« De quelle définition des forêts a-t-on besoin pour lutter contre la déforestation importée ? »

Apports des outils de télédétection pour cartographier l'état des forêts tropicales humides depuis 1990

Frédéric Achard

Clément Bourgoin

JRC.D1

05-07-2021

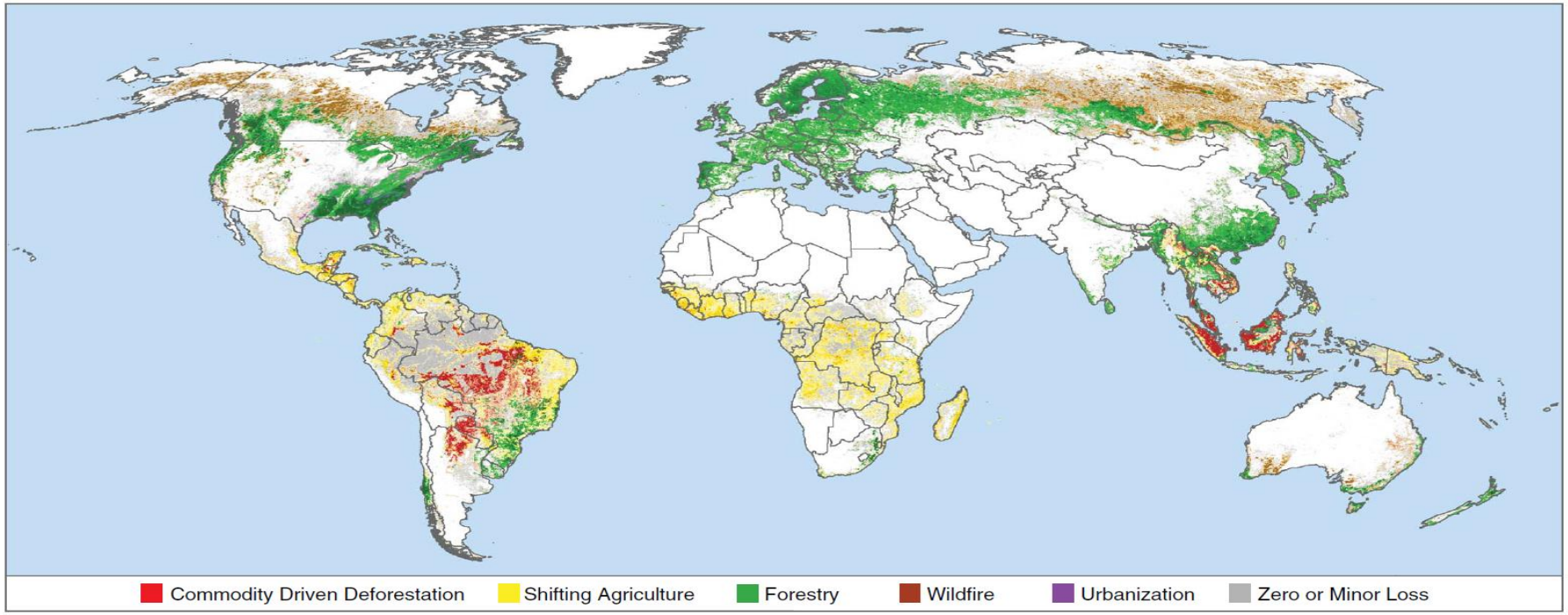
Contexte: Communication de la Commission Européenne and European Green Deal

Communication on
"Stepping up EU Action to
Protect and Restore the World's forests"
(COM(2019 352)

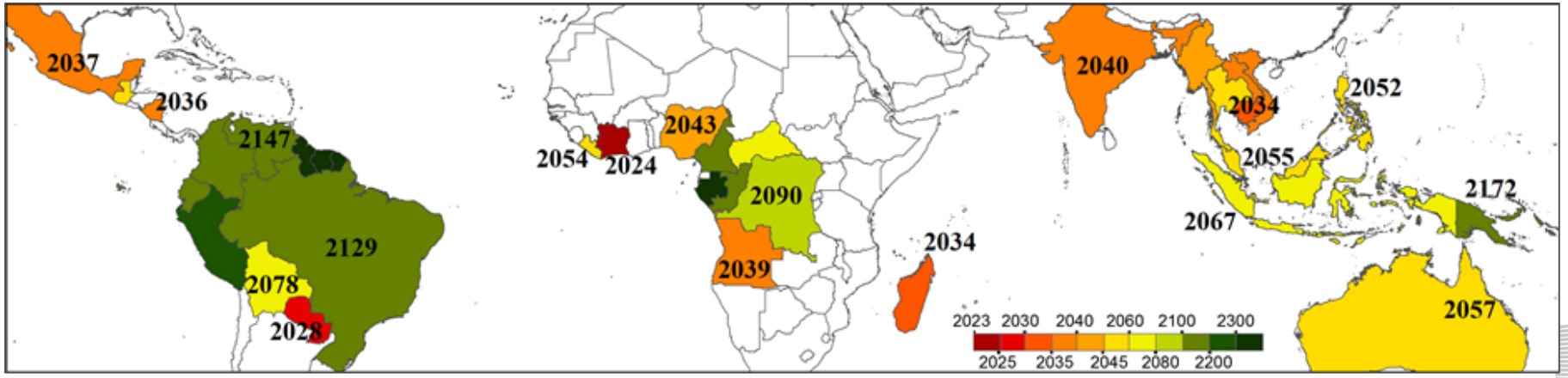
Trade policy can support the EU's ecological transition. It serves as a platform to engage with trading partners on climate and environmental action. … The Commission will propose to make the respect of the Paris agreement an essential element for all future comprehensive trade agreements. The EU's trade policy facilitates trade and investment in green goods and services and promotes climate-friendly public procurement ….

European Commission

Facteurs de déforestation et de dégradation des forêts



Primary drivers of forest cover loss between 2001 and 2015.
(Curtis et al. 2018, Science)



Forecasted year of disappearance of undisturbed moist forests in COM(2019)352 (source: JRC)

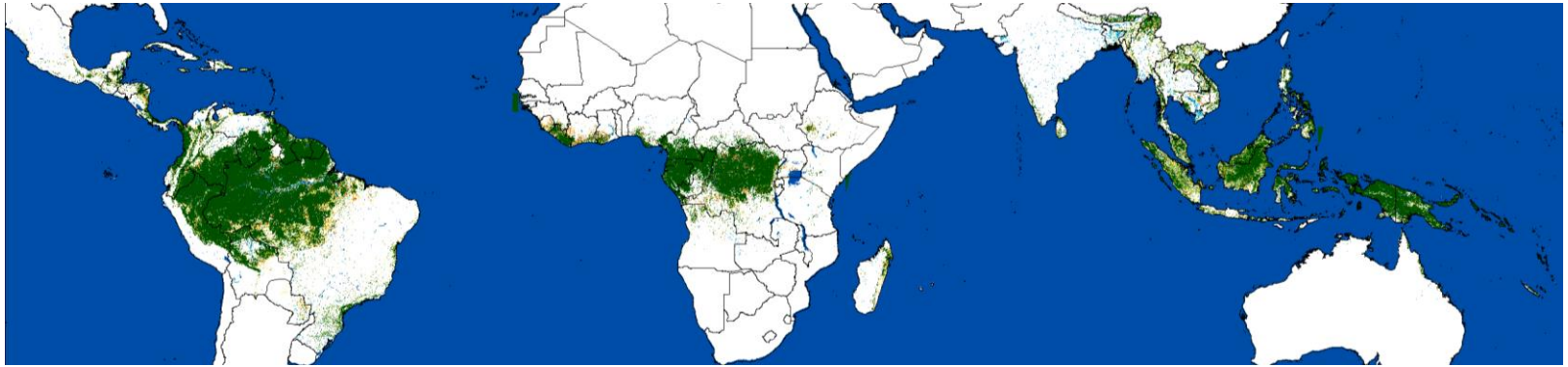
European Commission

Objectifs pour la cartographie et le suivi de l'état des forêts tropicales humides depuis 1990

- Projets financé par DG CLIMA: **Roadless-For** (2014-2018) & **ForMonPol** (2019-2022)
- **Peu d'informations sur la dynamique forestière à long terme:**

la caractérisation des perturbations (déforestation et dégradation) + des étapes de transition

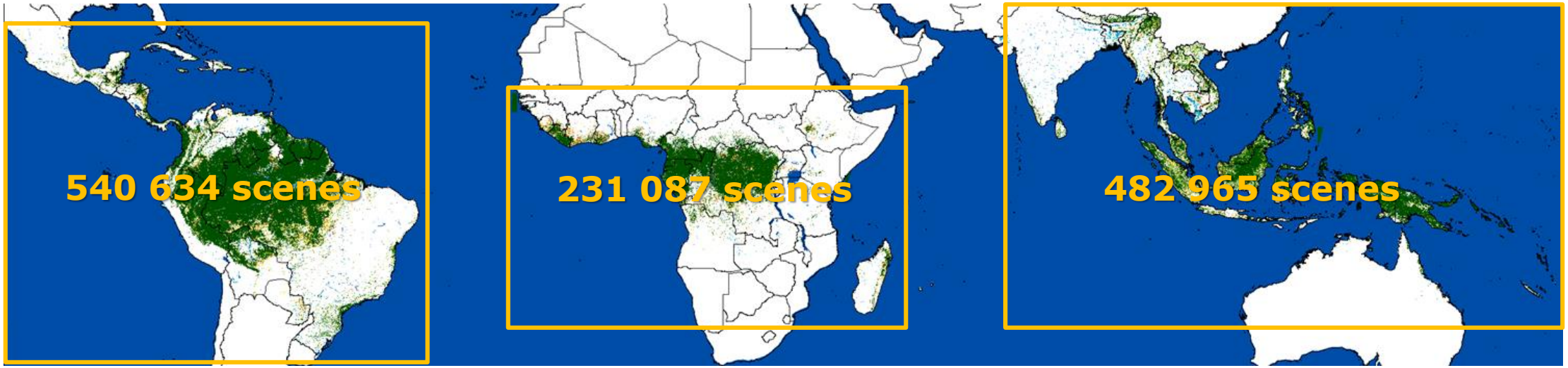
- Besoin crucial pour les politiques mondiales de conservation et pour quantifier avec précision leur contribution aux flux mondiaux de carbone
- **Objectif : Cartographier l'état des forêts tropicales humides depuis 1990**
  - Couverture pan-tropicale "Wall-to-wall"
  - Basée sur une longue et dense série temporelle de données (1982-2020)
  - Focalisé sur forêts sempervirentes
  - A la résolution Landsat (30m)



Données

- Longue série temporelle d'images optiques
- Archive Landsat **complète** (L4, L5, L7 et L8) depuis 1982

Nombre d'acquisitions Landsat
(~1 250 000 scenes)

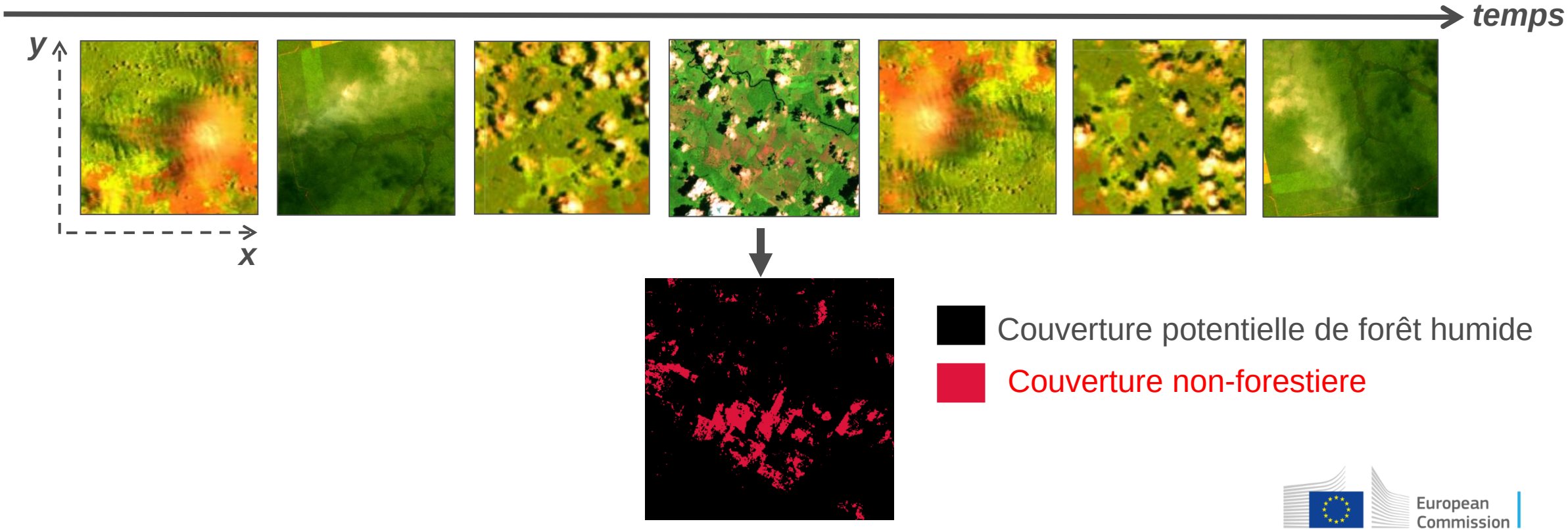


Méthodologie

1.Classification à <u>date unique</u> au cours des 39 années d'archives Landsat

Identification des pixels non-valides (nuages, brumes, ombres …)

Identification des pixels valides → **Couverture potentielle de forêt humide** + **couverture non-forestiere**

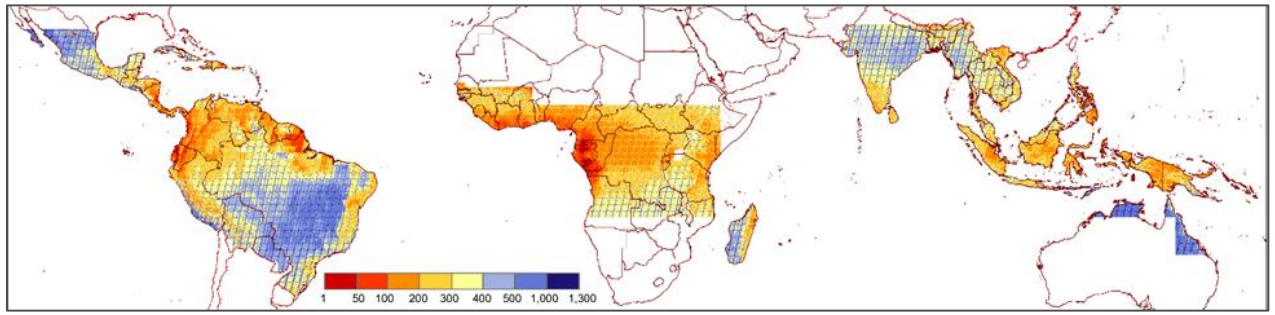


Méthodologie

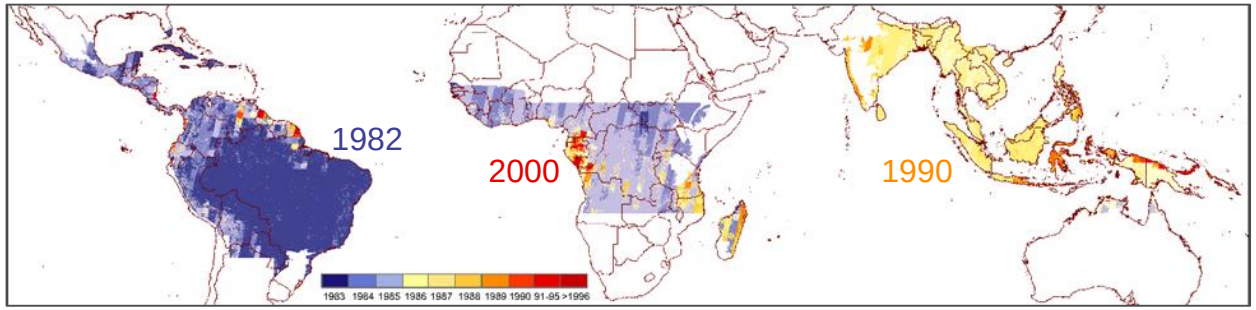
2. Classification <u>temporelle</u>

- Creation du masque initial de foret TMF

Nombre total d'observations valides (1982-2020)



Première année avec une observation valide



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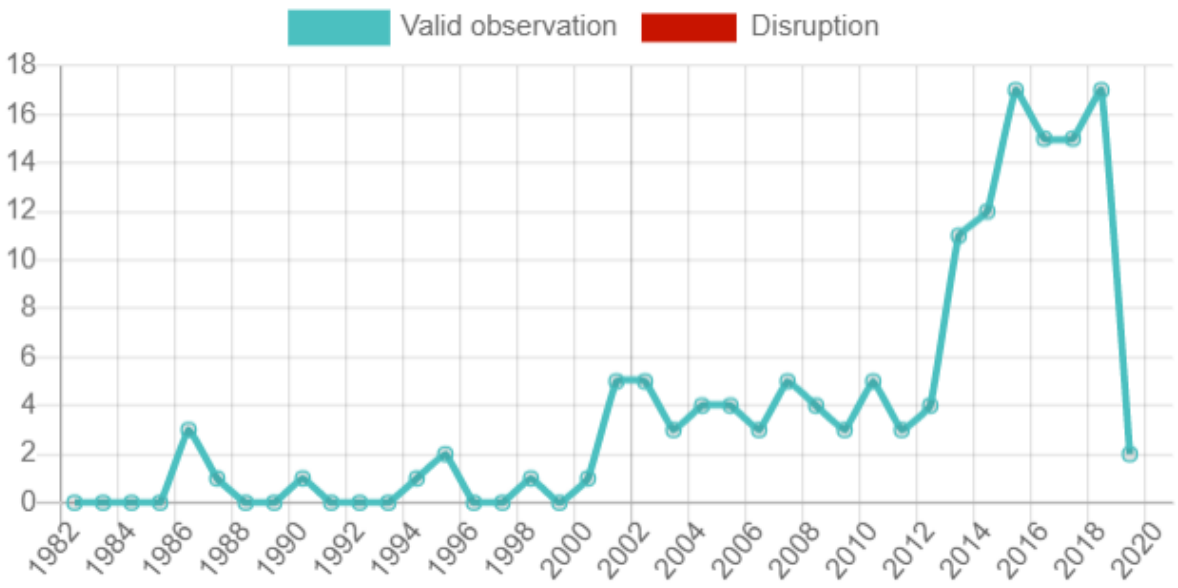
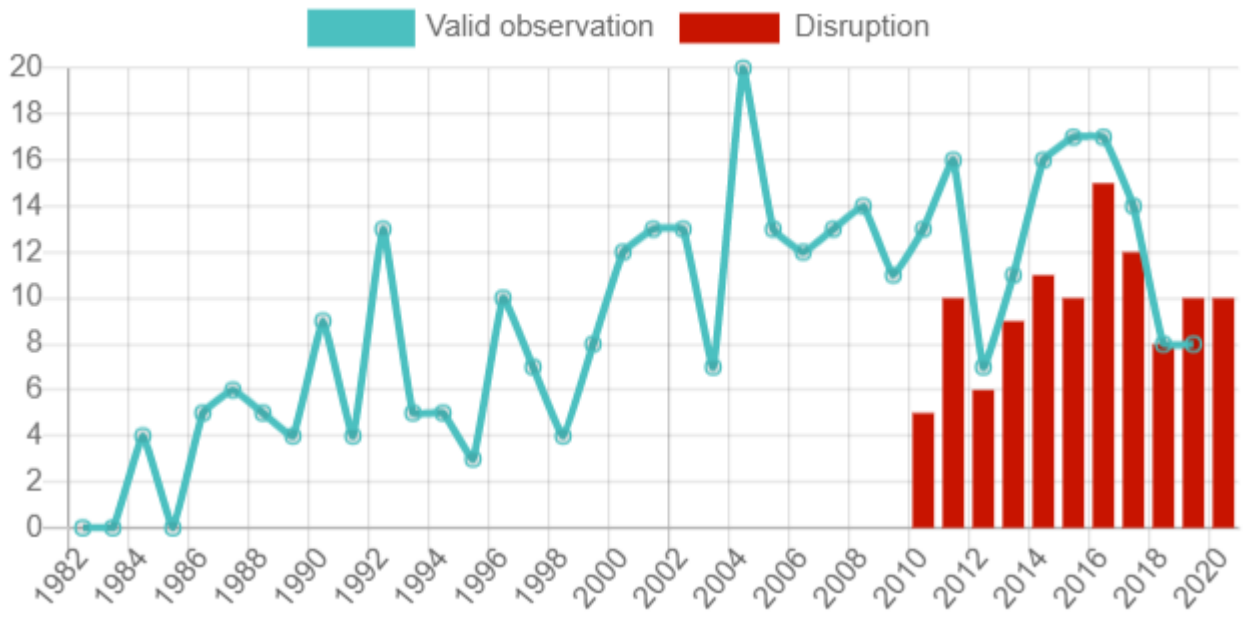
Méthodologie

2. Classification <u>temporelle</u>

- Analyse par pixel des changements TMF (non perturbées, déforestation, dégradation et régénération …)



Pas de perturbations



Ouverture de canopee en 2010
Detection de non-foret depuis

European Commission

Méthodologie

3. <u>Caractérisation</u> des changements

- En fonction des **<u>dates</u>**, de la **<u>durée</u>**, de la **<u>récurrence</u>** et du **<u>nombre de perturbations</u>**
- Identification de sous-classes à l'aide d'informations auxiliaires complétées par l'interprétation visuelle d'images à haute résolution

4. Production de cartes des changements annuels

Documenter l'étendue de la forêt tropicale humide et les perturbations pour chaque année

Foret non perturbee

Mangrove non perturbee

Degradation courte (<365 jours)

Degradation longue (<900 jours)

Reforestation (> 3 ans observe comme foret)

Deforestation* entre 1990-2010 (> 900 jours)

Deforestation* entre 2011-2017

Perturbations* recentes entre 2018-2020

* TMF et mangroves

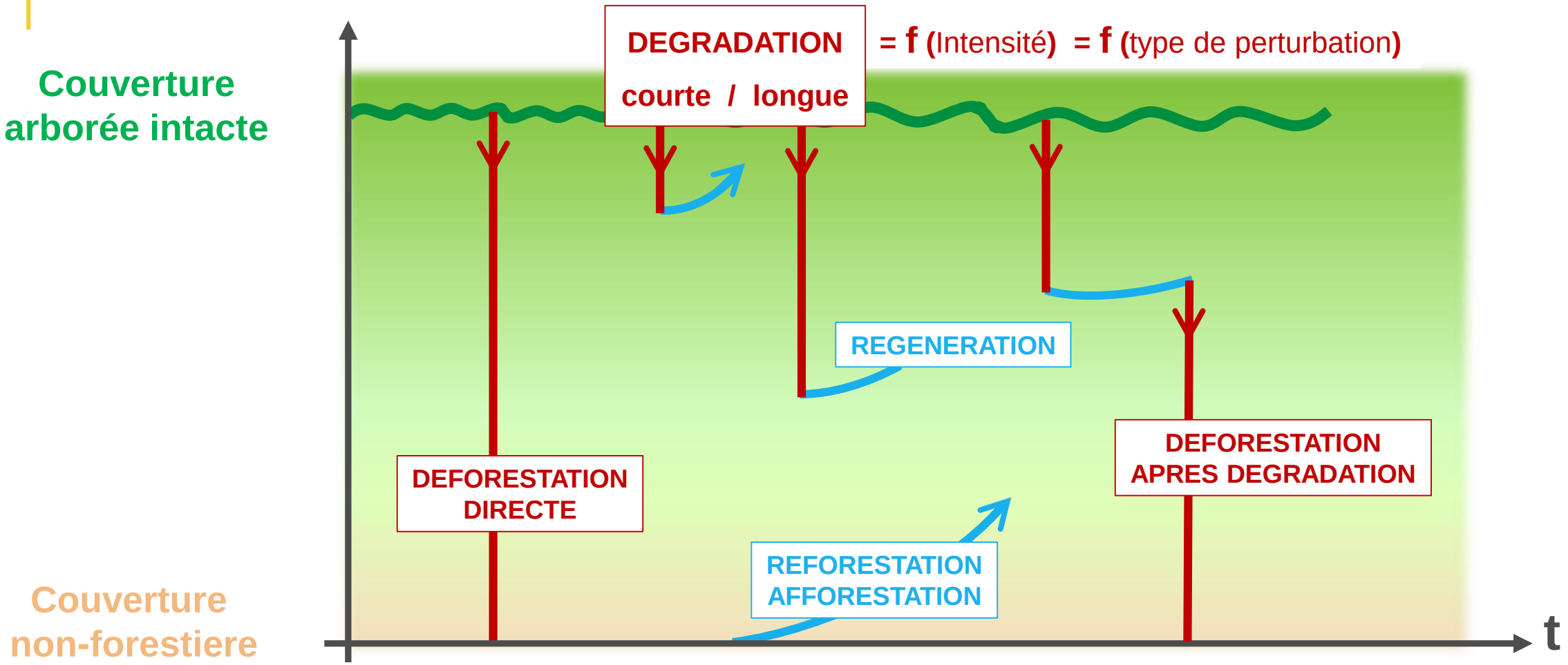
Eau saisonnière et permanente

Conversion TMF vers eau (barrages …)

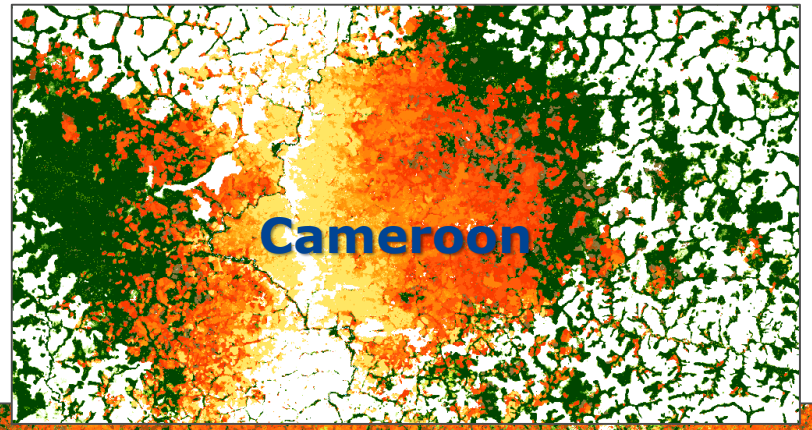
Plantations (palmier à huile, caoutchouc…)

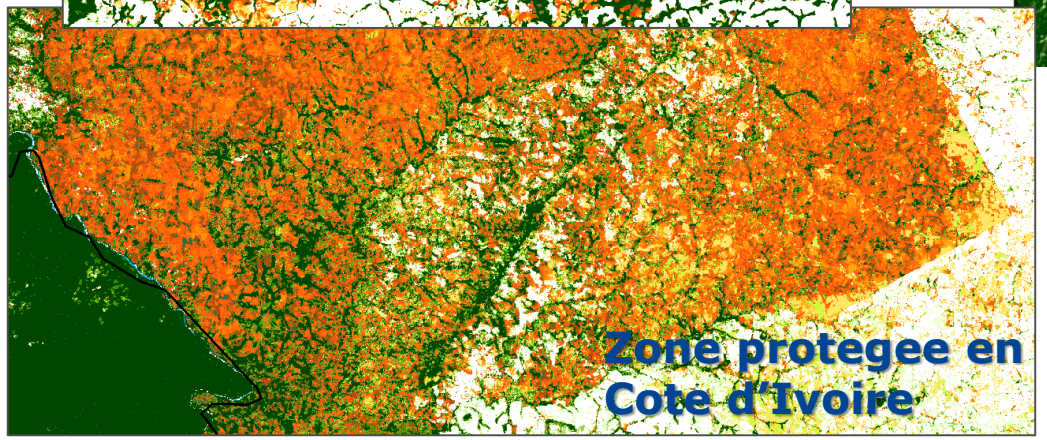
Conversion TMF vers plantations

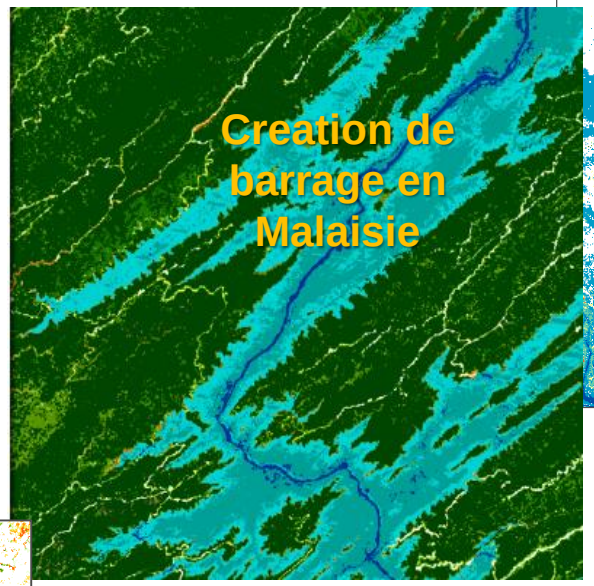
Definitions

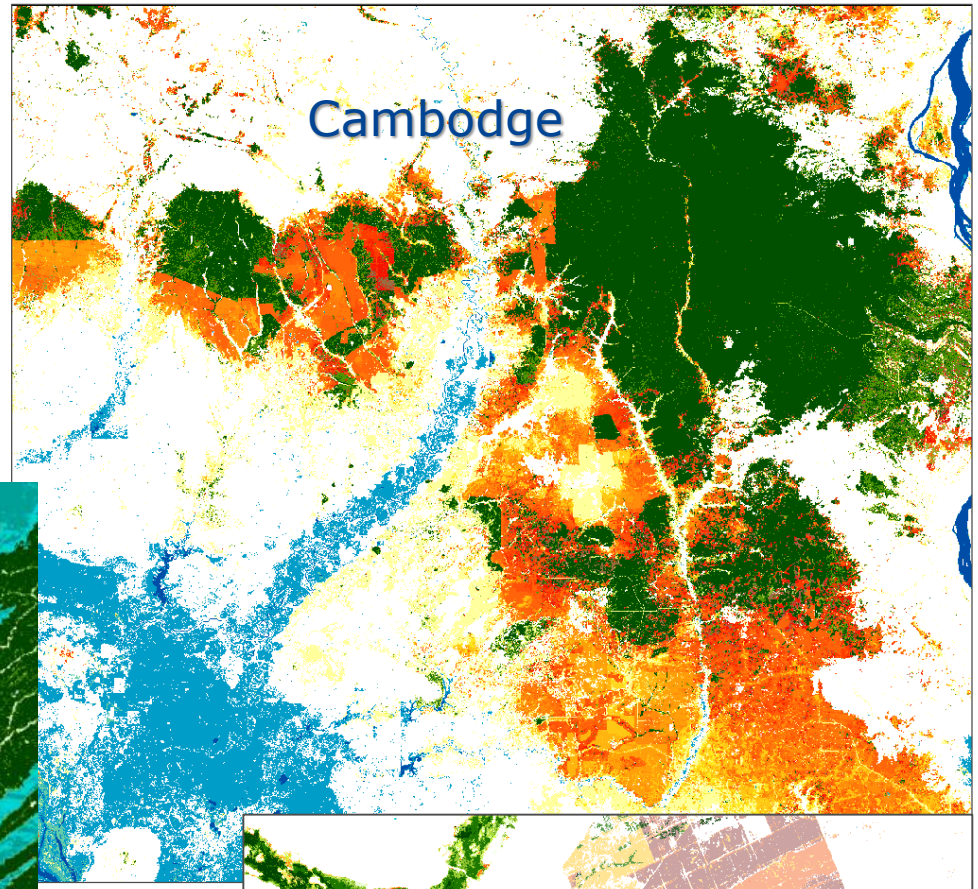


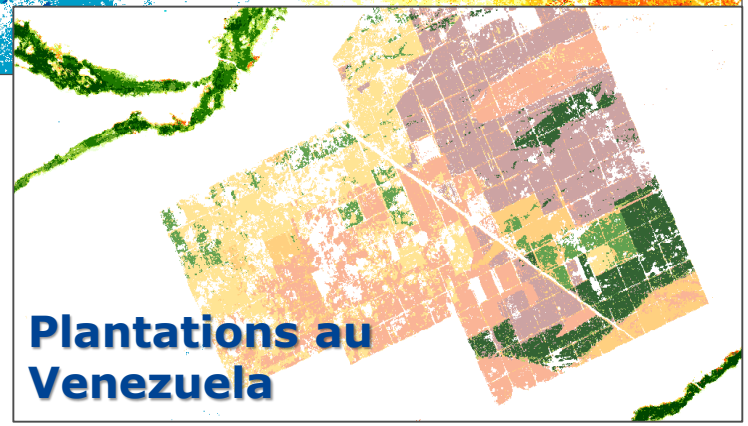
Exemples de déforestation





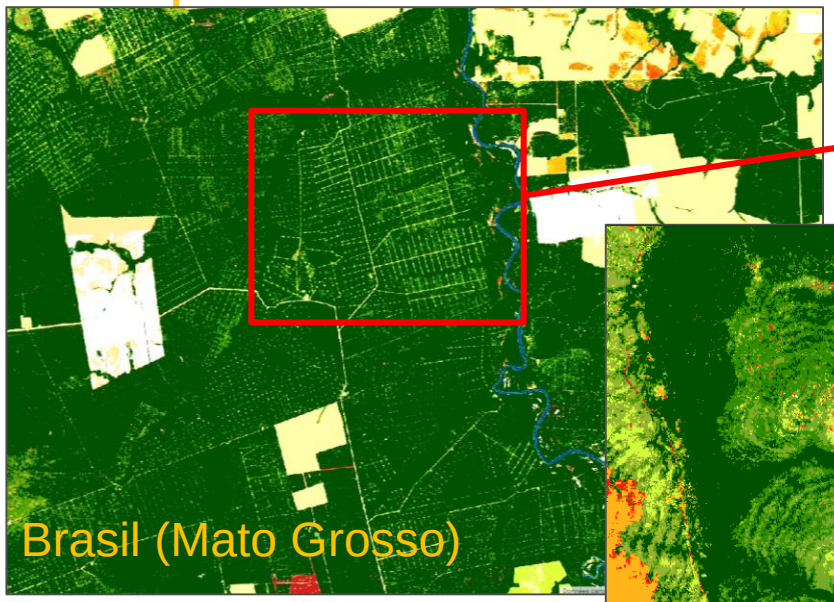


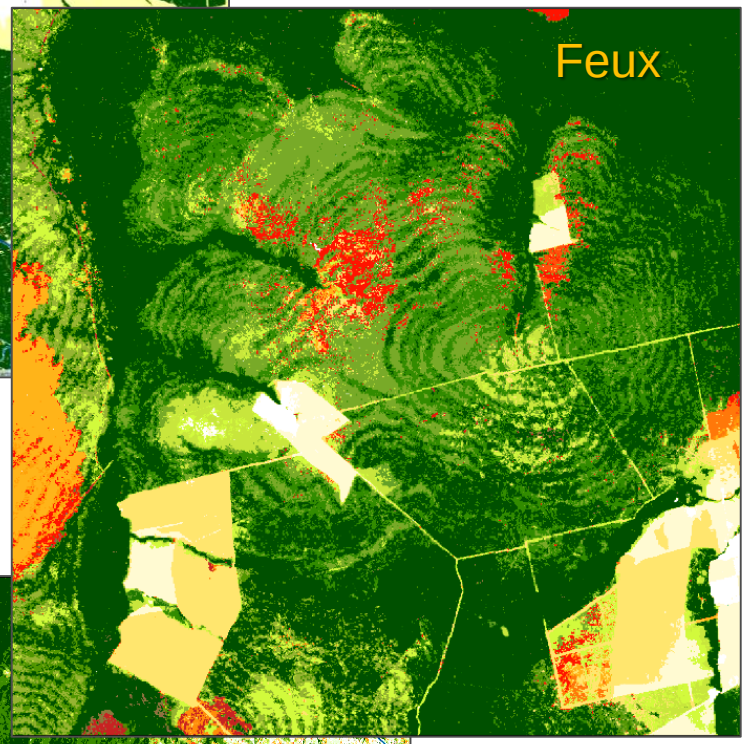


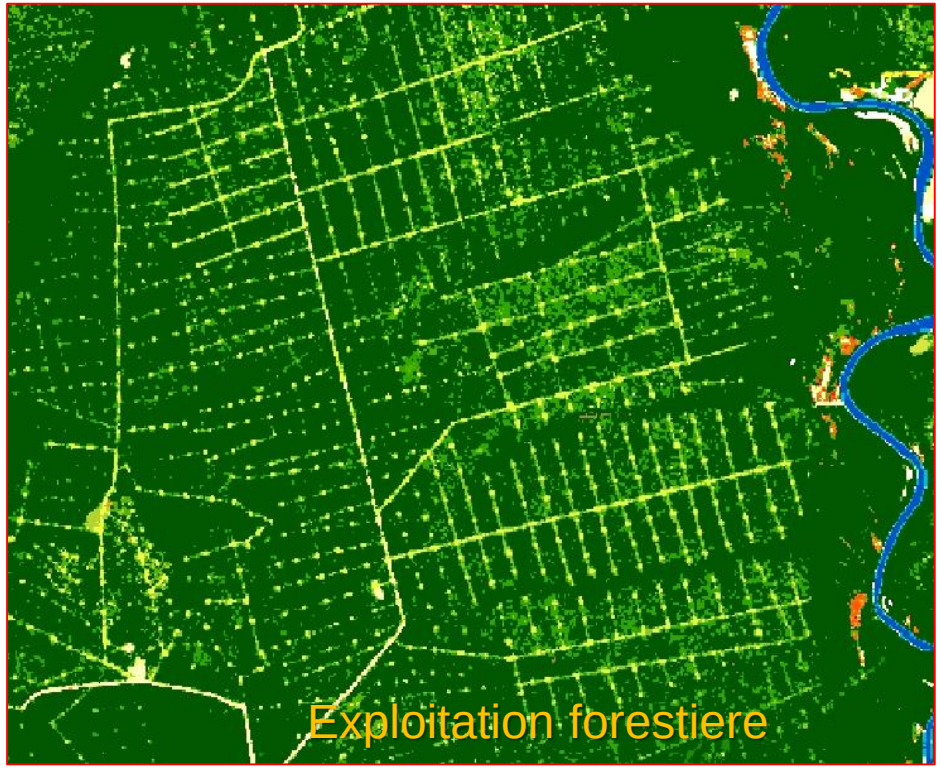


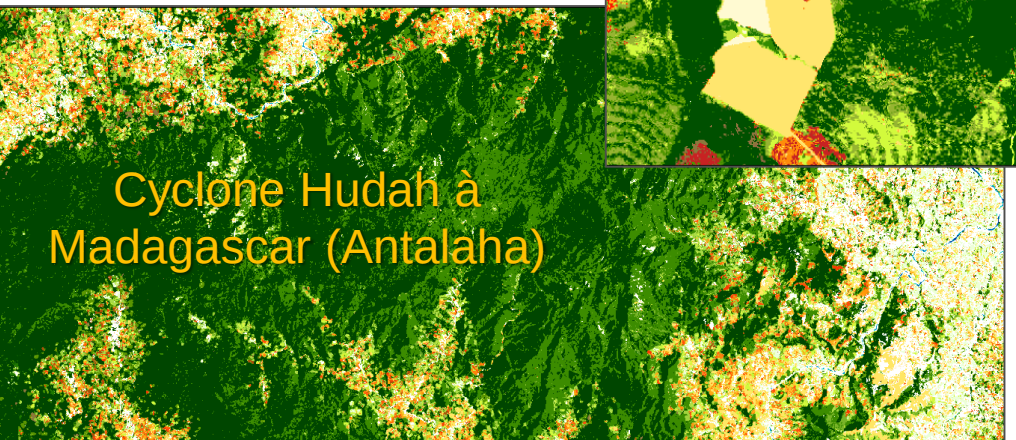
Undisturbed forest	Undisturbed mangrove	Seasonal and permanent water
Short-duration degradation	Deforestation started in 1990-2009	Deforestation to water
Long-duration degradation	Deforestation started in 2010-2016	Old to young plantations
Forest regrowth	Recent disturbances (started in 2017-2019)	Deforestation within the plantations

Exemples de dégradation

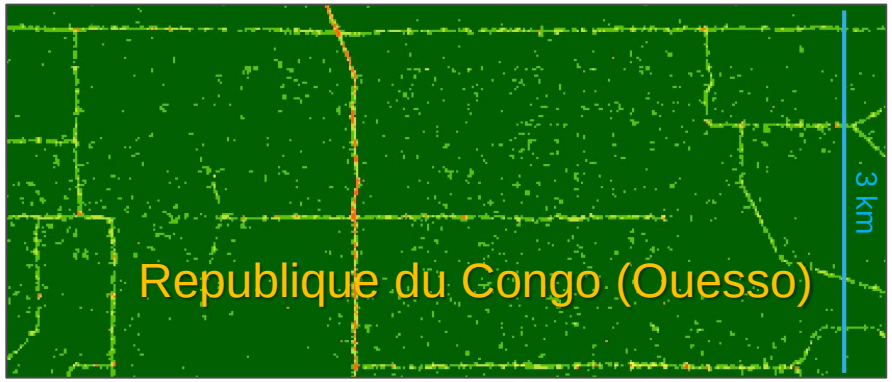








16 km



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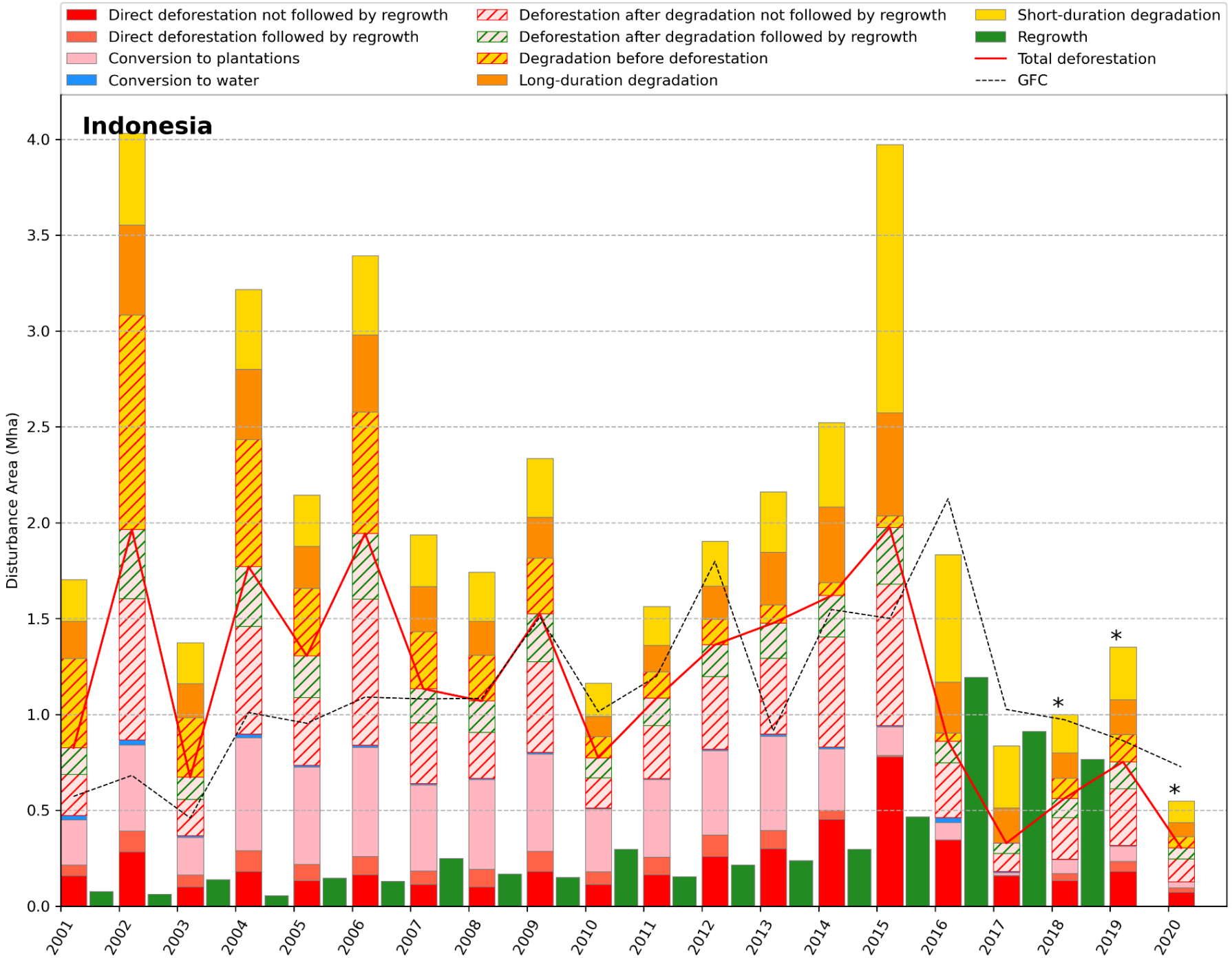
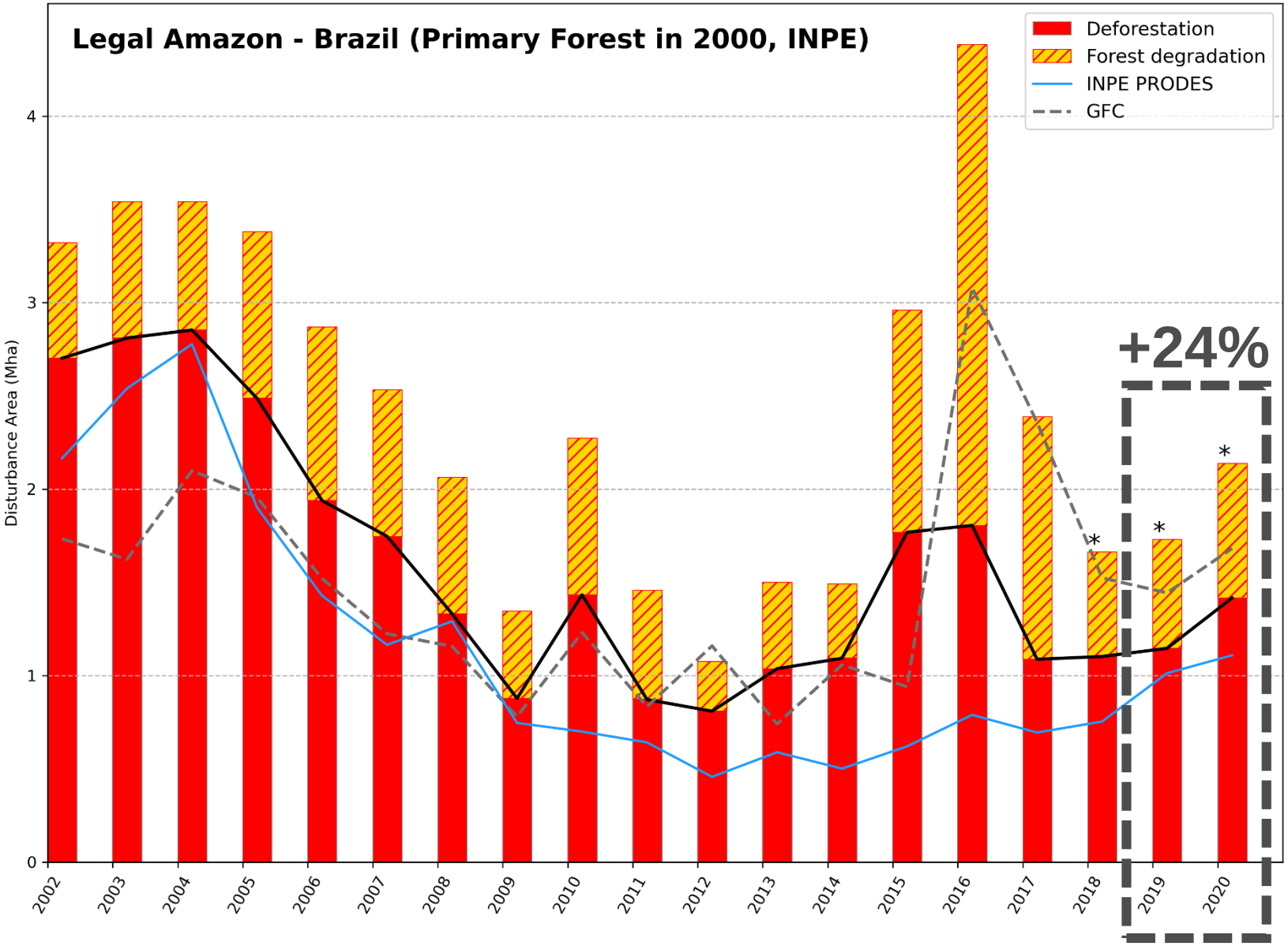
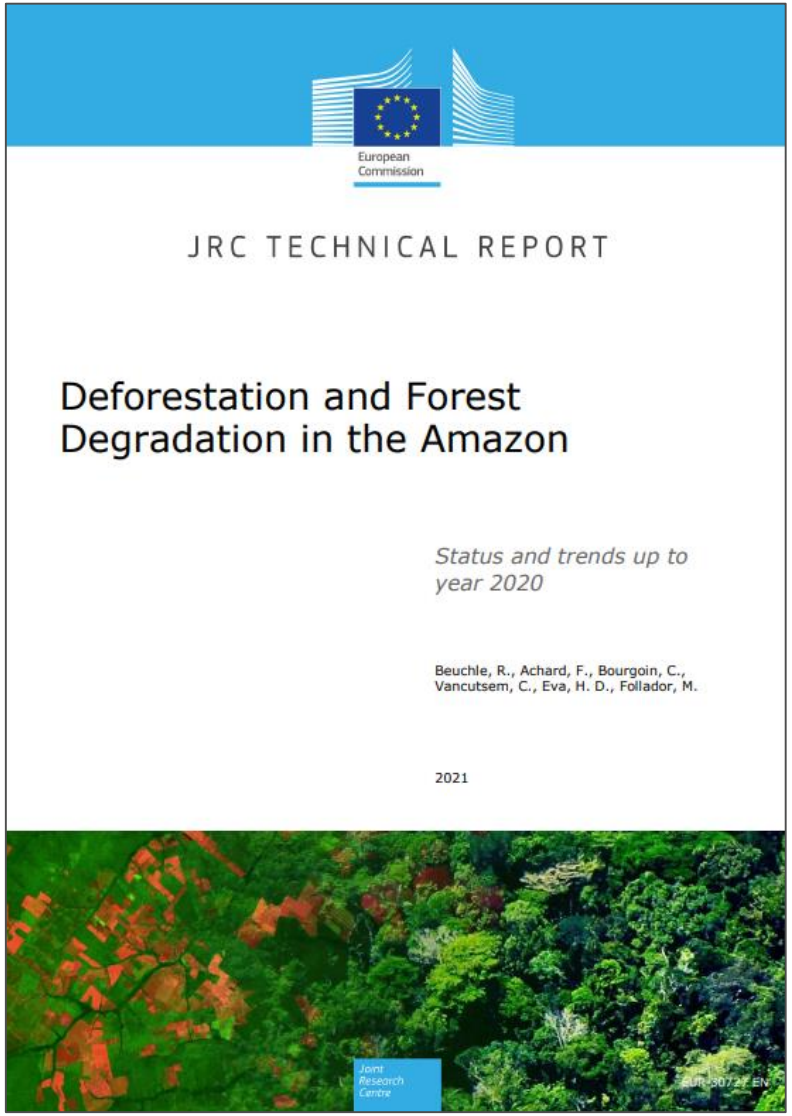

Direct deforestation not followed by regrowth
Direct deforestation followed by regrowth
Conversion to plantations
Conversion to water
Deforestation after degradation not followed by regrowth
Deforestation after degradation followed by regrowth
Degradation before deforestation
Long-duration degradation
Short-duration degradation
Regrowth
Total deforestation
GFC
Indonesia
Disturbance Area (Mha)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020





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Resultats principaux

SCIENCE ADVANCES | RESEARCH ARTICLE

ENVIRONMENTAL STUDIES

Long-term (1990–2019) monitoring of forest cover changes in the humid tropics

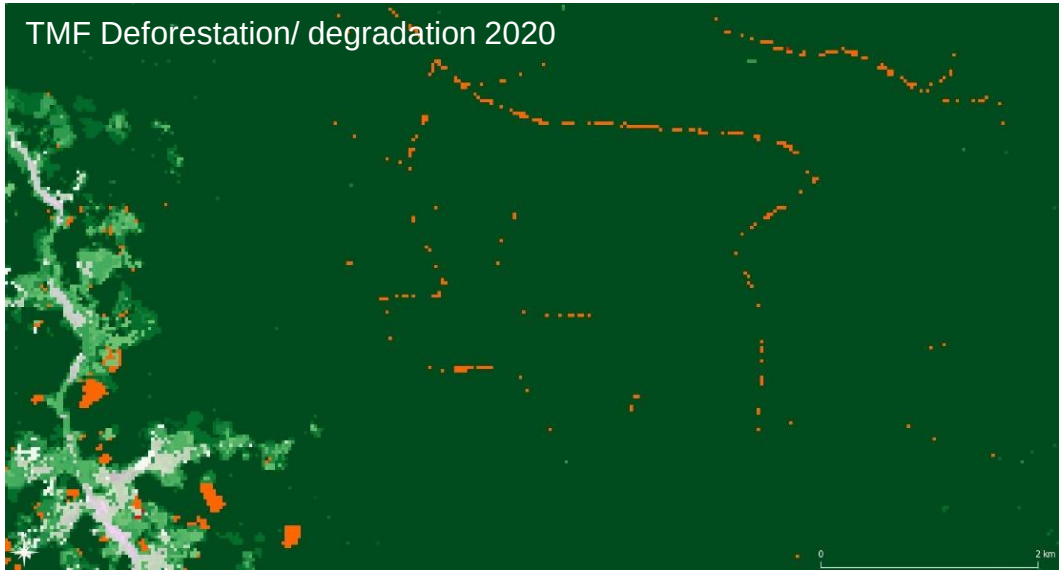
C. Vancutsem[1]*, F. Achard[1], J.-F. Pekel[1], G. Vieilledent[1,2,3,4], S. Carboni[5], D. Simonetti[1], J. Gallego[1], L. E. O. C. Aragão[6], R. Nasi[7]

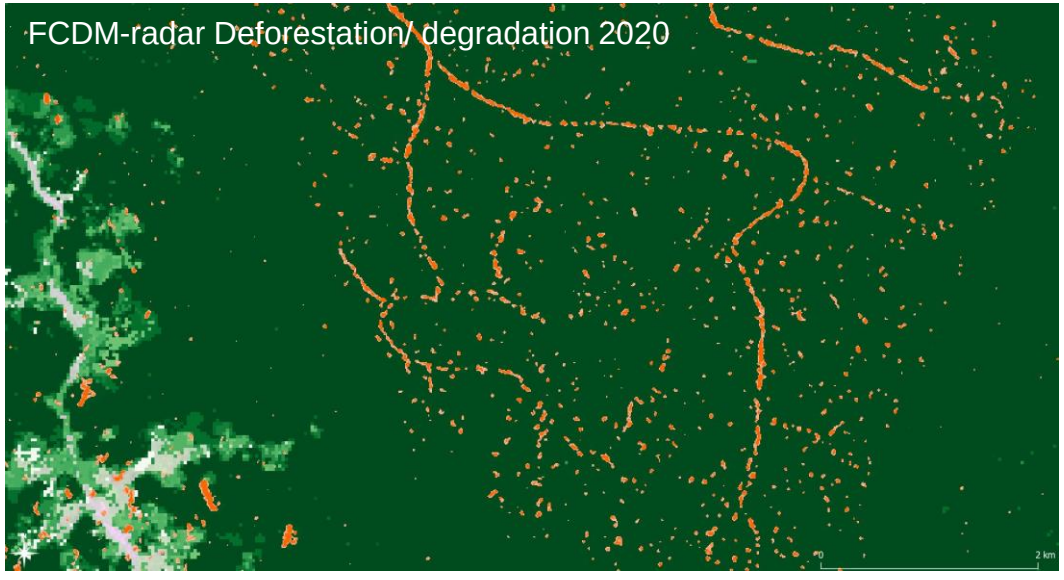
Accurate characterization of tropical moist forest changes is needed to support conservation policies and to quantify their contribution to global carbon fluxes more effectively. We document, at pantropical scale, the extent and changes (degradation, deforestation, and recovery) of these forests over the past three decades. We estimate that 17% of tropical moist forests have disappeared since 1990 with a remaining area of 1071 million hectares in 2019, from which 10% are degraded. Our study underlines the importance of the degradation process in these ecosystems, in particular, as a precursor of deforestation, and in the recent increase in tropical moist forest disturbances (natural and anthropogenic degradation or deforestation). Without a reduction of the present disturbance rates, undisturbed forests will disappear entirely in large tropical humid regions by 2050. Our study suggests that reinforcing actions are needed to prevent the initial degradation that leads to forest clearance in 45% of the cases.

- Environ **17%** de perte de TMF depuis 1990 (~ 220 millions ha)
- Surface forestière restante de **1088 million hectares** en 2020 dont **12%** sont dégradés
- **5,5 millions ha** de deforestation et **6 millions ha** de degradation, en moyenne chaque annee
- Environ **la moitié** des forêts dégradées annuellement est, par la suite, déforestée.

Autre outils pour le suivi de la degradation: Forest Canopy Disturbance Monitoring (Langner et al. 2018)

- Fonctionne a partir des images Landsat (30m), Sentinel-2 et Sentinel-1 (10m resolution spatiale, tous les 6 jours)
- Capacite de detecter les perturbations de petites tailles (< 0.09 ha)
- Echelle locale





remote sensing

MDPI

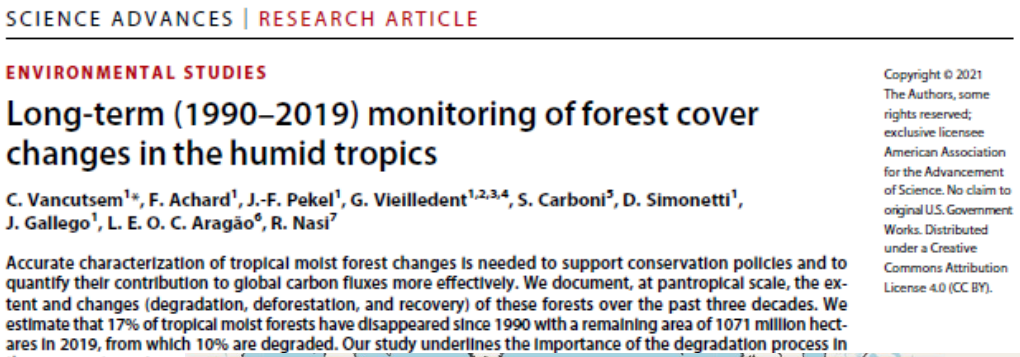
Article

Towards Operational Monitoring of Forest Canopy Disturbance in Evergreen Rain Forests: A Test Case in Continental Southeast Asia

Conclusions et perspectives

- TMF relève les défis de la surveillance des changements en forêts tropicales humides
  - Perturbations du TMF pour chaque année depuis 1990
  - Plusieurs processus : déforestation, dégradation, régénération, conversion en plantation et conversion en eau
  - Informations complémentaires fournies : Identification des plantations et des eaux permanentes/saisonnières
- Une démonstration pantropicale réussie
  - Capacité à ingérer de grands ensembles de données d'OT (> 1 million de scènes)
  - Archives complètes de Landsat à une résolution de 30m (1990-2020)
  - Précision globale de 91.4%.
- Intégration des images Sentinel-2

Références



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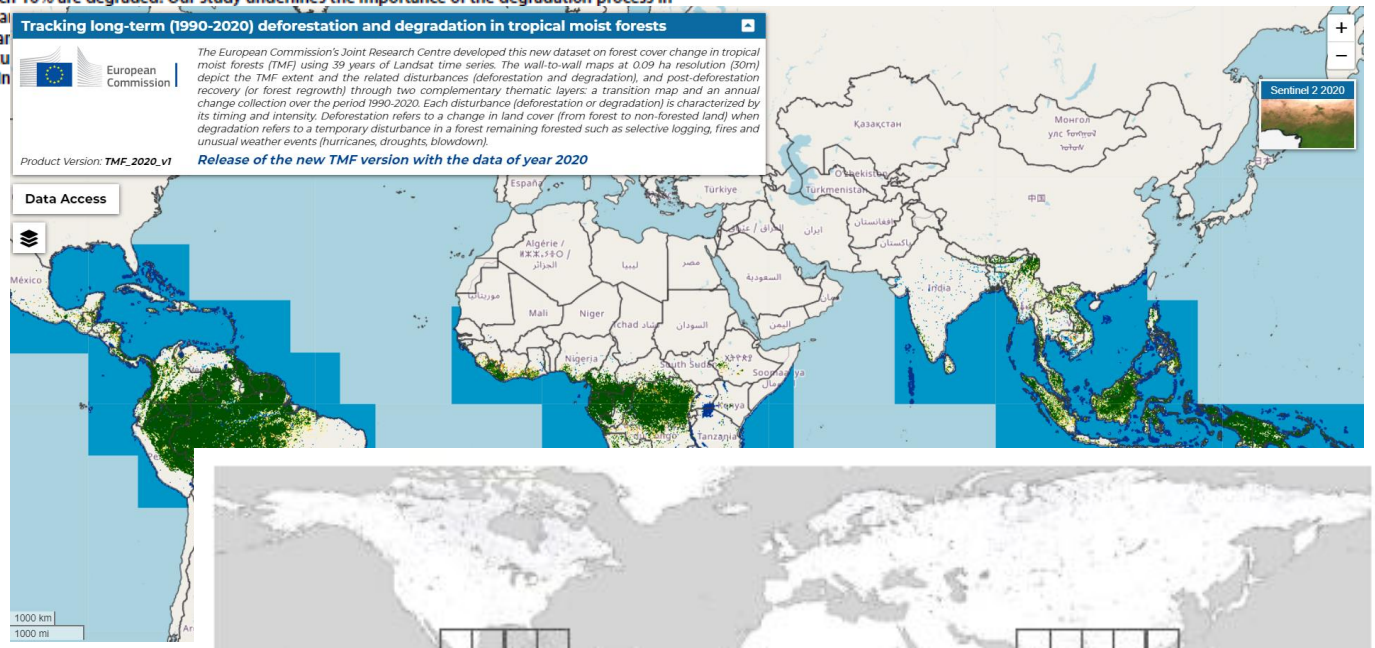

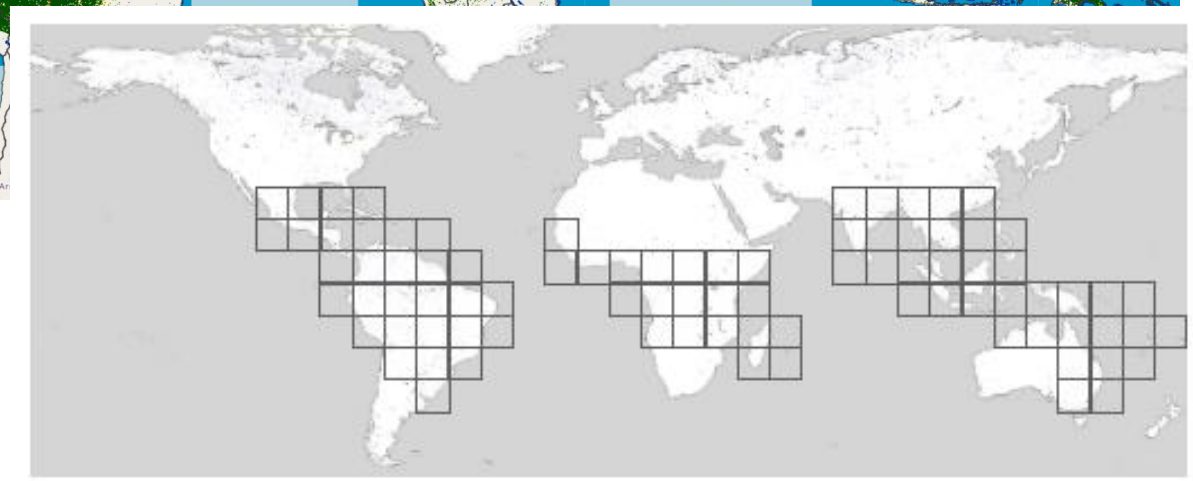

- Article https://advances.sciencemag.org/content/7/10/eabe1603

- TMF Explorer & accès aux données https://forobs.jrc.ec.europa.eu/TMF/

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