



Food and Agriculture
Organization of the
United Nations



Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

The International Climate Initiative (IKI)

Collect Earth

an innovative tool

Danilo Mollicone



Ingredients for the success:

1) Open source software

2) Developed on  technology

3) Rely of existing open source software (e.g. Saiku)

4) Learning from what is working

5) A clear strategy from measurements to submission under



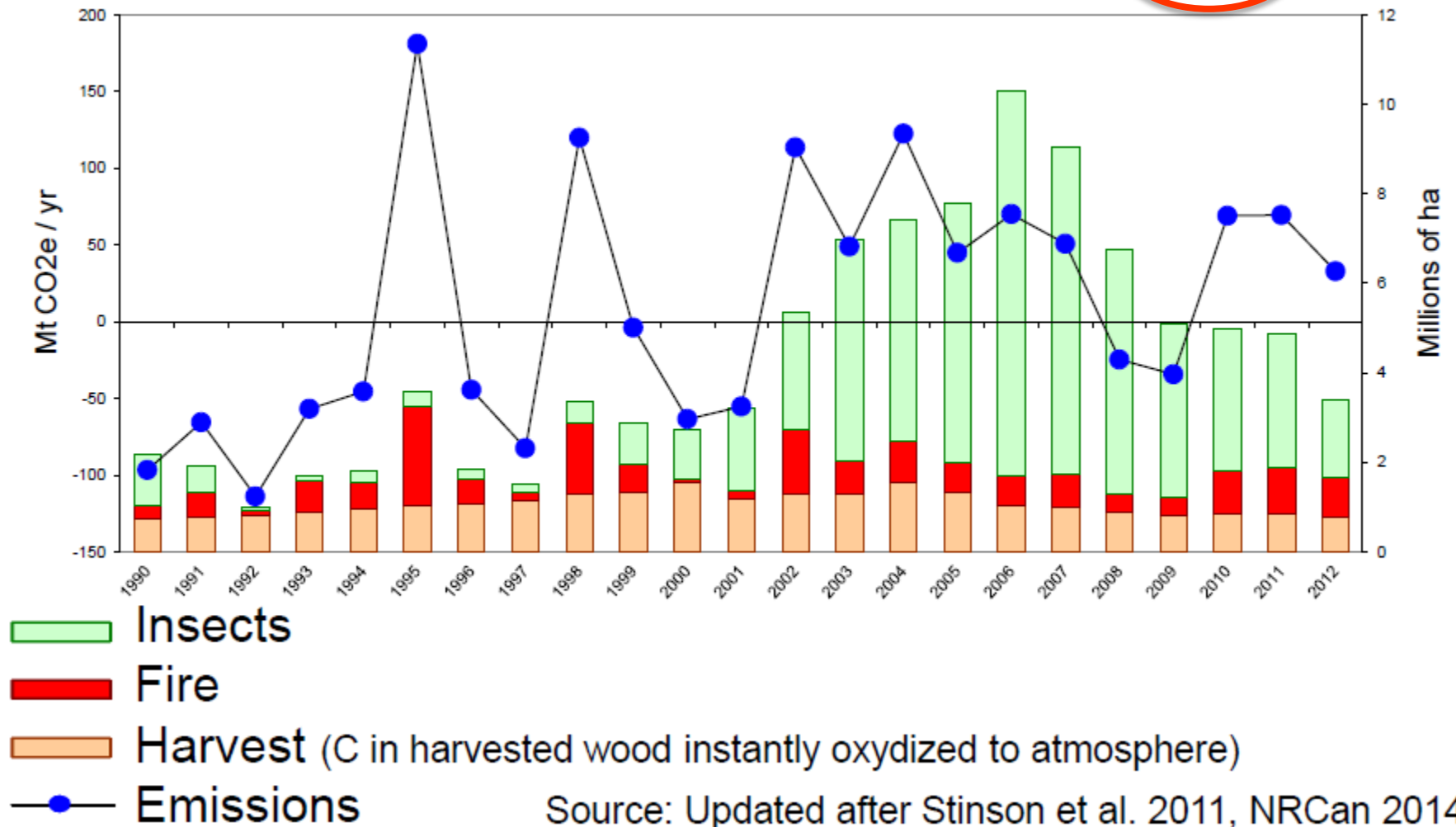
Learning from what is working:

Collect Earth has been developed
by learning from experiences from Annex I
countries reporting activity data under
UNFCCC



Canada's forest C balance as reported to UNFCCC

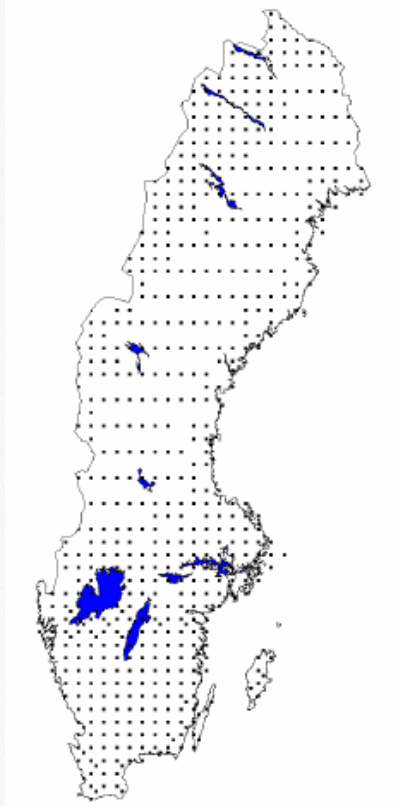
Carbon Emissions and Area distribution, **FL > FL**



All Annex I countries use IPCC Approach 3 to assess activity data:

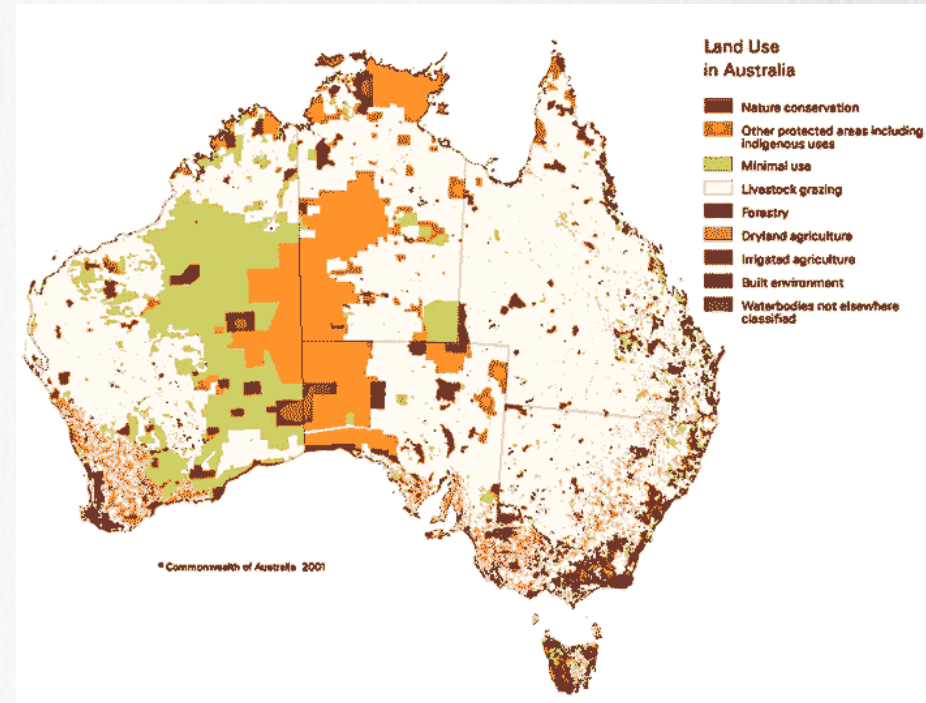
40 countries use
mainly sampling approaches

Sweden



2 countries use
mainly wall to wall approaches

Australia



National Inventory Report

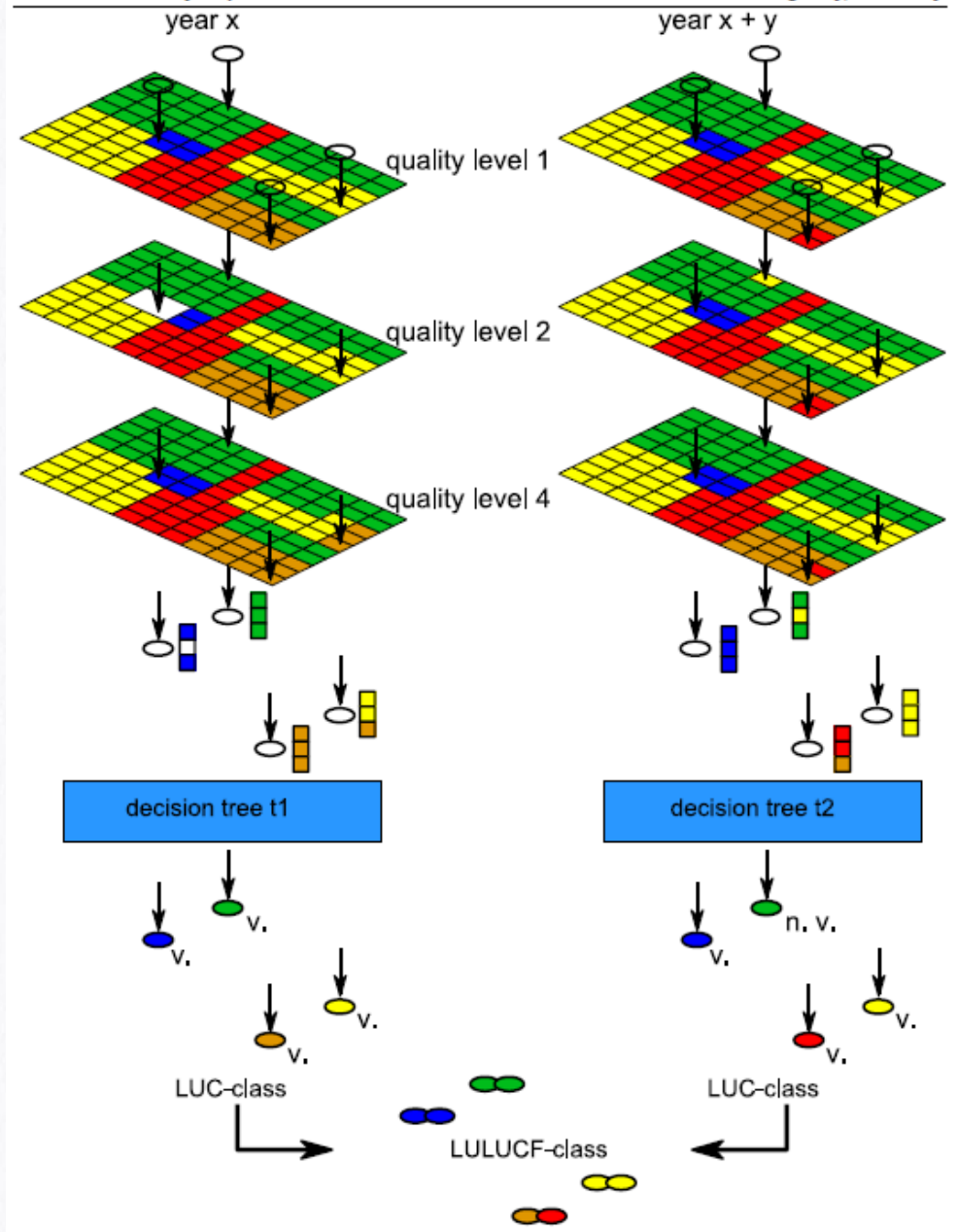
Germany

Schematic representation of allocation of sample points to a land-use category

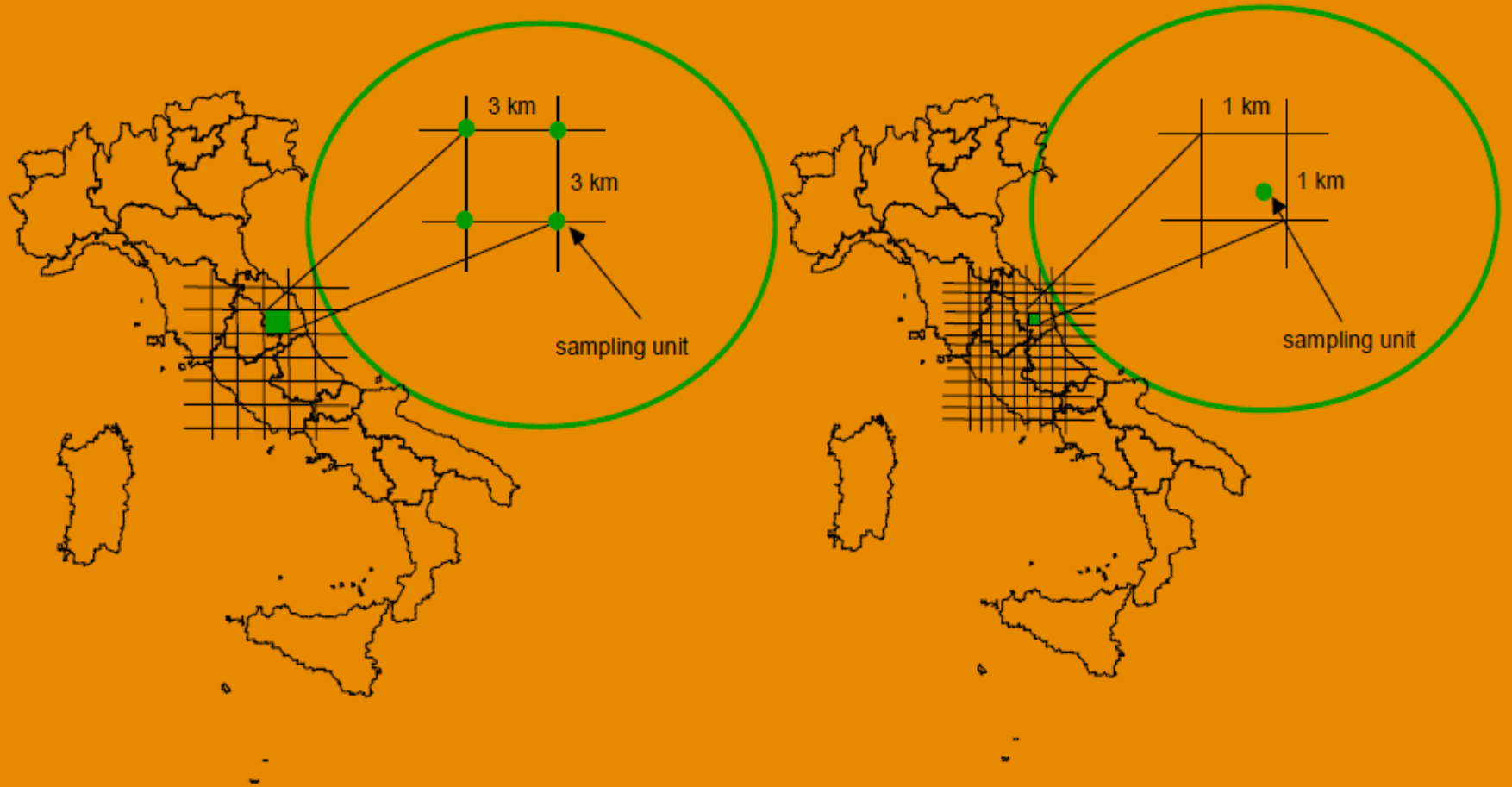
GHG NIR Germany 2013

http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/7383.php

The National Forest Inventory surveys the state of forests, and of forest production potential, on a large scale throughout Germany, using a standardised sampling procedure. The National Forest Inventory is a terrestrial sampling inventory that uses permanently marked sample points in a 4 km x 4 km basic grid whose resolution, at the request of the Länder, has been increased on a regional basis



The Italian sampling system (within NFI)



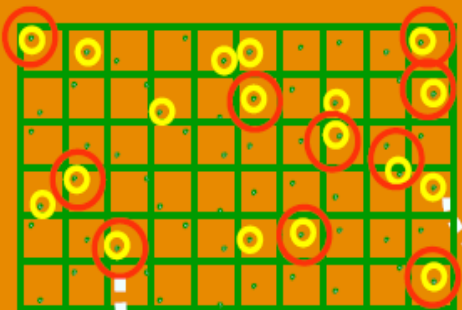
IFNI85
30,000 sampling units
Aligned Systematic Sampling
One-phase Sampling Design



INFC2005
300,000 sampling units
Unaligned Systematic Sampling
Three-phase Sampling Design

The Italian multi-phase sampling system (within NFI)

Phase 1 : Land Use & Cover classification

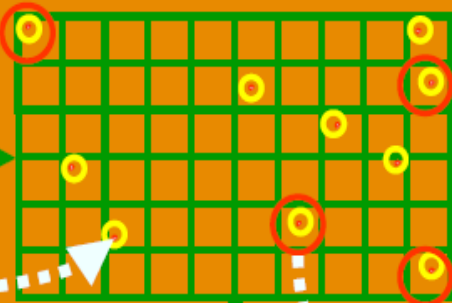


301,000 sampling points
randomly selected in each square of the grid

photo-interpretation

Forest and other wooded land points

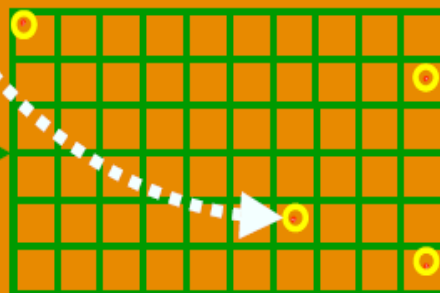
Phase 2 : Forest Classification and qualitative measurements



30,000 sampling points
randomly selected within the stratum of Forest and Other Wooded Land in each administrative region

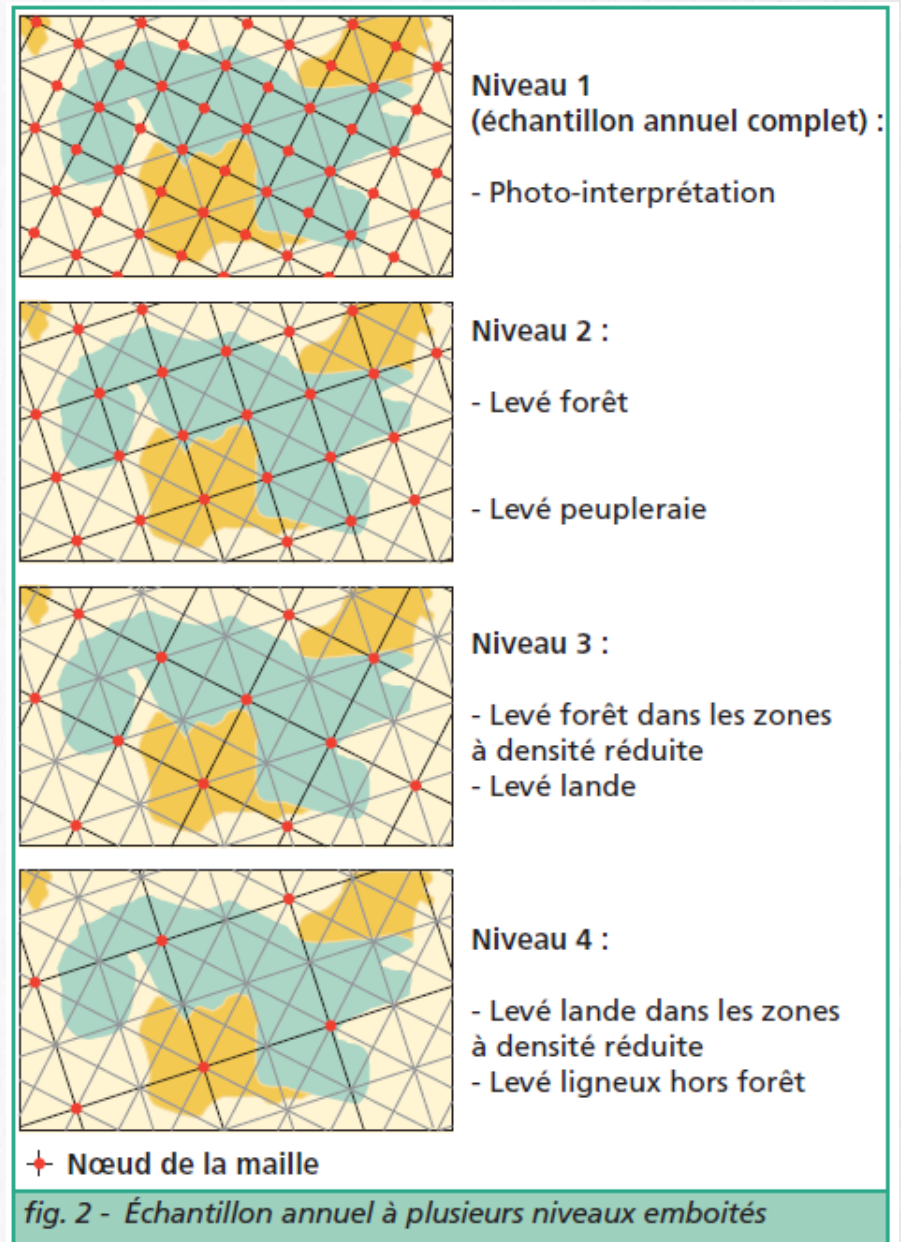
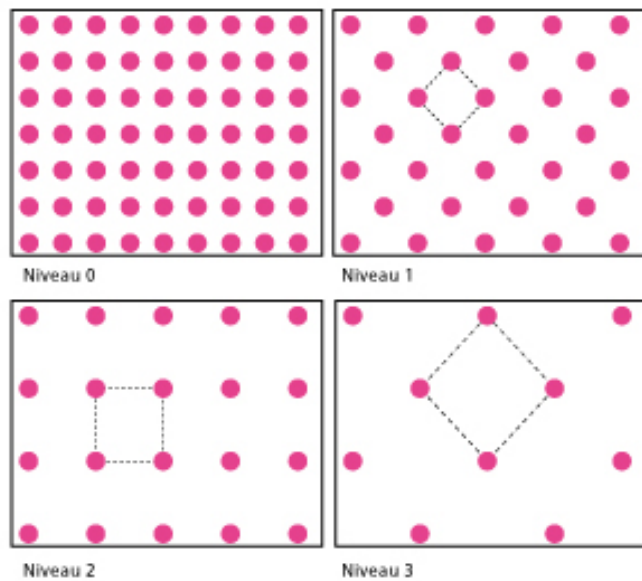
ground surveys

Phase 3: Quantitative measurement

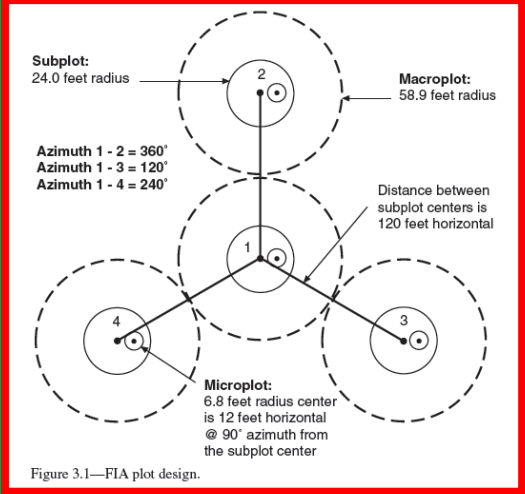
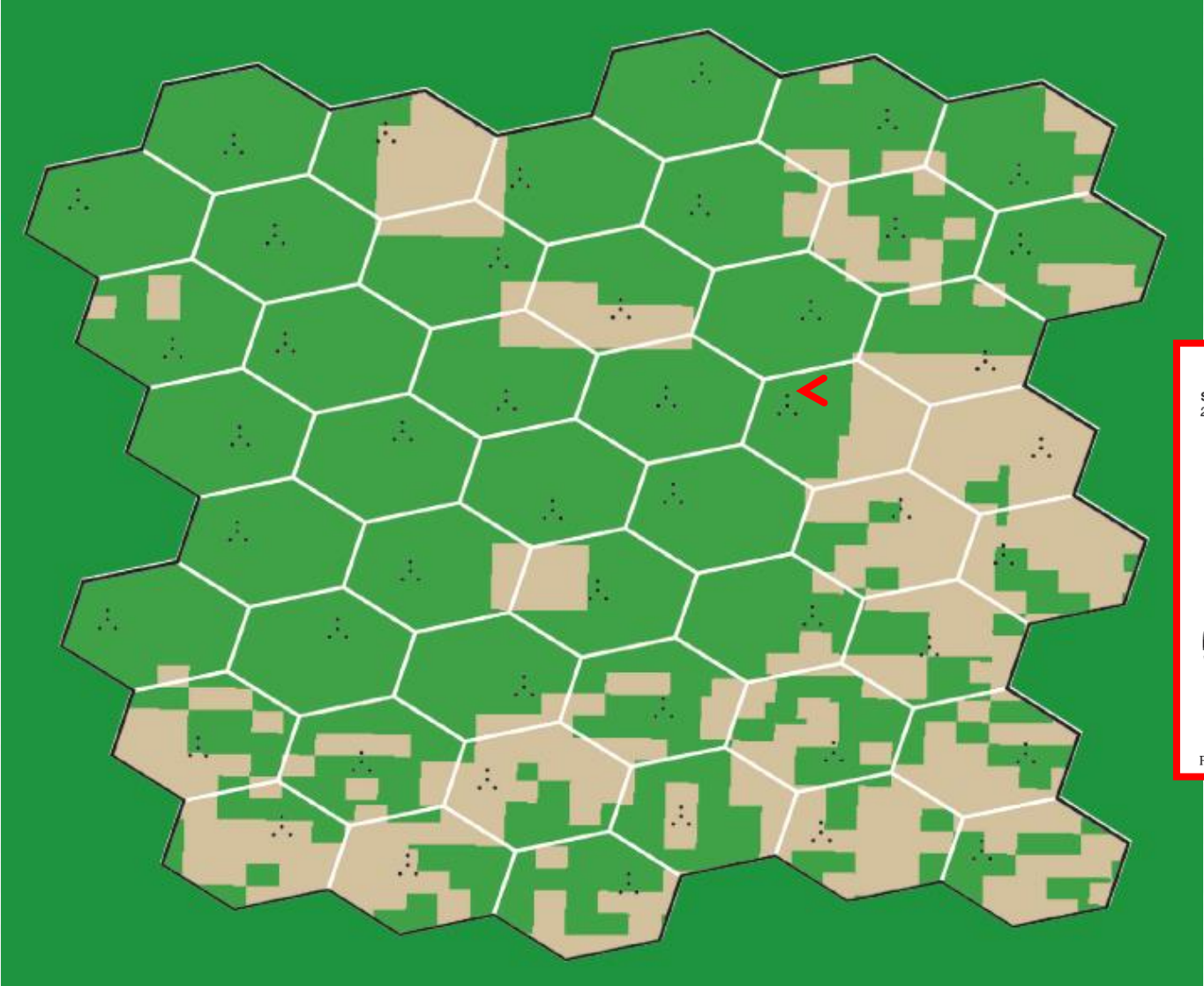


~ 7,000 sampling points
selected within the different strata detected in the second phase in each administrative region

France NFI multi-phase sampling design



USA NFI multi-phase sampling design



USA NFI multi-phase sampling design

Table 2.1—Summary of general attributes associated with FIA Phase 1, Phase 2, and Phase 3 sampling

Attribute	Phase 1	Phase 2	Phase 3
Sample type	Photo point or satellite pixel	Ground plot, subset of Phase 1	Ground plot, subset of Phase 2
Sample configuration	Point or pixel	Cluster of four 1/300-acre micro-plots, four 1/24-acre subplots, and optional four 1/4-acre macroplots	Same as Phase 2 ^a
Purpose	Stratification ^b of the landscape for the purpose of variance reduction	Samples FIA traditional attributes of interest, primarily related to tree species of all sizes	Samples FIA traditional attributes of interest, ^c plus additional attributes associated with forest health
Tessellation method	Supplemental regional grid superimposed over the population of interest ^d	Systematic national hexagonal cell grid	Systematic national hexagonal cell grid (subset of Phase 2 grid)
Base-grid intensity	At the discretion of each FIA unit	One plot per every 6,000-acre hexagonal cell	One plot per every 1/16 6,000-acre hexagonal cell (i.e., one per 96,000 acres)

NFI Sampling design in Czech Republic

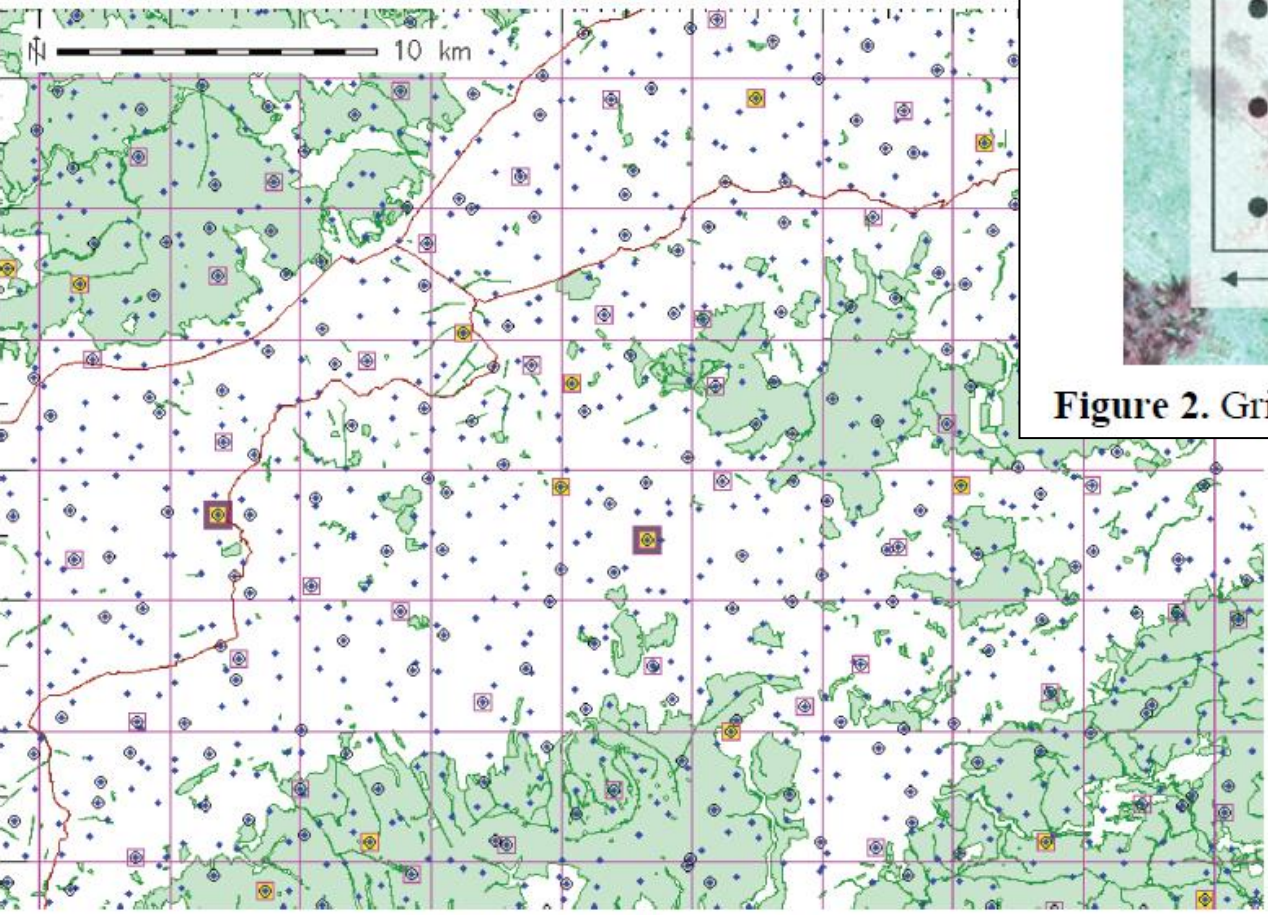


Figure 1. Czech NFI2 sampling grid.

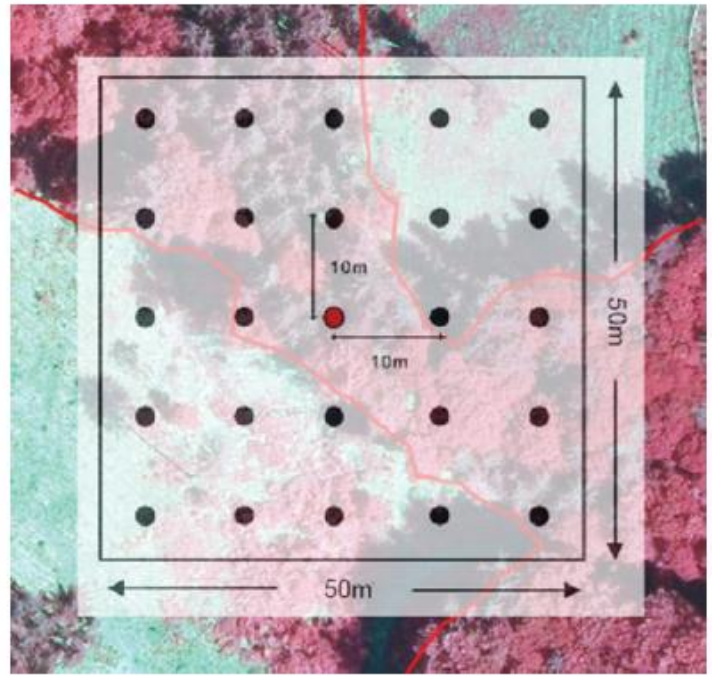


Figure 2. Grid points in the interpretation quadrat

The photogrammetric assessment will take part on a four times denser sample grid, with a limited set of acquired variables.





About the NFI

Inventory

Purpose

Methods

inventory concept

aerial photo interpretation

field survey

Organisation

Content

Implementation

Projects

Results

Services

Publications

Glossary / dictionary

Contact

Inventory concept

There are more than 500 million trees in Switzerland - far too many to investigate individually. Random sampling, however, yields adequate information. For that purpose a 1km-grid was mapped over Switzerland in the first NFI. The intersections defined the location of the sample plots in the forest.

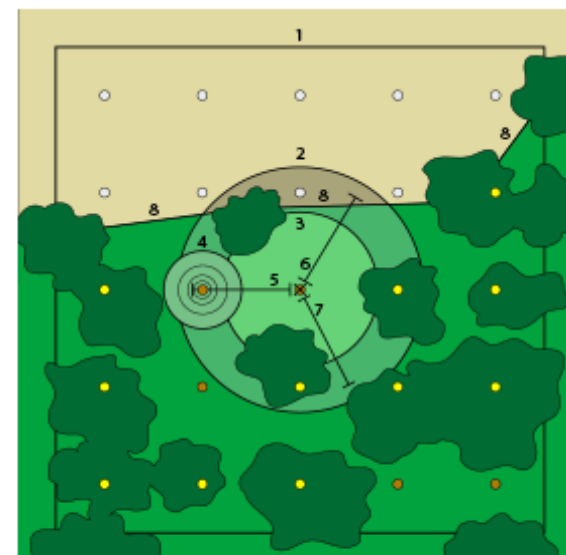
Since the second NFI, only half of these plots, roughly 6500, have been located in the field. The grid, which originally had a mesh size of 1 km, was extended to 1.4 km. To compensate for this reduction, the aerial photos were interpreted in a grid of 500 m.

The same methods have been carried out since switching from a periodic to a continuous survey in the fourth NFI, but the sample plots are now located over a period of nine years. Thereby another ninth of the sample plots, which are evenly distributed all over Switzerland, are surveyed every year.

Circles and radii of sample plots

The center of the sample plot is marked by a metal pole in the ground. Roughly 130,000 sample trees were measured in the NFI1 and marked so as they can be found again in later inventories. Thanks to the exact sketches, about 98% of the sample plots could be found directly during the NFI2 without having to search for them. In the NFI4, the position of the centers of the sample plots are located exactly with a GPS.

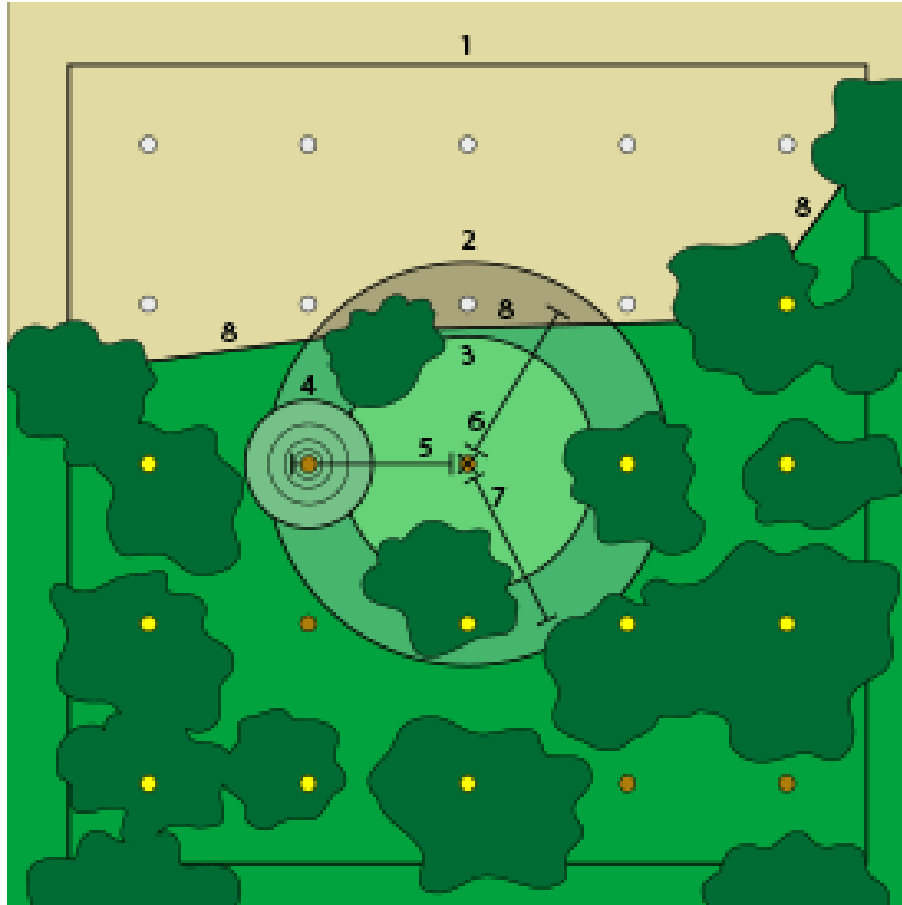
Within a 200 m² circle, every tree which has a diameter larger than 12 cm is recorded, and within a 500 m² circle, every tree which has a diameter larger than 36 cm is recorded. These diameters are measured at a height of 1.3 m (diameter at breast height DBH). The radii are 7.98 m (r_1) and 12.62 m (r_2) on level terrain.



- 1 NFI3 sample plot
- 2 circle for survey of trees with a DBH greater than 36 cm.
- 3 circle for survey of trees with a DBH greater than 12 cm
- 4, 5 circle for survey of young forest
- 5, 6, 7 transect for survey of deadwood
- X sample plot center

[Movie of the first NFI \(1983\)](#) (in German)

Swiss NFI sampling design



First Phase

1 Visual interpretation of NFI3 sample plots

Second Phase

2 circle for survey of trees with a DBH greater than 36 cm.

3 circle for survey of trees with a DBH greater than 12 cm

4, 5 circle for survey of young forest

5, 6, 7 transect for survey of deadwood

X sample plot centre

Collect Earth:

- 1) Open source software
- 2) Developed on **Google** technology
- 3) Rely of existing open source software
(e.g. Saiku)

The ***Open Foris Initiative*** launched in October 2014. Five tools, and others on the way



Home Tools ▾ Events Collaborators Community Support



Collect



Collect
Mobile



Collect
Earth



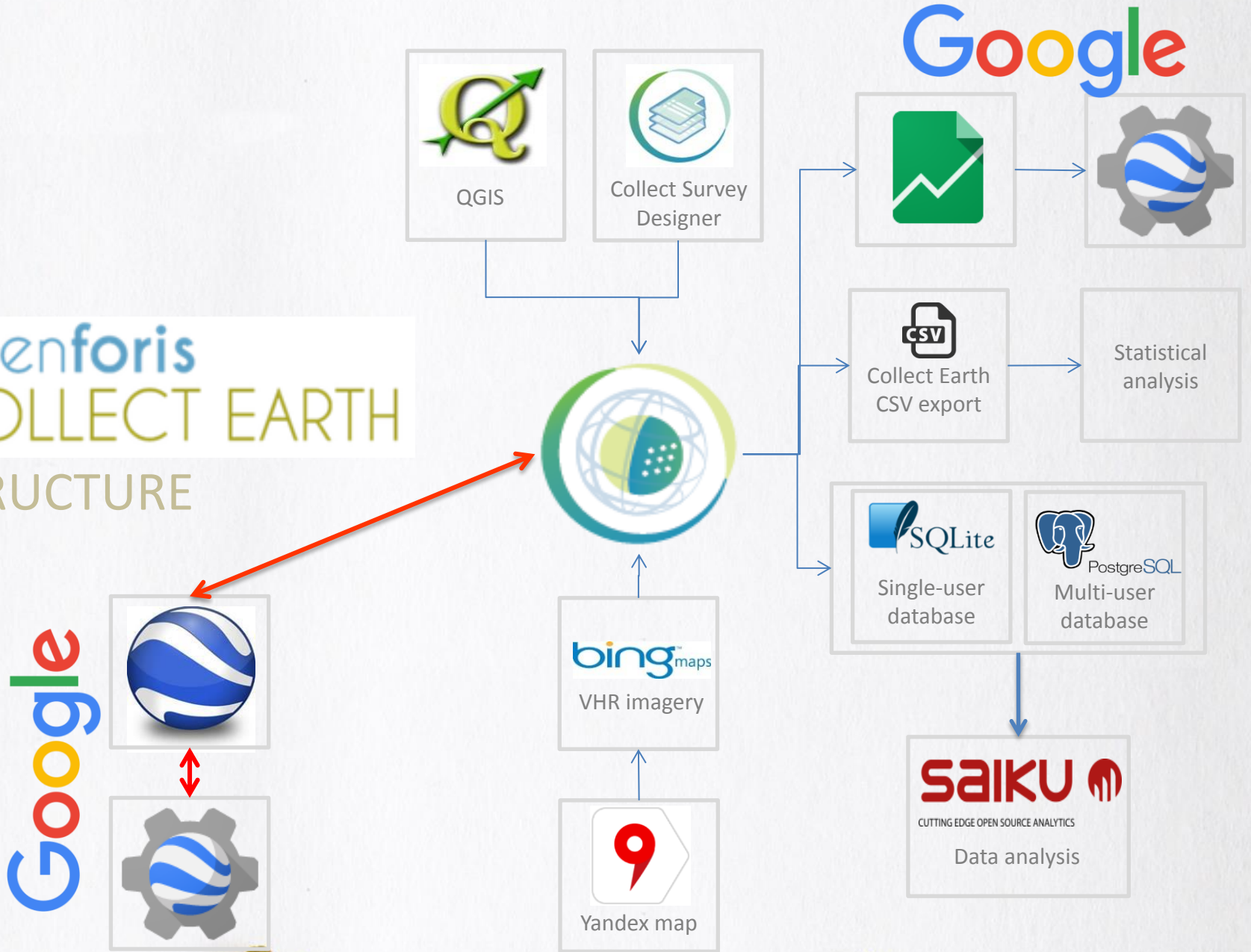
Calc



Geospatial
Toolkit

www.openforis.org

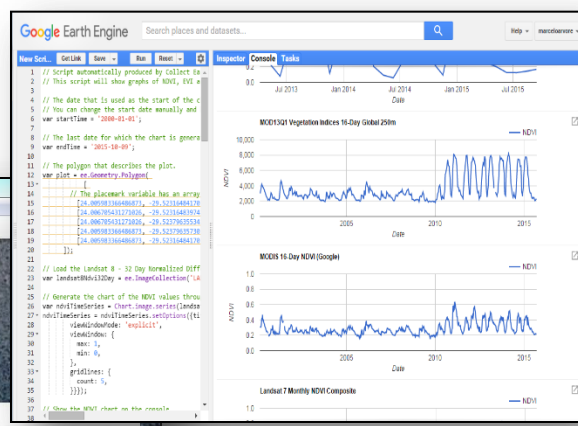
openforis COLLECT EARTH STRUCTURE



COLLECT EARTH

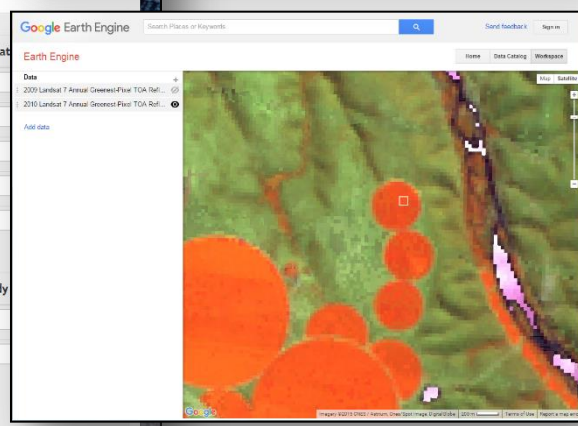
AN OPEN SOURCE TOOL FOR AUGMENTED VISUAL INTERPRETATION

Google Earth Pro interface showing a list of 38 parcels for drylands monitoring. The list includes IDs such as 1-ID#: 2HA4622, 2-ID#: 2HA4623, 3-ID#: 2HA4624, 4-ID#: 2HA4625, 5-ID#: 2HA4626, 6-ID#: 2HA4627, 7-ID#: 2XG31882, 8-ID#: 2HA4628, 9-ID#: 2HA4834, 10-ID#: 2HA4835, 11-ID#: 2HA4836, 12-ID#: 2HA4837, 13-ID#: 2HA4838, 14-ID#: 2HA4839, 15-ID#: 2HA4840, 16-ID#: 2HA4841, 17-ID#: 2HA4842, 18-ID#: 2HA4843, 19-ID#: 2HA4844, 20-ID#: 2HA4845, 21-ID#: 2HA4846, 22-ID#: 2HA4847, 23-ID#: 2HA4848, 24-ID#: 2HA4849, 25-ID#: 2HA4850, 26-ID#: 2HA4851, 27-ID#: 2HA4852, 28-ID#: 2HA4853, 29-ID#: 2HA4854, 30-ID#: 2HA5053, 31-ID#: 2HA5060, 32-ID#: 2HA5061, 33-ID#: 2HA5062, 34-ID#: 2HA5063, 35-ID#: 2HA5064, 36-ID#: 2HA5065, 37-ID#: 2HA5066, 38-ID#: 2HA5067. A yellow grid is overlaid on a circular field in the satellite view.



Vegetation type legend in Google Earth Engine:

Vegetation type	Vegetation
Tree	0%
Shrub	0%
Palm	0%
Bamboo	0%
Crop	0%
Water bodies	Water body
Lake	0%
River	0%



Collect Earth - Drylands Monitoring window:

File Tools Help

Operator:

Open Foris Collect Earth server should be running while the operator interprets data. Please maintain this window open while you are using Google Earth.

Collect Earth: Land Use and Land Cover Assessment through Augmented Visual Interpretation

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Academic Editors: Chandra Giri, James Campbell, Clement Atzberger and Prasad S. Thenkabail

Received: 2 June 2016 / Revised: 11 September 2016 / Accepted: 22 September 2016 / Published: 28 September 2016

(This article belongs to the Special Issue Monitoring of Land Changes)

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Abstract

<http://www.mdpi.com/2072-4292/8/10/807>




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AND ENHANCE
ITS VISIBILITY



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The image is a screenshot of the Google Earth web interface. The main map area shows a topographic view of Bhutan, with a dense grid of small white dots representing sampling points. The country's border is outlined in yellow, and the capital, Thimphu, is marked with a star. A red line highlights a specific region in the northern part of the country. The interface includes a search bar at the top left, a 'Layers' panel on the left side, and a status bar at the bottom. The status bar displays the following information: Imagery Date: 4/10/2013, lat 27.264910°, lon 90.600987°, elev 1225 m, eye alt 302.93 km. The 'Layers' panel is expanded to show 'Primary Database' with sub-layers for 'Borders and Labels', 'Places', 'Photos', 'Roads', '3D Buildings', 'Ocean', 'Weather', 'Gallery', 'Global Awareness', and 'More'. The 'Places' layer is checked. The 'Search' bar contains the text 'ex: NYC'. The 'Layers' panel also shows 'Earth Gallery >>'. The bottom right corner of the map area contains the text 'Image Landsat US Dept of State Geographer © 2013 Mapabc.com © 2013 Google' and the 'Google earth' logo.

openforis COLLECT EARTH in Google Earth Engine



Google Earth Engine <https://earthengine.google.org/#workspace>

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Data +

2015 Land at 8 Annual Greenest-Pixel TOA Refl...	+
2011 Land at 7 Annual Greenest-Pixel TOA Refl...	+
2010 Land at 7 Annual Greenest-Pixel TOA Refl...	+
2009 Land at 7 Annual Greenest-Pixel TOA Refl...	+
2003 Land at 7 Annual Greenest-Pixel TOA Refl...	+
2001 Land at 7 Annual Greenest-Pixel TOA Refl...	+

[Add data](#)

Map Satellite

Imagery ©2015, DigitalGlobe 200 m

Google

openforis COLLECT EARTH in Google Earth Engine Playground



*New Script - Earth Engine x
https://ee-api.appspot.com/#

Google Earth Engine Search places and datasets... Help danilo.mollicone

New Script * Get Link Save Run Reset

```
1 // Plot Landsat 8 NDVI band value means Collect Earth |
2
3
4 var startTime = '2000-05-1';
5 var endTime = '2015-01-01';
6
7 var plot = ee.Geometry.Polygon([
8   [151.3815653938843, -4.994553077089109],
9   [151.38219659531438, -4.994553077089109],
10  [151.38219659531438, -4.9951860872281975],
11  [151.3815653938843, -4.9951860872281975],
12  [151.3815653938843, -4.994553077089109],
13  [151.3815653938843, -4.994553077089109],
14  ]);
15 var landsat8Ndv32Day = ee.ImageCollection('LANDSAT/LC08/C01/T13/NV')
16   .filterDate(startTime, endTime)
17   .select('NDVI');
18
19 var ndviTimeSeries =
20   Chart.image.series(landsat8Ndv32Day, plot, ee.Reducer.MEAN, true);
21
22 ndviTimeSeries = ndviTimeSeries.setOptions({
23   title: 'Landsat 8 32 days NDVI',
24   hAxis: {
25     title: 'Date'
26   },
27   vAxis: {
28     title: 'NDVI'
29   }
30 });
```

Inspector Console Tasks

MODIS13Q1 Vegetation Indices 16-Day Global 250m

NDVI

MODIS 16-Day NDVI (Google)

NDVI

May 9, 2010
NDVI: 0.8504823148076232

Layers Map Satellite

Google Imagery ©2015, DigitalGlobe 100 m Terms of Use

Kyrgyzstan FULL 13368

Imported at Tue Apr 21 06:15:14 PDT 2015 from KYR_FULL_FUSION.csv.

Edited on June 2, 2015

File Edit Tools Help

Rows 1

Cards 1

Map of _location_kml

Filter No filters applied

Configure map

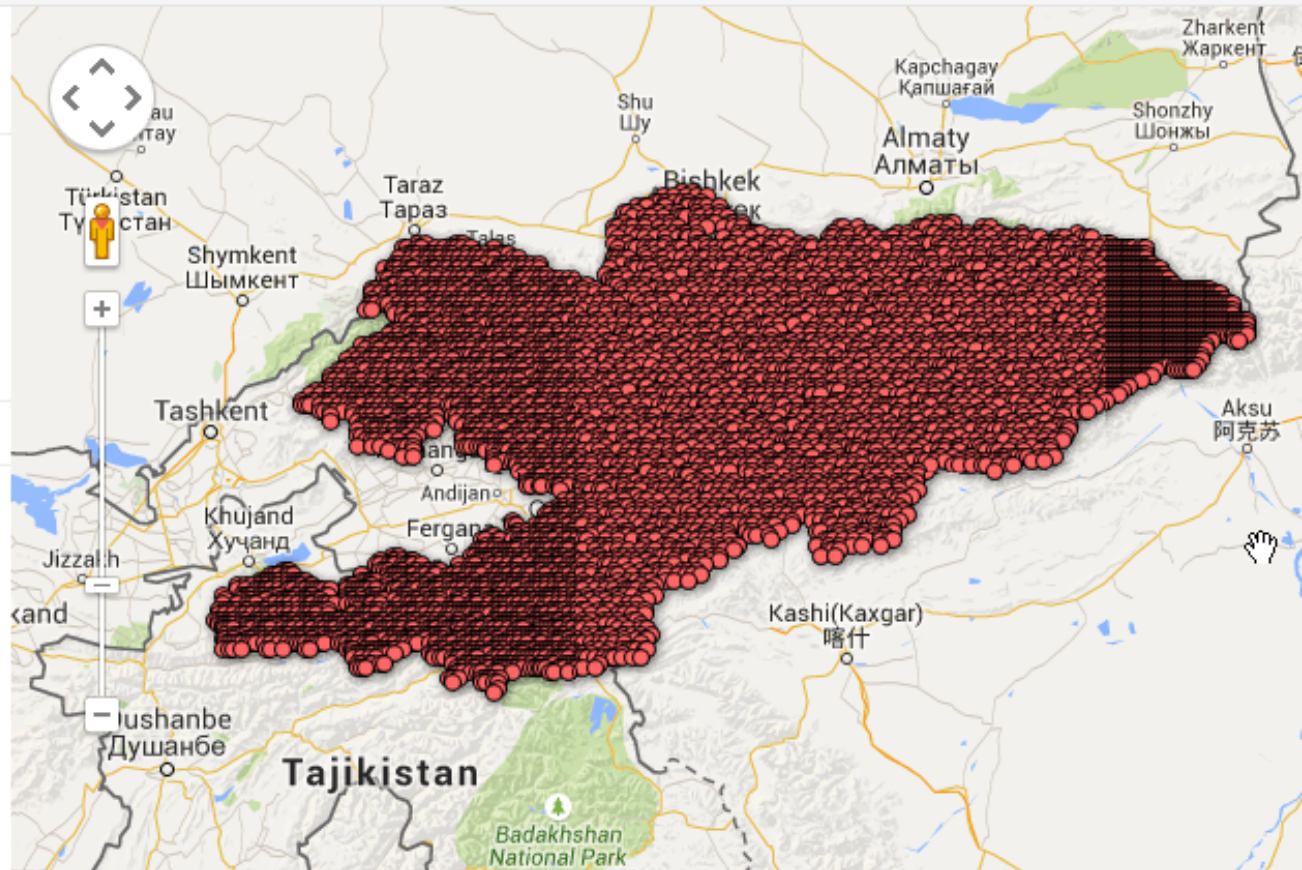
Location _location_kml

Feature map

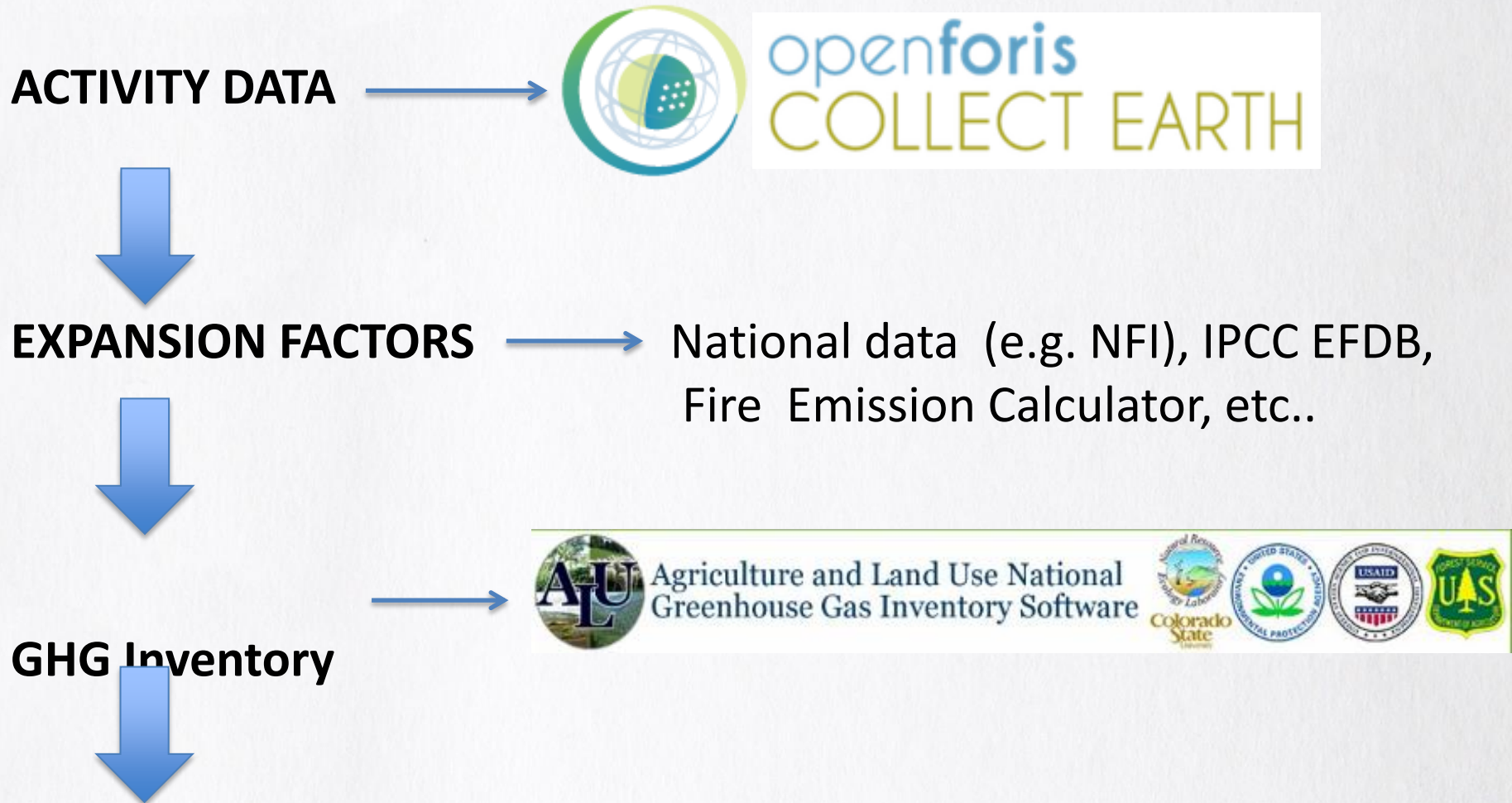
Change feature styles...

Change info window...

Heatmap



A clear strategy up to submission to UNFCCC:

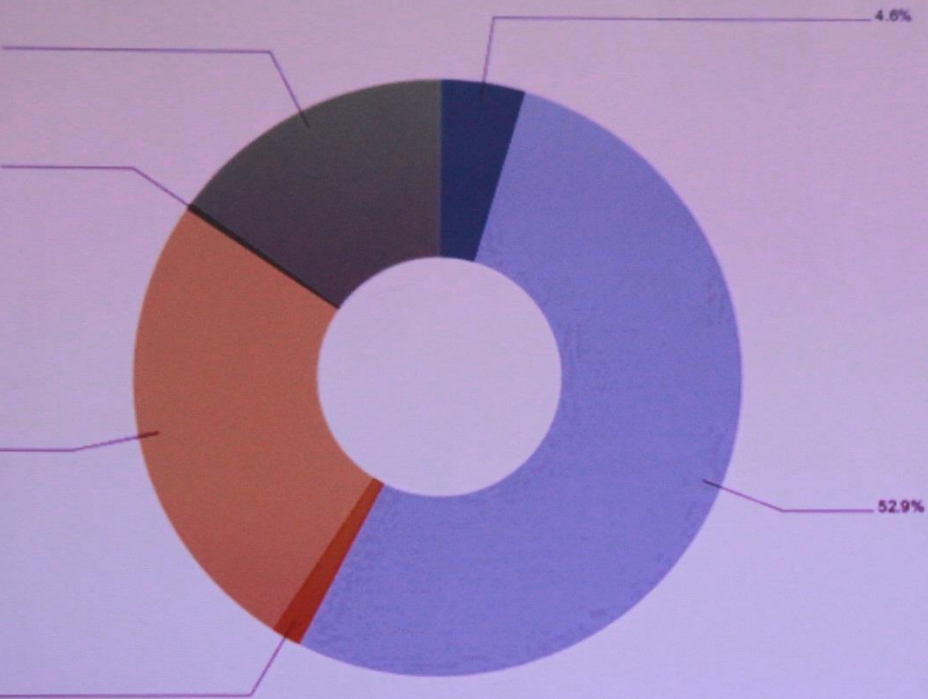


Submission by NAIS Web Application / REDD+ Platform (UNFCCC)

Niger, Action Against Desertification



площадь по категориям землепользования



площадь по категориям землепользования

Category	Area (HA)	%	km2
Forest	52 042	4,55%	52042,13318
Grassland	605 173	52,93%	605175,663
Settlement	17 843	1,56%	17843,01709
Other Land	289 949	25,36%	289949,8
Wet Land	4 461	0,39%	4460,877
Cropland	173 969	15,21%	173969,4166
	1 143 440	100,00%	1143440,01

Forest Grassland Settlement Other Land Wet Land Cropland





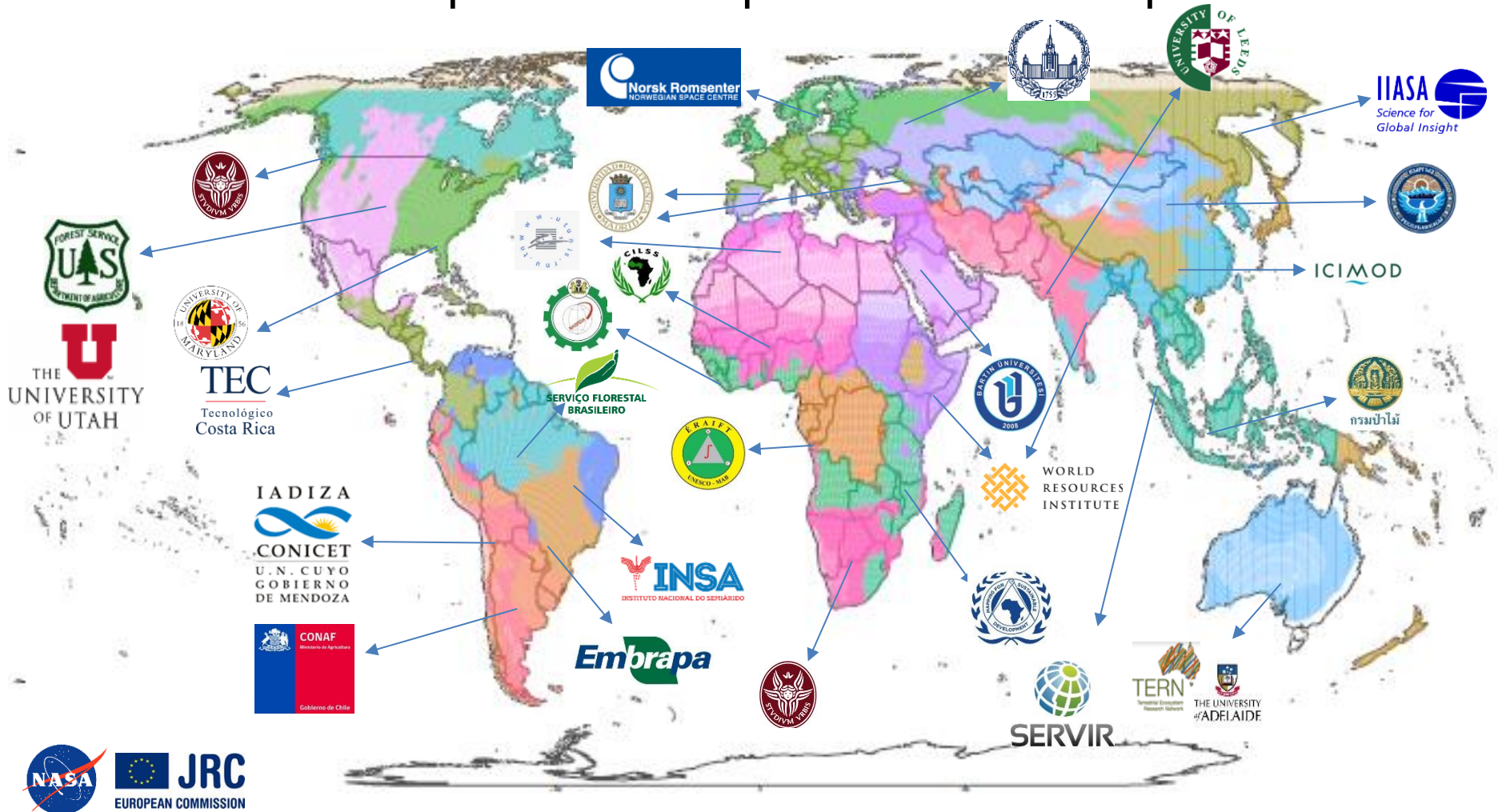
LUOD

Land Use Open Data

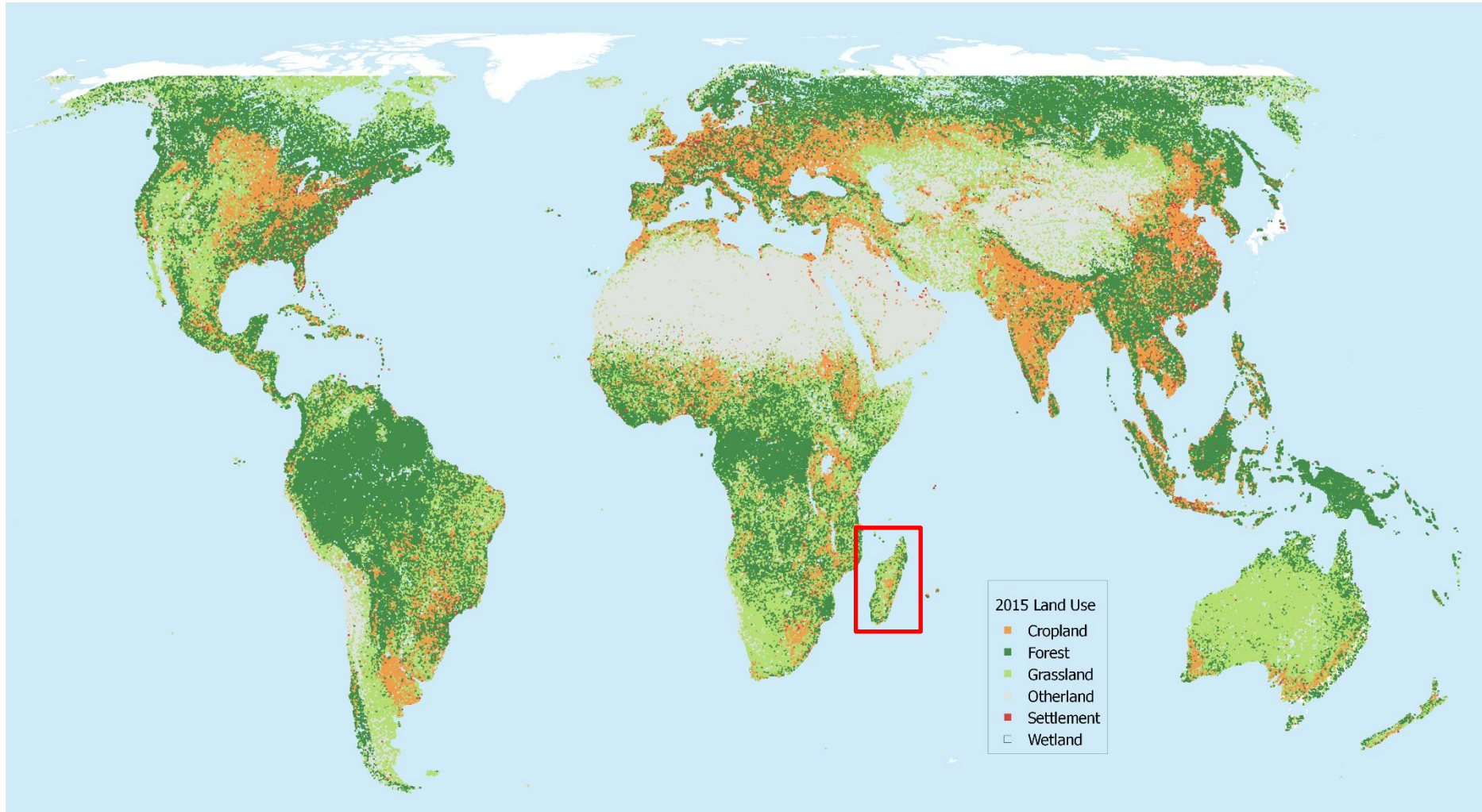


LOUD PARTNERS

+ 500 000 points / + 34 partners / + 500 operators



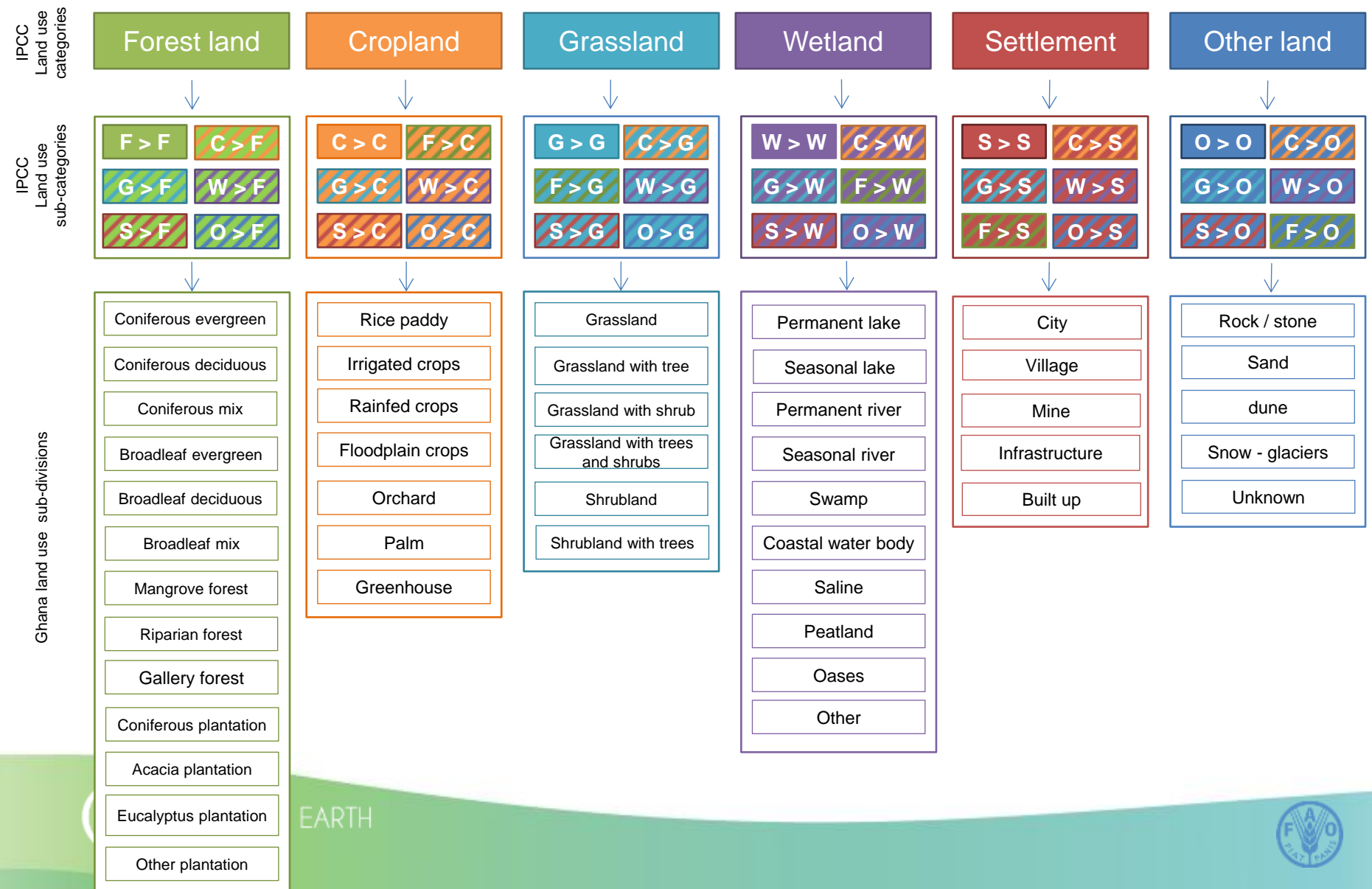
The first **Land Use** global representation



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LOUD classification scheme



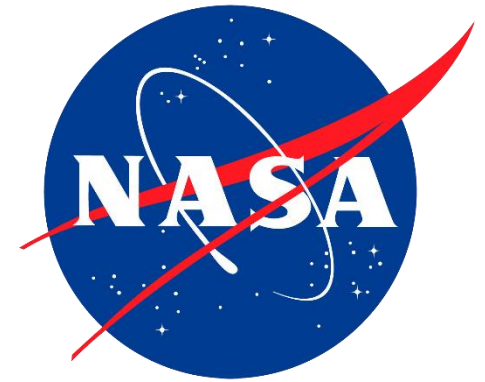




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Thank you

