



MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Spatial techniques applied to climate issues: case study in the Amazon region on satellite monitoring of tropical forests and capacity building

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National Institute for Space Research: from data to knowledge



SATELLITES

Earth and Space Observation



LAND SYSTEMS

Satellite Control, reception and dissemination of spatial data



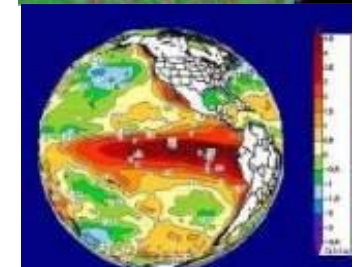
KNOWLEDGE GENERATION

R & D for Space and Environment



INFORMATION ACCESS

Products to society



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GOVERNO FEDERAL
BRAZIL
UNIÃO E RECONSTRUÇÃO

Amazon Spatial Coordination (COEAM) National Institute for Space Research (INPE)



Coordenação Espacial da Amazônia



PROJECTS DEVELOPED IN AMAZON REGION



www.inpe.br/cra



CAPACITY BUILDING IN SATELLITE FOREST MONITORING

DATA FROM 2010 - 2017



Deforestation and degradation warnings in Amazon and Cerrado Biomes delivered daily



Land Use and land cover in Amazon Region (drivers of deforestation)



National Courses (on demand)
International Courses (from Projects)



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Amazon challenge...



Comparative size
of Brazilian Amazon
and Europe

5,1 million km²

23 million
inhabitants

350,000
indigenous
people

Deforestation Process in Amazon Region



Forest

**Selective
Logging**

Fire

**Clear
cut**

**Agriculture
Pasture**



<http://queimadas.dgi.inpe.br/queimadas/porta>



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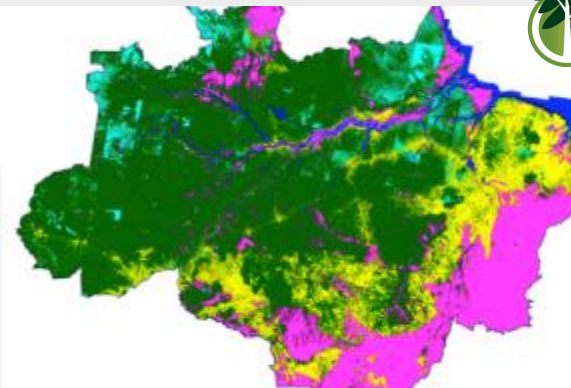
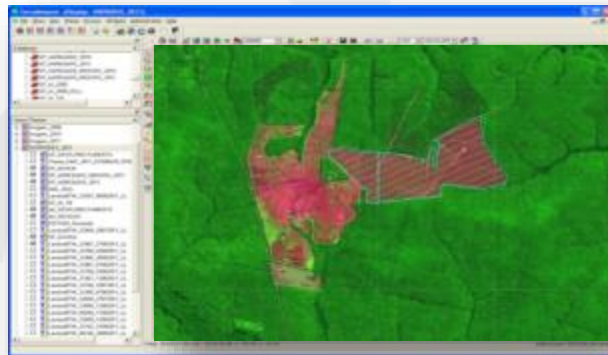


Program for Brazilian Amazon Forest Monitoring

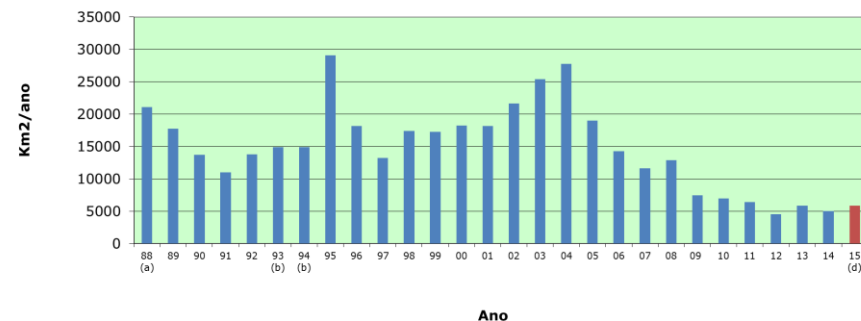
INPE provides data and information (land use and land cover mapping) to government (law enforcement) to prevent and control illegal deforestation activities in the Amazonia Forest since 1988.

PRODES: annual estimation of clear-cut deforestation

DETER: Early warning of deforestation process

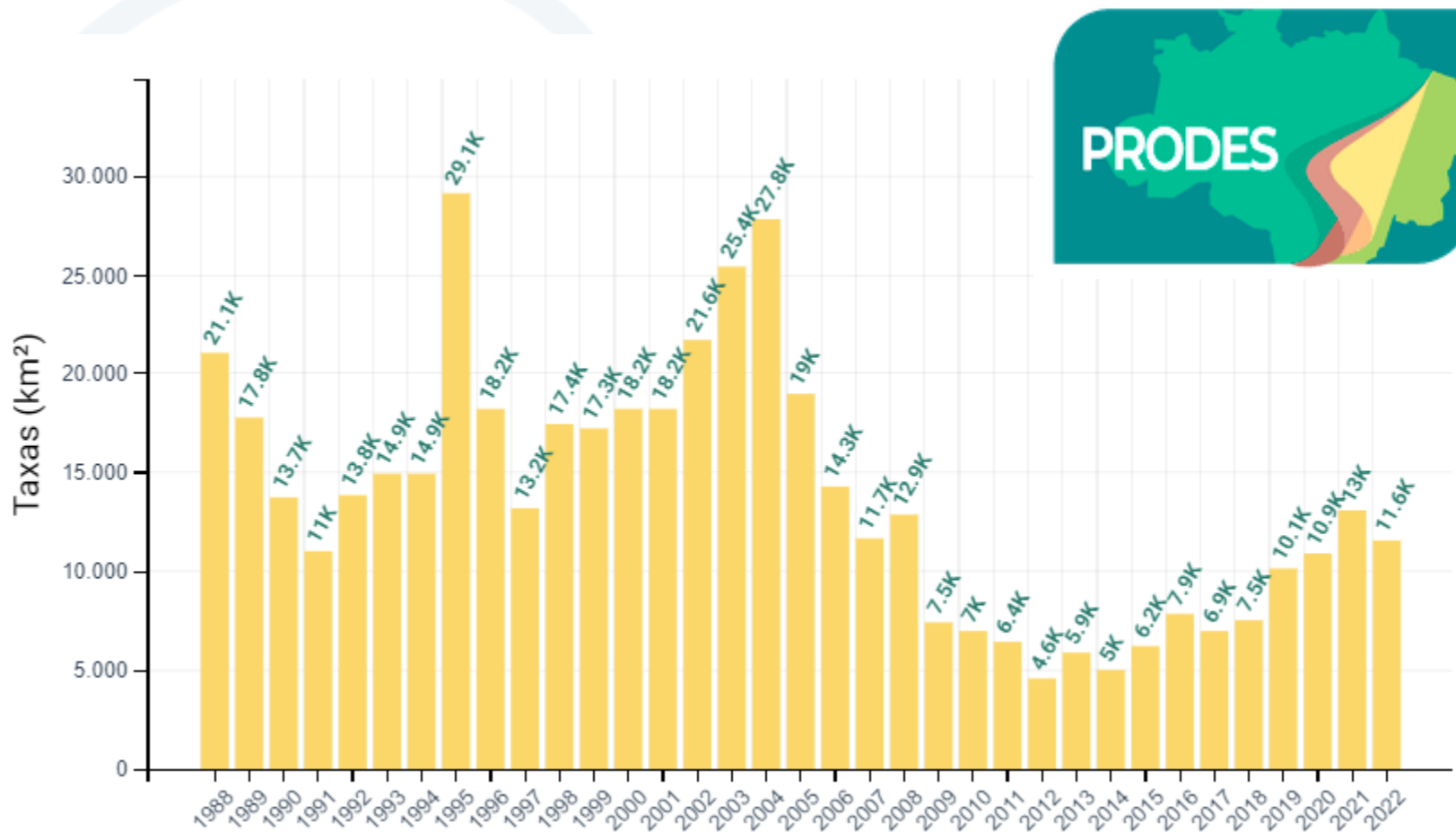


Taxa de Desmatamento Anual na Amazônia Legal



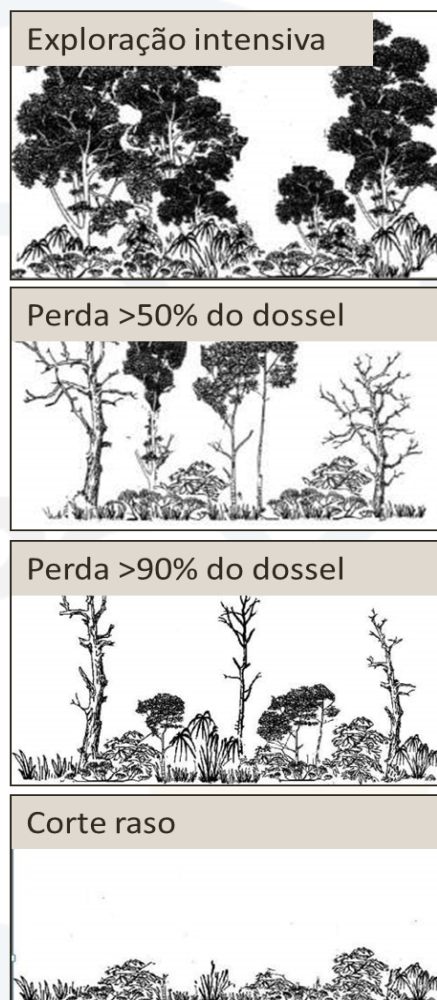
PRODES Project

34 years monitoring deforestation in Brazil



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Projects: PRODES and DETER



time



DETER
(deforestation process)



PRODES
(deforested)



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DETER Project

Motivation: Improve the resolution of DETER Project according the new deforestation polygons sizes



CLASSES – Level 1

**DEFORESTATION
(WARNINGS)**

DEGRADATION

WOOD EXPLORATION

CLASSES – Level 2

**Deforestation with bared soil
Deforestation with vegetation
Mining**

**Degradation
Burnt scars**

**Selective Logging type 1
(Disorder)
Selective Logging type 2
(Geometric)**

Acesso aos serviços interativos



Mapa de Desmatamento
Mapa interativo com polígonos de incrementos de desmatamento da Amazônia Legal e Cerrado



Dashboard de Desmatamento
Taxas anuais e incrementos de desmatamento na Amazônia Legal e Cerrado



Mapa de Alertas
Mapa interativo com polígonos de alertas de evidências de alteração da cobertura floresta na Amazônia Legal e Cerrado



Dashboard de Alertas
Alertas de evidências de alteração da cobertura da floresta na Amazônia Legal e Cerrado

Data Available:

<http://terrabrasilis.dpi.inpe.br/>

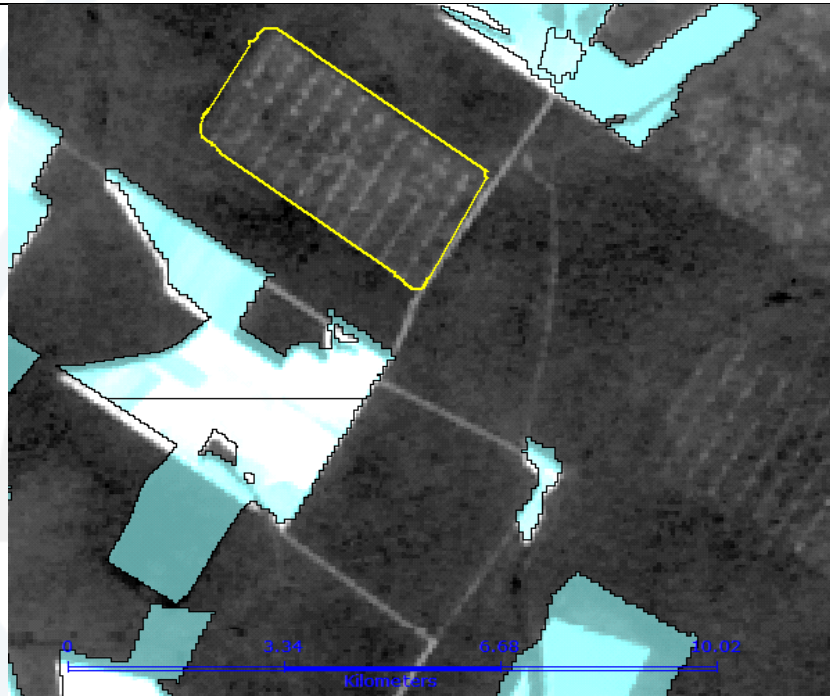


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Importance of DETER Project Warning System / Continuous mapping

Geometric Selective Logging



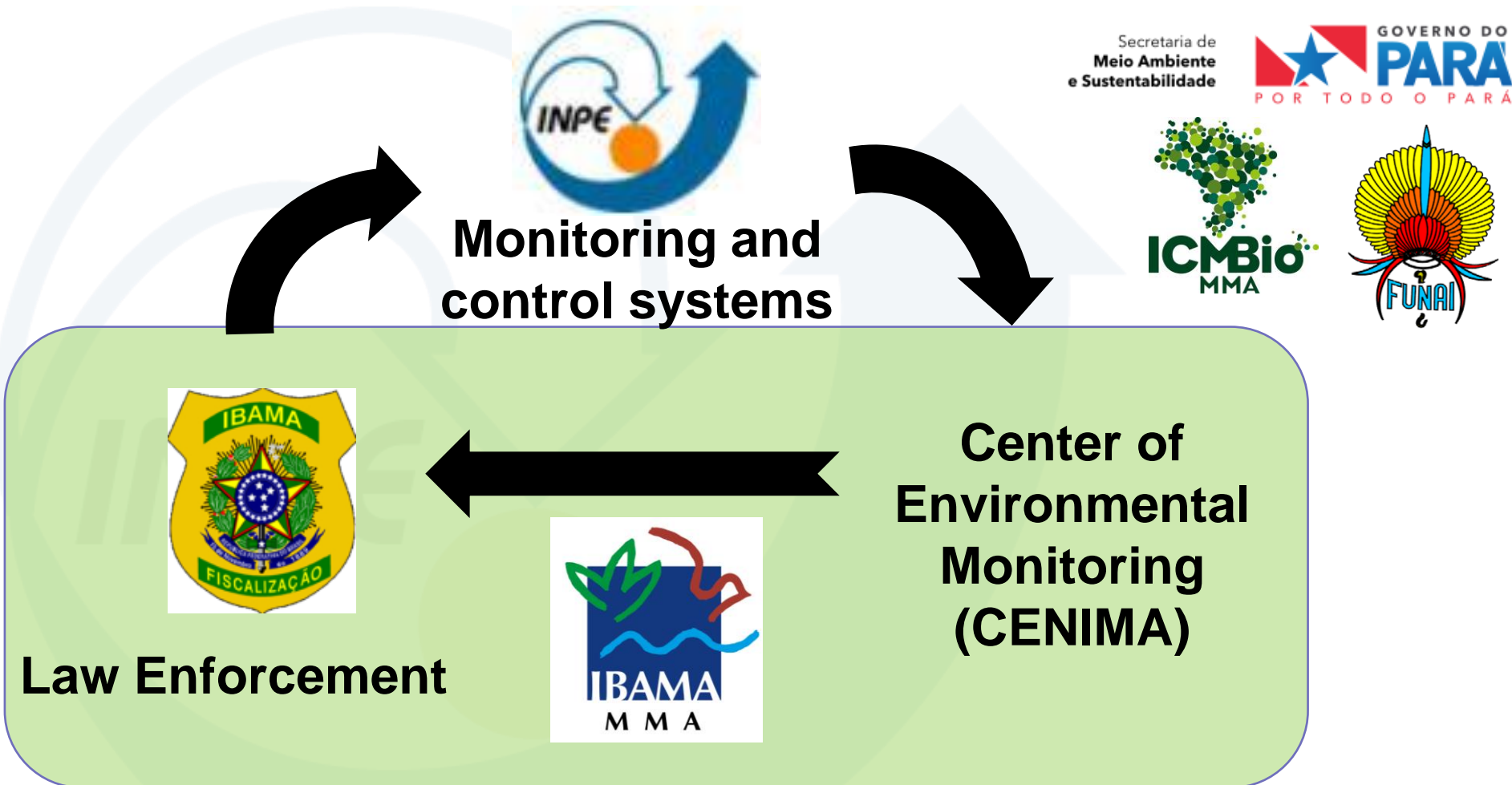
August, 8th, 2015

Clear Cut deforestation



April, 4th, 2016

Monitoring and Control Integrated actions



IBAMA - Brazilian environmental law enforcement authority at the federal level

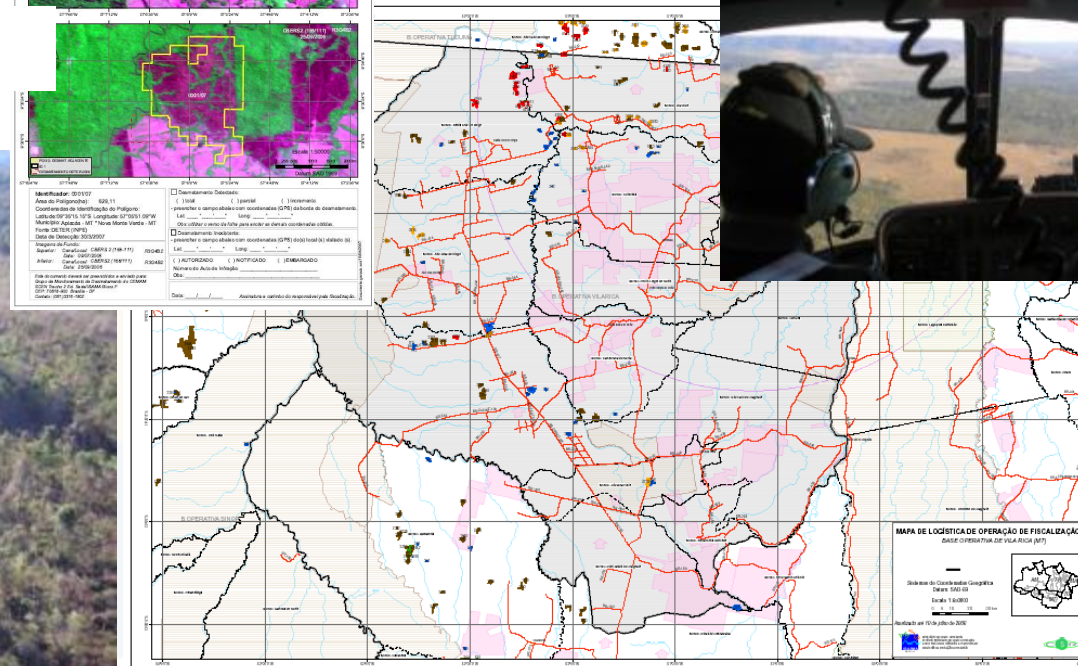
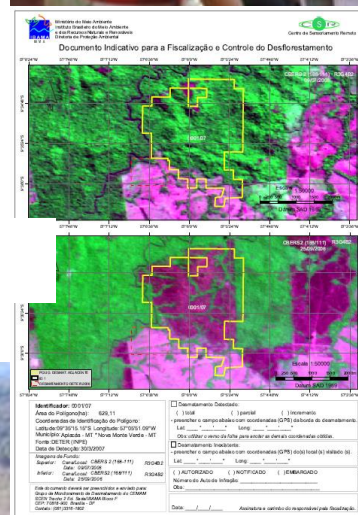


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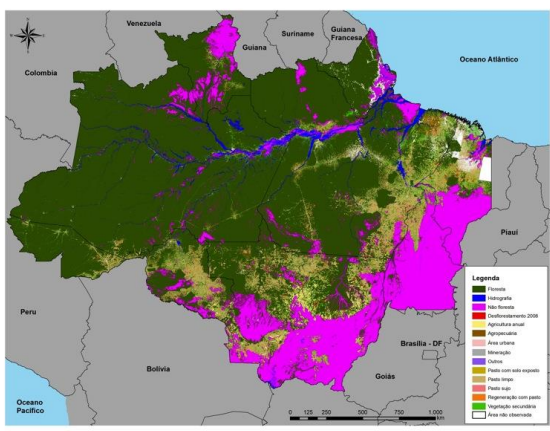
IBAMA organizes the law enforcement plan



Law enforcement map



TERRAClass PROJECT



- 19 classes of land use land cover
- TerraAmazon System and BDC Techniques
- INPE & Embrapa partnership for TerraClass Amazonia
- Perspectives: INPE + IBGE + Embrapa = TerraClass Brasil
- Data available: **2004 – 2008 – 2010 – 2012 – 2014 – 2020 - 2022**
- Next maps: 2018 – 2016 (complete time series)

GeoPortal TerraClass: <https://www.terraclass.gov.br/>



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Capacitree Project – 2010-2018

CAPACITY BUILDING IN SATELLITE FOREST MONITORING

DATA FROM 2010 - 2018



NORTH / CENTRAL
AMERICA

EUROPE

TOTAL PROFESSIONALS TRAINED : 819

ASIA

SOUTH AMERICA

AFRICA

OCEANIA

TOTAL COUNTRIES TRAINED: 64

NORTH/CENTRAL AMERICA

Professionals Trained: 37
Countries: 16
Projects: FAO - CARICOM - TCTP

SOUTH AMERICA

Professionals Trained: 588
Countries: 12
Projects: CARICOM - TCTP -
OTCA - FAO

AFRICA

Professionals Trained: 114
Countries: 20
Projects: COMIFAC - FAO -
TCTP

EUROPE

Professionals Trained: 05
Countries: 01
Projects: FAO

ASIA

Professionals Trained: 65
Countries: 14
Projects: FAO - TCTP

OCEANIA

Professionals Trained: 10
Countries: 01
Projects: FAO

Courses face-to-face at COEAM



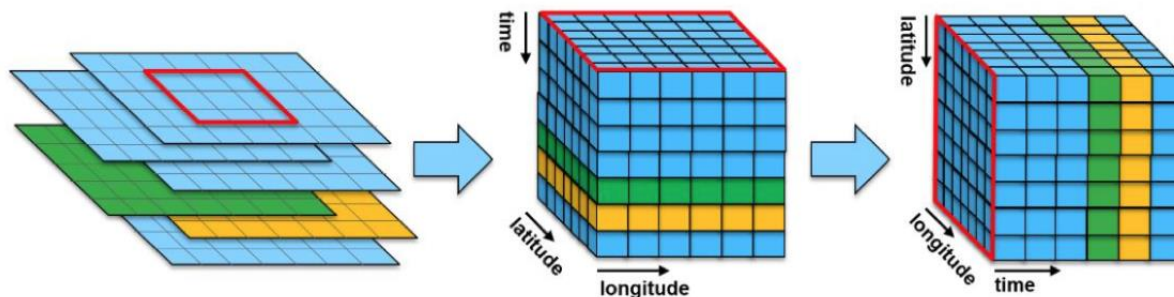
Food and Agriculture
Organization of the
United Nations



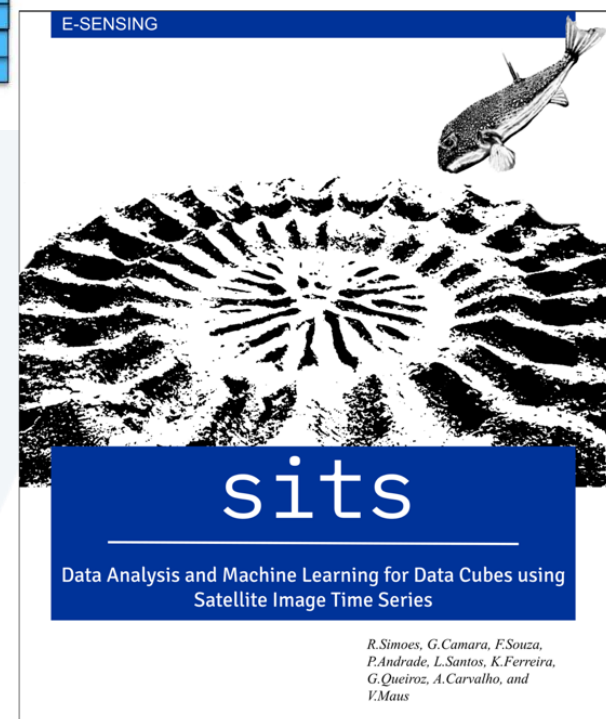
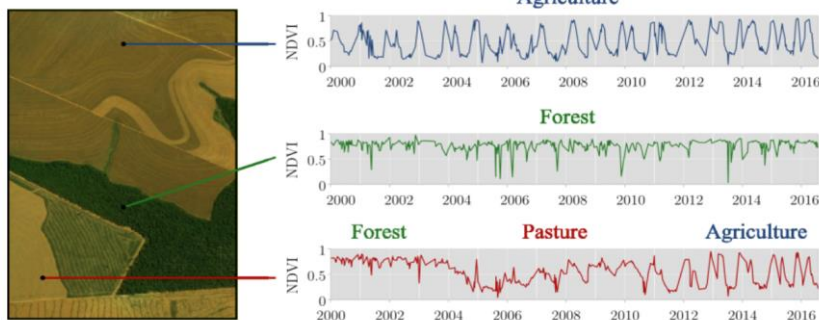
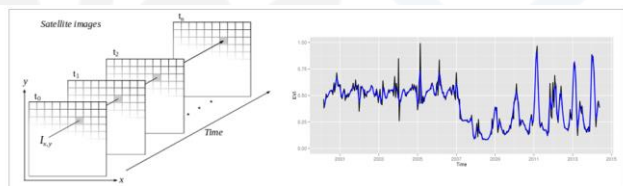
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NEW TECHNOLOGIES FOR MONITORING SYSTEMS: DATA CUBE AND SITS



Time series analysis



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Deforestation Monitoring: Research and Environmental Policies



Research

More than 1200 articles



Compliance



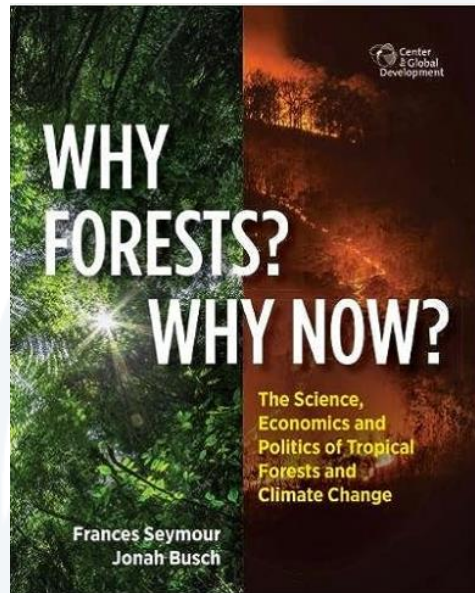
Public Policies



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Deforestation and climate change: cycle that exacerbates poverty



Deforestation x SDGs x Climate Change



“Guideline” for a forest monitoring project

- **Demand**
- **Extensive research**
- **Capacity building**
- **Definition of replicable methodology**
- **Institutional arrangements**
- **Public policy**
- **Free data access**
- **National and international commitments**
- **Independency, Governance and Sovereignty**





Thank you!
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