



Sentinel Landscapes

Edited by:

Tor-G. Vågen, World Agroforestry Centre (ICRAF)

Leigh A. Winowiecki, World Agroforestry Centre (ICRAF)



RESEARCH
PROGRAM ON

Forests, Trees and
Agroforestry

Contacts

Western Amazon

Valentina Robiglio (v.robiglio@cgiar.org)

Nicaragua / Honduras

Jenny Ordonez (j.ordonez@cgiar.org)

Burkina Faso / Ghana

Michael Balinga (m.balinga@cgiar.org)

Cameroon

Denis Sonwa (d.sonwa@cgiar.org)

Western Ghats

Claude Garcia (claudio.garcia@cirad.fr)

Sumatra / Borneo

Yves Laumonier (y.laumonier@cgiar.org)

Atiek Widayati (a.widayati@cgiar.org)

Mekong

Rhett Harrison (r.harrison@cgiar.org)

Global support

Anja Gassner (a.gassner@cgiar.org)

Tor-G. Vågen (t.vagen@cgiar.org)

Leigh Winowiecki (l.a.winowiecki@cgiar.org)



Preface

The CGIAR Research Program 'Forests, Trees and Agroforestry: Livelihoods, Landscapes and Governance' responds to the call for an urgent, strong and sustained effort focused on forest management and governance, given the crucial role of forests in confronting some of the most important challenges of our time: climate change, poverty, and food security.

The Center for International Forestry Research leads the program in partnership with Agricultural Research for Development, Bioversity International, CATIE, the International Center for Tropical Agriculture and the World Agroforestry Centre. The centers collaborate with leading national research institutes and other organizations, and they partner with knowledge-sharing experts to maximize outreach and share research results with policy and practitioners who can use and share this knowledge on the ground in the developing world.

An innovative set of '**sentinel landscapes**' – essentially a site or network of sites, geographically or issue-bounded, in which a broad range of biophysi-

cal, social, economic and political data are monitored, collected with consistent methods and interpreted over the long term to provide a common observation ground where reliable data from the biophysical and social sciences can be tracked in consort and over time.

Impact-driven and innovative, CRP-FTA seeks to enhance the management and use of forests, agroforestry and tree genetic resources across the landscape, from farms to forests.

A Global Network of Landscapes

2

One of the most innovative approaches proposed for the CGIAR Research Program on Forests, Trees and Agroforestry (FTA) is to invest in the development of a set of 'sentinel landscapes' which are geographic areas or sets of areas bound by a common issue, in which a broad range of biophysical, social, economic and political data are monitored, collected with consistent methods and interpreted over the long term.

These data are essential for addressing development, resource sustainability and scientific challenges, such as linking biophysical processes to human reactions and understanding the impacts of those reactions on ecosystems.


The Sentinel Landscapes represent a global network of landscapes where multidisciplinary teams of researchers are applying a set of consistent methods to study human-environment interactions.

The major justification for the sentinel landscapes is the need for reliable data from the biophysical and social sciences that can be tracked simultaneously over time in order to understand drivers of change and detect long-term trends, allowing for more informed land management decision making.

At the global scale, the data generated will feed into global analyses across a diverse range of networks, including both humid dryland ecosystems.

 Honduras / Nicaragua

 Western Amazon

 Burkina Faso / Ghana

 Cameroon

The seven sentinel landscapes that have ongoing activities as per October, 2014.

By building on an existing network of Land Degradation Surveillance Framework (LDSF) sites, the Sentinel Landscapes initiative is making rapid progress towards understanding important metrics of ecosystems health,

as well as drivers of land degradation across a range of ecosystems in the global tropics. An important part of this initiative is the integration of socio-economic surveys and ecosystem health metrics.



Nicaragua and Honduras

ESTABLISHED IN

2013

Lead partners:
CATIE, ICRAF

Sites:
El Tuma, Nicaragua
Columbus Mine, Nicaragua
Rio Blanco, Honduras
Rio Platano, Honduras

SUMMARY

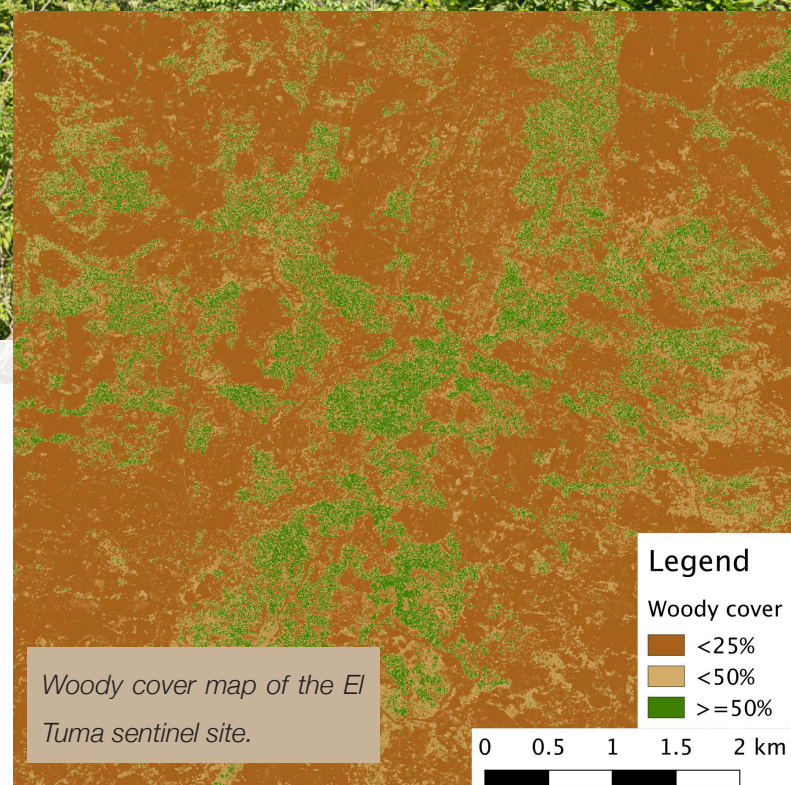
Site	Cultivated (%)	Grassland (%)	Forest cover (%)
El Tuma	59		18
Columbus Mine	12		28
Rio Blanco	11	70	6
Rio Platano	10		70

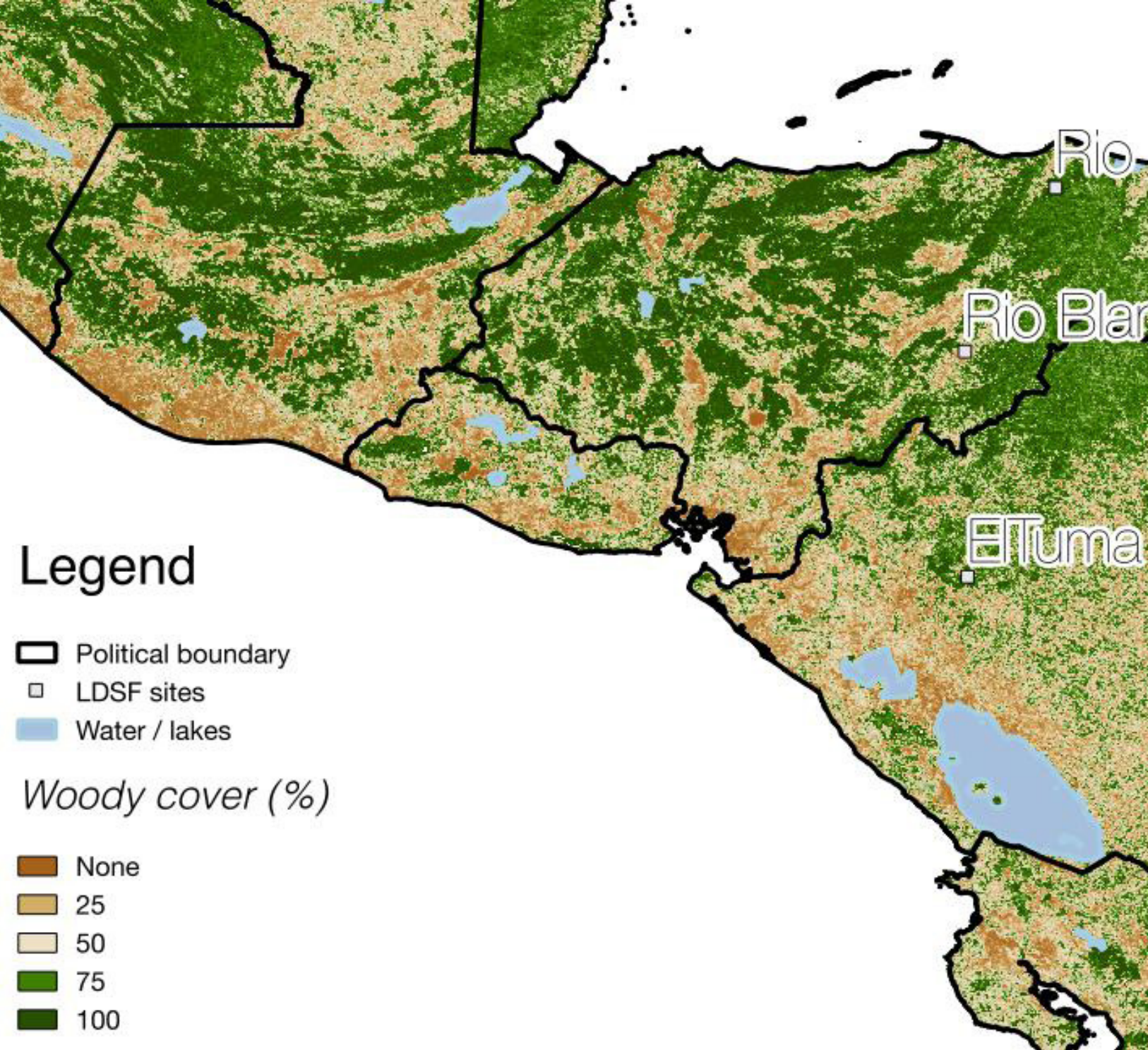


Map of the Nicaragua and Honduras Sentinel Landscape showing the location of the four sentinel sites.

The Nicaragua-Honduras Sentinel Landscape is a mosaic of forests, agricultural land, cattle ranches and agroforestry systems, covering 68,000 km², including two biosphere reserves and 13 protected areas. This landscape also contains the largest remaining forest area in Central America.

Four sentinel sites were chosen for the initial phase of the Sentinel Landscapes initiative, representing a gradient of intensive agriculture, pasture, agroforests and forests.





Legend

- Political boundary
- LDSF sites
- Water / lakes

Woody cover (%)

- None
- 25
- 50
- 75
- 100

Platano

anco

Columbus Mine

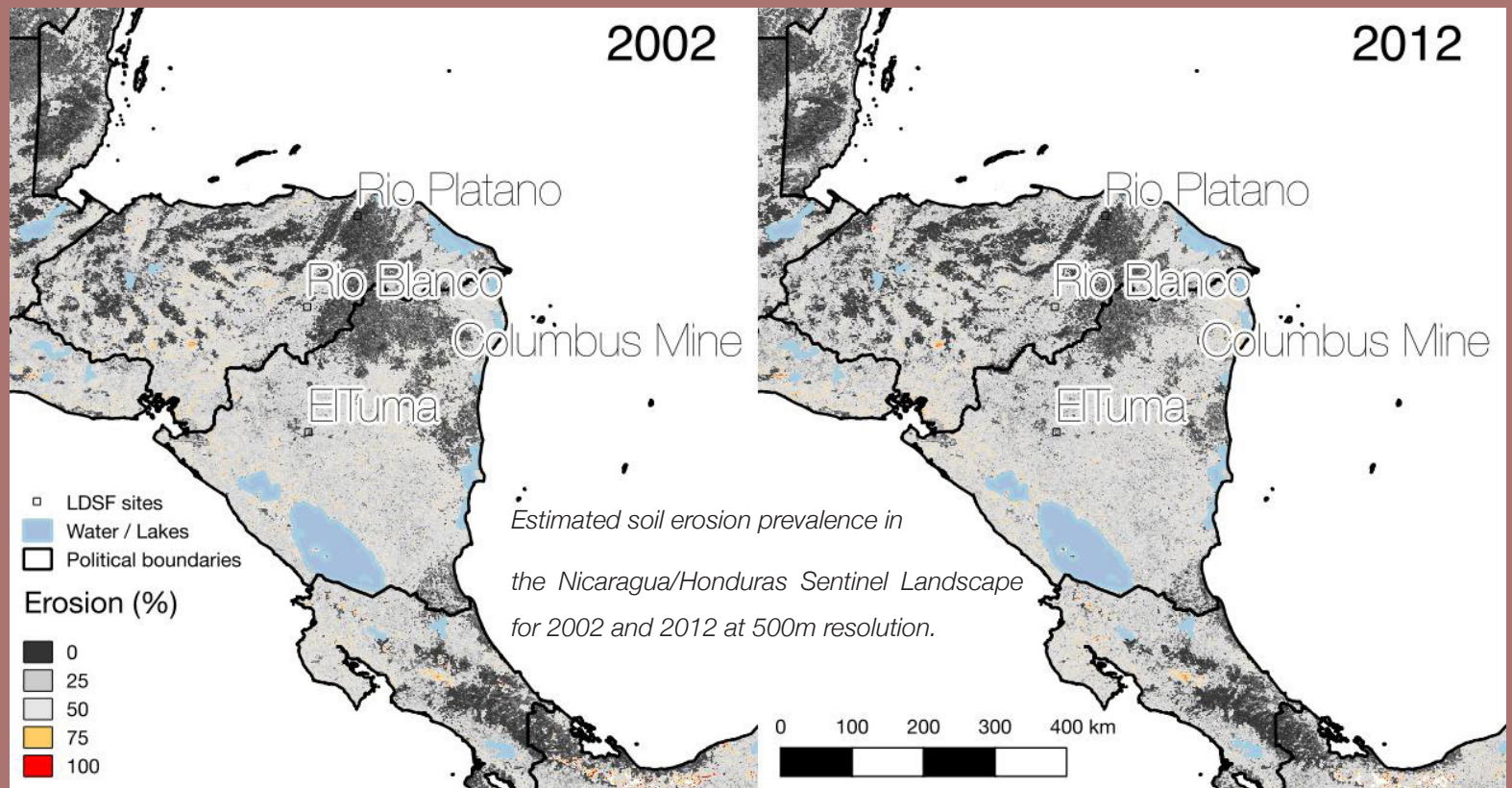


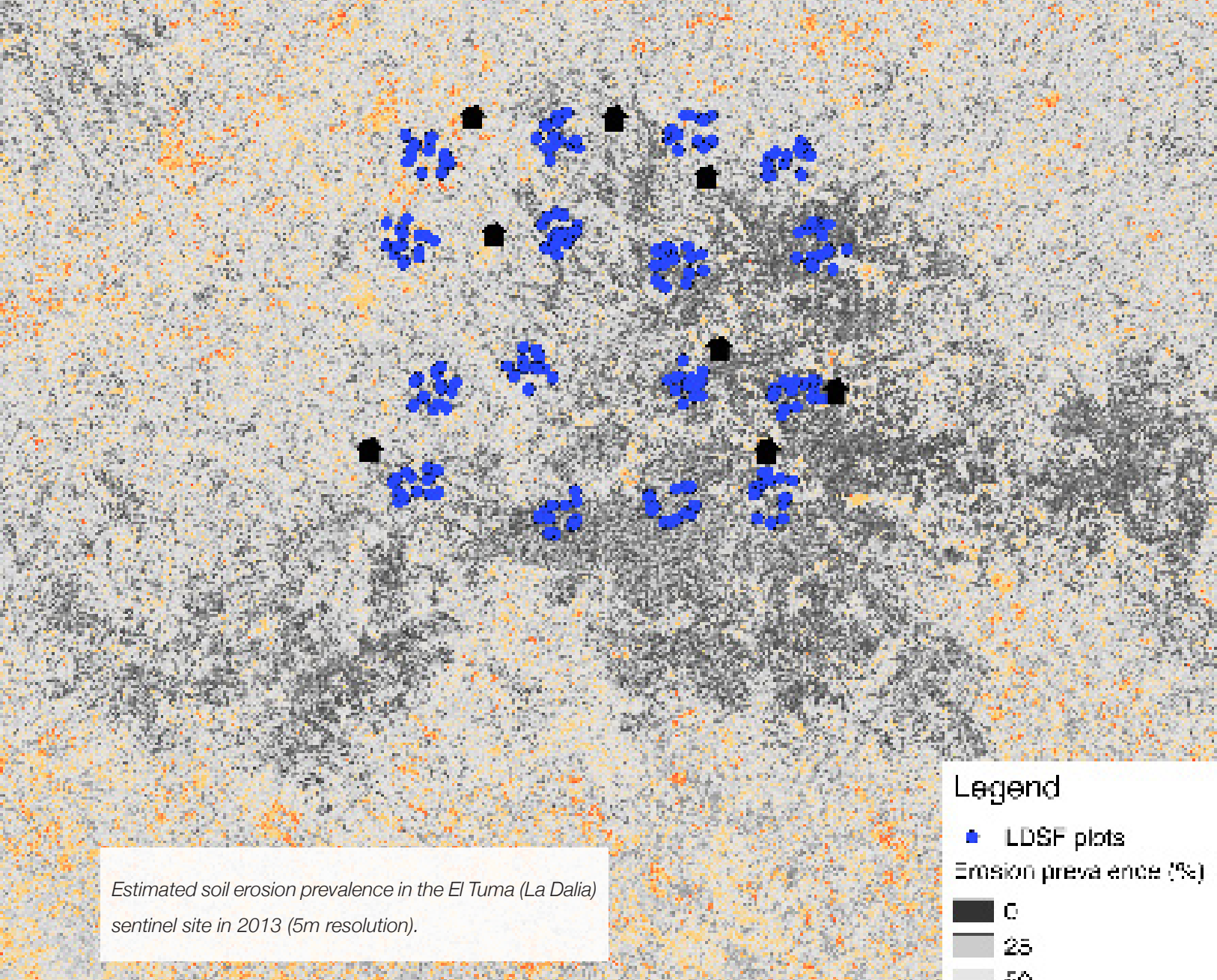
Estimated woody cover (woodlands and forests) for the Nicaragua / Honduras sentinel landscape based on MODIS for 2012.

The woody cover index values show the proportional cover of trees in each pixel. A woody cover index value of 100% indicates closed-canopy forest.

0 100 200 300 400 km

MAPPING LAND HEALTH @ multiple spatial scales





Estimated soil erosion prevalence in the El Tuma (La Dalia) sentinel site in 2013 (5m resolution).

Legend

- LDSF plots
- Erosion prevalence (%)
 - 0
 - 25
 - 50
 - 75
 - 100
- 🏠 Villages



Western Ghats, India

ESTABLISHED IN

2013

Lead partners:

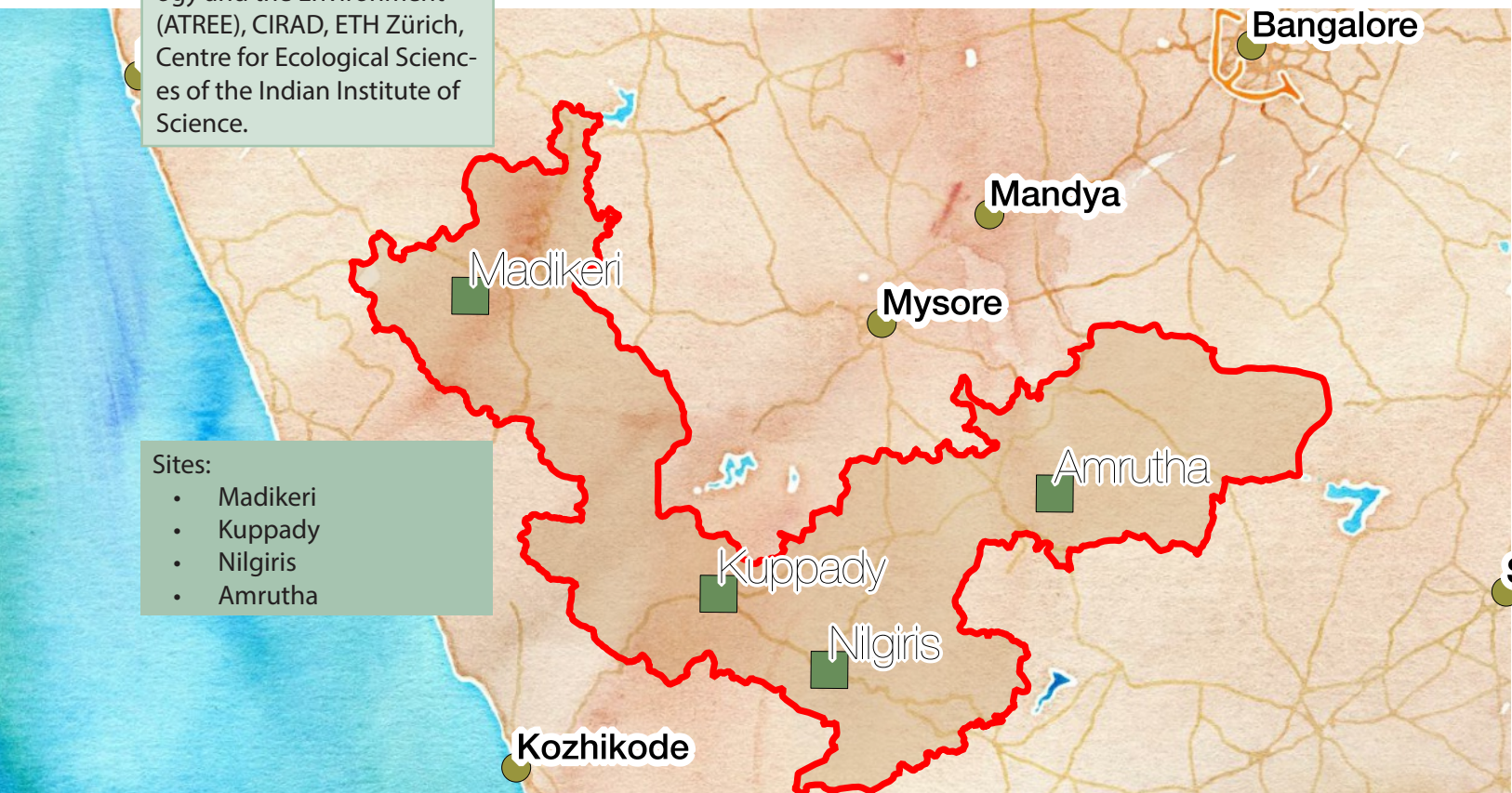
College of Forestry, Ashtoka Trust for Research in Ecology and the Environment (ATREE), CIRAD, ETH Zürich, Centre for Ecological Sciences of the Indian Institute of Science.


SUMMARY

Site	Cultivated (%)	Forest cover (%)	Erosion (%)
Madikeri	81	15	1

Sites:

- Madikeri
- Kuppady
- Nilgiris
- Amrutha





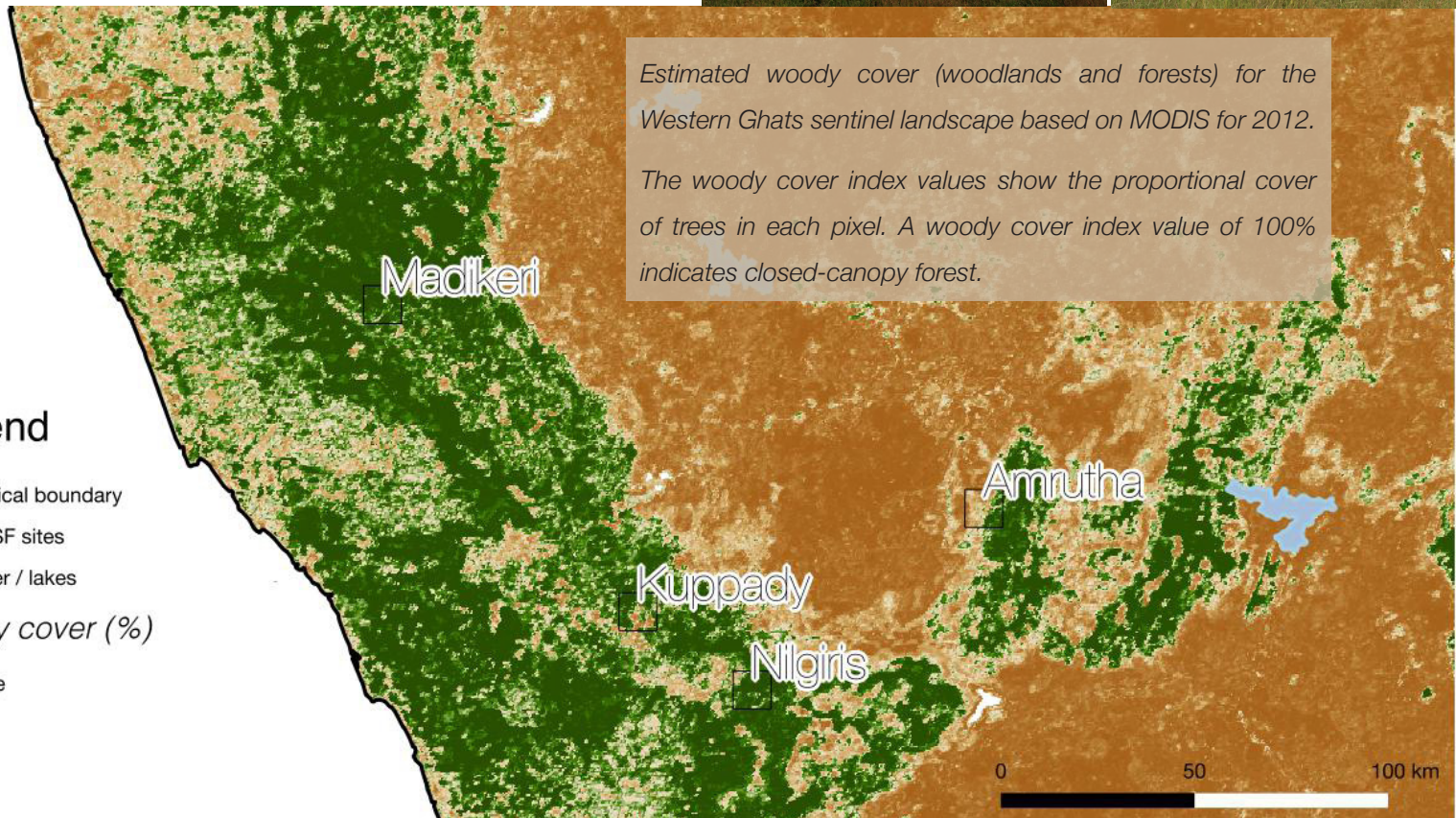
The Western Ghats stretches 160 000 km², and sustain over 245 million people that receive their water supply from the rivers originating in the region. The mountain range is a UNESCO World Heritage, and biodiversity hotspot. The forest cover is highly fragmented. Infrastructure development and agroforestry are the main drivers of change.

A consortium led by CIRAD presented the Western Ghats (WG) as a candidate to the Sentinel Landscape initiative in 2012. Activities in this landscape were initiated in 2013, following training of the Western Ghats team on the LDSF methodology. Four 100 km² LDSF sites were selected by local partners within the WGSL, based on an initial set of 14 sites representing areas with varying land cover trend trajectories, e.g., forested and forest-transition landscapes, including protected forest reserves and forest-agroforestry-annual crop mosaics.

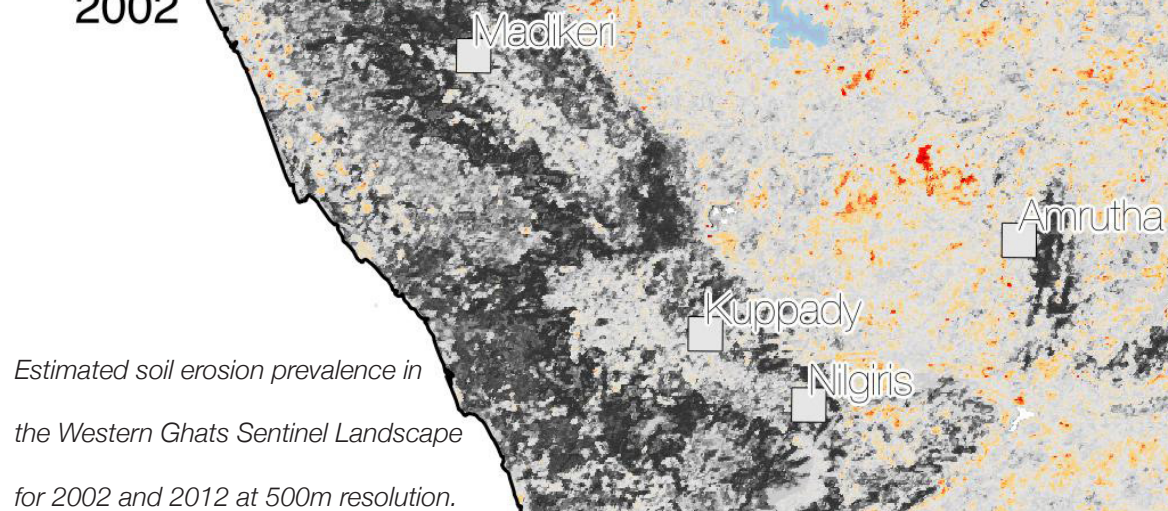
The georeferenced biophysical data collected at these sites will be linked with the socio-economic surveys and the data collected with the IFRI instrument, in order to conduct interdisciplinary analysis to assess drivers of forest change and its impact on land health. Important indicators that are measured as part of the biophysical field surveys include: woody cover, biodiversity of woody species, land use, and land use history, in addition to soil condition and erosion prevalence.

The Western Ghats Sentinel Landscape is dominated by complex, shade grown coffee agroforestry systems, with forest fragments and large tracts of state controlled forests. Forests, agroforestry and rice cultivation are about equally represented in the landscape.

Small holdings (<2 ha) represent 58% of the holdings and 22% of the coffee area. The tenure system is complex with over 39 land rights, while population density is 135 hab/km², the tribal population making up 8,41%. Female literacy rate is 72,26%.



2002



2012



0 100 km



The Mekong

ESTABLISHED IN

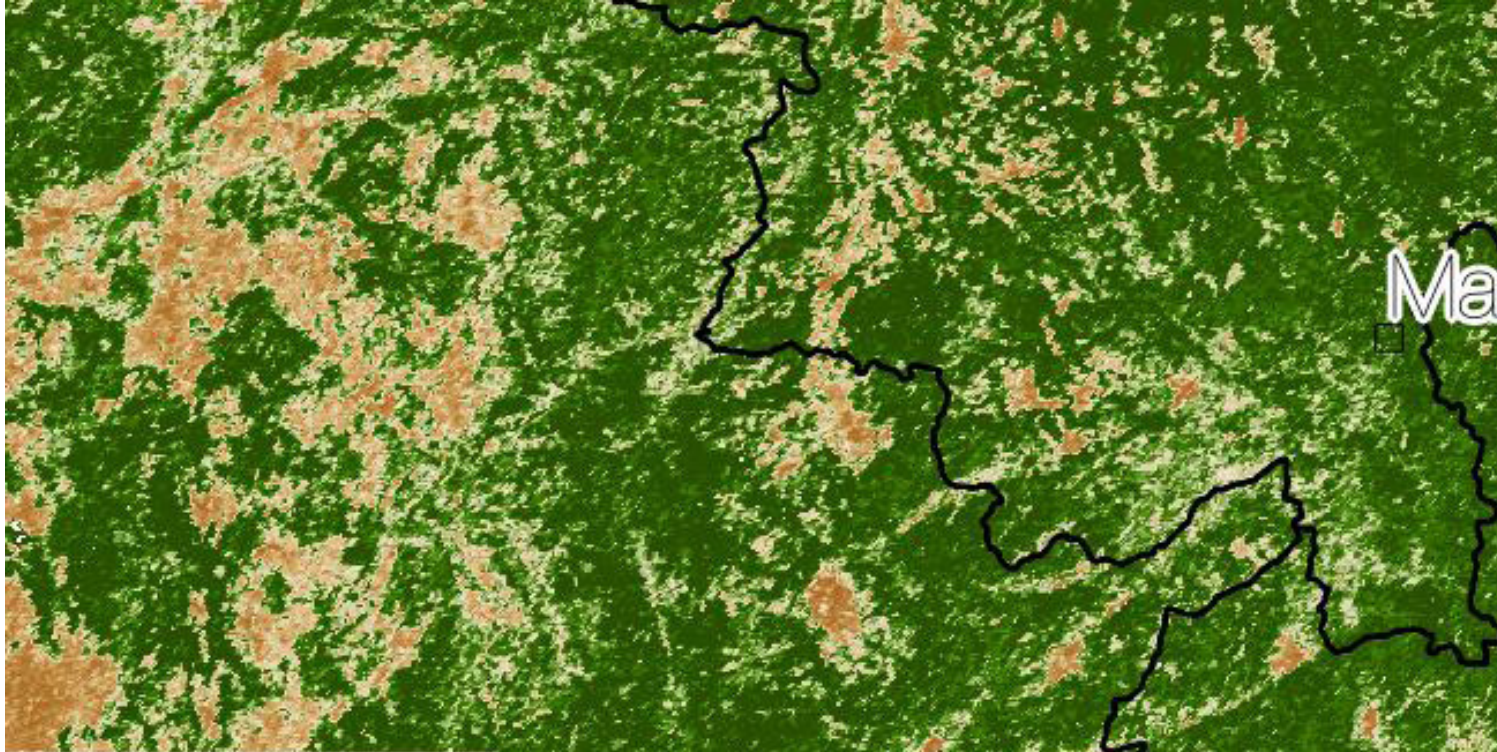
2014

Ongoing sites:
Manlaxiang, China
M-beng, Laos




The Mekong sentinel landscape has seen a reduction of forest cover and simplification of formerly multiuse landscapes, which have led to an erosion of ecosystem services. Rubber plantations started expanding into this landscape about 15 years ago. Other major land uses include paddy rice and tea. About 40% of the natural forest is in protected areas. Externalities are often borne by segments of the population who have benefited little from rubber income, causing increased disparities in wealth and social unrest.












Legend

-  Political boundary
-  LDSF sites
-  Water / lakes

Woody cover (%)

-  0
-  25
-  50
-  75
-  100

0 100 200 300



Ghana - Burkina Faso

ESTABLISHED IN

2013

SUMMARY

Site	Cultivated (%)	Woodland (%)	Erosion (%)
Cassou	41	23	9
Kongoussi	43	3	27



The Ghana - Burkina Faso Sentinel Landscape spans the Volta and Niger River Basins. South East Mali, most of Burkina Faso, Northern Ghana and Northern Togo are included in the landscape, with a total area of about 350,000 km², including Lake Bam and Park W in Burkina Faso, the Gbele Game Production Reserve in Ghana and the Fosse aux Lions National Park in Togo.

The region is characterized by large dryland areas, which has implications for ecosystem resilience, adaptive capacity of people in terms of managing water, energy, trees, crops, and livestock. Poverty levels are extremely high, with livelihood systems based primarily on agriculture, forestry, livestock and mining.

Sites were selected based on gradients of change with old change processes and more recent change processes, potential co-location with other CGIAR initiatives and partners, as well as accessibility and security.

Kongoussi

- Scattered homesteads, easily accessible.
- Primary and secondary schools.
- Departmental road.

Cassou

- Forested environment
- Scattered homesteads
- High in-migration
- Primary and secondary schools
- Departmental and Regional roads

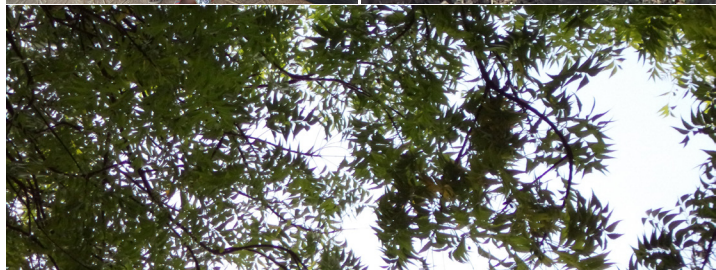
Walembelle

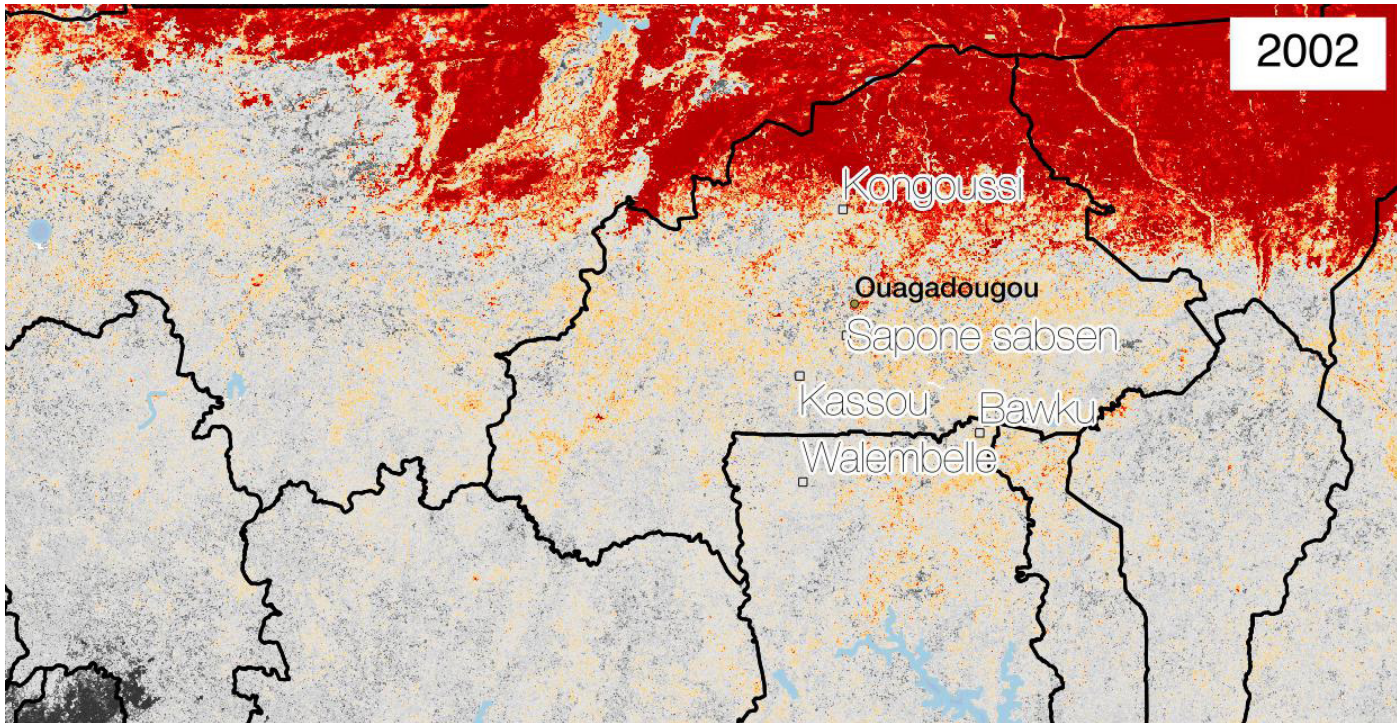
- Forested environment
- Clustered homesteads
- High in-migration
- Primary and secondary schools
- Departmental and Regional roads

Bawku

- Savannah type vegetation
- Frequent fires in grasslands
- Forest reserves include Morago West, Kuka and the White Volta basin.

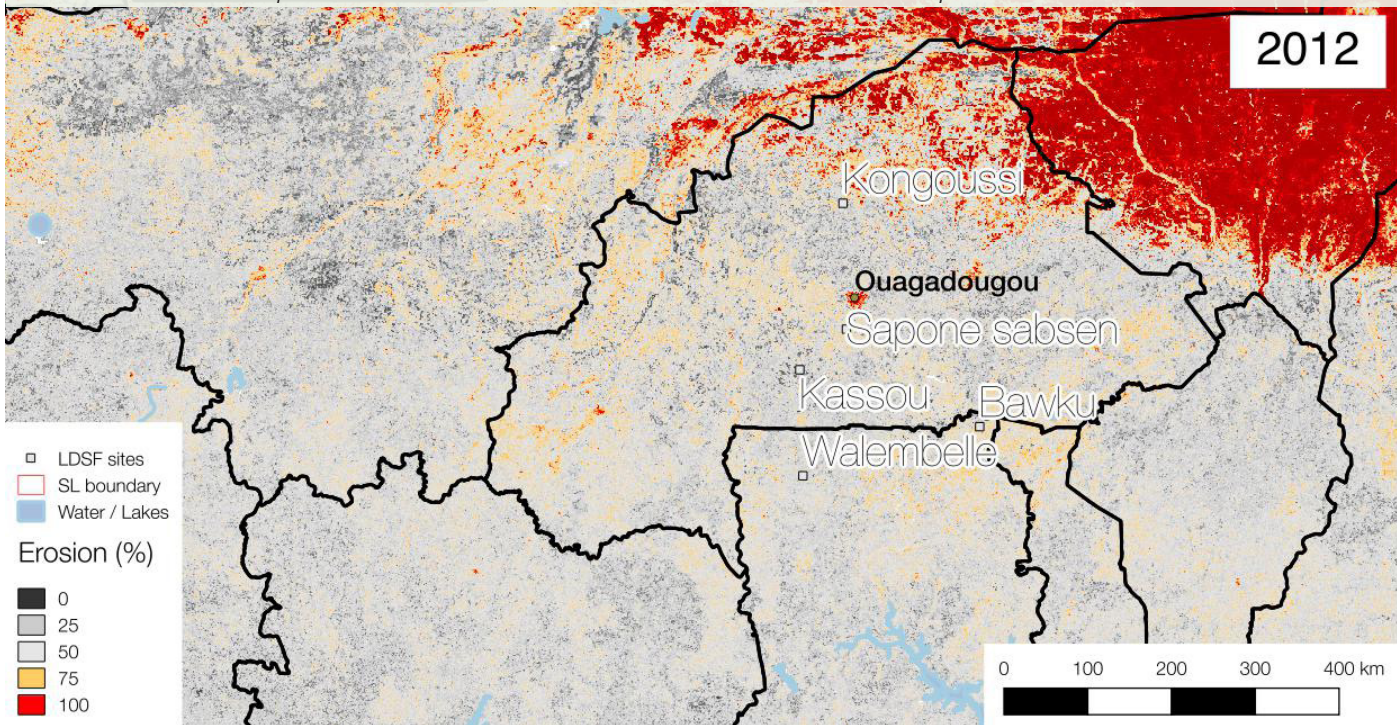






2002

Estimated soil erosion prevalence in the Burkina Faso / Ghana Sentinel Landscape for 2002 and 2012.



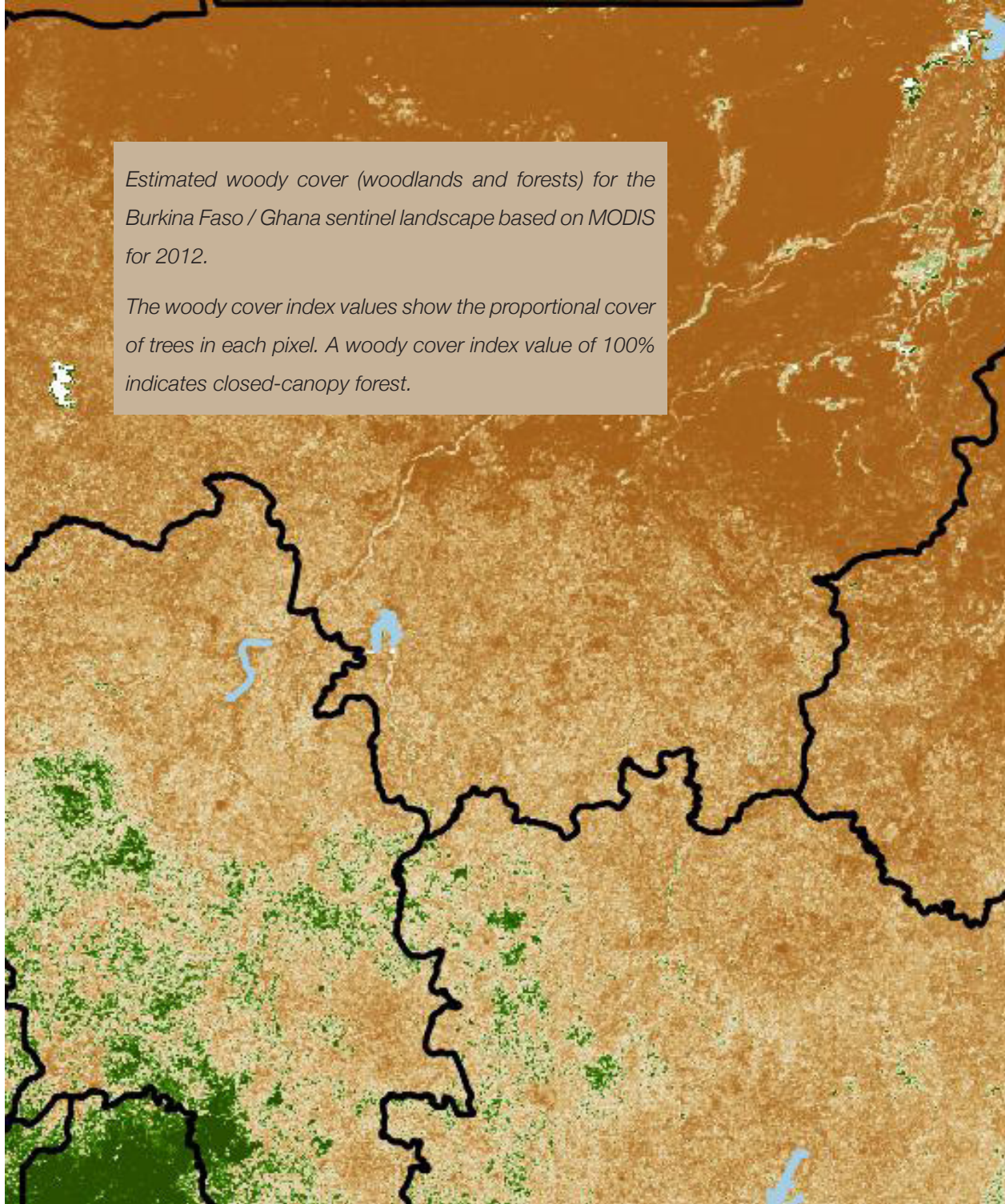
2012

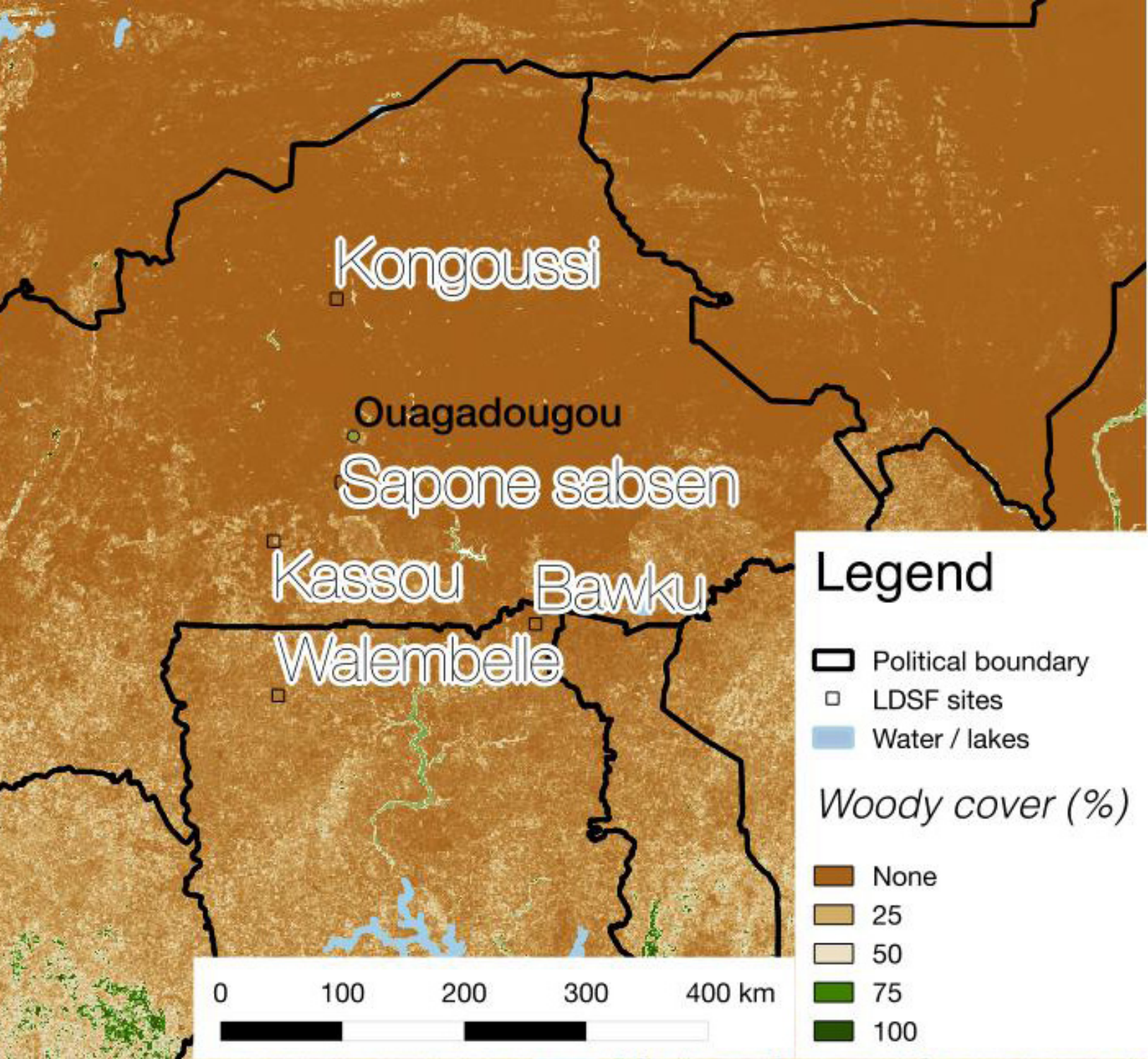
- LDSF sites
 - SL boundary
 - Water / Lakes
- Erosion (%)
- 0
 - 25
 - 50
 - 75
 - 100



Estimated woody cover (woodlands and forests) for the Burkina Faso / Ghana sentinel landscape based on MODIS for 2012.

The woody cover index values show the proportional cover of trees in each pixel. A woody cover index value of 100% indicates closed-canopy forest.





Western Amazon

ESTABLISHED IN

2014

Team:

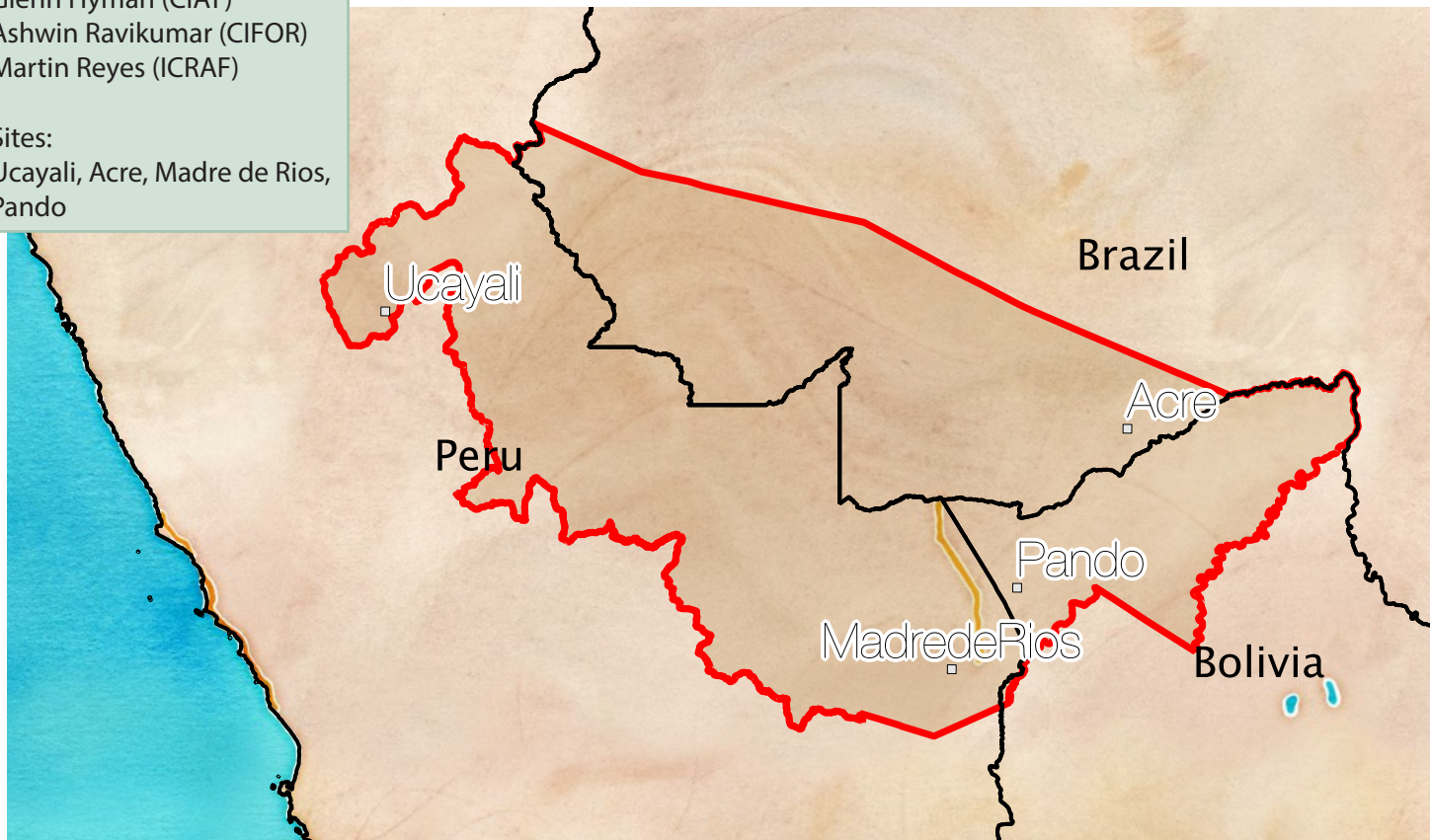
Valentina Robiglio (ICRAF)
 Evert Thomas (BIOVERSITY)
 Glenn Hyman (CIAT)
 Ashwin Ravikumar (CIFOR)
 Martin Reyes (ICRAF)


Sites:

Ucayali, Acre, Madre de Rios,
 Pando

Post-deforestation land-use trajectories in the Western Amazon Sentinel Landscape vary considerably, from degraded pasturelands, large areas of fallow and secondary forest, to oil palm plantations and cocoa agroforestry.

A total of 21 candidate sites were generated for this landscape, based on estimates of woody cover. Four sites were selected by local partners during working groups as part of a site





selection meeting that gathered more than 15 experts coming from the four Amazonian regions.

Sites in each region were ranked by local experts using a set of criteria that was proposed by the coordinating team and approved. A subset of three sites per region was proposed to the plenary group, and 4 sites were agreed upon by the plenary to cover variation along the forest transition curve.

Ucayali

Forest (in the native community), legal timber production and small-scale illegal logging, coca fields, shifting cultivation and fallow systems, cocoa production and extensive livestock at the margin. Accessibility is limited, especially during rainy season.

Madre de Rios

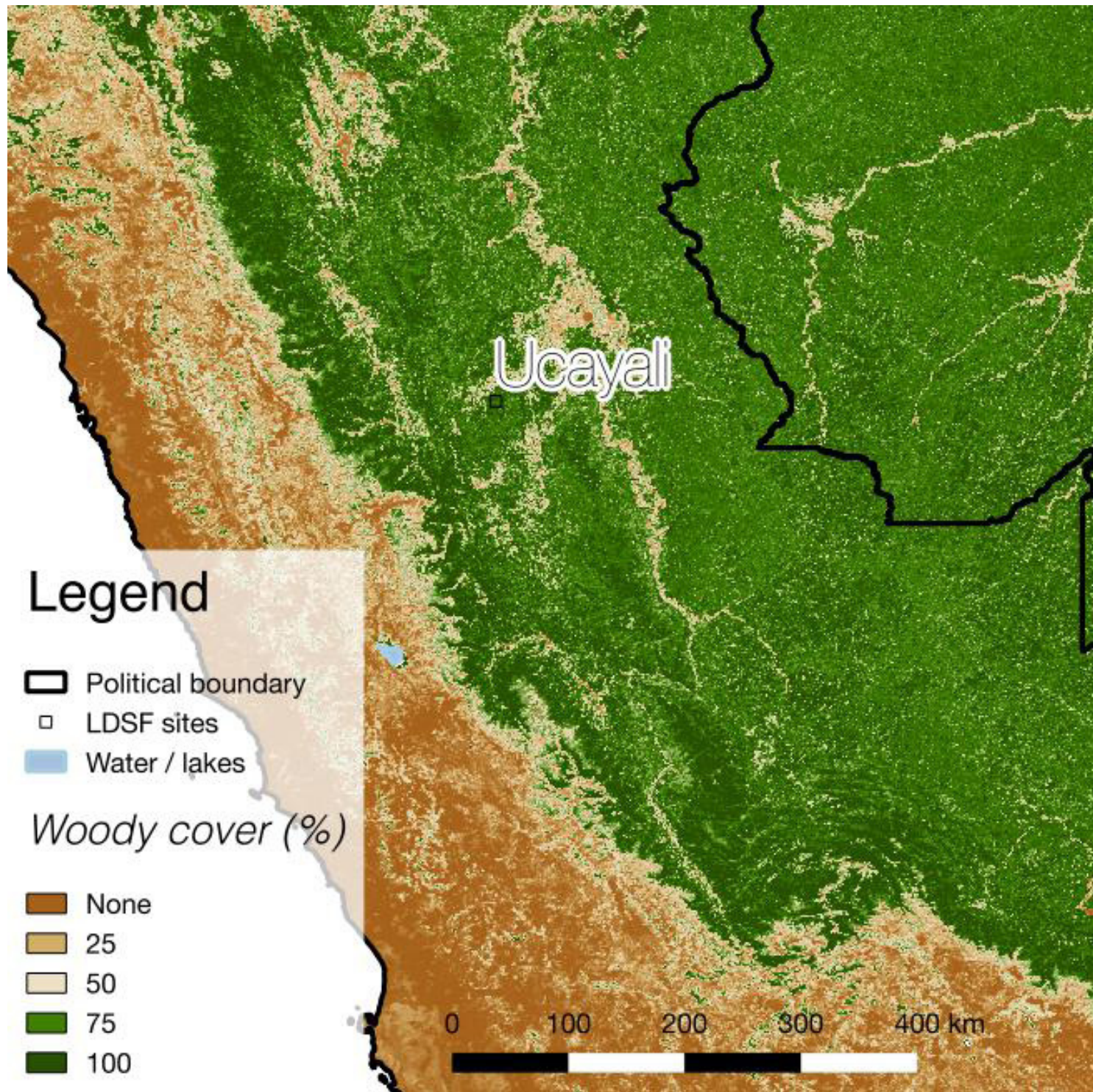
Part of the site is located within the “La Perla” mining concession, while the rest is private land or land without legal titles. Old growth forest is mixed with secondary forest, mining, agricultural land, pastureland (degraded and improved). Accessibility is good.

Pando

This site is in an area with high conservation value, but with high levels of insecurity due to drug trafficking in the region.

Acre

This area is predominantly agricultural land and pastures, with some logging.



Estimated woody cover (woodlands and forests) for the Western Amazon sentinel landscape based on MODIS for 2012.

The woody cover index values show the proportional cover of trees in each pixel. A woody cover index value of 100% indicates closed-canopy forest.



Borneo - Sumatra

ESTABLISHED IN

2014

Lead partners:
CIFOR, ICRAF

Sites:
Batang Lupar, Mentebah,
Batang Merangin and Sarolangun

Two sites in Borneo and another two sites in Sumatra, along forest transition gradients were selected in the Borneo - Sumatra landscape.

The sites encompass representative vegetation types in Indonesia and representative landscapes:





Batang Lupar

- Non-swamp lowland forest
- Secondary regrowth
- Traditional agroforestry
- Swidden agriculture systems
- Smallholder timber
- Oil palm

The Batang Lupar site is dominated by the Dayak people, mostly Iban Dayaks who live in longhouses. The site consists of natural forest, logged-over forest, secondary forest, sacred forests, swidden agriculture and rubber gardens.

Mentebah

The dominant ethnic group in this site is Iban Dayaks, living mostly in individual houses. Land use is similar to Batang Lupar, with natural forest, logged-over forest, secondary forest, sacred forests and swidden agriculture.

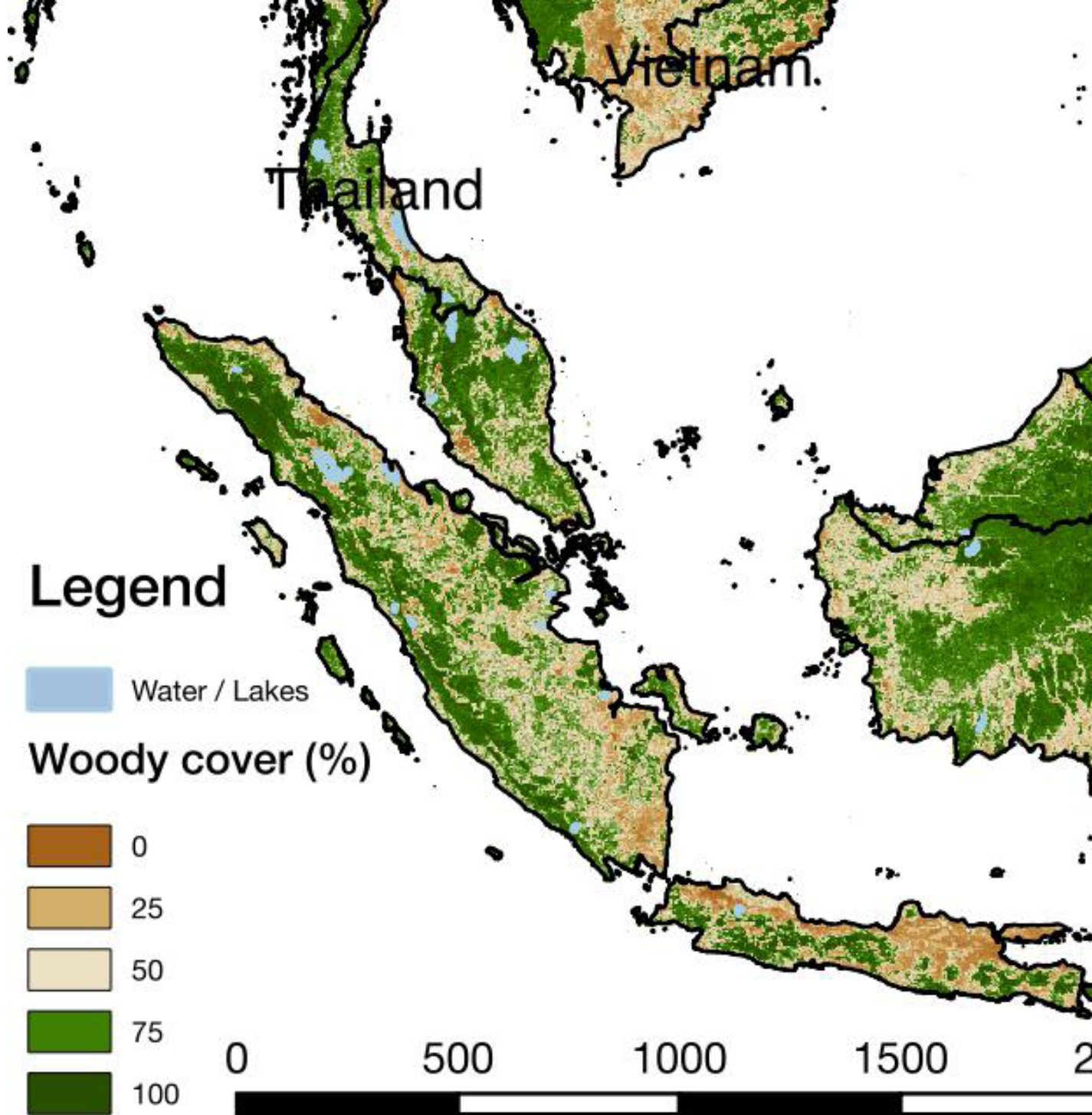
Batang Merangin

The terrain is undulating with young rubber agroforest as the major land cover type. The site has some smallholder oil palm gardens and paddy fields, and there are remnants of natural forest and some customary forest in the site.

Sarolangun

This site has both privately owned plantations and plantation concessions. Major land cover types are smallholder rubber gardens, young oil palm and smallholder forest plantations.







Cameroon

ESTABLISHED IN

2014

Coordinating team:

Dennis Sonwa (CIFOR)

Bertin Takoutsing (ICRAF)

Patrice Levang (IRD & CIFOR)

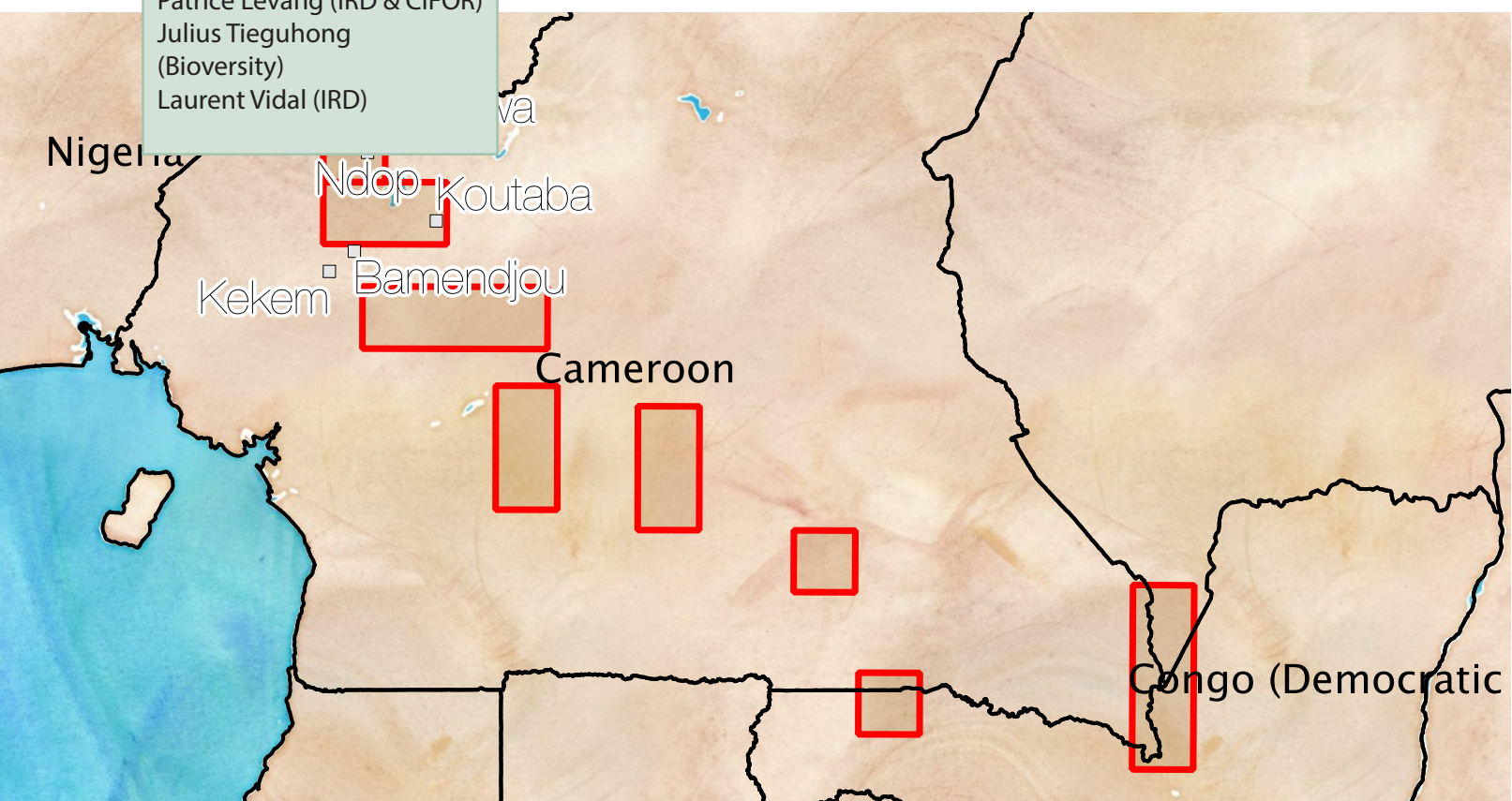
Julius Tieguhong

(Bioversity)

Laurent Vidal (IRD)

SUMMARY

Site	Cultivated (%)	Forest cover (%)	Agroforestry (%)	Erosion (%)
Bokito	23	9		21



Mintom

- Transition between mature old growth forest and logged-over forest, where there is a mixture of active forest concessions, recently allocated community forests and unallocated forest concessions.
- Currently the site hosts both production and virgin primary forest, but a major road is being opened through this area.
- Activities include opening of markets and intensification of smallholder/community activities - including agriculture and agroforestry, hunting, informal logging and commercial activities.

Bokito

- Forest-savannah or deforested landscape where secondary forest is used for growing cash and subsistence agricultural and agroforestry crops.
- All forest land has been allocated, and some has been converted to cocoa and oil palm.
- Good access by road, and a long-term CIRAD presence, ensuring links to local smallholders and some past data.

Ayos

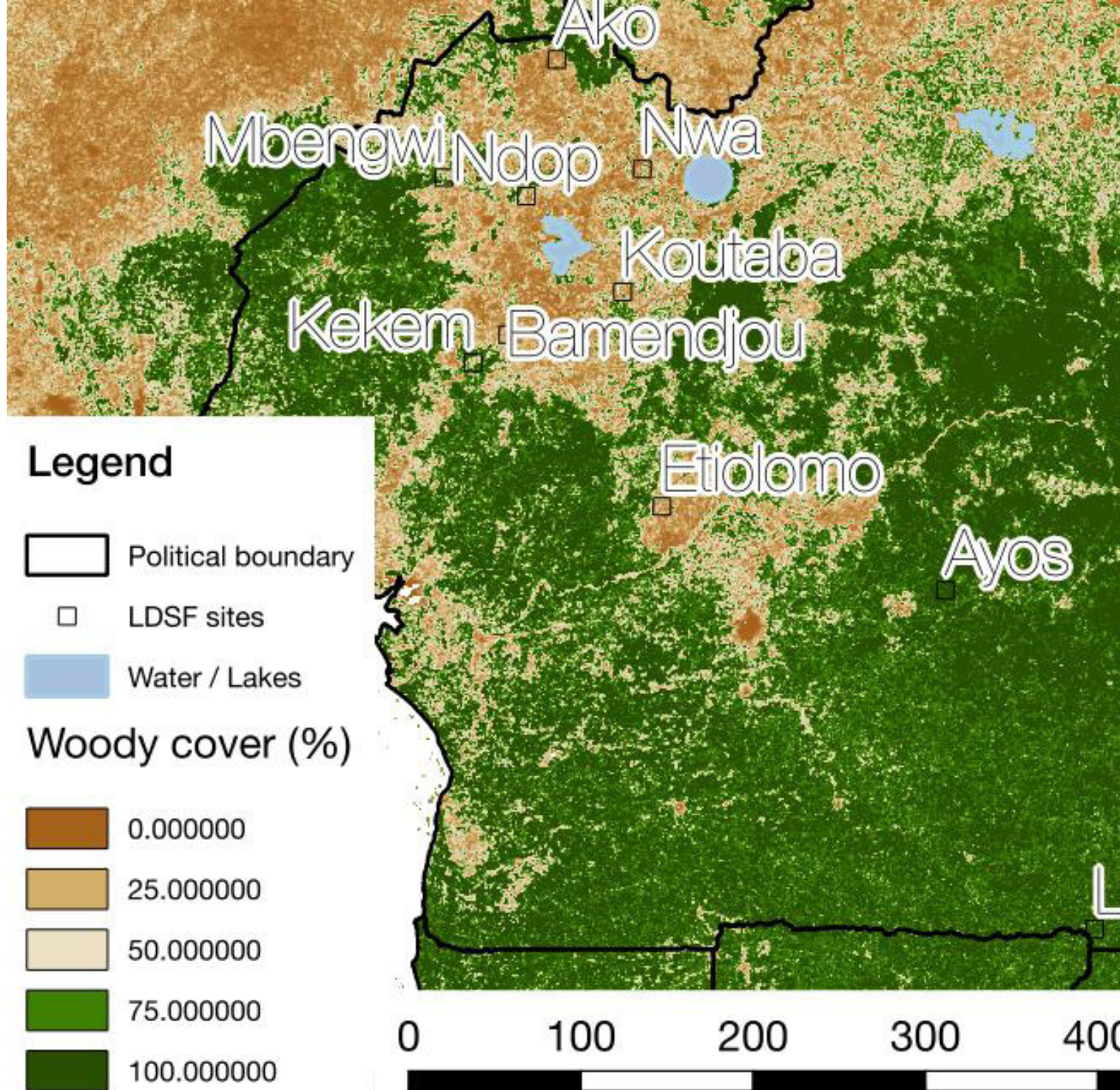
- Vegetation is characterized by gallery forests surrounded by swamp forests of raffia, with a surface area is 1250 km² with an estimated population of 22,899 inhabitants.
- Agriculture and agroforestry products are the mainstay for a large proportion of the population, and agricultural practices are relatively mature (mostly cocoa, coffee, oil palm).
- The area is inhabited by a growing rural community with access to markets, and comprises about 39 villages under two mains groups - YEBEKOLO-Est and OMVANG.



Lomie-Kongo

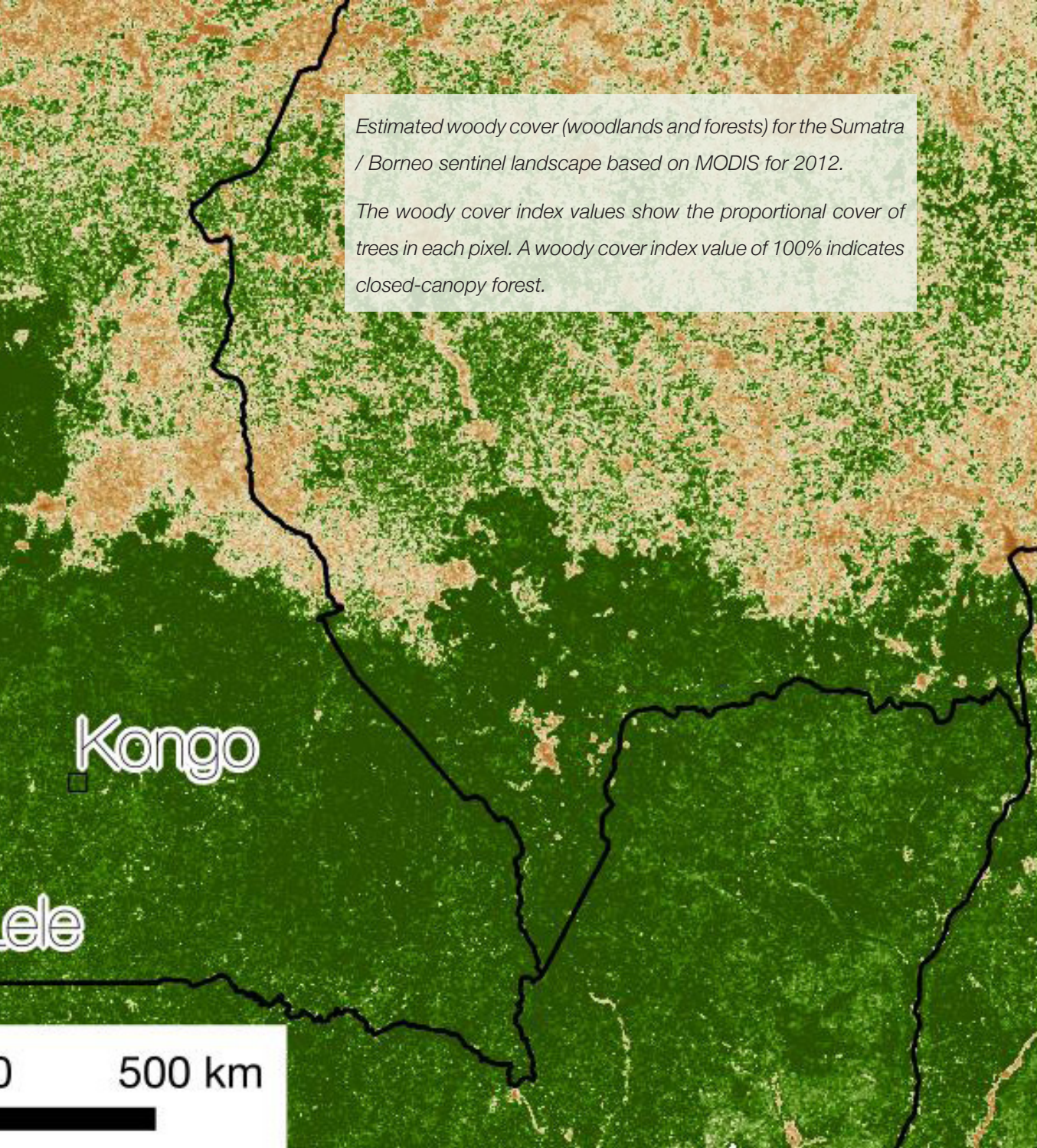
- Degraded mature forest, where Concession and community forestry and timber exploitation are some of the principal activities influencing forest structure in the area.
- In addition to this, other forest-related activities include hunting and the collection of some non-timber forest products.
- Agriculture and agroforestry practices exist, however access to markets is slightly more difficult, meaning that they have not been intensified.





Estimated woody cover (woodlands and forests) for the Sumatra / Borneo sentinel landscape based on MODIS for 2012.

The woody cover index values show the proportional cover of trees in each pixel. A woody cover index value of 100% indicates closed-canopy forest.





RESEARCH
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WORLD AGROFORESTRY CENTRE

P.O. Box 30677 - 00100 GPO, Nairobi, KENYA
E-mail t.vagen@cgiar.org • www.worldagroforestry.org