographie des sentiers en 2018



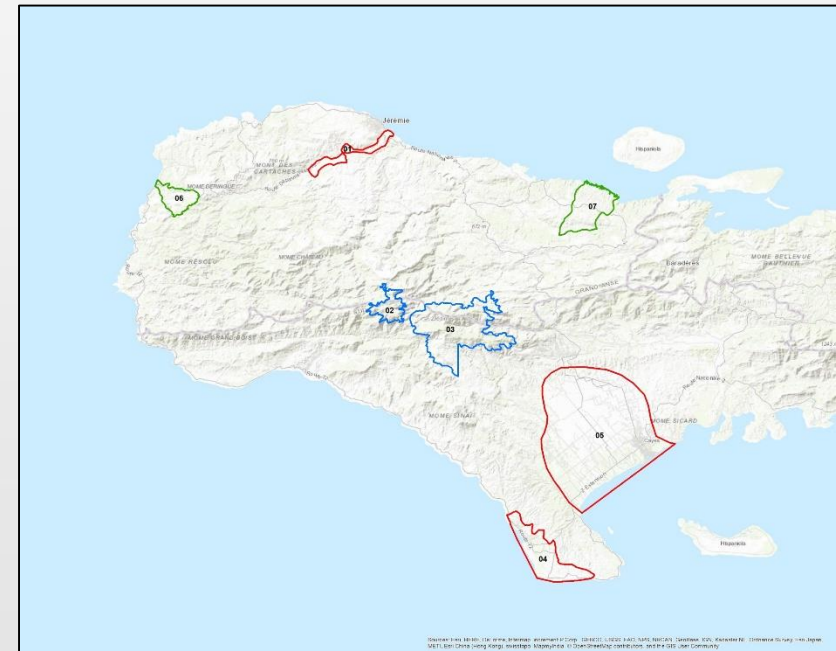
Contexte

Sollicitation en 2018 et 2020 du service Risk & Recovery de la Commission Européenne

Travaux réalisés sur les deux aires protégées du Parc Macaya

<https://emergency.copernicus.eu/mapping/list-of-components/EMSN051>

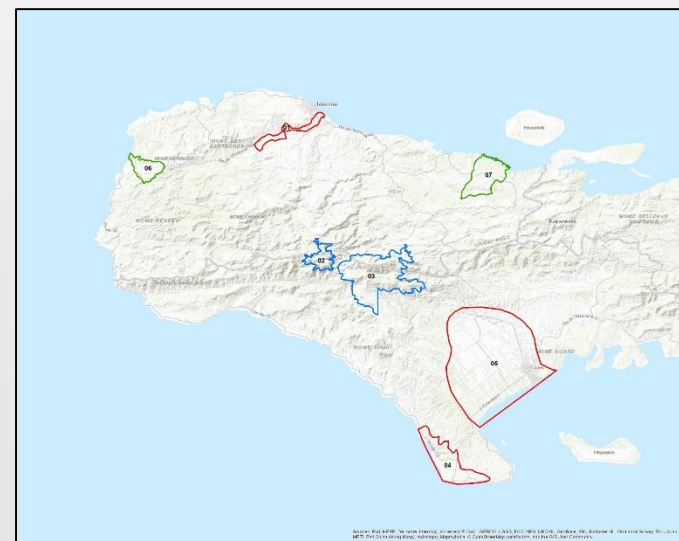
<https://emergency.copernicus.eu/mapping/list-of-components/EMSN065>





Données produites

- EMSN051 (2018) :
 - Classification de la végétation à T0
 - Dégâts sur le couvert forestier à début T1
 - Suivi reprise de la végétation à fin T1
 - 2x3 cartes
- EMSN065 (2020) :
 - Classification de la végétation à T3
 - Evolution du couvert forestier T0/T3
 - 2x2 cartes





Classification de la végétation

Classes basées sur la nomenclature CNIGS

3 classes de végétation visées :

- Végétation arborée
- Végétation arbustive
- Végétation à dominante herbacée

1 classe de sol nu :

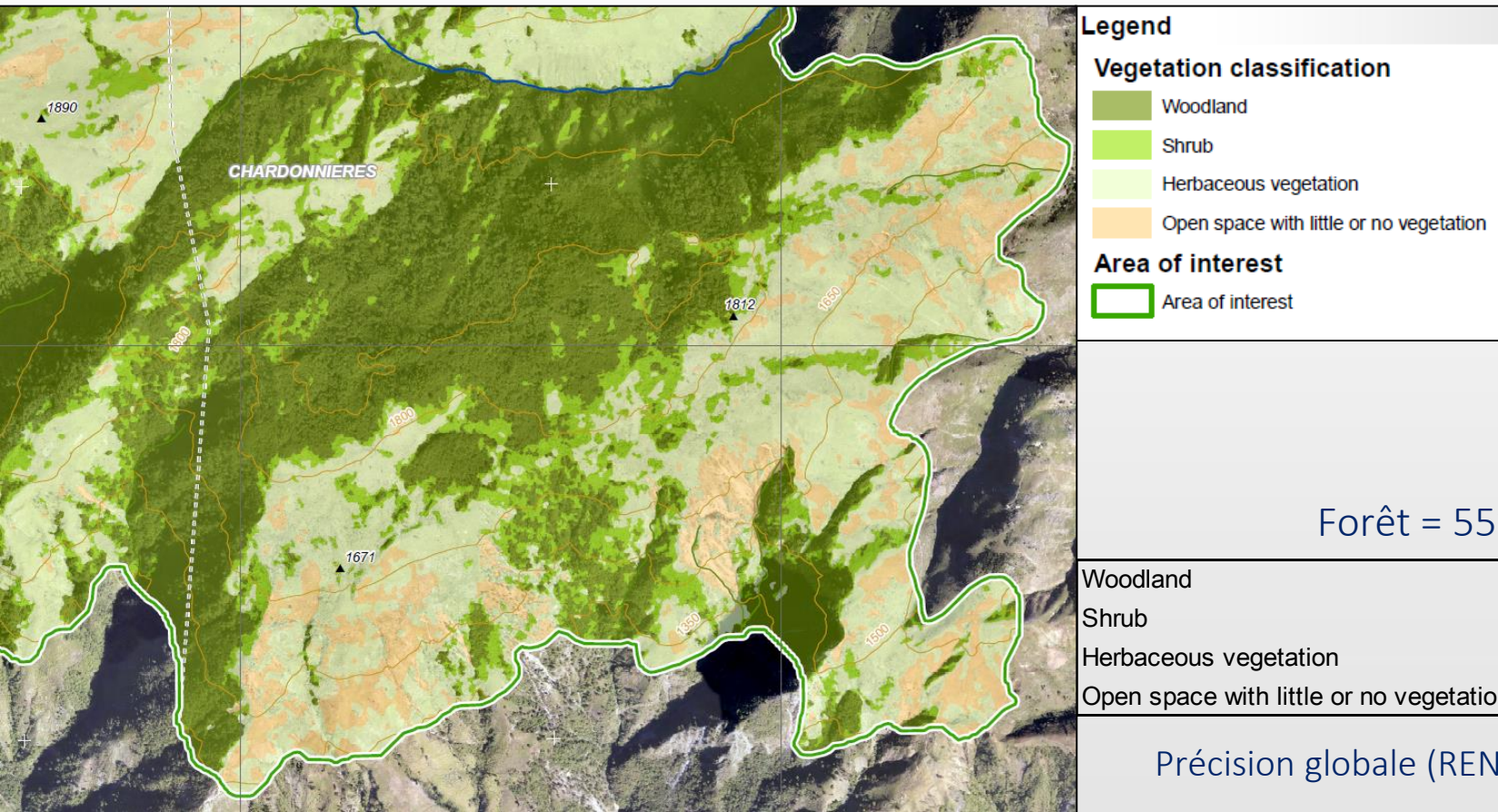
- Espace ouvert avec sans ou très peu de végétation

On considère que dans le Parc la végétation arborée correspond principalement à de la forêt !

Végétation naturels et semi-naturels terrestre - Surfaces essentiellement occupées par une végétation naturelle ou semi-naturelle	
3.1 Végétation arborée <i>Surfaces occupées par une végétation naturelle ou semi-naturelle arborée représentant une proportion à plus de 40%</i>	Primarily Vegetated Areas Terrestrial Natural and Seminatural Terrestrial Vegetation Trees Closed to Open (40 -100)% > 30 - 3m (Trees Height)
3.2 Végétations arbustives <i>Surfaces occupées par une végétation naturelle ou semi-naturelle de type arbustive à plus de 40 % et occupées par moins de 40 % d'arbres</i>	Primarily Vegetated Areas Terrestrial Natural and Seminatural Terrestrial Vegetation Shrubs Closed to Open (40 -100)% 5 - 0.3m (Shrubs Height)
3.3 Végétation a dominance herbacée <i>Surfaces occupées par une végétation naturelle ou semi-naturelle de type herbacée à plus de 4% moyennant que arbres et arbustes sont inférieurs à 40% chacun.</i>	Primarily Vegetated Areas Terrestrial Natural and Seminatural Terrestrial Vegetation Herbaceous Vegetation Closed to Open (15 - 100)% 3 - 0.03m (Herbaceous Height)
Zones sans végétation	
5.1 Espace ouvert sans ou avec très peu de végétation <i>Sols nu et/ou zones couvertes par affleurements de roches, cailloux, «badlands», etc; Zones occupées par les lits des rivières et les dépôts alluvionnaires associés; Zones occupées par les plages et du sable, en général au bord de la mer.</i>	Primarily Non-Vegetated Terrestrial Bare Areas

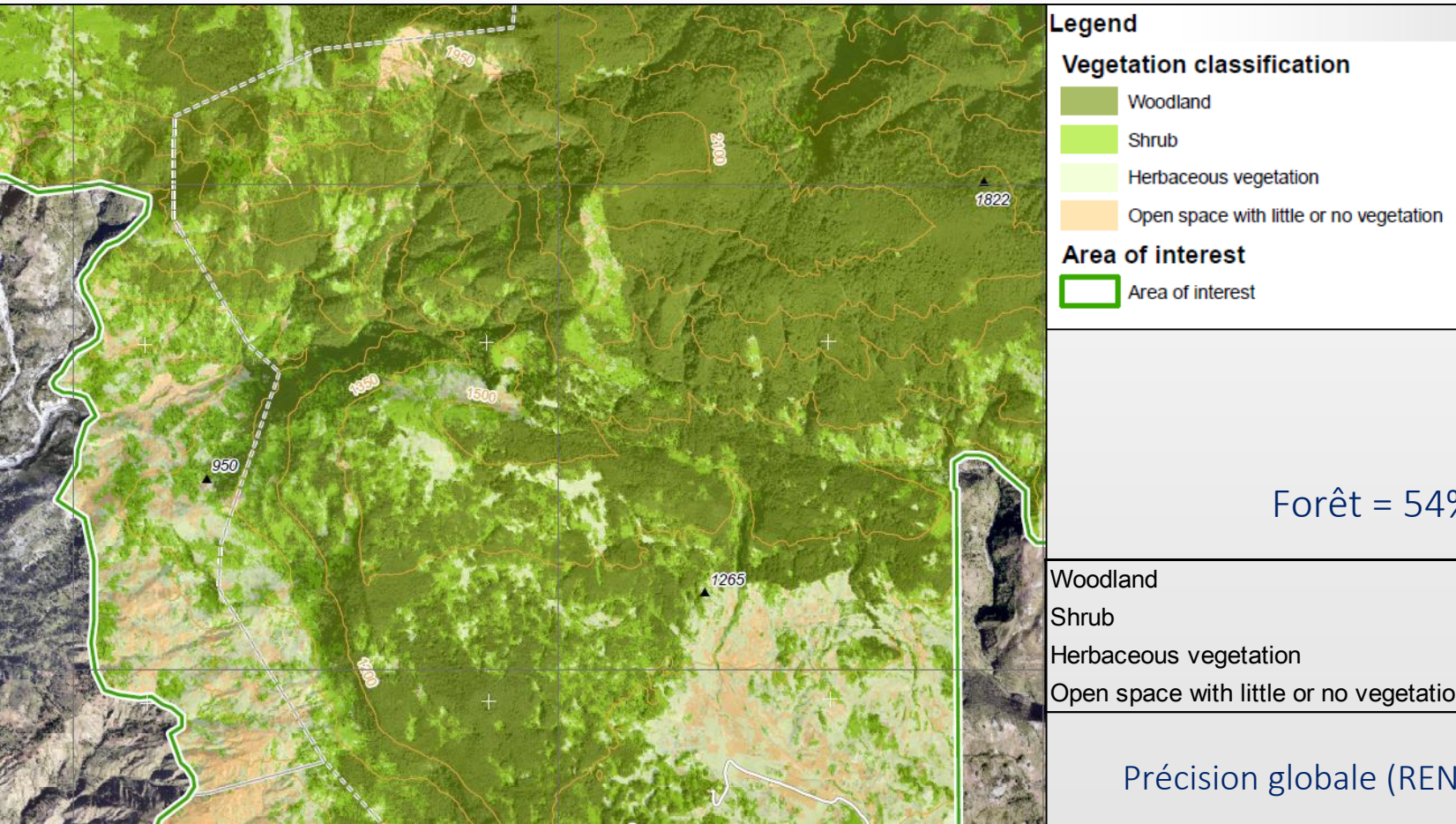


Classification de la végétation pour la petite aire protégée (1510,4 ha)





Classification de la végétation pour la grande aire protégée (8719,2 ha)



Legend

Vegetation classification

- Woodland
- Shrub
- Herbaceous vegetation
- Open space with little or no vegetation

Area of interest

- Area of interest

Forêt = 54%

Woodland	ha	4704.5
Shrub	ha	2258.6
Herbaceous vegetation	ha	1379.6
Open space with little or no vegetation	ha	376.5

Précision globale (RENOP) = 86%



Evaluation des dégâts sur la forêt (végétation arborée)

Identification de la forêt endommagée à partir d'images satellites THR Pléiades

Gradation des dommages en deux classes :

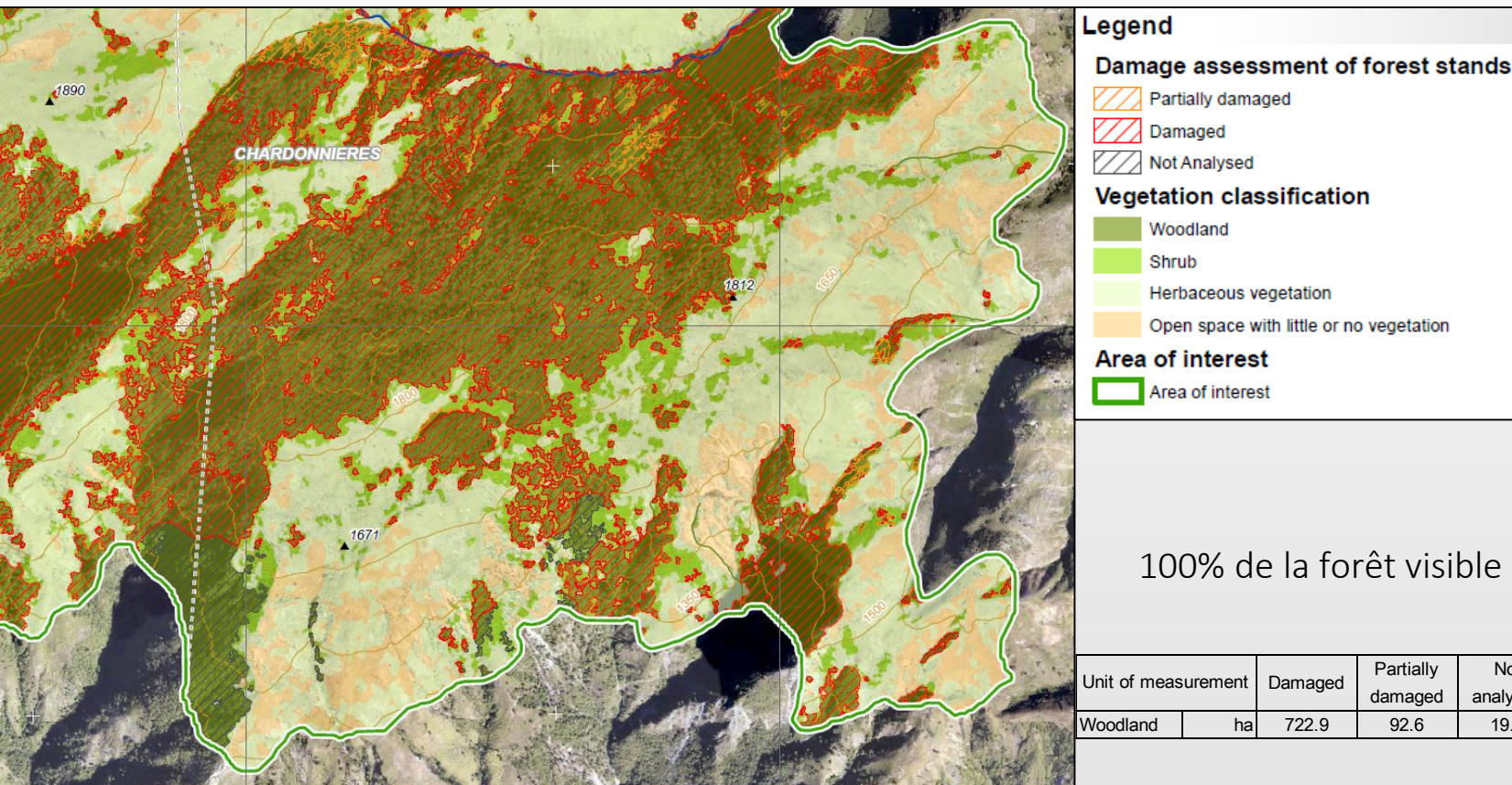
- Partiellement endommagée (végétation affaiblie mais existante)
- Endommagée (végétation non existante)

Zones non analysées = présence de nuages

Images acquises en hiver : l'ombre portée des versants est très importante



Evaluation des dégâts sur la forêt pour la petite aire protégée (853,3 ha)

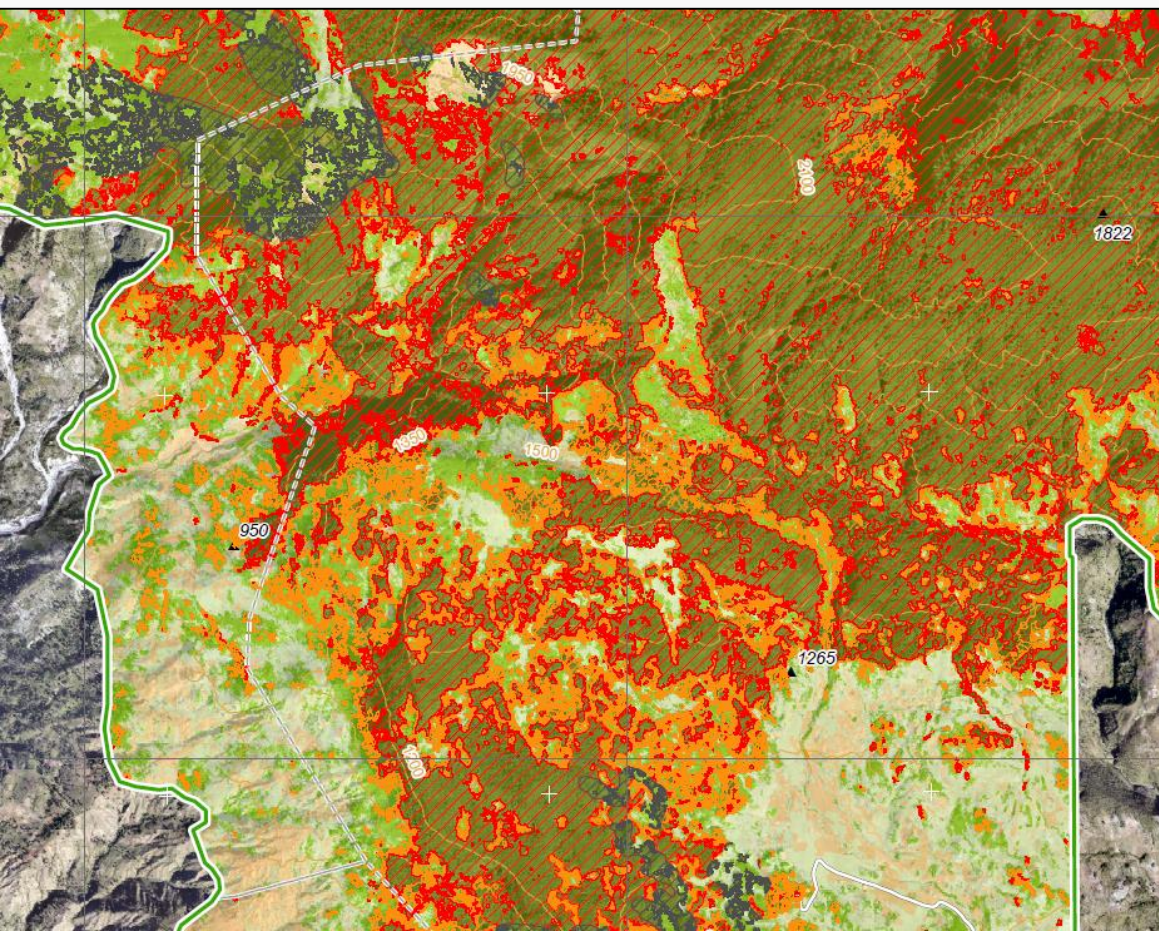


100% de la forêt visible est affectée

Unit of measurement		Damaged	Partially damaged	Not analyzed	Total affected	Total in AOI
Woodland	ha	722.9	92.6	19.8	815.5	835.3






Evaluation des dégâts sur la forêt pour la grande aire protégée (4704,6 ha)







Legend


Damage assessment of forest stands

-  Partially damaged
-  Damaged
-  Not Analysed

Vegetation classification

-  Woodland
-  Shrub
-  Herbaceous vegetation
-  Open space with little or no vegetation

Area of interest

-  Area of interest

100% de la forêt visible est affectée

Unit of measurement	Damaged	Partially damaged	Not analyzed	Total affected	Total in AOI	
Woodland	ha	3925.8	684.3	94.5	4610.1	4704.6



Suivi de la reprise de la végétation

Identification de la reprise de la végétation au sein de la forêt endommagée à partir d'images satellites THR Pléiades

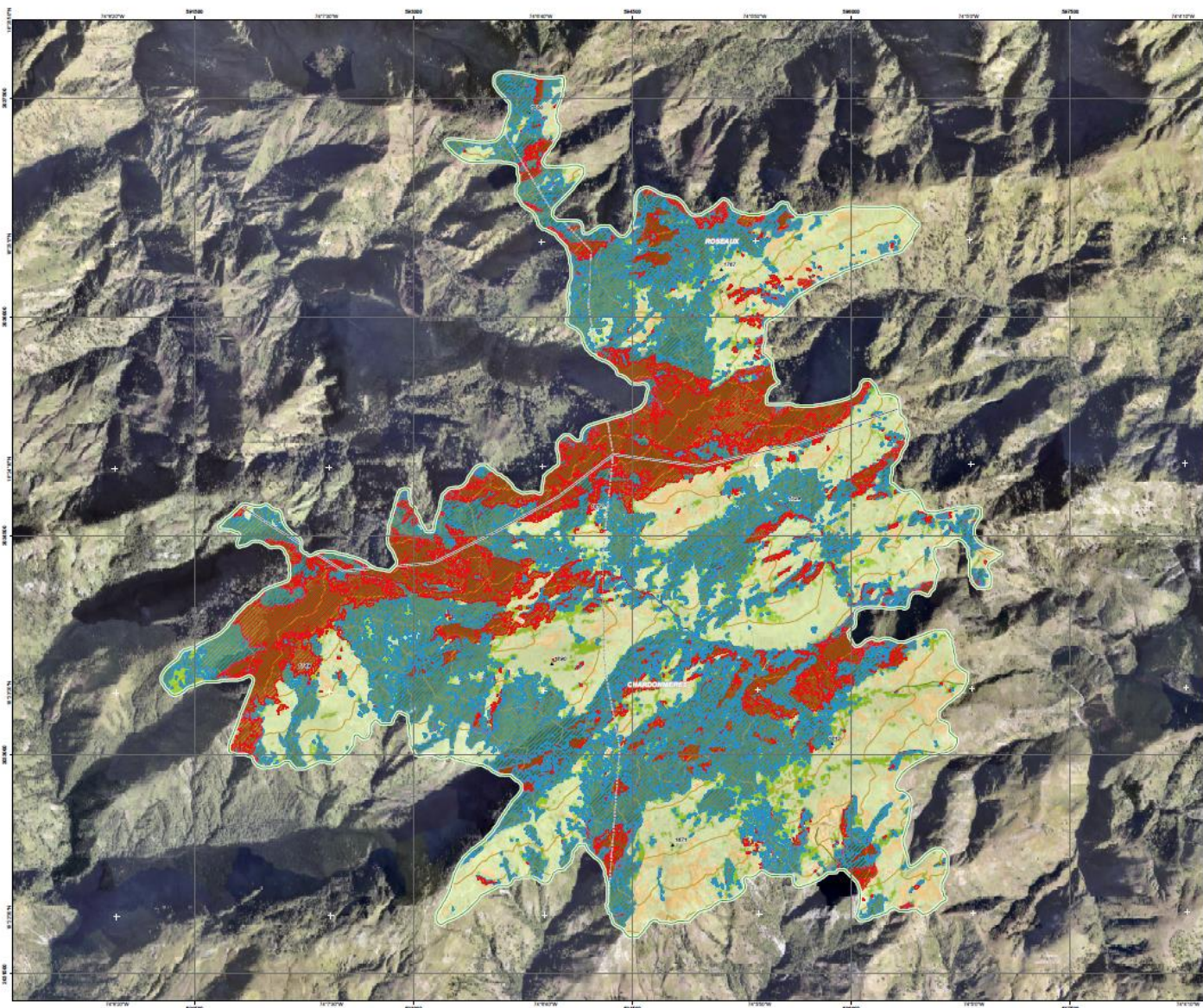
Classification binaire :

- Régénération (végétation active)
- Pas de changement visible (absence de végétation active)

Zones non analysées = présence de nuages

Images acquises en hiver : l'ombre portée des versants est très importante

Suivi du Parc Macaya



Title Number: (N/A) Product N.: (2)MAKAYAWEST_v2_Englis
 Activation ID: (2)MAKAYAWEST
Makaya Park (West) - HAITI
Forest stands - 08/12/2017
Monitoring Map - Overview



Cartographic information
 1:12 000 Full color A1, high resolution (300dpi)
 0 0.50 1.00 2.00 4.00 8.00 km

- Legend**
- Monitoring of forest stands**

 - Regeneration under old stands
 - No visible change
 - Vegetation classification
 - Woodland
 - Shrub
 - Herbaceous vegetation
 - Open spaces with little or no vegetation
 - Administrative boundary**

 - Region
 - Province
 - Commune
 - River
 - Road
 - Settlement Point
 - National Boundary (N)

Changes within the AOI

Forest stands	Unit of measurement		Total in AOI
	ha	%	
No visible change	517.4		517.4
Regeneration		0.0	

Map Information

Content: Database version: 08/12/2017, 10:58:00 AM
 Date of acquisition: 08/12/2017, 10:58:00 AM
 Data source: Copernicus Sentinel-2 (MSI)
 Date of publication: 08/12/2017, 10:58:00 AM
 Author: Copernicus Sentinel-2 (MSI)

Data Sources

Copernicus Sentinel-2 (MSI) (Copernicus Sentinel-2 (MSI))
 Copernicus Sentinel-2 (MSI) (Copernicus Sentinel-2 (MSI))
 Copernicus Sentinel-2 (MSI) (Copernicus Sentinel-2 (MSI))
 Copernicus Sentinel-2 (MSI) (Copernicus Sentinel-2 (MSI))

Disclaimer

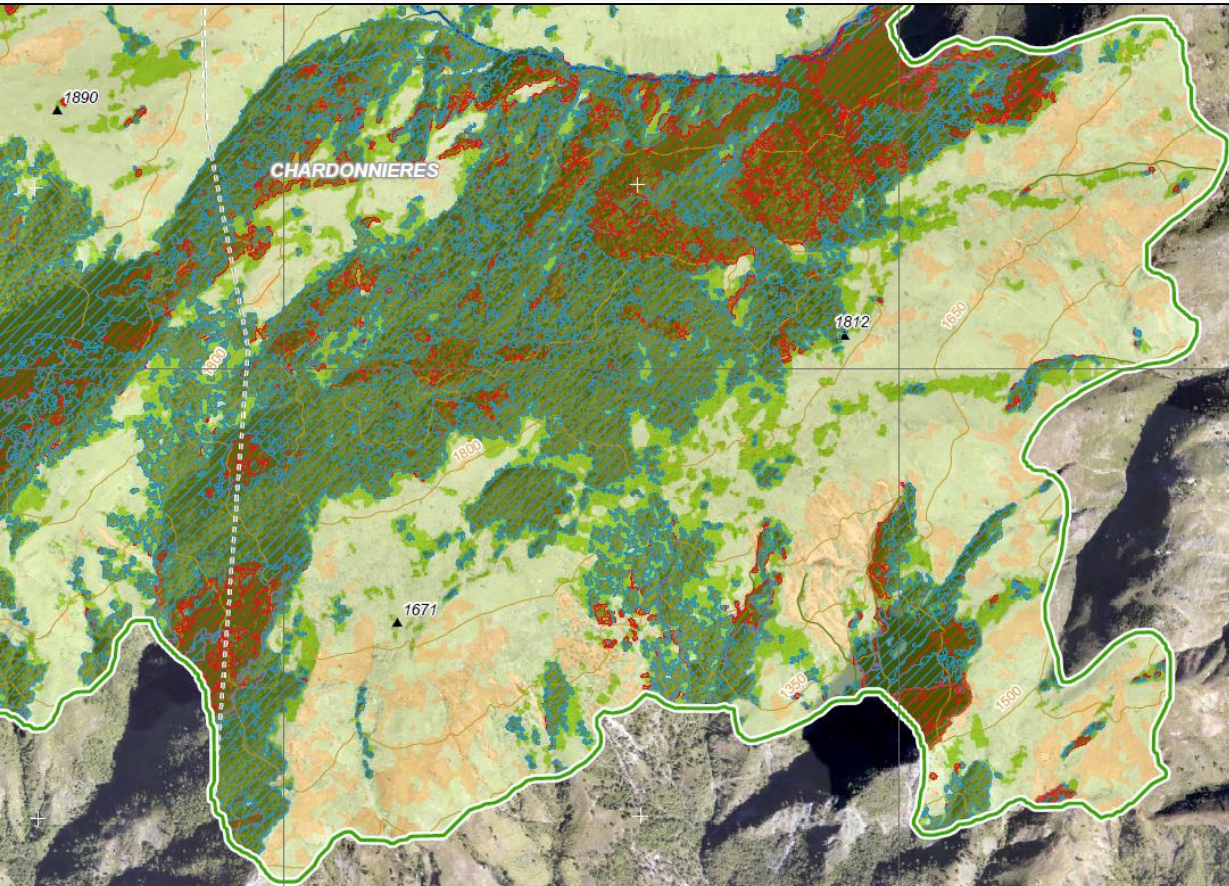
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Contact

For more information, please contact the Copernicus Data User Support Centre (CDUSC) at the following URL:
<http://www.copernicus.eu/data-user-support>
 Email: cdusc@ec.europa.eu
 Phone: +352 4303 4244





Suivi de la reprise de la végétation pour la petite aire protégée (835,3 ha)







Legend


Monitoring of forest stands

-  Regeneration under old stands
-  No visible change

Vegetation classification

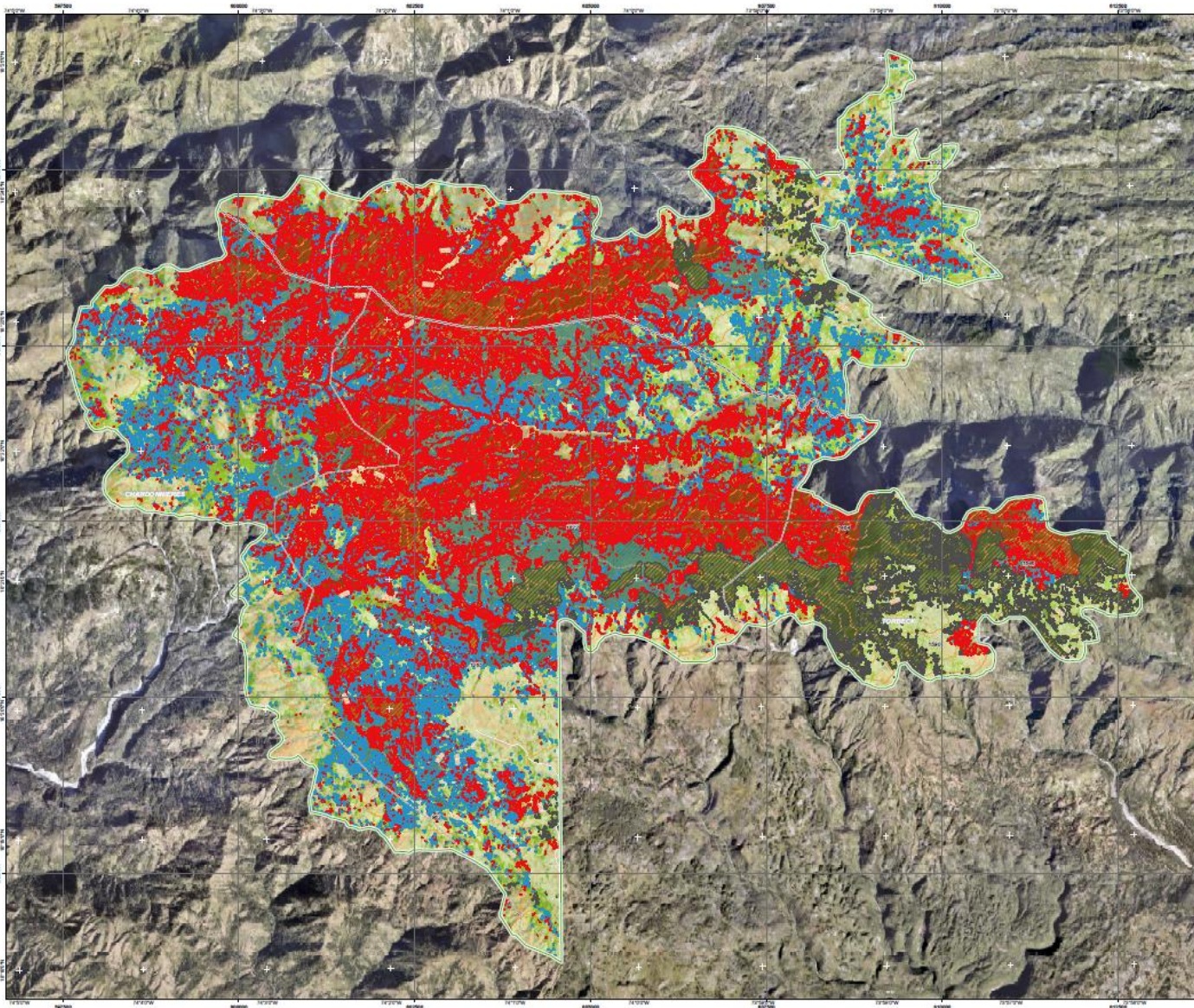
-  Woodland
-  Shrub
-  Herbaceous vegetation
-  Open space with little or no vegetation

Area of interest

-  Area of interest

Changes within the AOI

	Unit of measurement		Total in AOI
Forest stands	No visible change	ha	297.6
	Regeneration	ha	515.6
	Not analysed	ha	22.2



Glishe Number: (N/A)
 Activation ID: 62620261
 Product ID: COMACAMACT4-VL-Flaggs
Makaya Park (East) - HAITI
Vegetation - 08/12/2017
Monitoring Map - Overview



Cartographic Information:
 1:25 000
 Full color A1, high resolution (300dpi)

Legend
Monitoring of forest stands
 □ regeneration under set stands
 □ no visible change
 □ no analysis
Vegetation classification
 □ Woodland
 □ shrub
 □ herbaceous vegetation
 □ Open areas with little or no vegetation
 □ Lowland

Forest stands	Unit of measurement		Total in ACI
	Min	Max	
No visible change	ha	17500.0	
Regeneration	ha	23306.6	
Not analyzed	ha	608.6	

Map Information
 Creative Commons Attribution 4.0 International License (CC BY) as of October 03, 2014. We have been a 100% free to use and distribute. We are committed to the Open Access movement. The data has been derived from the satellite imagery and processed by the Copernicus Sentinel-2 mission. The data is provided as a public service and is intended to be used for research and monitoring purposes only. We do not assume any liability for the use of the data.

Event	Date (UTC)	Last file update
Event	08/12/2017	08/12/2017
Activation	16/08/2016	Map production: 23/01/2018

Data Sources
 Data has been based on: Administrative boundaries, LRS 2016, IGN/CN 2016, © Copernicus Sentinel-2, Copernicus Sentinel-1, Copernicus Sentinel-3, Copernicus Sentinel-5P, Copernicus Sentinel-6, Copernicus Sentinel-7, Copernicus Sentinel-8, Copernicus Sentinel-9, Copernicus Sentinel-10, Copernicus Sentinel-11, Copernicus Sentinel-12, Copernicus Sentinel-13, Copernicus Sentinel-14, Copernicus Sentinel-15, Copernicus Sentinel-16, Copernicus Sentinel-17, Copernicus Sentinel-18, Copernicus Sentinel-19, Copernicus Sentinel-20, Copernicus Sentinel-21, Copernicus Sentinel-22, Copernicus Sentinel-23, Copernicus Sentinel-24, Copernicus Sentinel-25, Copernicus Sentinel-26, Copernicus Sentinel-27, Copernicus Sentinel-28, Copernicus Sentinel-29, Copernicus Sentinel-30, Copernicus Sentinel-31, Copernicus Sentinel-32, Copernicus Sentinel-33, Copernicus Sentinel-34, Copernicus Sentinel-35, Copernicus Sentinel-36, Copernicus Sentinel-37, Copernicus Sentinel-38, Copernicus Sentinel-39, Copernicus Sentinel-40, Copernicus Sentinel-41, Copernicus Sentinel-42, Copernicus Sentinel-43, Copernicus Sentinel-44, Copernicus Sentinel-45, Copernicus Sentinel-46, Copernicus Sentinel-47, Copernicus Sentinel-48, Copernicus Sentinel-49, Copernicus Sentinel-50, Copernicus Sentinel-51, Copernicus Sentinel-52, Copernicus Sentinel-53, Copernicus Sentinel-54, Copernicus Sentinel-55, Copernicus Sentinel-56, Copernicus Sentinel-57, Copernicus Sentinel-58, Copernicus Sentinel-59, Copernicus Sentinel-60, Copernicus Sentinel-61, Copernicus Sentinel-62, Copernicus Sentinel-63, Copernicus Sentinel-64, Copernicus Sentinel-65, Copernicus Sentinel-66, Copernicus Sentinel-67, Copernicus Sentinel-68, Copernicus Sentinel-69, Copernicus Sentinel-70, Copernicus Sentinel-71, Copernicus Sentinel-72, Copernicus Sentinel-73, Copernicus Sentinel-74, Copernicus Sentinel-75, Copernicus Sentinel-76, Copernicus Sentinel-77, Copernicus Sentinel-78, Copernicus Sentinel-79, Copernicus Sentinel-80, Copernicus Sentinel-81, Copernicus Sentinel-82, Copernicus Sentinel-83, Copernicus Sentinel-84, Copernicus Sentinel-85, Copernicus Sentinel-86, Copernicus Sentinel-87, Copernicus Sentinel-88, Copernicus Sentinel-89, Copernicus Sentinel-90, Copernicus Sentinel-91, Copernicus Sentinel-92, Copernicus Sentinel-93, Copernicus Sentinel-94, Copernicus Sentinel-95, Copernicus Sentinel-96, Copernicus Sentinel-97, Copernicus Sentinel-98, Copernicus Sentinel-99, Copernicus Sentinel-100.

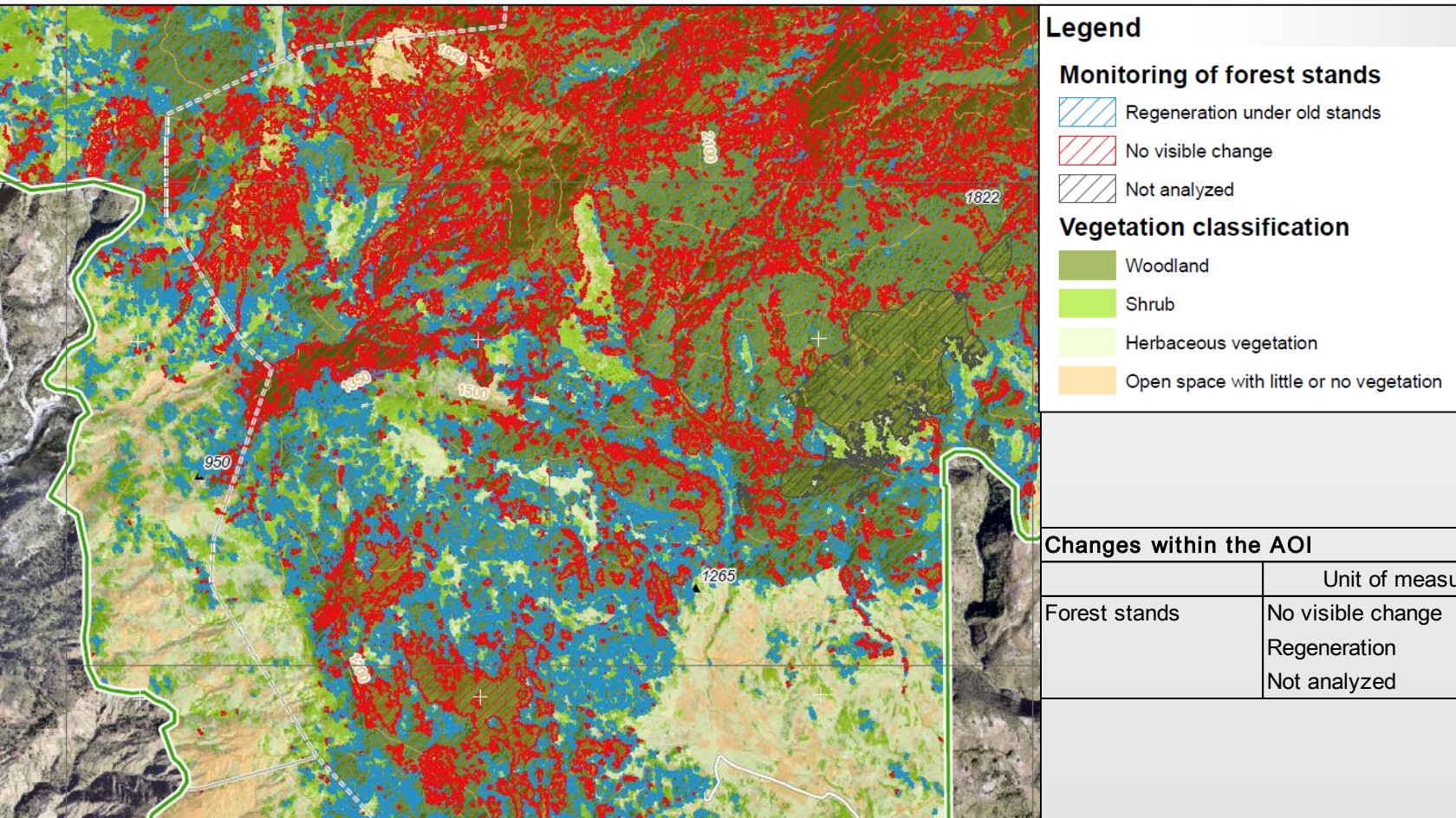
Dissemination/Publication
 Map products are available in the Copernicus Data Store at the following URL: <https://data.mfn.eu/>. Delivery formats are GeoTIFF, GeoJSON, GeoRSS and vector (shapefile and KMZ, FileGlobe).

Disclaimer
 The products generated in the framework of current mapping in Haiti and necessary information are subject to the usual quality, including the possible data and information of the target data sources. The products are provided with Copernicus Data Store and necessary disclaimer information.

Contact
 Map produced on 23/01/2018. 08/12/2017 (date indicated: 08/12/2017) with the Sentinel-2 products. All products are © of the European Commission. For more information, contact: info@copernicus.eu






Suivi de la reprise de la végétation pour la grande aire protégée (4704,6 ha)







Legend

Monitoring of forest stands

-  Regeneration under old stands
-  No visible change
-  Not analyzed

Vegetation classification

-  Woodland
-  Shrub
-  Herbaceous vegetation
-  Open space with little or no vegetation

Changes within the AOI

	Unit of measurement		Total in AOI
Forest stands	No visible change	ha	1759.2
	Regeneration	ha	2336.5
	Not analyzed	ha	608.8



Classification de la végétation (2019)

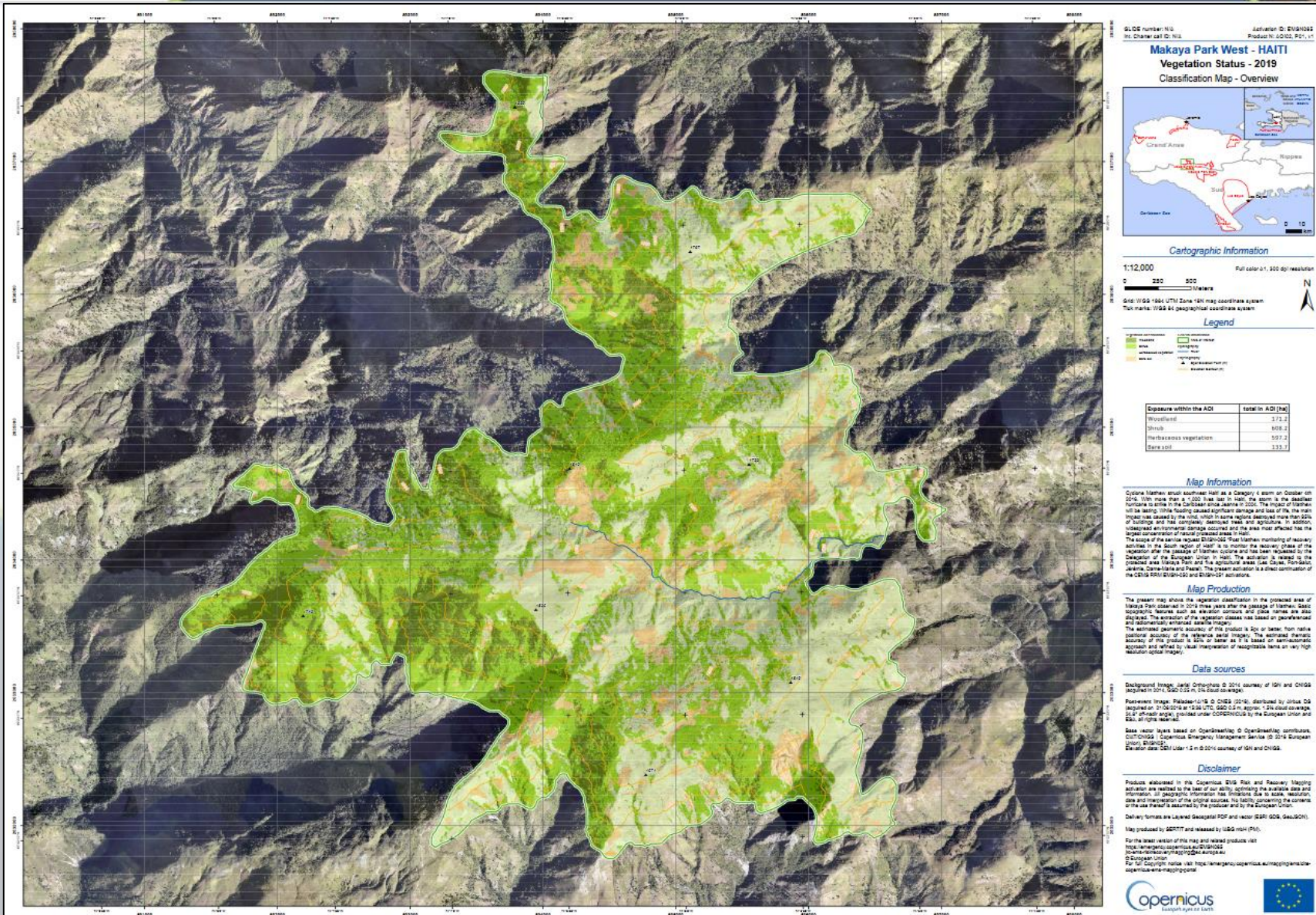
Même méthode appliquée que pour 2016, et même nomenclature

Evolution du couvert forestier (2016/2019)

Croisement des classifications 2016 et 2019

Création d'une matrice de correspondance pour la mise en évidence des changements

Initial class	Final class	Monitoring class name
313	313	Woodland under recovery (since all woodland have been at least damaged after Matthew cyclone)
313	324/321/336	Disappeared woodland



SLD number: NIS Action: O. D104003
 in: Charter call ID: NIS Product: D.0202_2019_v1

Makaya Park West - HAITI Vegetation Status - 2019 Classification Map - Overview



Cartographic Information

1:12,000 Full color (1, 200 dpi) resolution
 0 250 500 Meters N

Grid: WGS 1984 UTM Zone 18N map coordinate system
 The map uses WGS 84 geographical coordinate system

Legend

Grassland	Water	Non-forest	Forest
Herbaceous vegetation	Shrub	Deciduous forest	Evergreen forest
Bare soil	Urban	Shrub	Deciduous forest
	Urban	Shrub	Deciduous forest

Vegetation within the ADI	Area in ADI (ha)
Woodland	174.2
Shrub	408.1
Herbaceous vegetation	597.2
Bare soil	132.7

Map Information

Cyclone Mathias struck southern Haiti as a Category 4 storm on October 01 2016. With more than a 1000 mm of rain, the storm is the deadliest hurricane to strike the Caribbean since Maria in 2017. The impact of Mathias will be lasting with flooding caused significant damage and loss of life, the main impact was caused by the wind, which caused significant destruction to the roofs of buildings and has completely destroyed trees and agriculture. In addition, widespread environmental damage occurred and the area most affected has the lowest concentration of forest protected areas in Haiti.
 The scope of the satellite based D104003 Cyclone Mathias monitoring of recovery activities in the study area is to provide the recovery status of the vegetation after the passage of Mathias, cyclone and has been realized by the Department of Environment and Sustainable Development of Haiti in the protected area Makaya Park and the agriculture area (Les Cayes, Fort-Saint-Jean, Duvallier, Duvallier, and Duvallier) and the present satellite data is a direct continuation of the SLD D104002 and D104001 activities.

Map Production

The present map shows the vegetation classification in the protected area of Makaya Park collected in 2019, three years after the passage of Mathias. Basic geographic features, such as elevation contours and place names are also displayed. The accuracy of the vegetation classes was checked on ground-based and independently generated satellite images.
 The estimated geometric accuracy of this product is 5m or better, from native positional accuracy of the reference aerial imagery, the estimated thematic accuracy of this product is 40% or better in the field, depending of the accuracy of the data provided in the input and the quality of the classification approach and refined by visual interpretation of recognizable items on very high resolution optical imagery.

Data sources

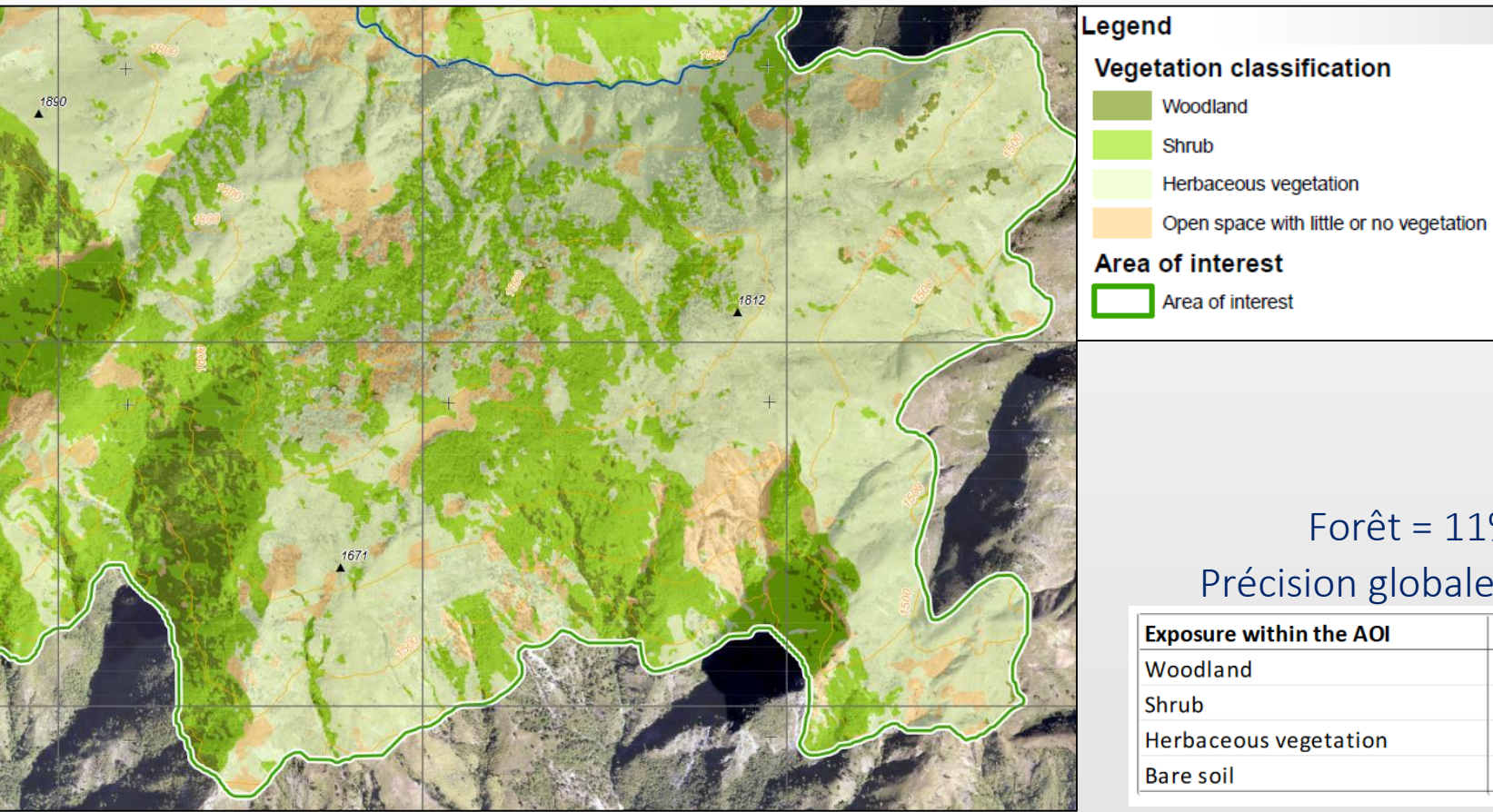
Background Image: Landsat Orthorectified © 2014 courtesy of USGS and CNRS (Landsat-7, 2002-2013), USGS Landsat-8
 Post-event Image: Planet-1015 © CNRS (2016), distributed by Airbus DS (acquired on 17/06/2016 at 13:38 UTC, 200-0.5 m, approx. 75% cloud coverage, 24 bit channel depth), provided under CONTRIBUTION by the European Union and ESA, at rights reserved.
 Base elevation data: Derived from Copernicus Data Coordination, coordinates: Copernicus Copernicus Emergency Management Service © 2016 European Union, Elevation data: SRTM 1 arc second © 2014 courtesy of USGS and CNRS

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 Delivery format: Geotiff (zip) and vector (GML, CSV, GeoJSON).
 Map produced by: ESA/ESA and released by: USGS (PMA).
 For the most recent version of this map and related products visit:
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 Copernicus Emergency Management Service
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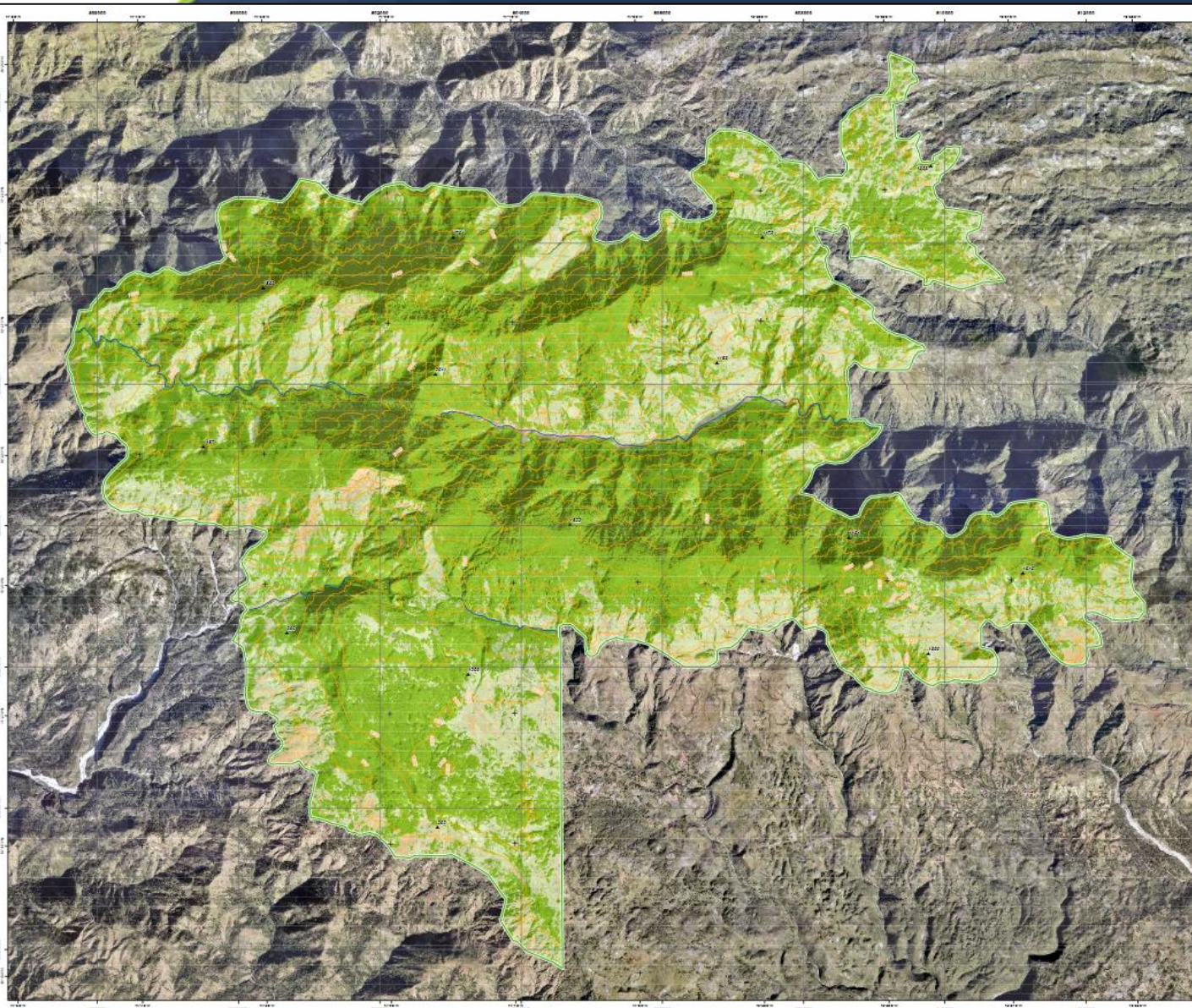
Classification de la végétation pour la petite aire protégée (1510,4 ha)



Forêt = 11%

Précision globale = 89%

Exposure within the AOI	total in AOI [ha]
Woodland	171.2
Shrub	608.2
Herbaceous vegetation	597.2
Bare soil	133.7



GLIDE number: N/A
 Int. Charter call ID: N/A
 Revision ID: EIV10045
 Product No: A005_P01_v1

Makaya Park East - HAITI Vegetation Status - 2019 Classification Map - Overview



Cartographic Information

1:25,000
 Full color at 300 dpi resolution
 0 250 500 1,000 1,500 Meters
 448 1168 1668 UTM Zone 18N map coordinate system
 Tick marks: UTM 84 geographical coordinate system

Legend

Forest (dark green)	Shrub (medium green)	Herbaceous vegetation (light green)	Water (blue)	Urban (grey)	Other (brown)
Bare soil (brown)	Water (blue)	Urban (grey)	Other (brown)		

Exposure within the ACI	Total in ACI (ha)
Forest	1131.0
Shrub	5003.4
Herbaceous vegetation	2177.7
Bare soil	772.2

Map Information

Cyclone Matthew struck southern Haiti as a Category 4 storm on October 29, 2016, more than 4,000 km east of Haiti. It was the deadliest hurricane to strike in the Caribbean since Jeanne in 2004. The impact of Matthew will be lasting, with flooding caused significant damage and loss of life. The most impact was caused by the wind, which in some regions destroyed more than 95% of buildings and has completely destroyed trees and agriculture. In addition, widespread environmental damage occurred and the area most affected was the largest concentration of natural protected areas in Haiti.
 The scope of the satellite based GLIM-2016 Post-Matthew monitoring of recovery activities in the south-west of Haiti is to monitor the recovery of the vegetation after the passage of Matthew, cyclone and has been requested by the Director of the Biosphere Circle in Haiti. This activities is related with the protected area Makaya Park and the agriculture area (Les Cayes, Fort-Denis, Jeanne, Cap-Haïtien and Pétion). The present application is a direct continuation of the GLIM 2016 (GLIM-2016 and EIV10045) activities.

Map Production

The present map shows the vegetation classification in the protected area of Makaya Park East obtained in 2019 from satellite data after the passage of Matthew. Basic geographic features such as elevation contours and place names are also displayed. The extraction of the vegetation classes was based on supervised and automatically enhanced satellite images.
 The estimated geometric accuracy of this product is 20 m based from native positional accuracy of the reference satellite images. The estimated thematic accuracy of this product is 80% or better as it is based on semi-automatic approach and verified by visual interpretation of recognizable items on very high resolution optical images.

Data sources

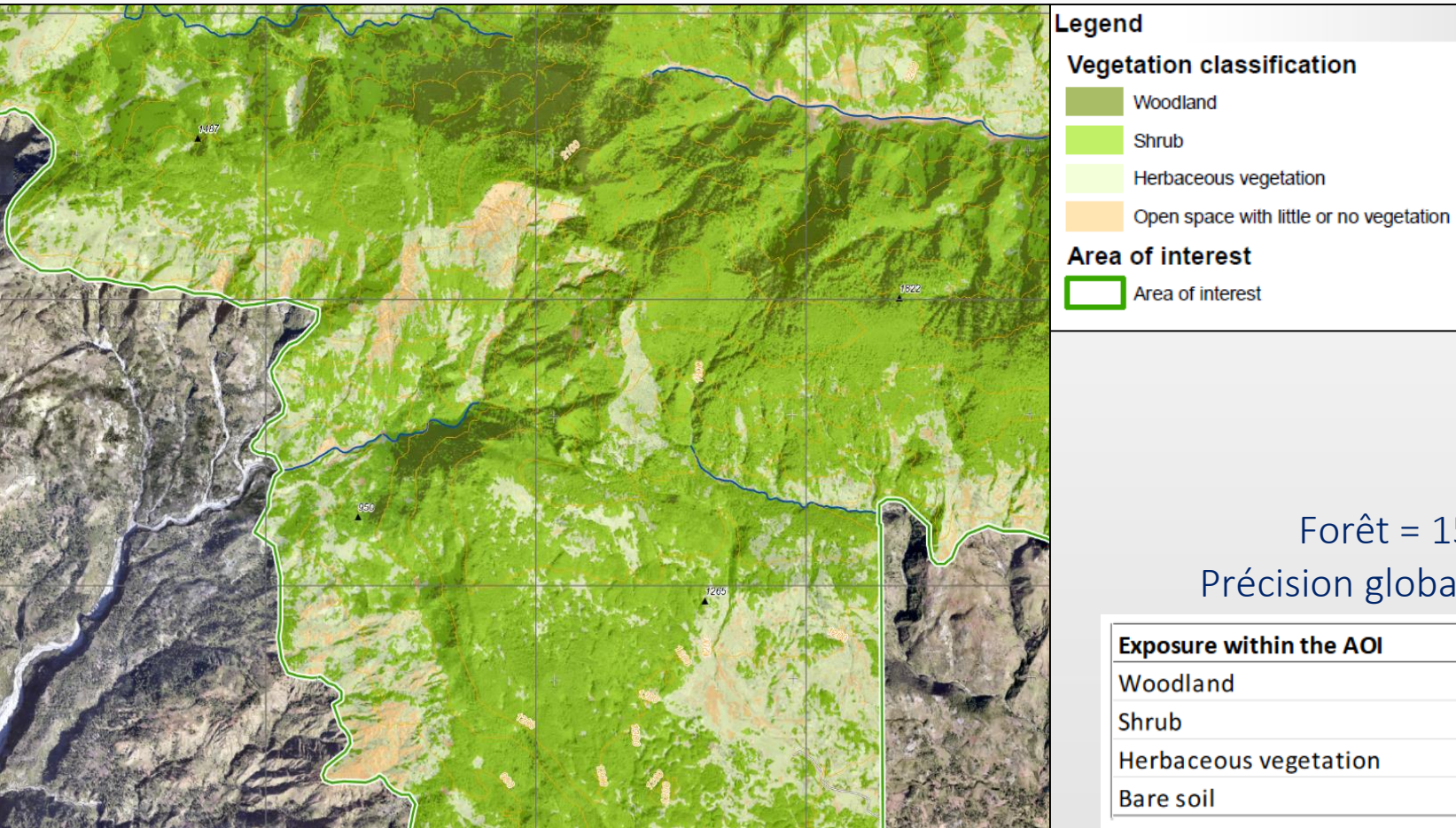
Background image: satellite Orthorectified © 2014 courtesy of IGN and CNRS (acquired in 2014, 30m x 30m resolution).
 Post-event image: Sentinel-2 © 2019 Digital Globe Inc. (acquired on 01/01/2019 at 10:00 UTM 18N E 1870000, 1668000, 1668000 coverage, 10m resolution, 10-bit radiance, provided under Copernicus Data User Agreement (DUA) and Sentinel-2 Data User Agreement (DUA)).
 Pre-event image: Sentinel-2 © 2019 Digital Globe Inc. (acquired on 01/01/2019 at 10:00 UTM 18N E 1870000, 1668000, 1668000 coverage, 10-bit radiance, provided under Copernicus Data User Agreement (DUA) and Sentinel-2 Data User Agreement (DUA)).
 Elevation data: SRTM30 PLUS © 2006, distributed by United States Geological Survey (USGS) under the Earth Data Policy and Access System (EDPAS) license.
 Data user: based on Copernicus Data User Agreement (DUA) and Sentinel-2 Data User Agreement (DUA).
 Elevation data: SRTM30 PLUS © 2006, distributed by United States Geological Survey (USGS) under the Earth Data Policy and Access System (EDPAS) license.

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 Delivery formats are Layered Geospatial PDF and vector (SHP, GML, GeoJSON).
 Map produced by SERTT and released by US&MSH (P/E).
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 For Copernicus terms, visit: <http://ec.europa.eu/copernicus-data-user-agreement/>.

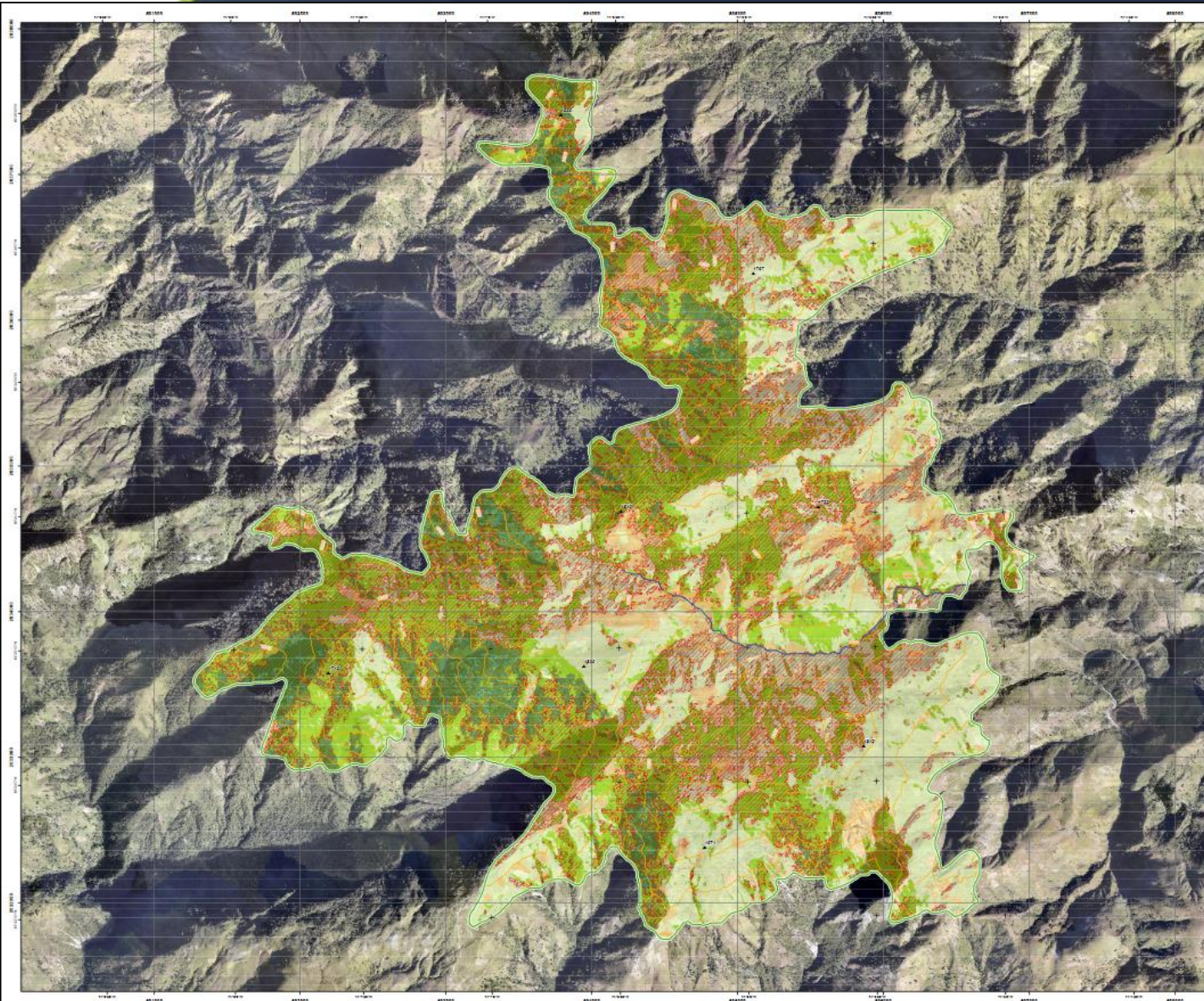


Classification de la végétation pour la grande aire protégée (8719,2 ha)



Forêt = 15%
Précision globale = 87%

Exposure within the AOI	total in AOI [ha]
Woodland	1315.4
Shrub	5004.4
Herbaceous vegetation	2127.2
Bare soil	272.2



GLIDE Number: N/A
 Proj. Charter call ID: N/A
 Version: 014/0623
 Product: 0002_002_v1

Makaya Park West - HAITI
Vegetation Regeneration - 2019
 Monitoring Map - Overview



Cartographic Information

1:12,000 Full color at 1,500 dpi resolution

0 250 500 Meters

SRS: UTM Zone 18N
 SRS: UTM Zone 18N map coordinate system
 TPC marks: WGS 84 geographical coordinate system

Legend

Vegetation	Water
Forest	Open water
Regeneration	Swamp
Urban	Shallow water
Barren	Deep water
Shrubland	Ice
Grassland	Perennial snow
High mountain	Seasonal snow
Low mountain	Sea level

Changes within the BS	Surface (km ²)
Woodland under recovery	121.5
Disappeared woodland	102.8

Map Information

Cyclone Matthew struck southwest Haiti as a Category 4 storm on October 08, 2016. With winds near a 200 km/h gust, it made the storm the deadliest hurricane to strike in the Caribbean since James in 2005. The impact of Matthew will be lasting, with flooding, eroded agriculture, damage and loss of life, the worst impact has caused in the past. Loss of forest, agriculture, and loss of the built environment has caused the most. Loss of forest, agriculture, and loss of the built environment has caused the most. Loss of forest, agriculture, and loss of the built environment has caused the most.

Map Production

This project was funded by the Copernicus Programme in the protected area of Makaya Park before the passage of Matthew cyclone and 2016. Basic topographic features such as elevation contours and place names are also displayed. The accuracy of the vegetation dataset was based on ground-truthed and independently validated satellite imagery. The estimated geometric accuracy of this product is 5 m or better from native positional accuracy of the reference aerial imagery. The estimated thematic accuracy of this product is 80% or better as it is based on semi-automatic approach and refined by visual interpretation of representative areas on very high resolution optical imagery.

Data sources

Background Image: Jaxa: GTOPO30 © 2016 courtesy of USGS and CNES (acquired in 2015, 500 x 500 m, 1% cloud coverage)

Post-event Image: Planet: 1.1 m © CNES (2016), distributed by Jaxa: DS Acquisition: 2016/09/16 in 1.1 m © CNES (2016), 1% cloud coverage, 20.1° off-nadir angle, provided under COPERNICUS by the European Union and ESA, all rights reserved.

Basic vector layers based on OpenStreetMap © OpenStreetMap contributors, Copernicus Copernicus Emergency Management Service © 2016 European Union, ESRI/DeLorme

Vector data: IGN/IGNF 1:50,000 © 2016 courtesy of IGN and CNES

Disclaimer

Product elaborated in the Copernicus EMIS Risk and Recovery Mapping activation are realized in the best of our ability, optimizing the available data and information. Copernicus information has limitations due to its nature, resolution, data and interpretation of the original sources. Its liability concerning the content of the data and its reliability is the producer's and the European Union's.

Delivery format: as Layered Geospatial PDF and vector (GeoJSON, GeoJSON, GeoTIFF)

Map produced by: GEOINT and released by: GEOINT (RIS)

For the latest version of this map and related products visit: <https://emergency.copernicus.eu/mapping/en/activations/recovery-mapping-haiti>

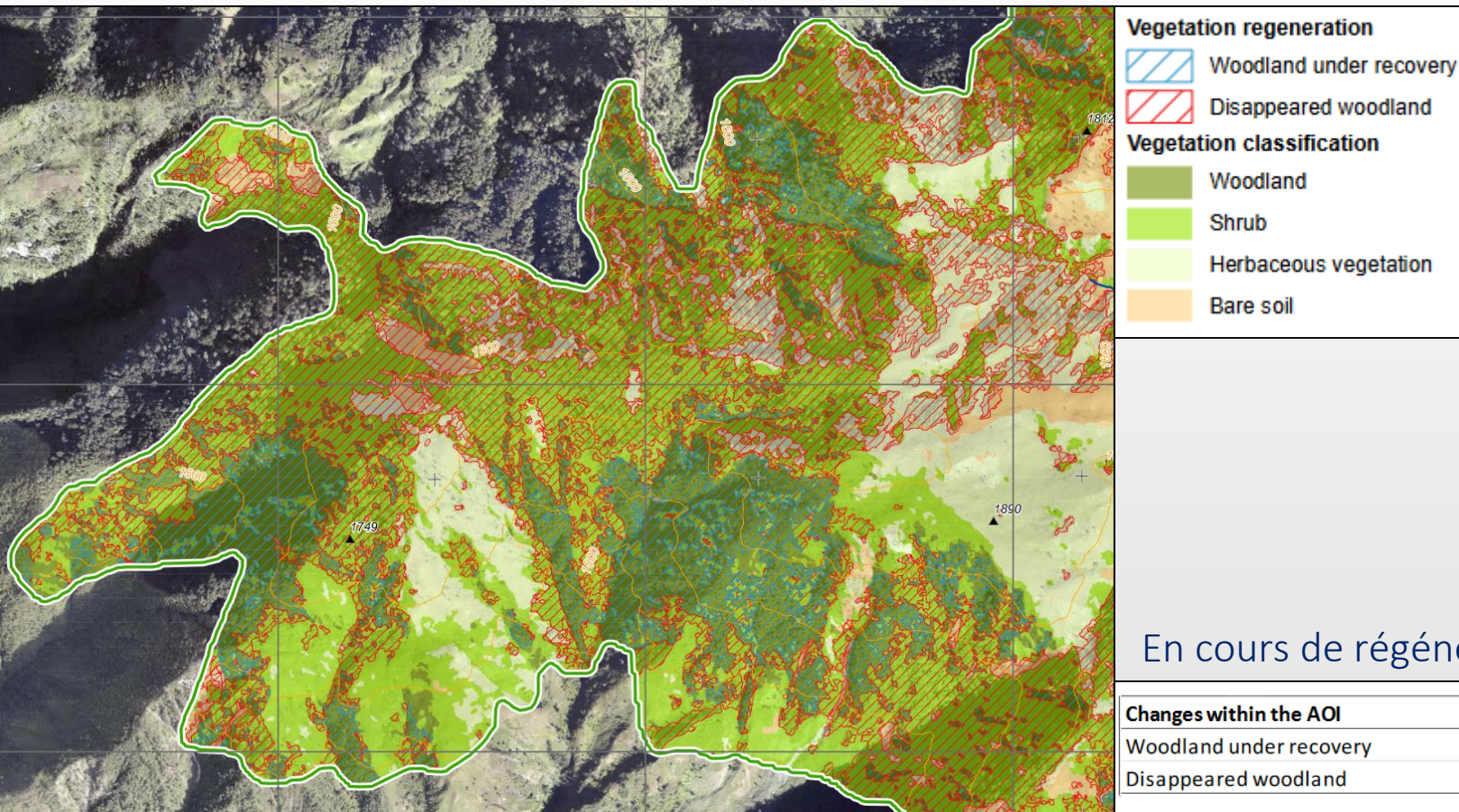
For further information visit: <https://emergency.copernicus.eu/mapping/en/activations/recovery-mapping-haiti>

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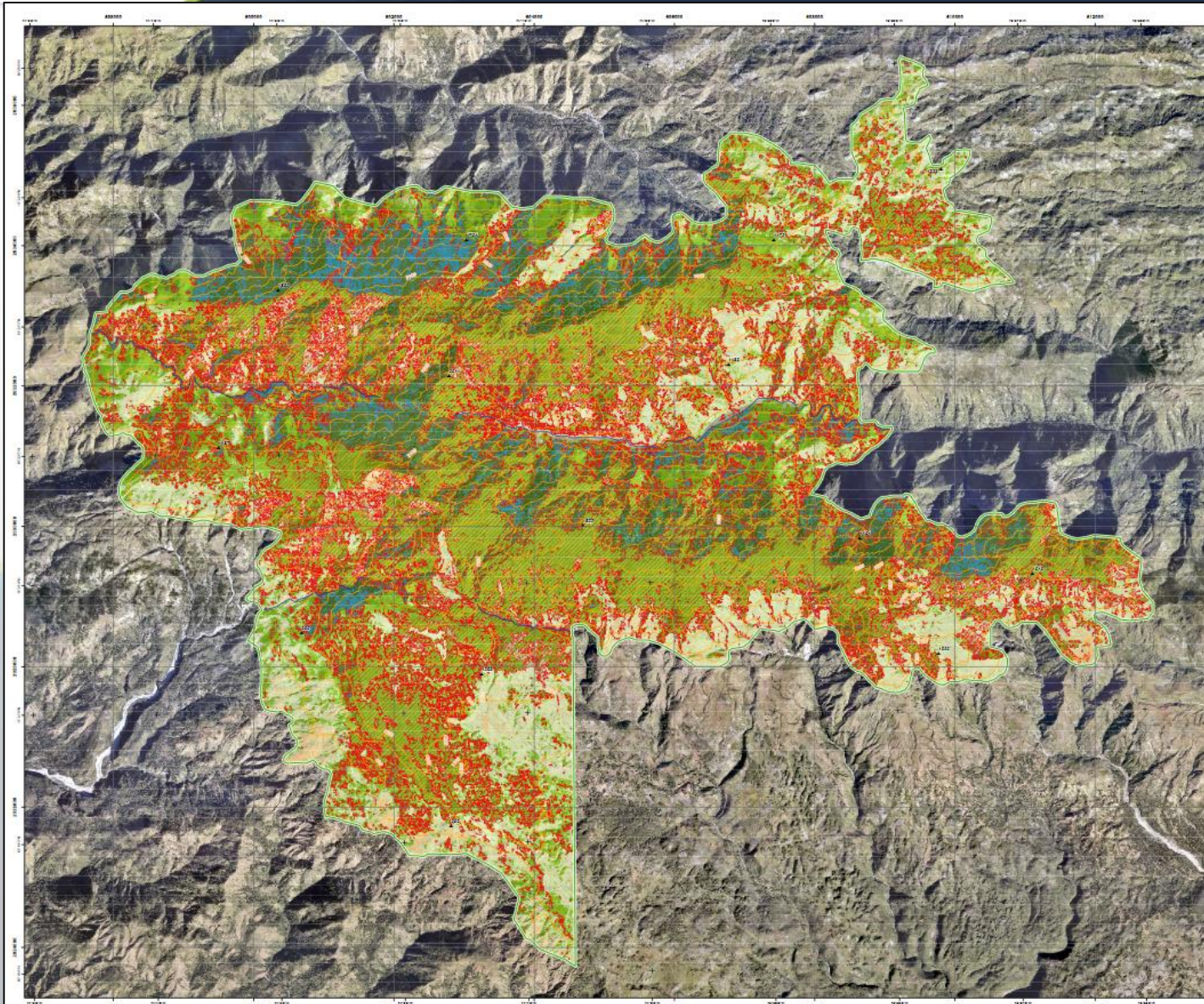
Evolution du couvert forestier pour la petite aire protégée (835,3 ha)



En cours de régénération = 18%

Changes within the AOI	total in AOI [ha]
Woodland under recovery	153.5
Disappeared woodland	681.8

Suivi du Parc Macaya



SLC Number: N10
 Charter call ID: N10
 Station ID: ENV0002
 Product ID: 0202_P02_1

Makaya Park East - HAITI
Vegetation Regeneration - 2019
 Monitoring Map - Overview



Cartographic Information

1:25,000 Full color 31,500 dpi resolution
 0 250 500 1,000 1,500 Meters

SRS: UTM Zone 18N
 Top: WGS 84 geographic coordinate system
 Top: WGS 84 geographic coordinate system

Legend

Vegetation classes	Water bodies
Forest cover losses	Open areas
Regeneration classes	Urban built
Water bodies	Water bodies
Open areas	Open areas
Urban built	Urban built
Water bodies	Water bodies
Open areas	Open areas
Urban built	Urban built

Map Information

Cyclone Matthew struck southern Haiti as a Category 4 storm on October 08, 2016, with 100 km/h (62 mph) winds. The storm is the strongest hurricane to strike the Caribbean since Jeanne in 2004. The impact of Matthew will be lasting, with flooding caused significant damage and loss of the major crop and livestock. In some regions, between 60% and 90% of buildings and infrastructure were destroyed. In addition, widespread environmental damage occurred and the area most affected has the largest concentration of natural reserves in Haiti.

The scope of the present report is to monitor the recovery of the vegetation in the study region after the passage of Matthew cyclone and has been prepared by the Department of the Environment of Haiti. The information is related to the protected area Macaya Park and the agricultural areas Les Cayes, Port-au-Prince, Cap-Haïtien and Les Cayes. The present information is a direct continuation of the CEOS 2007 ENV0002 and ENV0003 activities.

Map Production

The present map shows the vegetation regeneration in the protected area of Macaya Park. Data between before the passage of Matthew cyclone and 2019. Basic topographic features such as elevation contours and place names are also displayed. The extraction of the vegetation classes was based on geographical and automatically enhanced satellite imagery.

The estimated accuracy of the product is 80% or better from native positional accuracy of the reference aerial images. The estimated thematic accuracy of the product is 80% or better as it is based on semi-automatic approach and refined by visual interpretation of recognizable items on very high resolution optical imagery.

Data sources

Background image: JRC Orthophoto © 2014 courtesy of IGN and CNIGS (acquired in 2014, 500 m in 1x cloud coverage)

Forest cover image: GeoEye © 2018 Digital Globe Inc. (acquired on 01/01/2018 at 1.01 UTC, 500 0.5 m, approx. 0% cloud coverage, 23.0° azimuth angle, all 0% haze)

Reference data: CNIGS © 2018, distributed by IGNIS SA (acquired on 04/02/2018 at 10:42 UTC, 500 0.5 m, approx. 0% cloud coverage, 23.0° azimuth angle, all 0% haze)

Reference data: CNIGS © 2018, distributed by IGNIS SA (acquired on 04/02/2018 at 10:57 UTC, 500 0.5 m, approx. 0% cloud coverage, 23.0° azimuth angle, all 0% haze)

Disclaimer

Product elaborated in the Copernicus ENV Risk and Resilience Mapping activities are provided to the best of our ability, according to the available data and information of the original sources. No liability, concerning the contents of the use of the product, is assumed by the Copernicus Mission.

Delivery formats are Legend Geographical PDF and raster: GeoTIFF (GeoTIFF/GeoJSON)

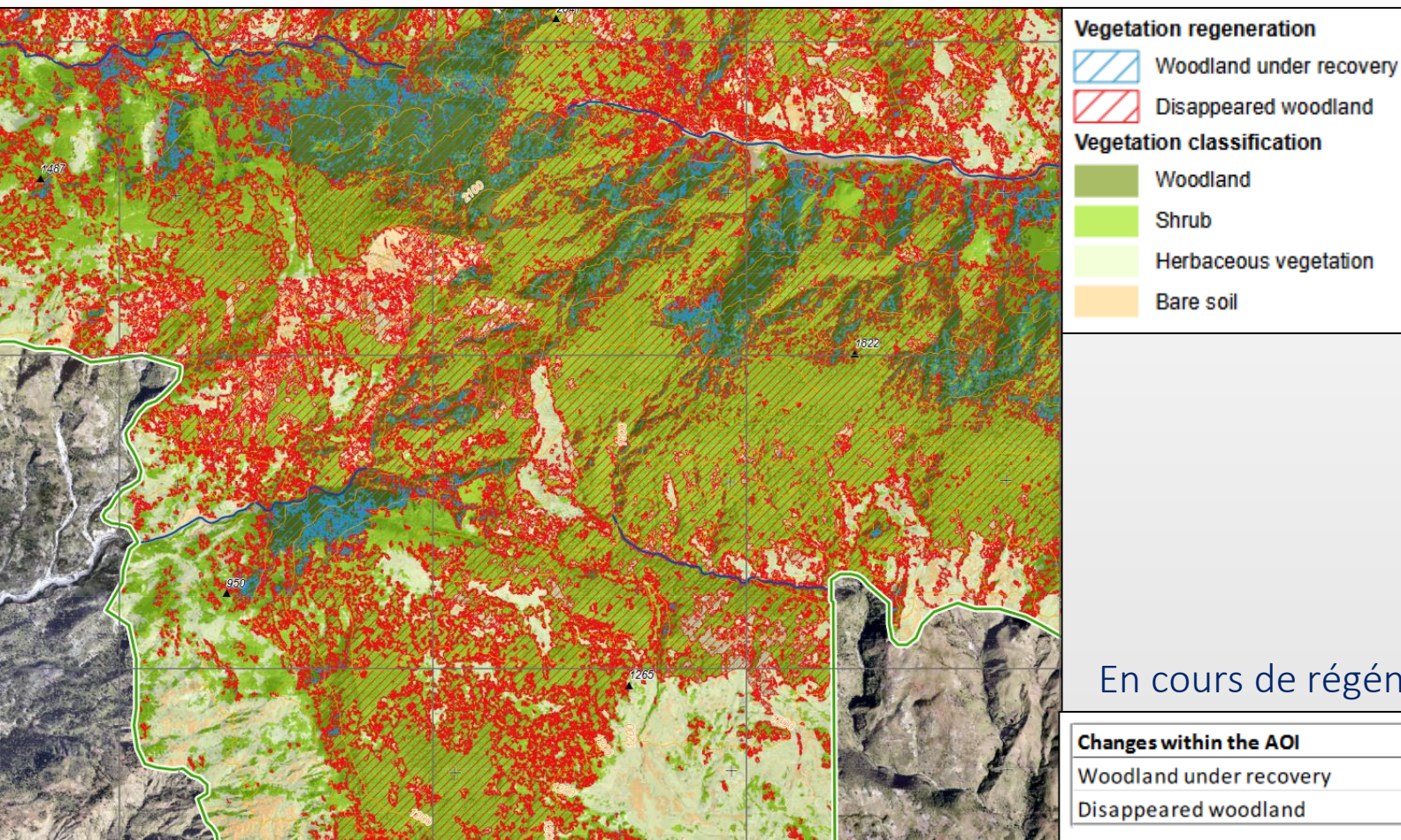
Map produced by: SERTT and released by: IGNIS (IGNIS)

For the latest version of this map and related products visit: <http://amigo.copernicus.eu/ENV0002>

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Evolution du couvert forestier pour la grande aire protégée (4704,6 ha)



En cours de régénération = 23%

Changes within the AOI	total in AOI [ha]
Woodland under recovery	1098.5
Disappeared woodland	3606.1



Résultats

Statistiques disponibles dans le rapport final:

- Surface pour chaque classe en 2019
- Variation par rapport à 2016
- Evolution de la forêt 2016/2019
- Tableau croisé des changements par classe entre 2016 et 2019

Code	Class name	AOI2 - Surface (ha)	Variation 2016-2019 (%)	AOI3 - Surface (ha)	Variation 2016-2019 (%)
313	Woodland	171.2	-79.50%	1,315.4	-72.00%
324	Shrub	608.2	+296.50%	5,004.4	+121.60%
321	Herbaceous vegetation	597.2	+36.10%	2,127.2	+54.20%
336	Bare soil	133.7	+61.50%	272.2	-27.70%

Class name	AOI2 - Surface (ha)	Relative to 2016	AOI3 - Surface (ha)	Relative to 2016
Woodland under recovery	153.5	18.4%	1,098.5	23.3%
Disappeared woodland	681.8	81.6%	3,606.1	76.7%

	T3	313	324	321	336
T0	Vegetation classes				
313	Woodland	18.4%	6.7%	1.4%	1.6%
324	Shrub	52.0%	40.7%	24.6%	3.8%
321	Herbaceous vegetation	23.2%	42.3%	62.6%	77.1%
336	Bare soil	6.4%	10.2%	11.4%	17.5%
	Sum	100.0%	100.0%	100.0%	100.0%



Conclusions

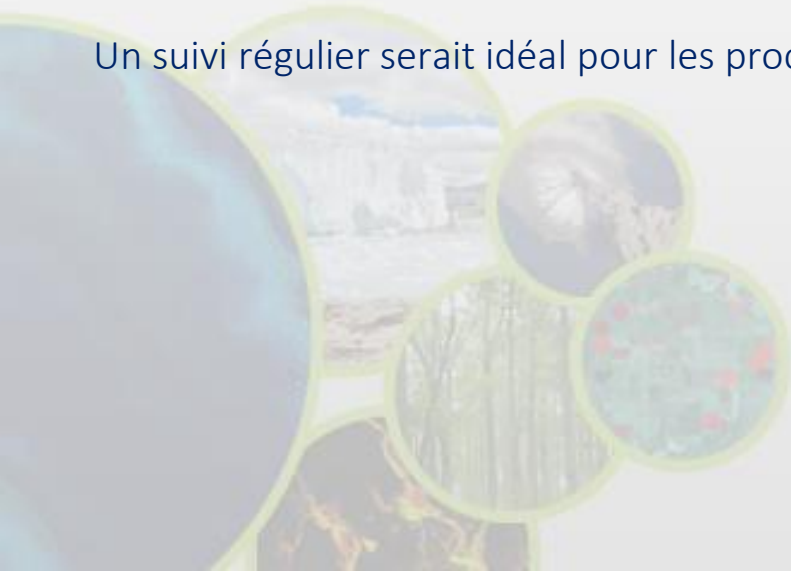
Avant le passage du cyclone Matthieu, la forêt occupait environ 50% des deux aires protégées.

L'ensemble de la forêt a été affectée (partiellement ou fortement) !

Phase de croissance nécessaire avant de retrouver la hauteur et la densité de canopée équivalente.

En 2019, la forêt occupait environ 20% des deux aires protégées !

Un suivi régulier serait idéal pour les prochaines années (fréquence annuelle ?)



- Classification de la végétation pré-Matthieu (2016)
- Evaluation des dégâts et suivi de la reprise végétale (2017)
- Classification de la végétation post-Matthieu (2019)
- Evolution du couvert forestier entre 2017 et 2019
- **Suivi de l'habitat entre 2014 et 2018**
- Etude pour la cartographie des sentiers en 2018

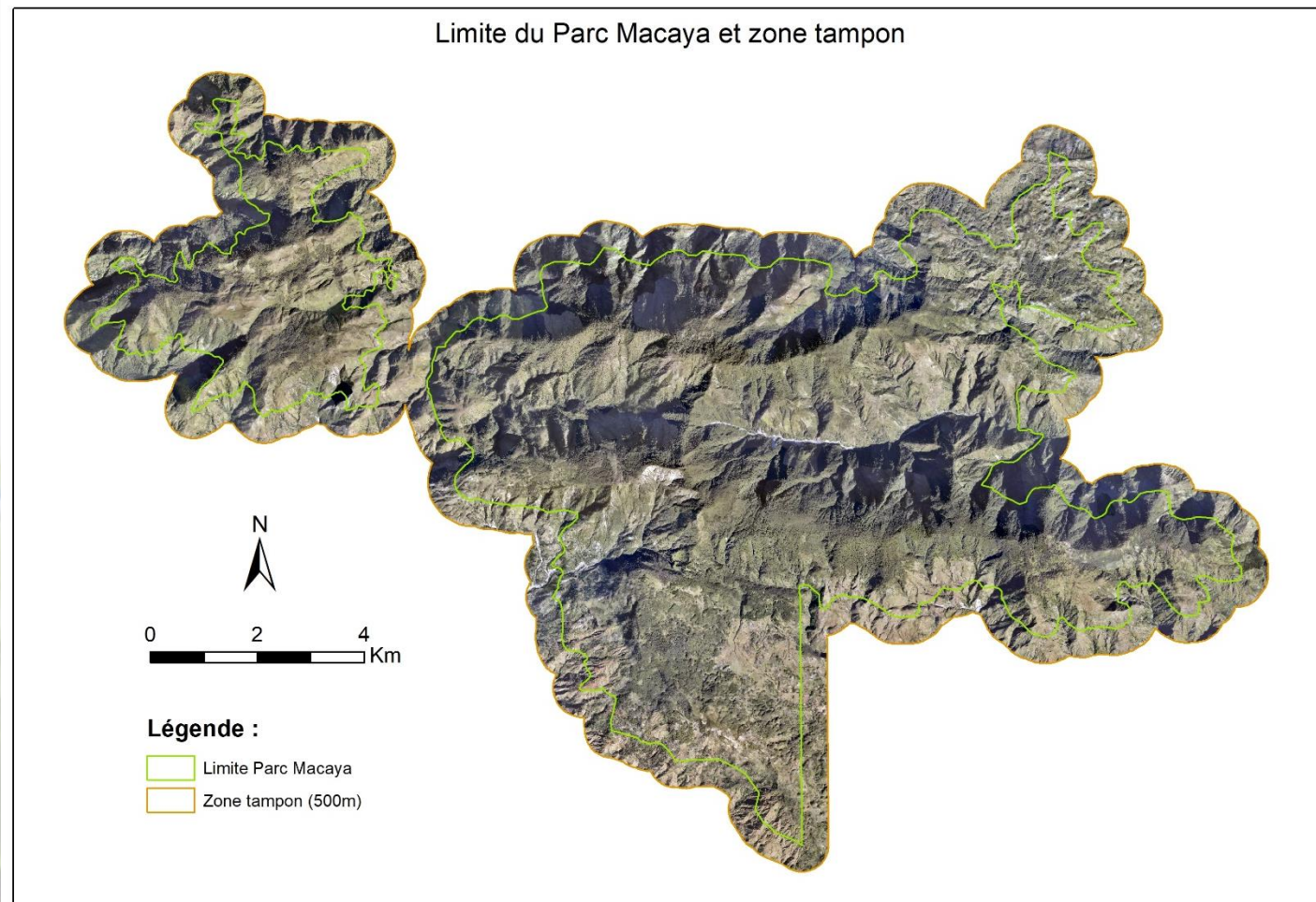


Zone d'étude

Les deux aires protégées du Parc Macaya.

Avec une zone tampon de 500 mètres.

Permet d'avoir une continuité spatiales





Information produite

- Cartographie complète des bâtiments présents sur la zone étendue du Parc Macaya en 2014
- Cartographie partielle (présence de nuages) des bâtiments présents sur la zone étendue du Parc Macaya en 2017 et 2018
- Une même couche d'information avec un champ permettant de renseigner la présence ou l'absence pour chaque date :
 - 0 : absence
 - 1 : présence
 - 2 : non analysé (nuages)



Quelques chiffres :

2014	
Nombre de bâtiments	1 299
Surface de la zone d'étude	15 105 ha
Densité	8,6 bâtiment/km ²

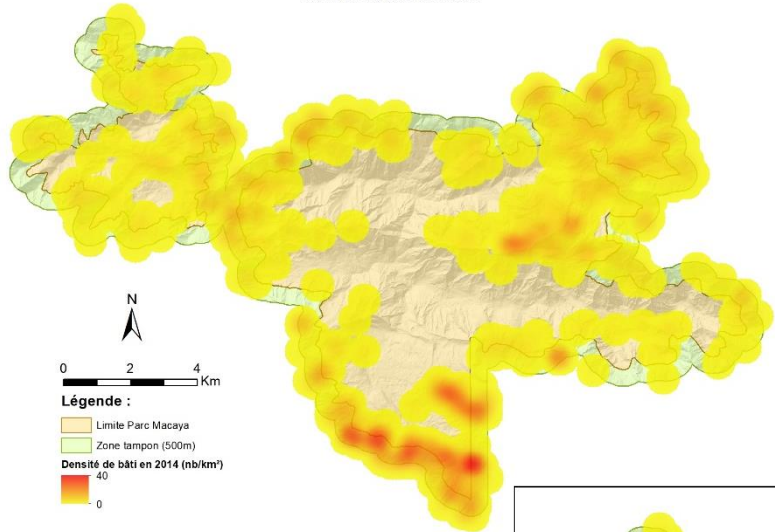
2014-2017	
Bâtiments toujours présents	637
Nouveaux bâtiments	153
Bâtiments disparus	546
Bâtiments non analysés (nuages)	116
Surface de la zone d'étude	15 105 ha
Densité	Non applicable

2014-2017-2018	
Bâtiments toujours présents	533
Nouveaux bâtiments	232
Bâtiments reconstruits	25
Bâtiments disparus	554
Bâtiments non analysés (nuages)	219
Surface de la zone d'étude	15 105 ha
Densité	Non applicable

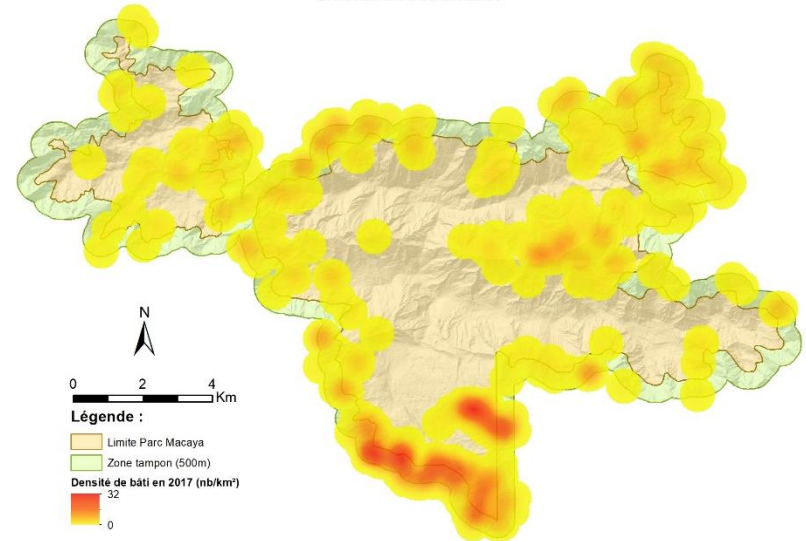


Evolution de la densité du bâti :

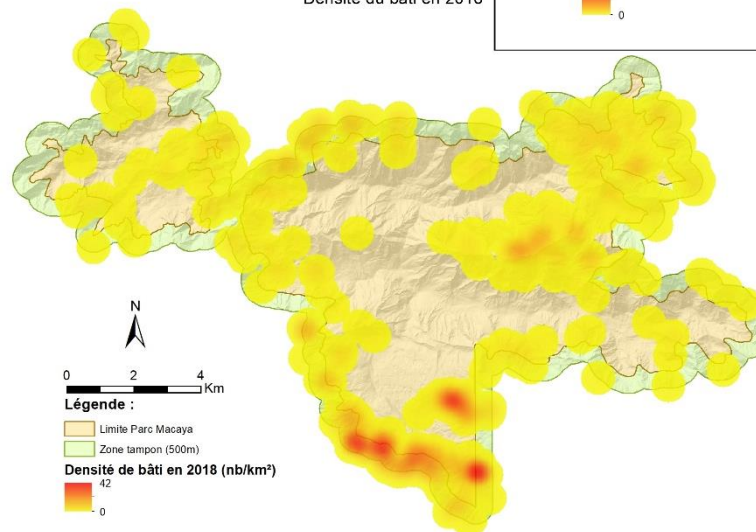
Densité du bâti en 2014



Densité du bâti en 2017



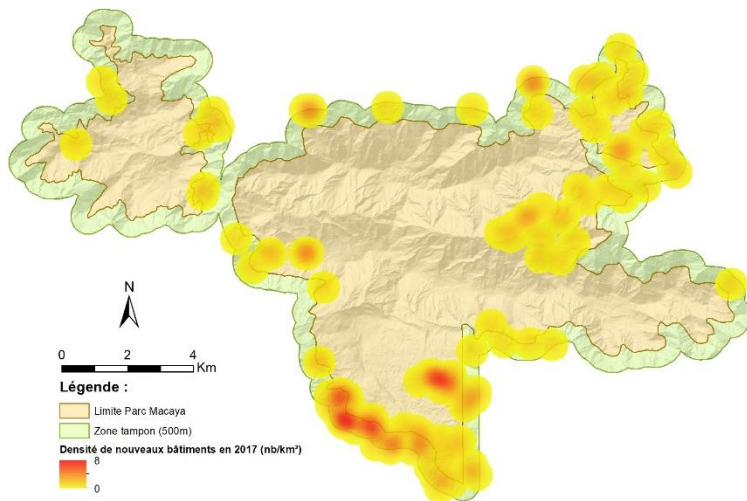
Densité du bâti en 2018



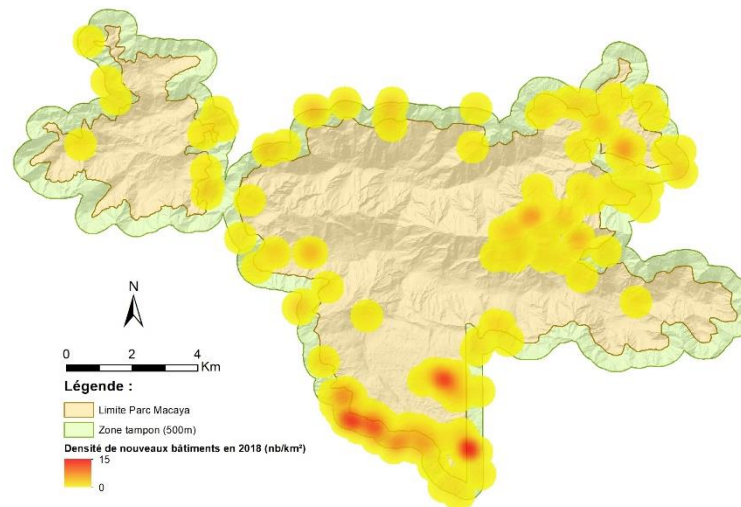


Evolution de la densité du bâti :

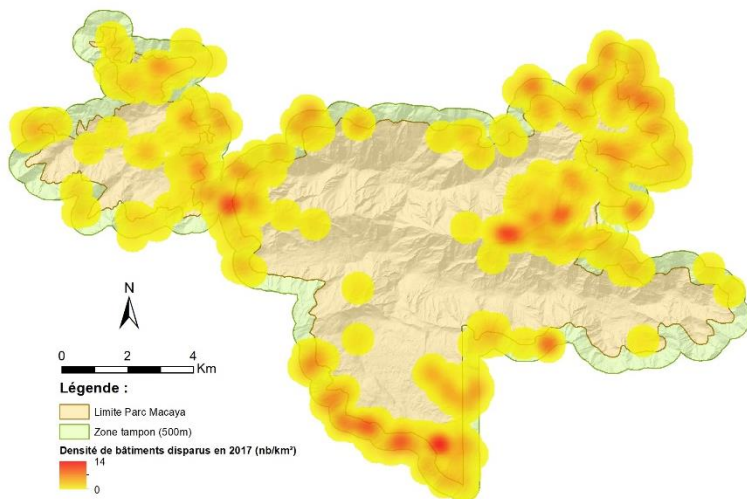
Densité de nouveaux bâtiments en 2017



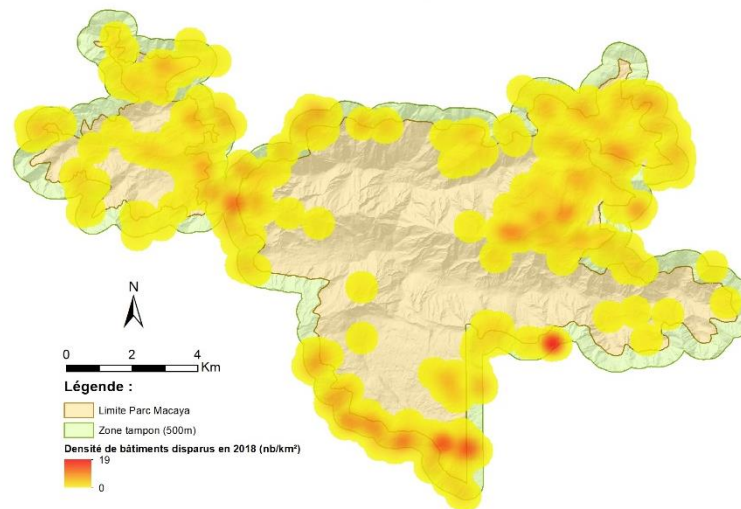
Densité de nouveaux bâtiments en 2018



Densité de bâtiments disparus en 2017

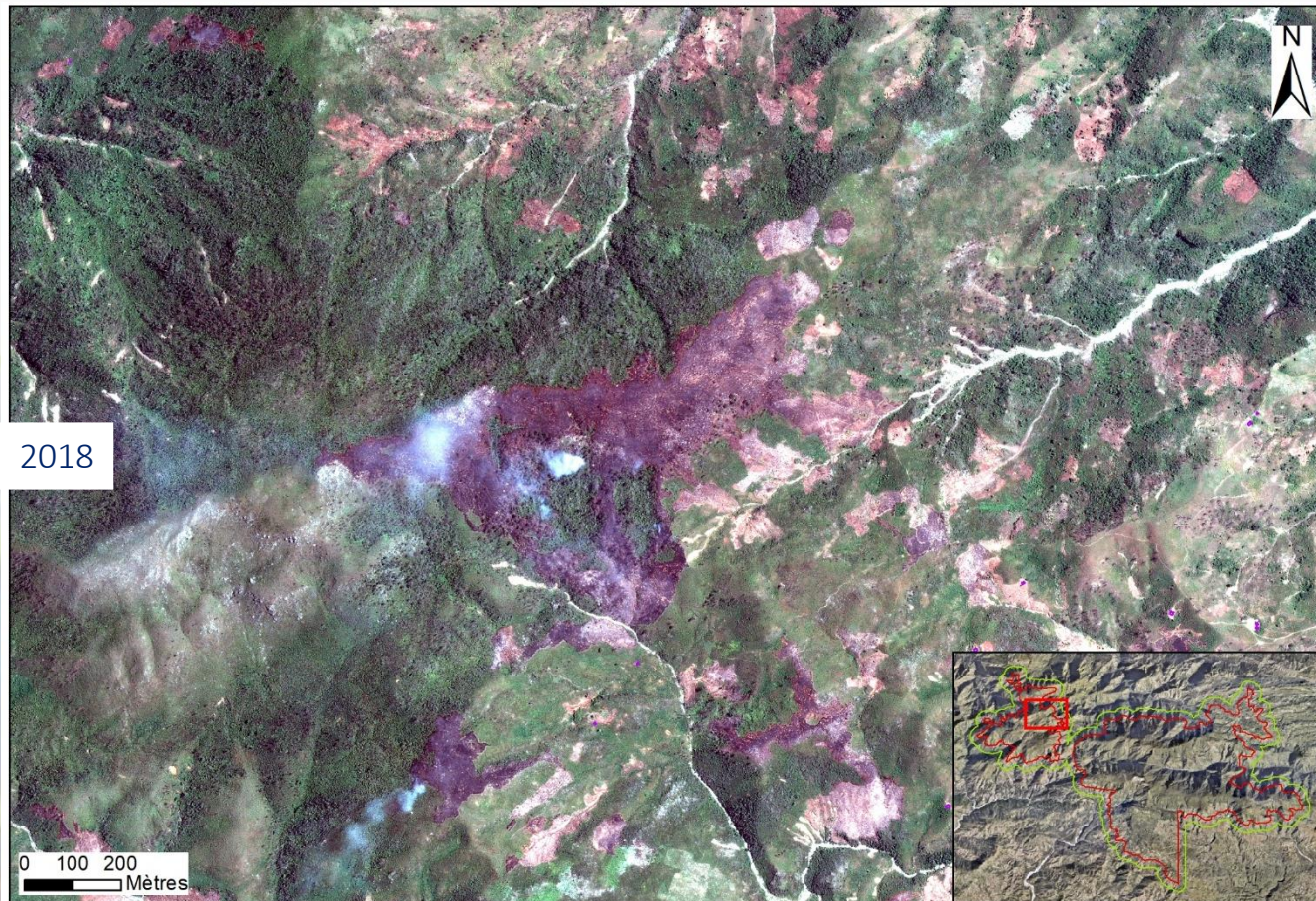


Densité de bâtiments disparus en 2018





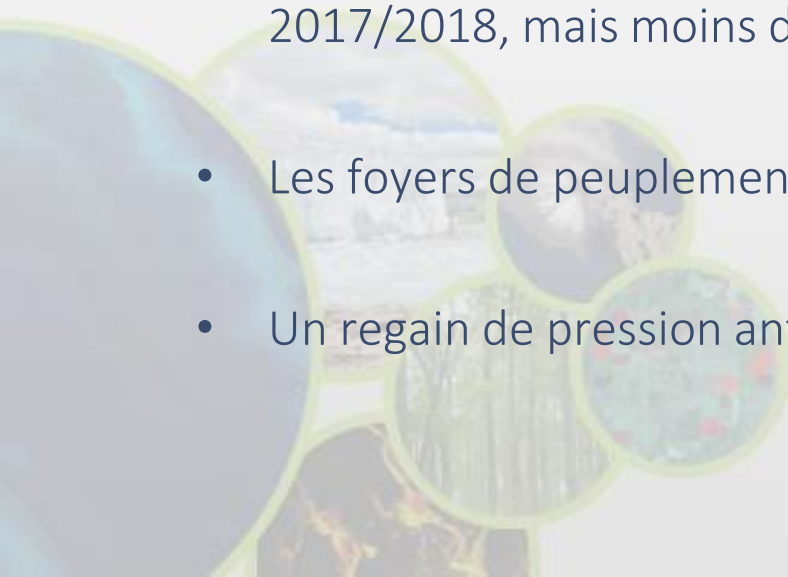
Exemple de pression anthropique :





Conclusions et questionnements :

- Beaucoup de bâtiments disparus entre 2014 et 2017 : effet seulement lié au cyclone Matthieu ?
- De nombreux nouveaux bâtiments et un peu de reconstruction en 2017/2018, mais moins d'habitations qu'en 2014. Déprise ou reprise ?
- Les foyers de peuplement sont les mêmes
- Un regain de pression anthropique ?



- Classification de la végétation pré-Matthieu (2016)
- Evaluation des dégâts et suivi de la reprise végétale (2017)
- Classification de la végétation post-Matthieu (2019)
- Evolution du couvert forestier entre 2017 et 2019
- Suivi de l'habitat entre 2014 et 2018
- **Etude pour la cartographie des sentiers en 2018**



Cartographie des sentiers

Etude de faisabilité pour les besoins de la BID

Travail exploratoire autour de cinq cabanes de surveillance

Rayon d'analyse : 1km

Utilisation des données Pléiades (i.e. 50cm) acquises en 2018

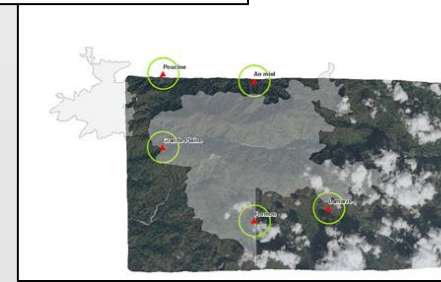
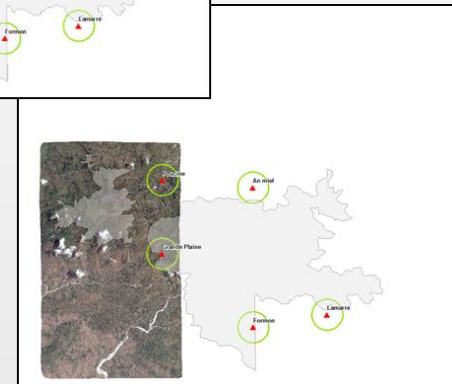
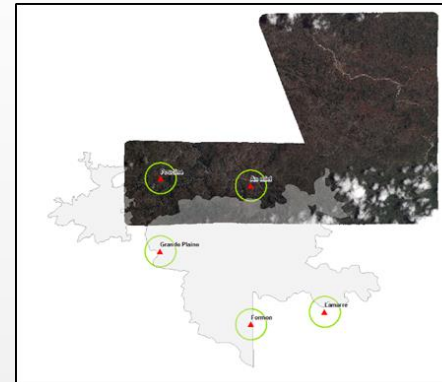
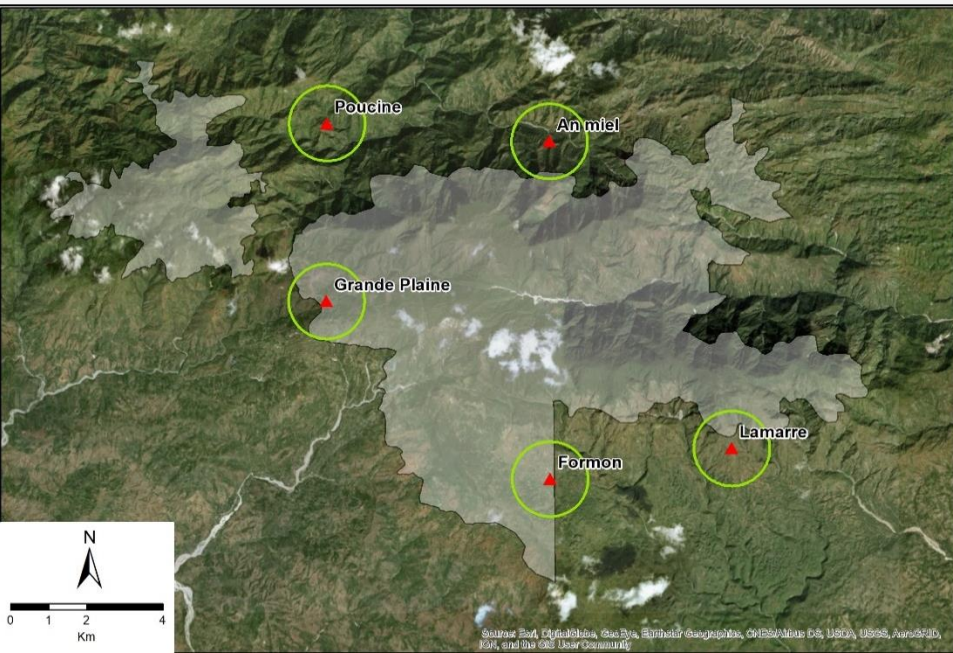




Cartographie des sentiers

Seulement 3 zones visibles en 2018

Surface: 3 x 3,14km²





- Retour d'expérience génération des produits

L'étude de la végétation est rendue difficile en raison d'une nébulosité constante sur le secteur du Parc Macaya.

Il est préférable de travailler avec des images acquises durant la période estivale pour éviter les ombres portées (mais plus forte nébulosité ...)

- Retour d'expérience utilisations des produits

