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Measurement, Reporting and Verification for REDD+

UN-REDD Asia-Pacific Regional Workshop

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UN-REDD Viet Nam Programme

FAO FIAT PANIS

UNDP

UNEP

Introduction

- MRV for REDD
- Functions of MRV
- Co-benefits of MRV
- Linking MRV with other things

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Why MRV?

- The MRV system will provide the evidence of reduced emissions and enhanced removals
- The MRV system should also be able to tell who can claim this money
  - Who is participating?
  - How did they perform?

REDD+ requirements

- Robust and transparent **national monitoring, reporting and accounting for emissions and removals in the forest sector** shall be established, in accordance with national circumstances and capabilities, with the establishment of subnational accounting as an optional interim
- Each developing country Party should develop a unique emissions and removals accounting and monitoring system for its forestry sector which includes all subnational activities

  (FCCC/AWGLCA/2009/INF.1, paragraph 111)

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Input / Output

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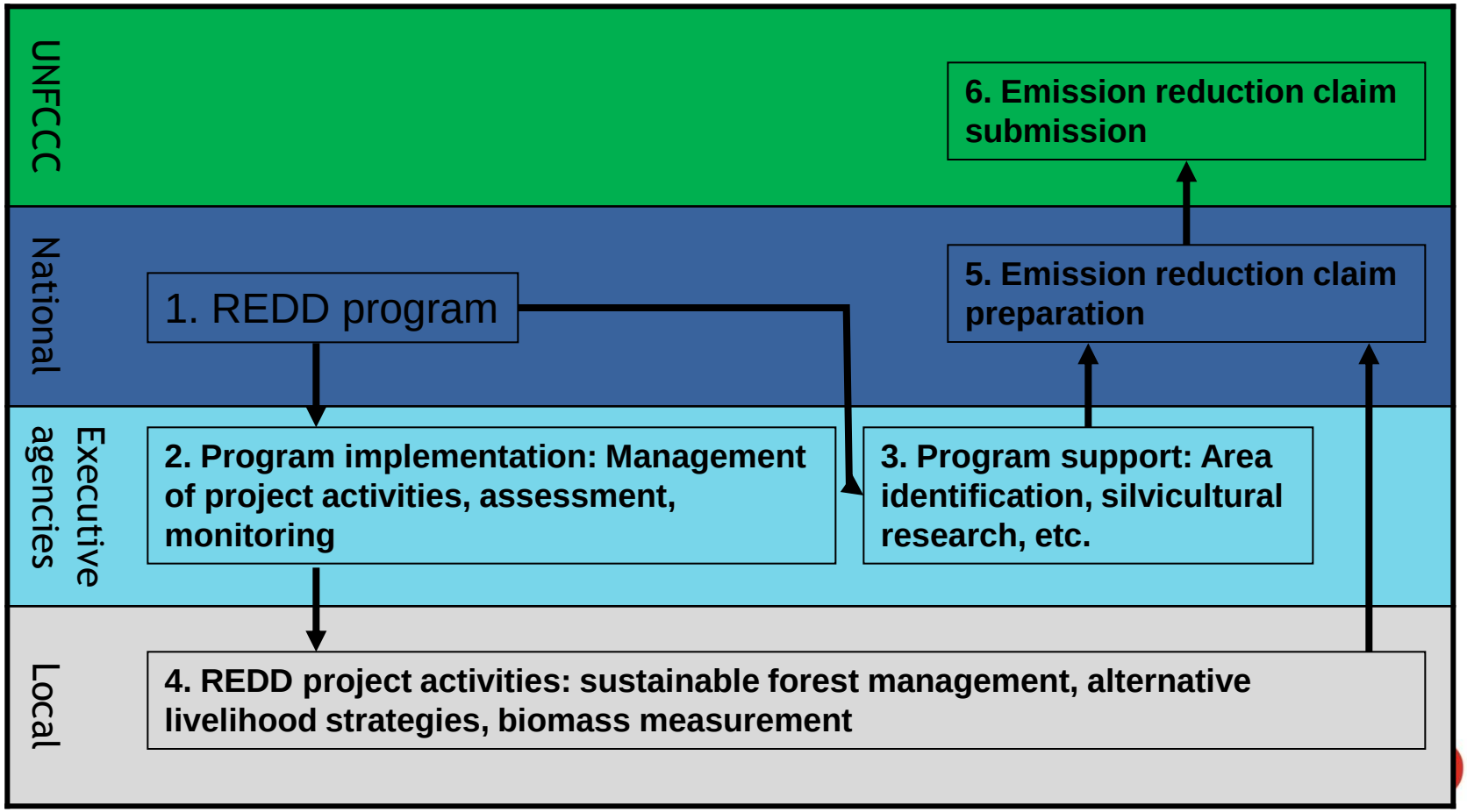
REDD as a national program



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Tiers of carbon monitoring

- The IPCC distinguishes between three tiers of reporting carbon dynamics
- Tier 1
  - When no local information is available, use can be made of globally available information
  - The estimates are conservative, meaning that very low carbon credits will be generated
- Tier 2
  - Local information on forest areas and types is available, but no or little information on floristic composition or biomass content, for which standard values will be used
  - Again, estimates are conservative
  - Relatively good assessment with little effort
  - Changes may not be easily detected
- Tier 3
  - Every forest needs to be described in detail, using locally collected data
  - Expensive to implement, but it gives the highest carbon credits
  - For REDD this may be the only sensible solution

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Measuring carbon

- Carbon stored in the forest needs to be measured in order to get accurate estimates of reduction in emissions or enhanced removals
  - Change is small relative to the total biomass
  - This implies that a small error in the measurements can have a large impact on the assessment of emission reductions
- Countries can use their existing forest inventory practices as long as they comply with the requirements of REDD
  - Field inventory data
  - Wood production data
  - Silvicultural analysis
- However, the data may not be comprehensive enough to generate accurate local estimates
  - Involvement of local communities in measurement of forest properties may be required

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Field data to be collected

- The type of data to be collected depends on the methods that are applied for reporting
- For allometric equations, the typical data are
  - Diameter at breast height
  - Tree density
  - Total tree height
  - Wood density
  - Free branch height
- Data can be collected in standard (permanent) sampling plots, or scattered throughout the forest
- In either case, a sampling approach has to be taken that is relevant for the conditions of the forest (ecological type, disturbance regime)
- Other data may be relevant as well
  - Use of the forest resources by the local population
  - Substitution of non-renewable resources by forest products
  - Ownership, use rights, cultural and social importance

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Sampling and representativity

- Measuring biomass is expensive so it is important to know where to sample, what to collect, and how much of it
- Standard statistical techniques can be applied to determine the number of samples in order to reduce the uncertainty to an acceptable level
- Stratification of the forest in homogeneous units based on ecological type, resource condition and management regime will help to reduce the number of samples
  - Homogeneous units have low variance in the samples, meaning that fewer samples are required for a good assessment
- Stratification of the forest and its description in statistical terms are important elements of reporting to the UNFCCC
  - It is necessary to validate a national Tier 3 reporting method
  - It is important source of information for independent validation of carbon emission reduction claims both at the national level and at the UNFCCC

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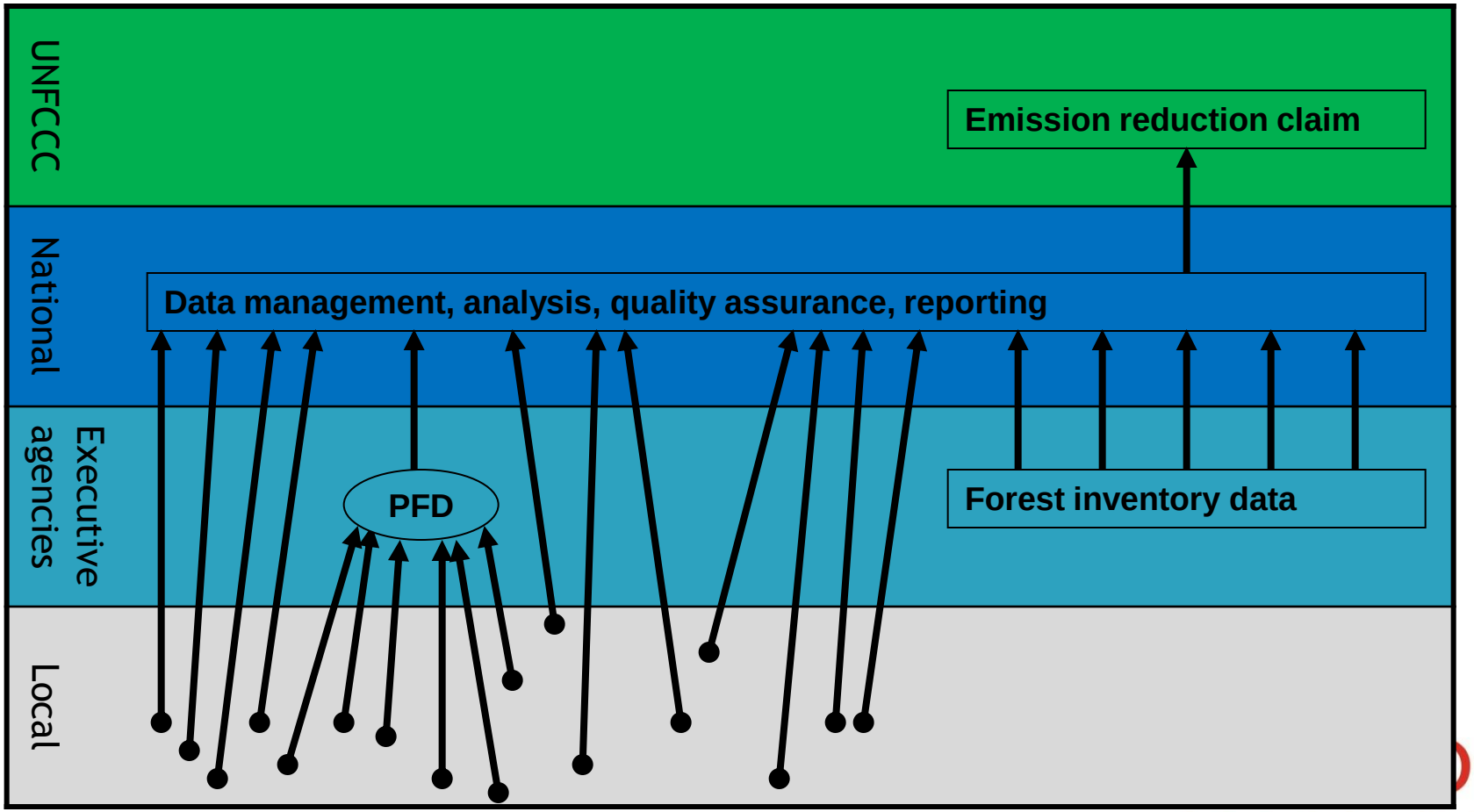
Data management for REDD



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Data analysis

- The data that is being delivered from the field needs to be processed in order to be useful
  - E.g. using allometric equations
- This requires a very professional design of the data management system
  - Link measurements to time and place
  - Link measurements to community
  - Link measurements to ecological unit
  - Link measurements to satellite imagery and other data
- Data analysis is a continuous process
  - Process data as it is received
  - Do not accumulate data until a report to the UNFCCC is due!

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Data quality assurance

- Data has to be checked for consistency over time and spatially
  - Remove measurement or reporting errors
  - Check if there are consistent errors from a location
    - Is the stratification wrong?
    - Does the community receive support or training?
- Data are grouped in large homogeneous units for reporting
  - Multiple measurements give indication of variability and accuracy of the measurement
  - If the accuracy is too low:
    - Refine the stratification
    - Add more measurements
    - Improve quality of measurements
- Data quality assurance requires specially trained staff
  - Forest ecologists: stratification, evaluation of measurements
  - Statisticians: error analysis, sampling scheme design, QA indicators

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Access to data

- Even if all the data is uploaded to a national database, access should be given to third parties to support their efforts
  - Provincial Forest Departments
    - Planning
    - Evaluation of performance
    - Distribution of benefits
  - District Forest Department
    - Planning of activities
    - Support for communities
  - Communities
    - Overview of performance
    - Insight in benefits
  - Society at large
    - Overview of achievements
- Access can be provided through a web site or with brochures, newsletters, etc

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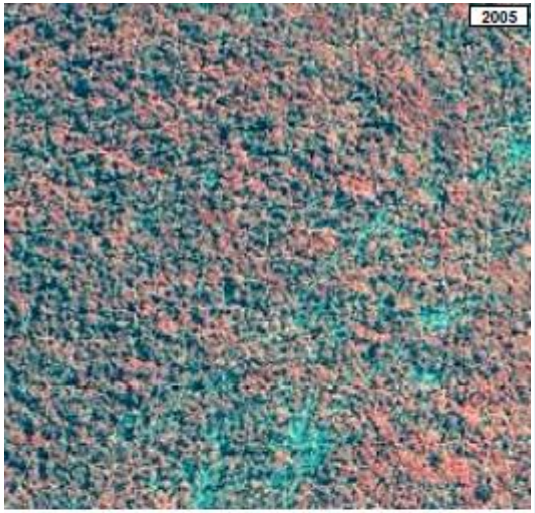
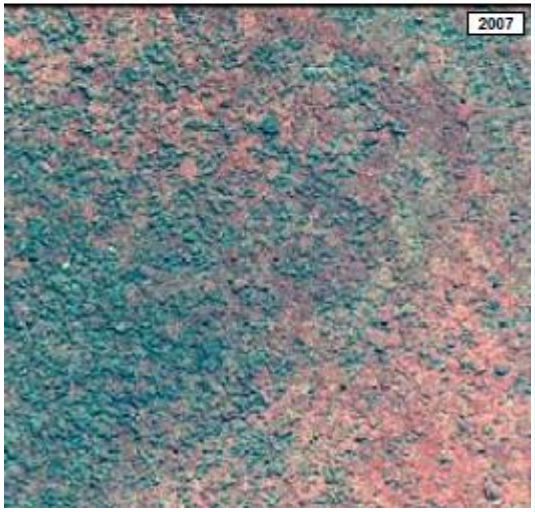
Verification of emission reductions

- Verification of claims will be handled by the UNFCCC
- Countries will probably like to have their own verification options
- Verification is ideally done with remote sensing
  - Avoid too many expensive field visits
  - Verification should validate the claim of emission reduction, not repeat the carbon measurement
  - Verification can be done on a sampling basis, using statistically proven methods that are acceptable by the UNFCCC
  - In order to capture reduction in forest degradation high resolution data sources must be used





Elements of verification

- Verification has to meet certain criteria
  - It has to be objective
  - It has to be accurate
  - It has to be repeatable
- The UNFCCC sets standards for verification

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Problems with verification

- Verification is costly
  - Transaction costs in AR-CDM projects were so high that many projects were not economically viable
  - Small-scale AR-CDM was introduced, with much lower requirements for verification, in order to reduce transaction costs
- Verification has to be done by an independent (read: international) party
  - Fees are high
  - Fieldwork is prohibitively expensive
  - Process is “foreign”, no national inputs

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Verification with remote sensing

- Verification can be performed with remote sensing
- Current techniques have some drawbacks
  - Accuracy of biomass estimation is low
  - Still requires fieldwork to establish correlation factors and accuracy
- New technologies may help in the longer term
- New analysis with high-resolution optical data appears to be promising

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Object-oriented analysis for verification

- From high-resolution images it is easy to detect even small changes in the canopy
- These small changes may be indicative of forest degradation, but it requires fieldwork to ascertain this
- New method being developed has some important new analysis method
  - Assumption that changes in biomass content of the forest due to degradation or regrowth has effect on the canopy
  - Correlate biomass to forest properties from object-oriented analysis
  - Compare correlation at beginning and end of assessment period
  - Establish if the reported changes correspond to the observed changes in the canopy

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Object-oriented validation concepts

- The idea is not to estimate biomass from the satellite image, but to correlate some easily observed property from the image to biomass in the field
- It is not important to know what the properties represent, only that their magnitude or expression is related to biomass
- This procedure can be applied with any kind of imagery, but different properties will have to be developed

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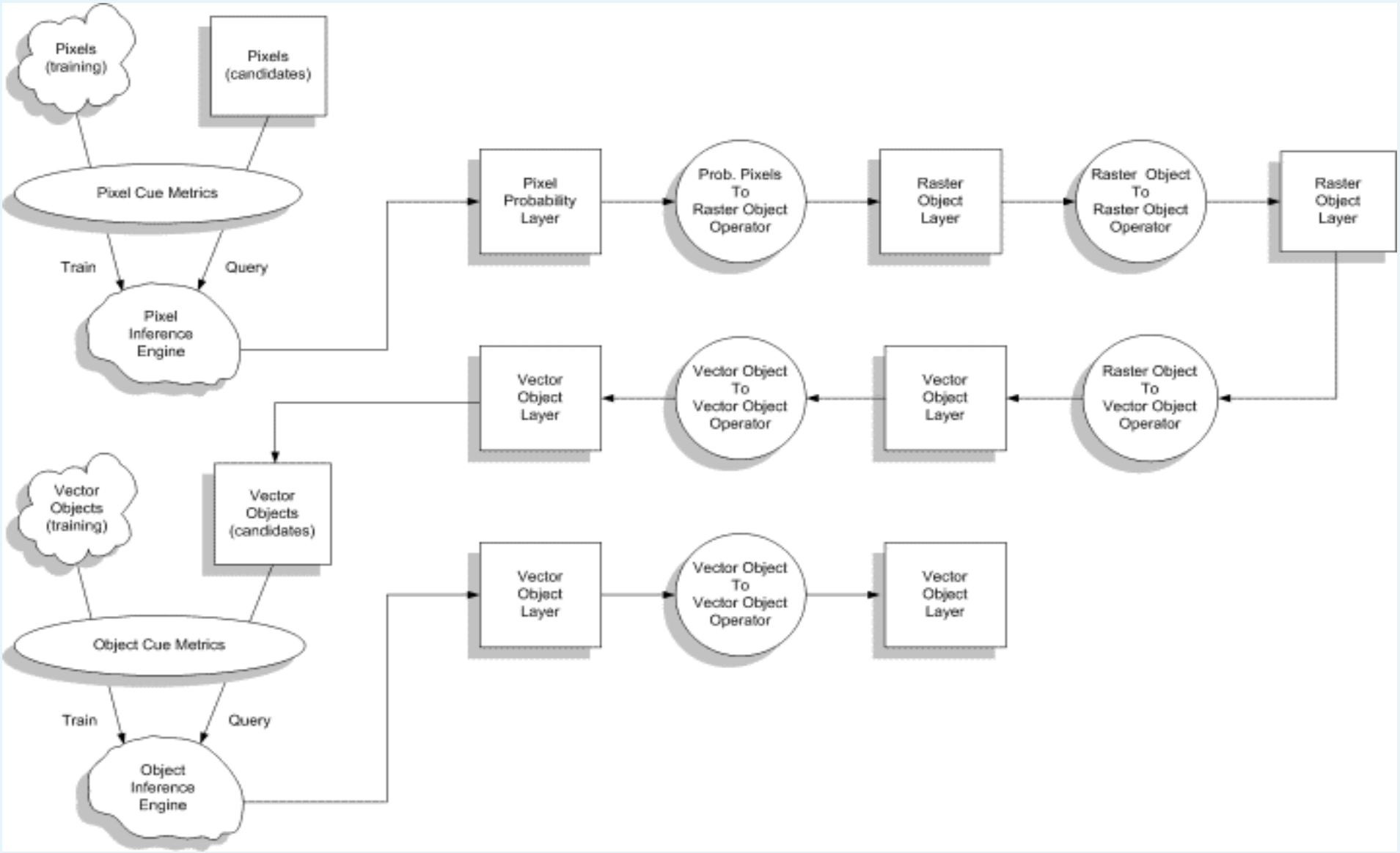
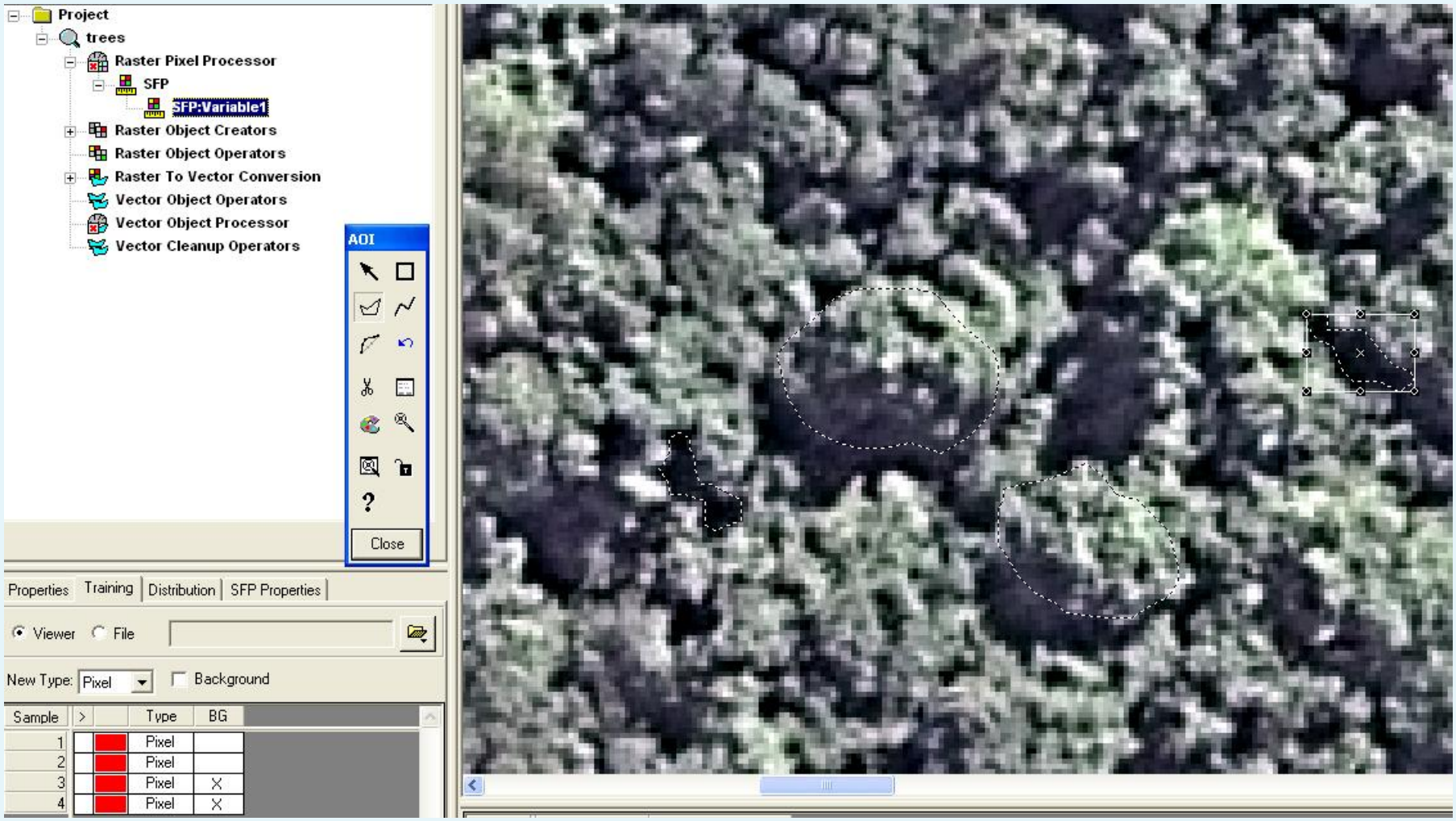

Pixels (training)
Pixels (candidates)
Pixel Cue Metrics
Train
Query
Pixel Inference Engine
Pixel Probability Layer
Prob. Pixels To Raster Object Operator
Raster Object Layer
Raster Object To Raster Object Operator
Raster Object Layer
Raster Object To Vector Object Operator
Vector Object Layer
Vector Object To Vector Object Operator
Vector Object Layer
Vector Objects (training)
Vector Objects (candidates)
Object Cue Metrics
Train
Query
Object Inference Engine
Vector Object Layer
Vector Object To Vector Object Operator
Vector Object Layer


Project
trees
Raster Pixel Processor
SFP
SFP:Variable1
Raster Object Creators
Raster Object Operators
Raster To Vector Conversion
Vector Object Operators
Vector Object Processor
Vector Cleanup Operators
AOI
Close
Properties
Training
Distribution
SFP Properties
Viewer
File
New Type:
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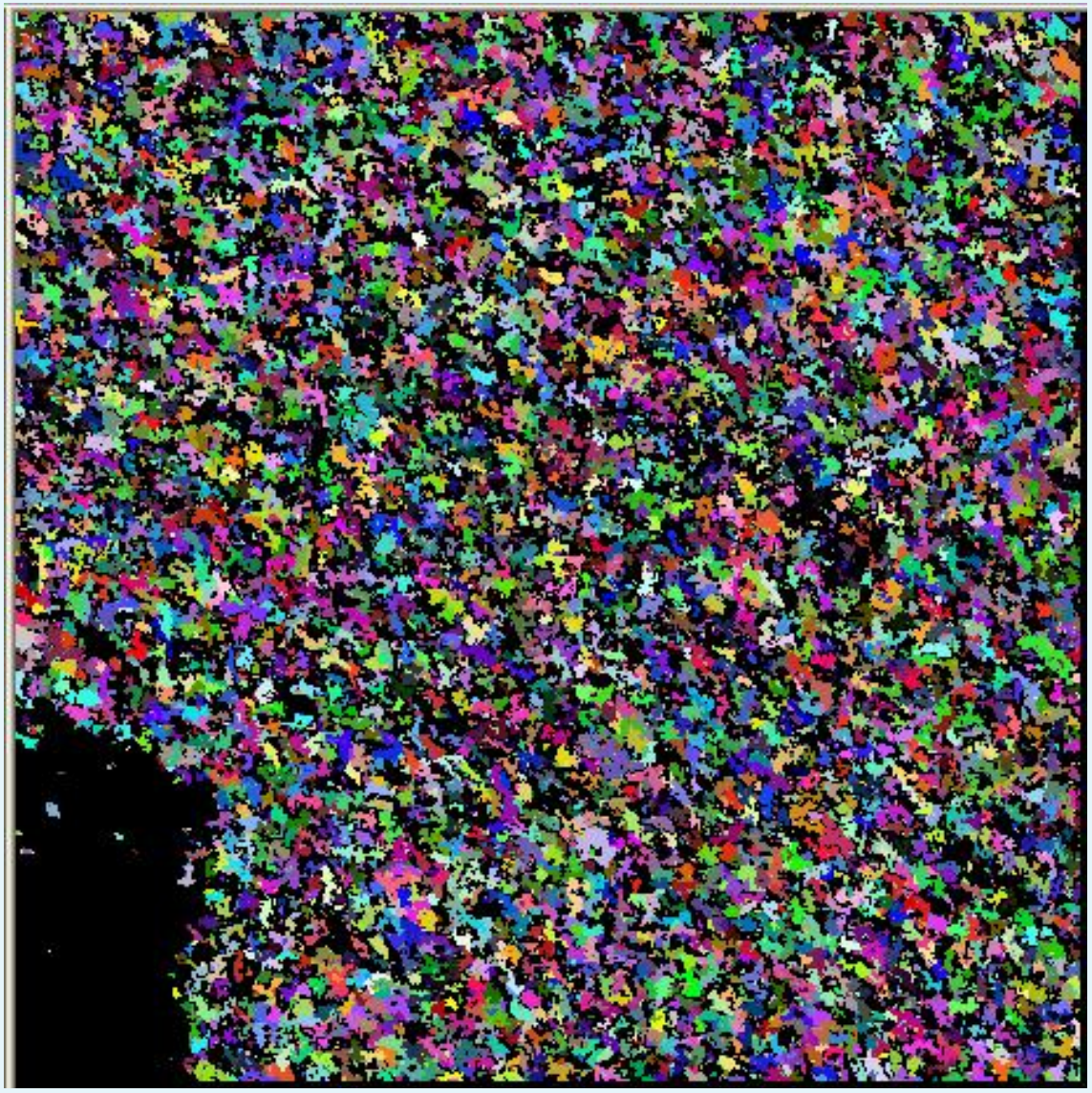
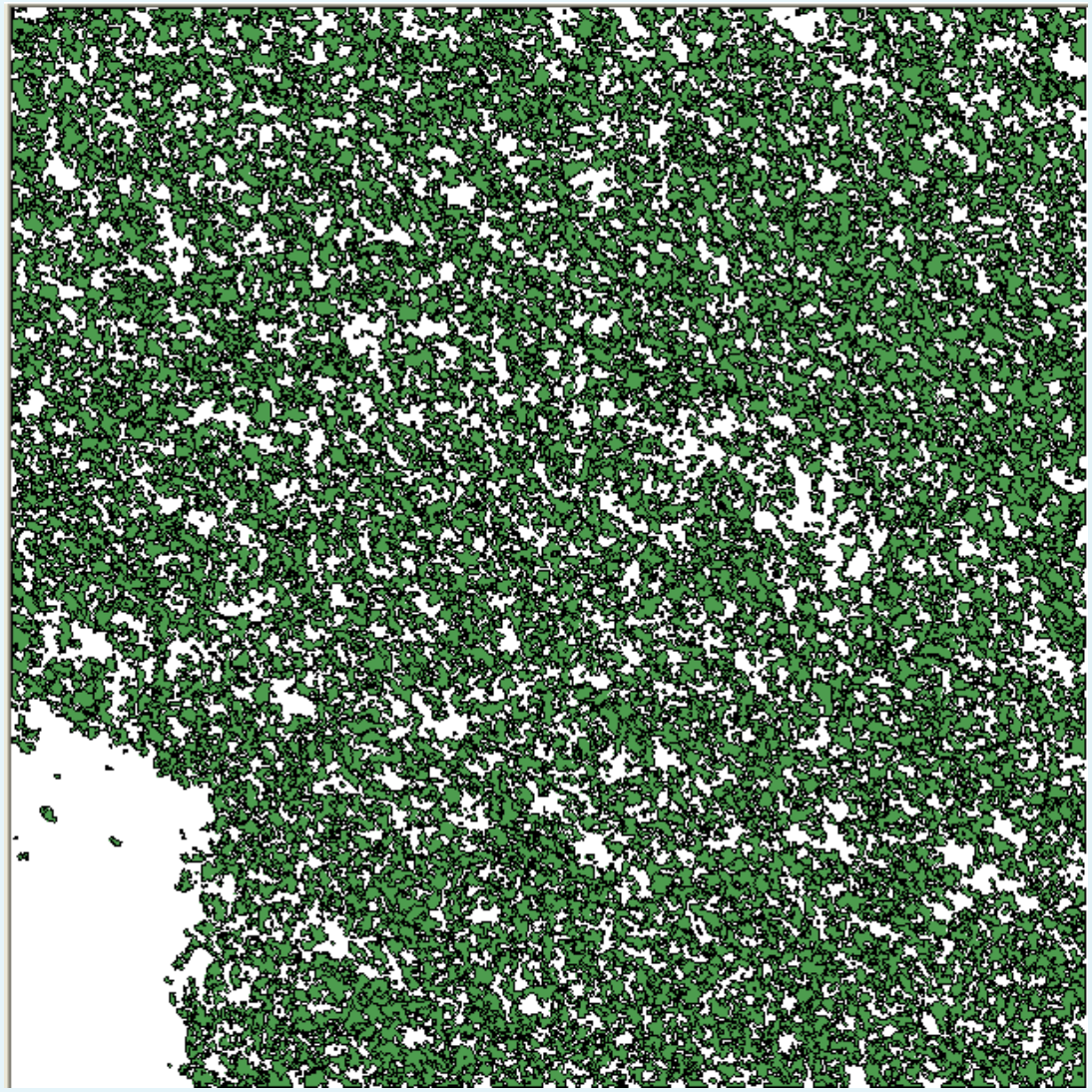
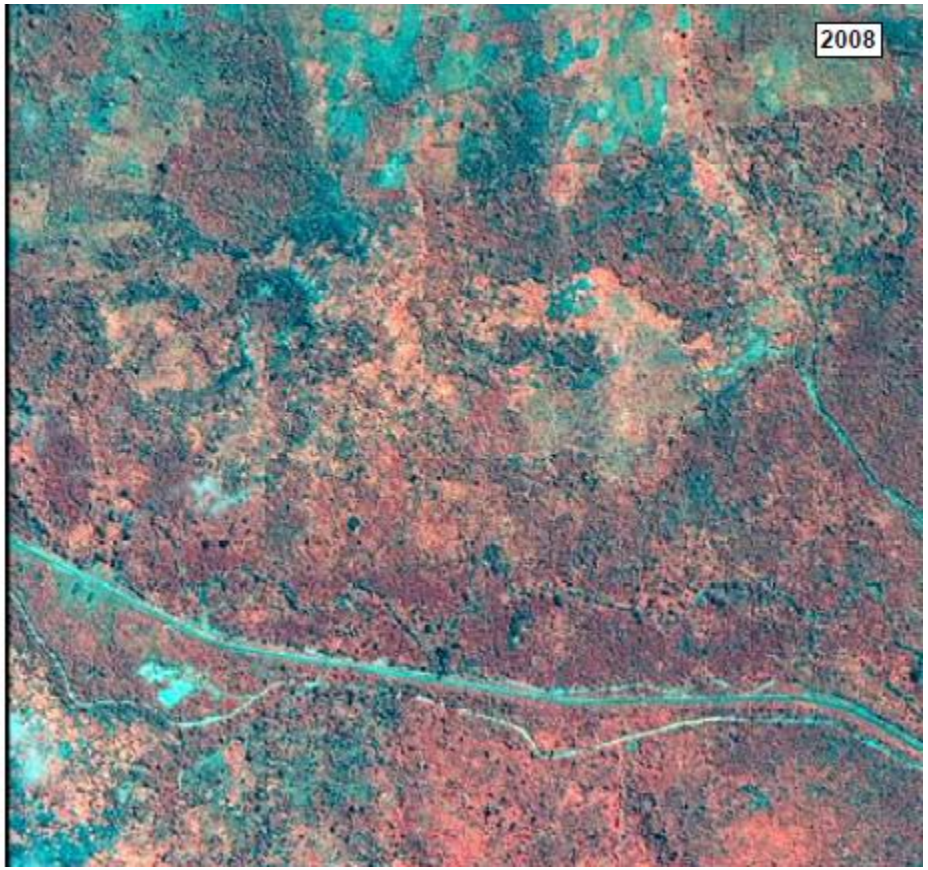


Segmentation



Objects

Verification of emission reductions



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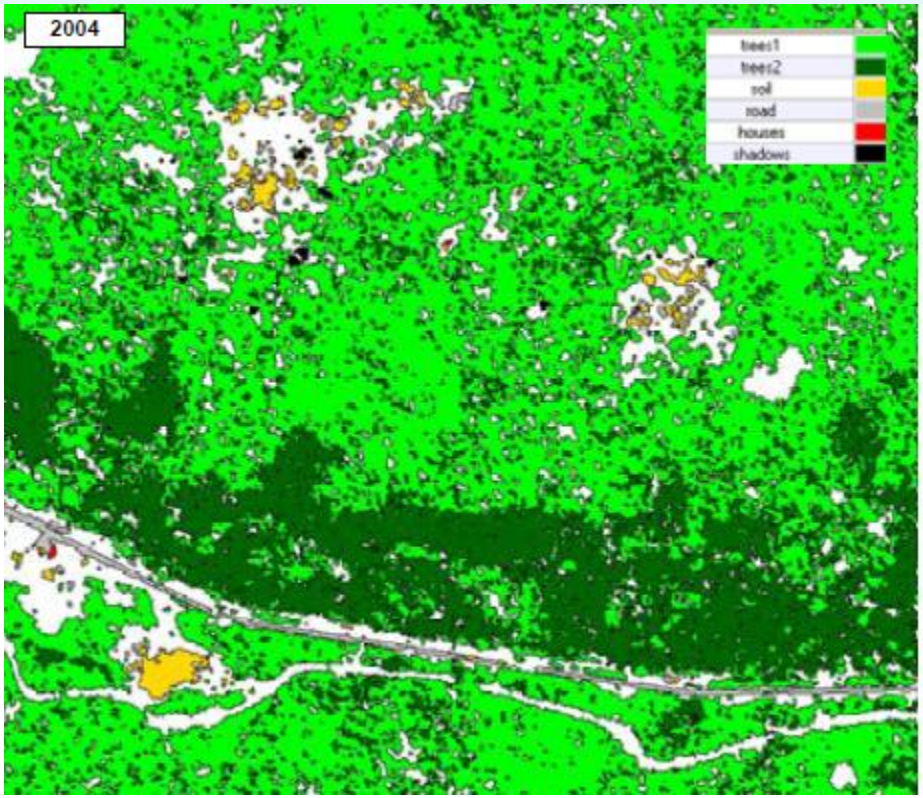
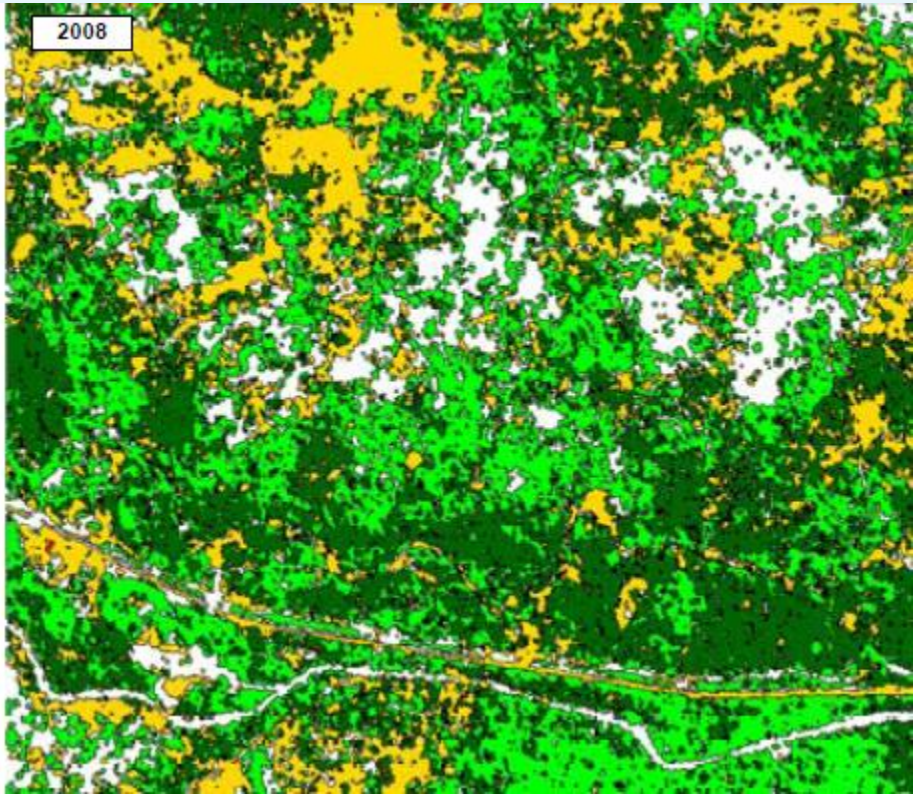
Verification of emission reductions





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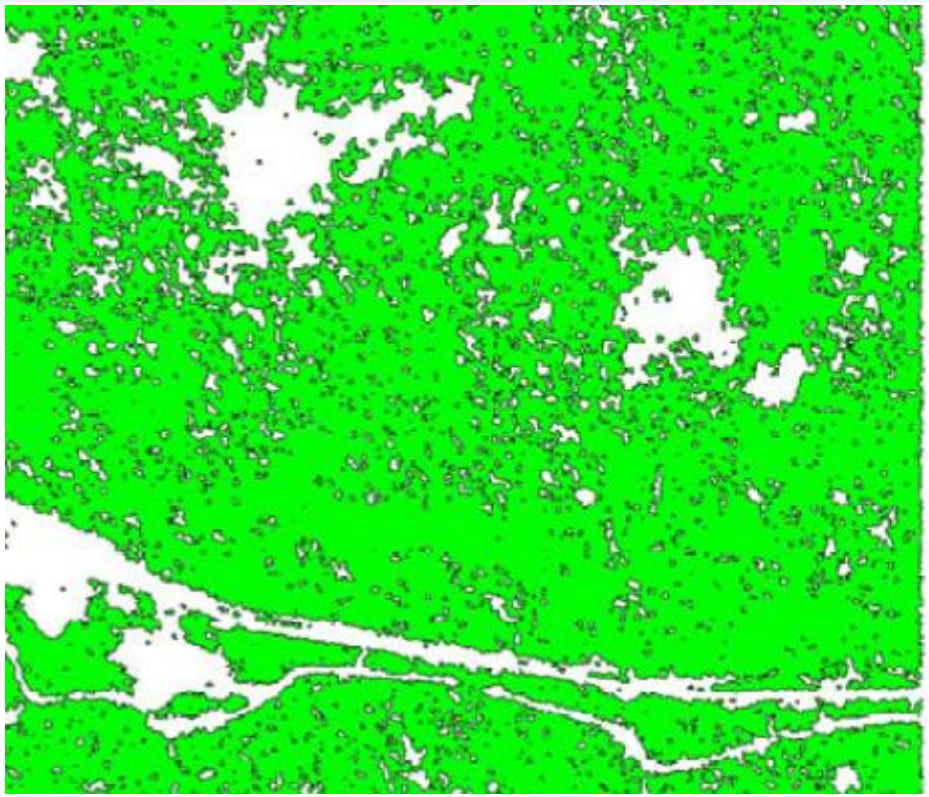

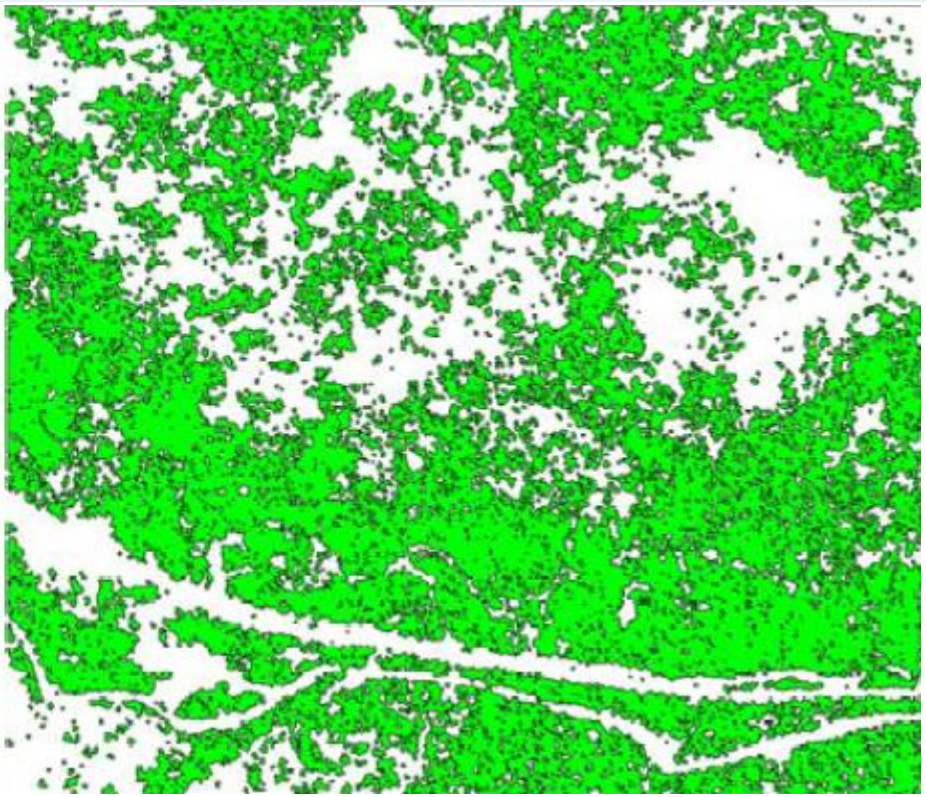

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Co-benefits of MRV

- Once the MRV is gathering data on REDD+ areas and interventions it can quickly become an important database with which other functions in the forestry sector can be supported
  - Development of RELs and RLs
  - Benefit distribution: Who is participating and how much do they contribute to the generation of credits
  - Planning and monitoring of REDD+ interventions
  - National Forest Inventory and National Communication on GHG
  - Biodiversity, watershed management, poverty reduction, etc

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Conclusion

- The National MRV system is required for REDD
- A good MRV system is very expensive, but it will also enable the generation of extra credits through proper accounting of impacts
- The MRV should be integrated with other elements of REDD and other government forestry programs
  - Benefit distribution
  - Planning and monitoring of interventions
  - Forestry planning

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