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Using Systematic Field Surveys to Assess the Effects of Land Use on Soil Health Across Diverse Landscapes

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Sentinel Landscape Workshop, CATIE

3 March 2014




Land Degradation, Ecosystem Services, Land Health, Soil Health, and Agricultural Production are inextricably linked




Systematic assessments for cross-site analysis

nature Vol 466|29 July 2010

OPINION



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RESEARCH PROGRAM ON Forests, Trees and Agroforestry

Global Change Biology

Review

Towards an integrated global framework to assess the impacts of land use and management change on soil carbon: current capability and future vision

Pete Smith^{1,*}, Christian A. Davies², Stephen Ogle³, Giuliana Zanchi⁴, Jessica Bellarby¹, Neil Bird⁴, Robert M. Boddey⁵, Niall P. McNamara⁶, David Powelson⁷, Annette Cowie⁸, Meine van Noordwijk⁹, Sarah C. Davis¹⁰, Daniel DE B. Richter¹¹, Len Kryzanowski¹², Mark T. van Wijk^{13,14}, Judith Stuart¹⁵, Akira Kirton¹⁶, Duncan Eggar¹⁷, Geraldine Newton-Cross¹⁶, Tapan K. Adhya¹⁶, Ademola K. Braimoh¹⁹

Issue



Global Change Biology
Early View (Online Version of Record published before inclusion in an issue)

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Journal of Environmental Monitoring

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PERSPECTIVE

Effective monitoring of agriculture: a response

Jeffrey D. Sachs,^{†**} Roseline Remans,^{†*ab} Sean M. Smukler,^{†**a} Leigh Winowiecki,^{†**c} Sandy J. Andelman,^d Kenneth G. Cassman,^e David Castle,^f Ruth DeFries,^g Glenn Denning,^{ah} Jessica Fanzo,ⁱ Louise E. Jackson,^j Rik Leemans,^k Johannes Lehmann,^l Jeffrey C. Milder,^{mmm} Shahid Naeem,^g Generose Nziguheba,^a Cheryl A. Palm,^a Prabhu L. Pingali,^o John P. Reganold,^p Daniel D. Richter,^q Sara J. Scherr,^{mm} Jason Sircely,^g Clare Sullivan,^a Thomas P. Tomich^r and Pedro A. Sanchez^a

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Objectives

- To illustrate the use of a systematic sampling framework to multi-level modeling for cross-site/cross-country analysis
- To assess the linkages between inherent soil properties, land cover typologies and soil health
- To explore the LDSF data from five SL

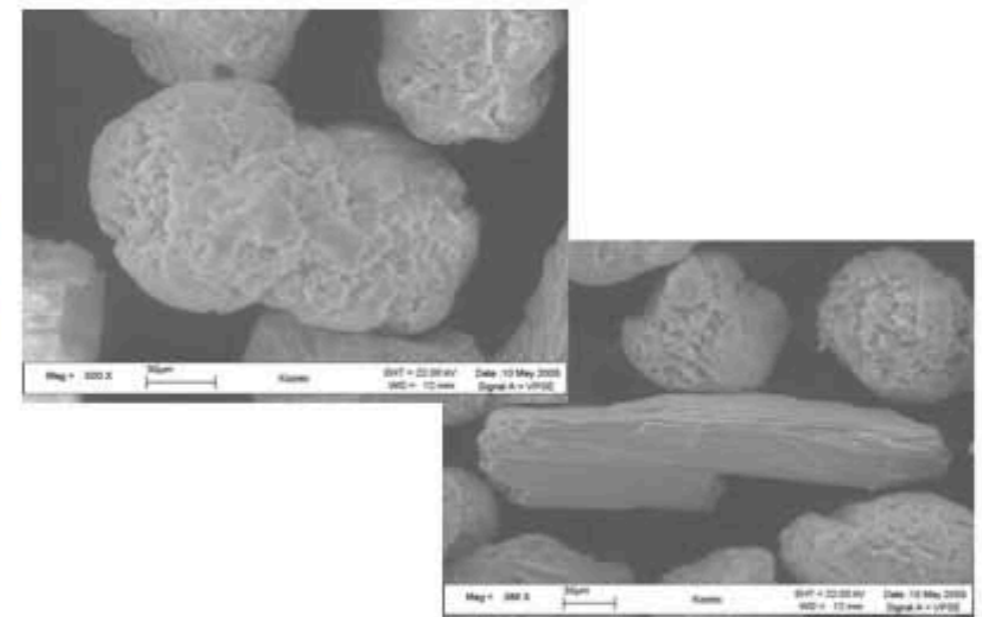
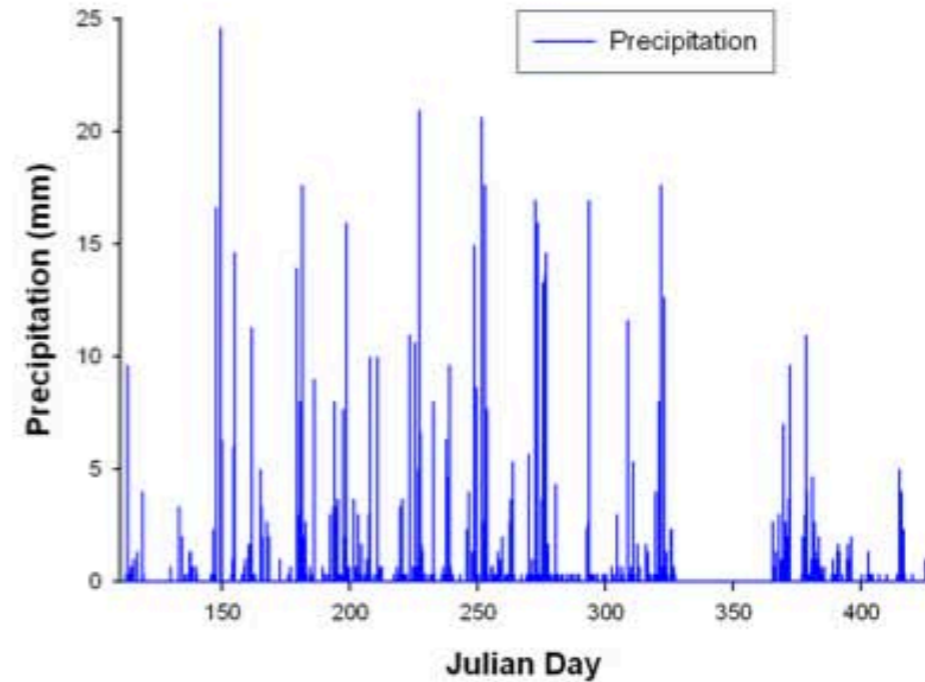
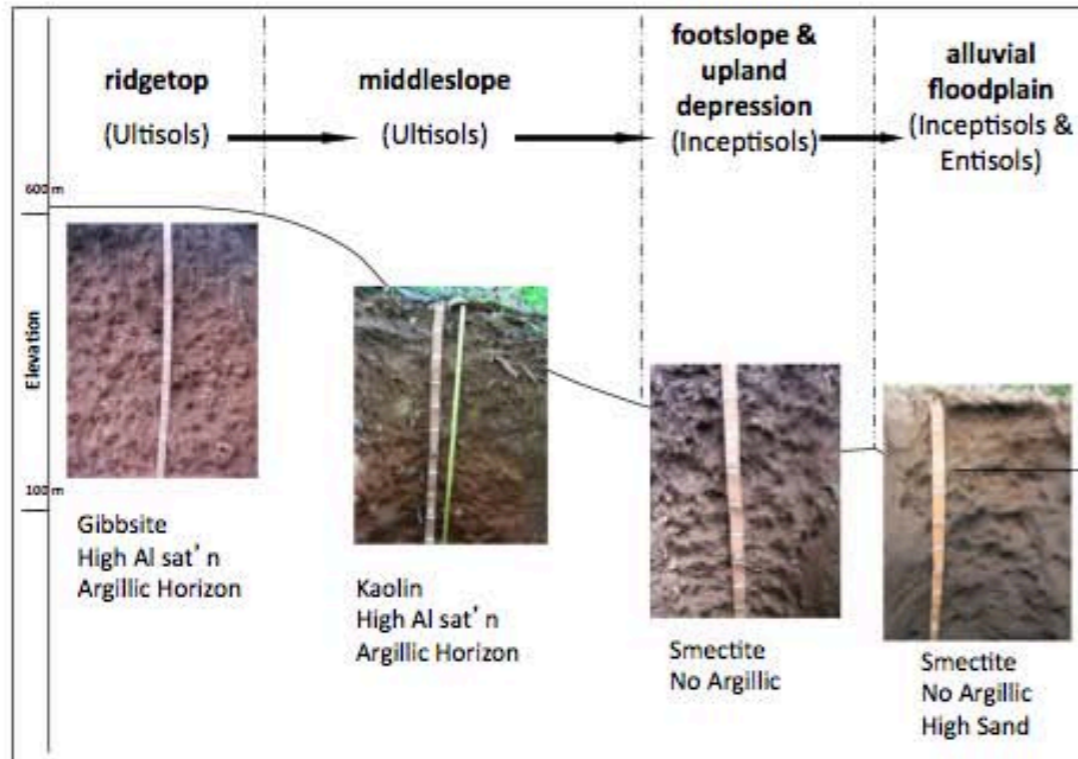


Importance of Soil

- **Soil provides multiple ecosystem services:**
 - **medium for plant and ag production;**
 - **filter for toxins;**
 - **regulating hydrologic cycle** (Millennium EcoSystem Assessment, 2005)
- **Plant-soil relationships that determine the distribution of aboveground vegetation**

Factors of Soil Formation

Climate, organisms, relief, parent material, time....



Influence of Soil Forming Factors on Inherent Soil Properties

- **Parent material** - > soil texture (% clay), total elemental composition
- **Climate** - > degree of weathering and available nutrients

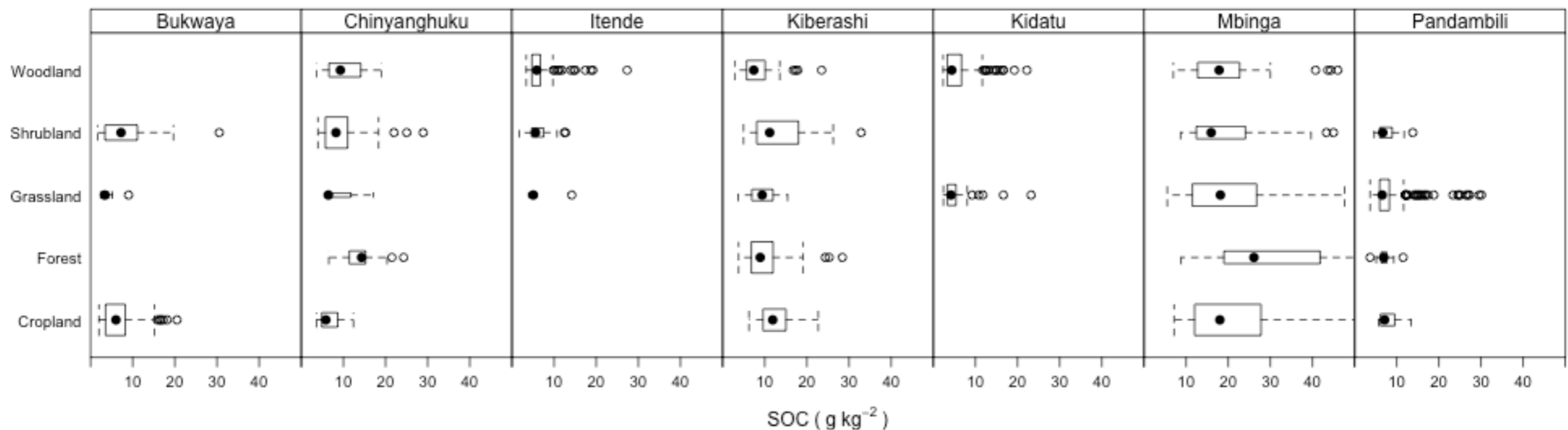
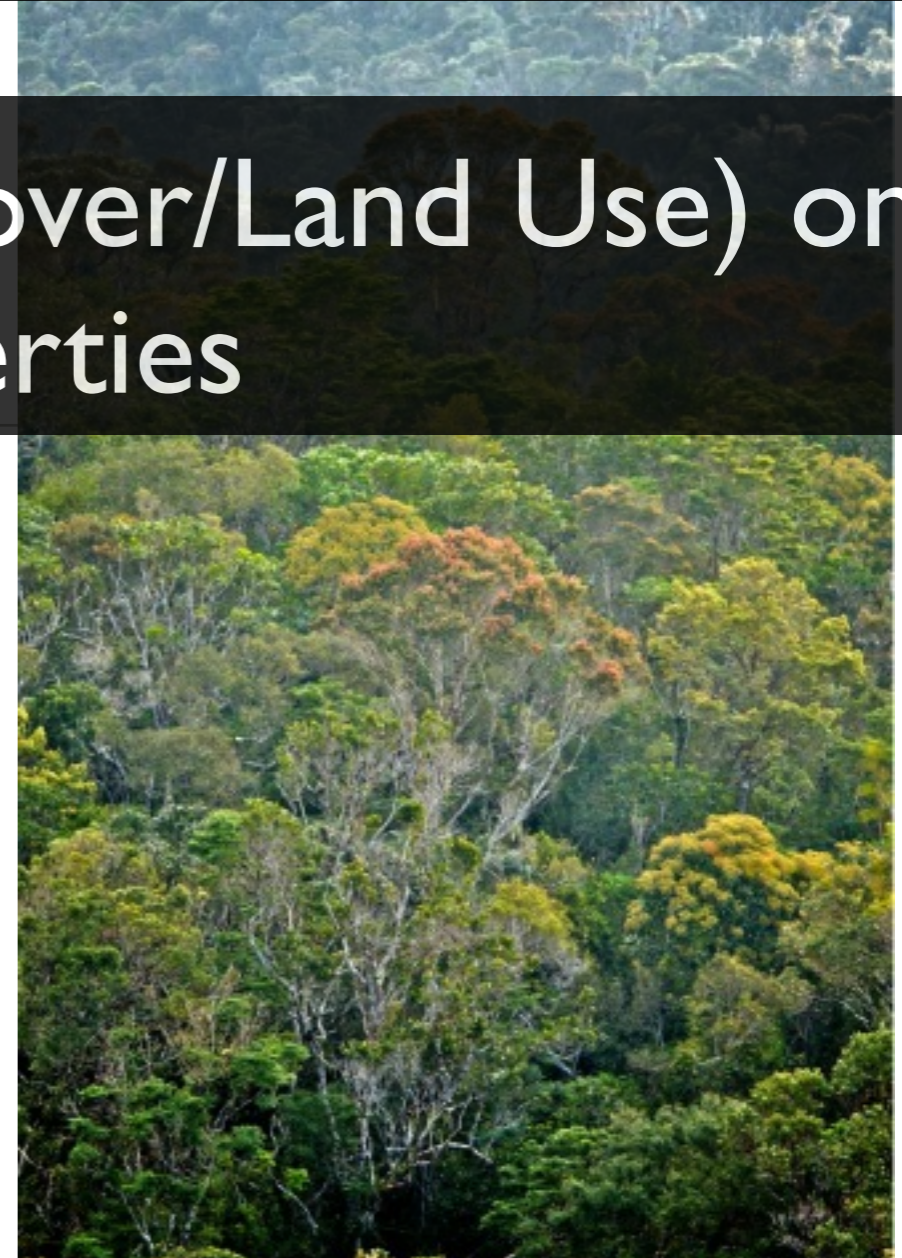


Forming inherent constraint envelopes for the soil (e.g., capacity to store and exchange cations (nutrients))

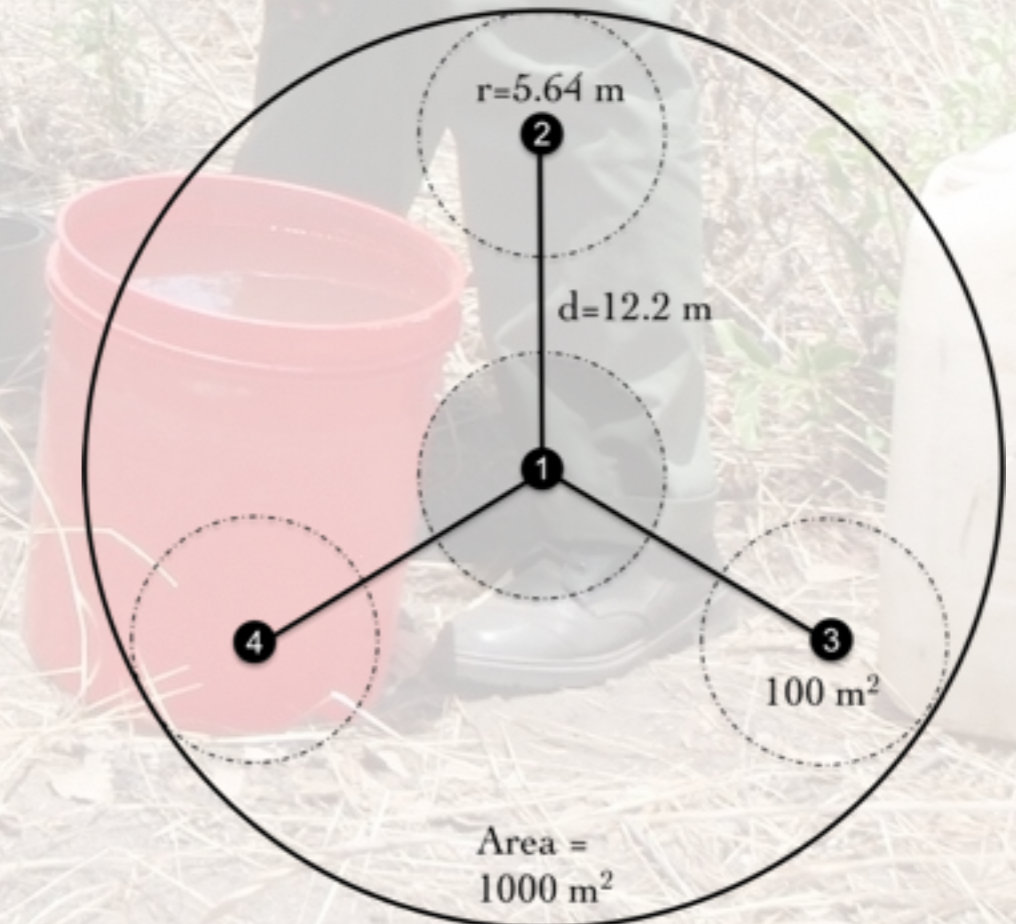
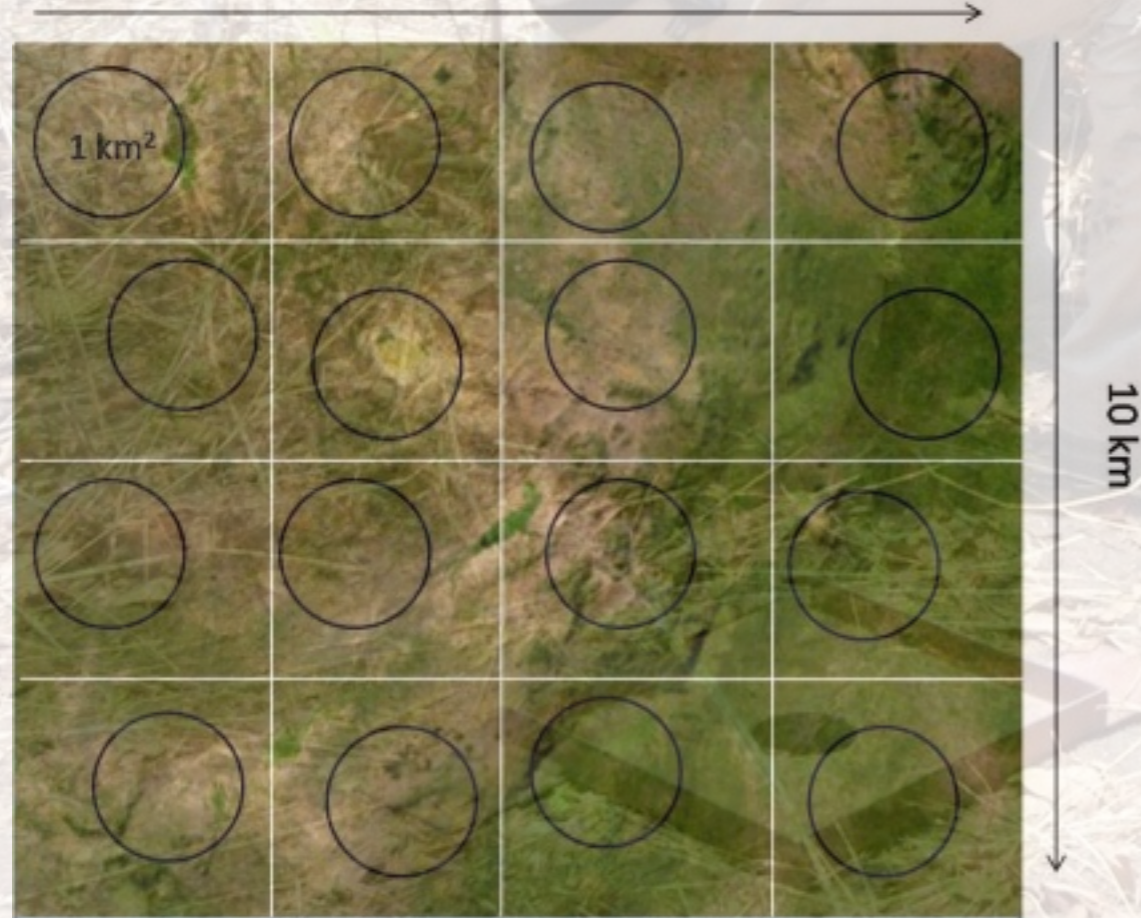
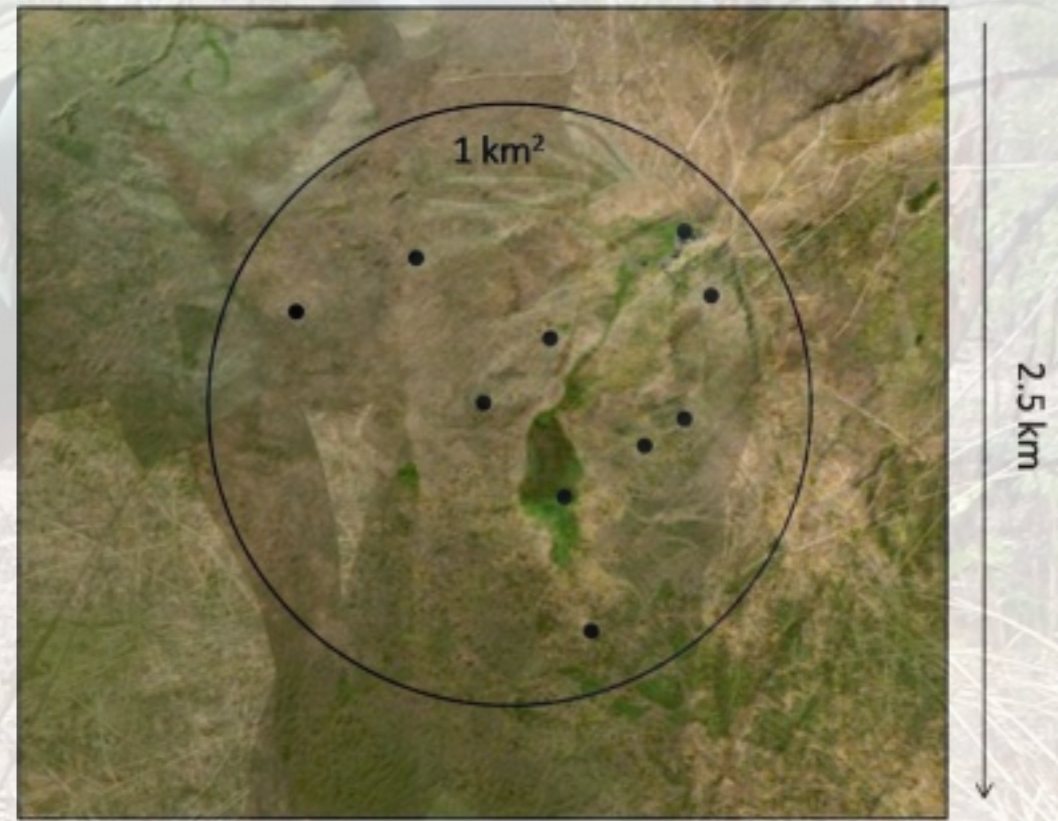
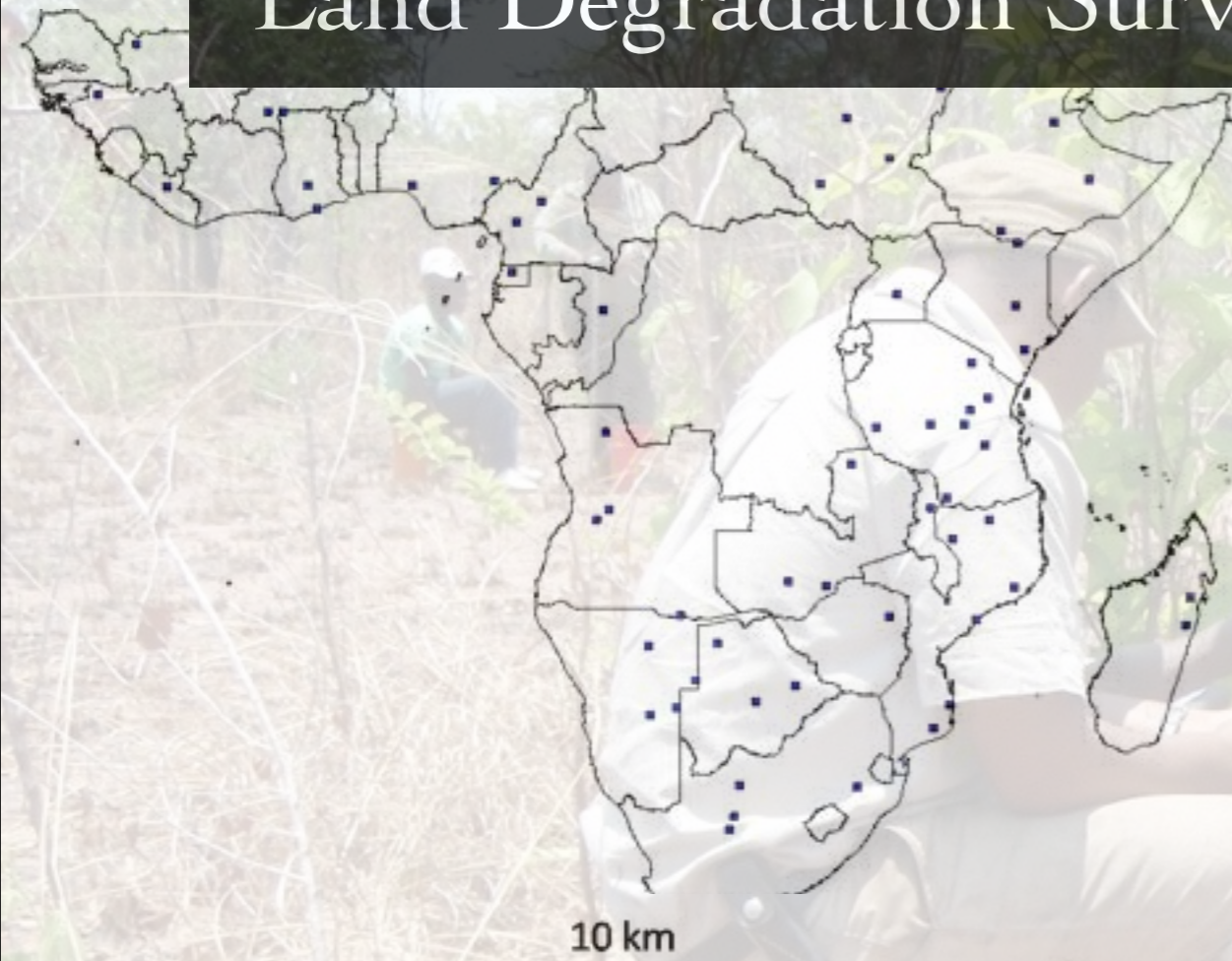
Influence of Organisms (Land Cover/Land Use) on Dynamic Soil Properties

Land use can influence soil health but inherent soil properties determine the magnitude of these effects.

Hence it is important to understand the complexity of the soil system.



Land Degradation Surveillance Framework (LDSF)



Plot observations

- Land cover and land-use history
- Topographic position
- Primary use
- Woody leaf types
- Landform
- Slope
- Vegetation structure
- Impact on habitat



PLOT (1,000 m²) **LDSF Field Form v4 2013**

Site: _____ Date (ddmmy): _____ Latitude (DD): _____
 Cluster: _____ Photo ID: _____ Longitude (DD): _____
 Plot: _____ Elevation (m): _____ Pos error (m): _____
 Country Name: _____

Slope Up °: _____ Slope Down °: _____

Major landform: Level Sloping Steep Composite

Position on topographic sequence:
 Upland Ridge/Crest Midslope Foothill Bottomland

Landform designation:
 Medium gradient mountain Dissected plain Major depression
 Medium gradient hill High gradient mountain Narrow plateau
 Medium gradient escarpment High gradient hill Plain
 Ridges High gradient escarpment Low gradient mountain
 Mountainous highland Valley Low gradient hill

Plot bare? Yes No
 Plot regularly flooded? Yes No
 Plot cultivated? Yes No

Vegetation types: Trees Yes No
 Shrubs Yes No
 Graminoids Yes No
 Forbs Yes No
 Other Yes No

Woody leaf types: Broadleaf Yes No
 Needle leaf Yes No
 Allophytic Yes No
 Evergreen Yes No
 Deciduous Yes No

Vegetation structure*:
 Other description: _____

* Forest, Woodland, Bushland, Thicket, Shrubland, Grassland, Wooded grassland, Cropland, Mangrove, Freshwater aquatic, Halophytic, Other

Herb height (m): 0.8-3.0 (m) 0.3-3.0 (m) 0.3-0.8 (m) 0.03-0.3 (m) Herbaceous annual: Yes No

Same landuse since 1990: Yes No Land ownership: Private Communal Government Don't Know

Primary current use:
 Food/Beverage Yes No
 Timber/fuelwood Yes No
 Storage: Yes No
 Other: Yes No

Soil and water conservation:
 Number: _____ None
 Vegetative
 Structural

Vegetation strata description:
 Impact on habitat:
 0 1 2 3
 Impact of tree cutting
 Impact of agriculture
 Impact of grazing/browsing
 Impact of fire
 Impact of urban activities
 Impact of industry
 Impact of erosion
 Impact of alien vegetation
 Impact of firewood collection
 Other: _____

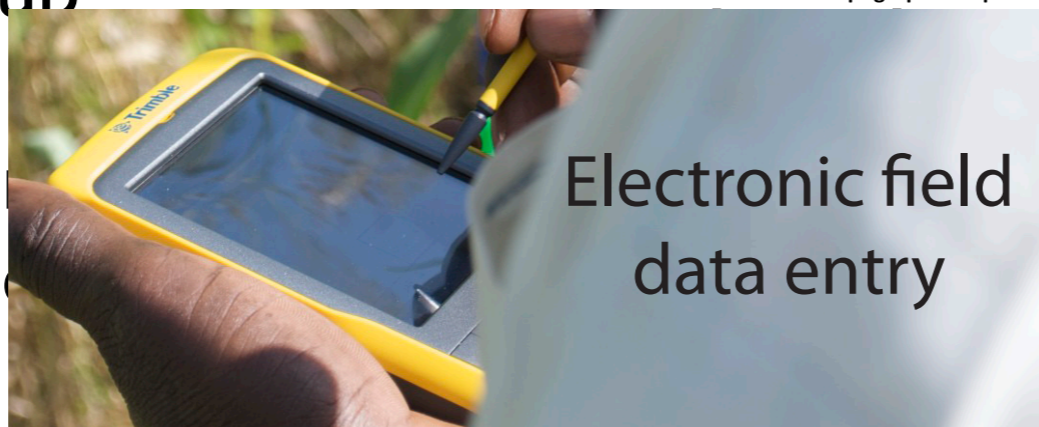
Describe land cover/ use history: _____



SUB-PLOT (100 m ²)		1		2		3		4	
Rock/stone, Gravel cover (%)		<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40
Visible erosion		<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass
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Herbaceous Cover rating (%)		<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65
Auger depth restriction (cm)		cm		cm		cm		cm	
Topsoil ribbon length (mm)	Texture: (*Gritty/ Smooth/ Neither)	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____
Subsoil ribbon length (mm)	Texture: (*Gritty/ Smooth/ Neither)	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____	Length: _____ mm	*Texture: _____
Notes:									

Subplot observations

- Tree and shrub densities
- Woody cover rating
- Herbaceous cover rating
- Erosion prevalence
- Root depth restrictions
- Composite soil samples (320 per site) (0-20 cm and 20-50 cm)



Electronic field data entry

LDSF Field Form v4 2013

PLOT (1,000 m²)
 Site: _____ Date (ddmmyy): _____ Latitude (DD): _____
 Cluster: _____ Photo ID: _____ Longitude (DD): _____
 Plot: _____ Elevation (m): _____ Pos error (m): _____
 Country: _____
 Name: _____

Slope Up °: _____ Slope Down °: _____

Major landform: Level Sloping Steep Composite

Position on topographic sequence: Midslope Foothlope Bottomland

Dissected plain Major depression
 High gradient mountain Narrow plateau
 High gradient hill Plain
 High gradient escarpment Low gradient mountain
 Valley Low gradient hill

Woody leaf types:
 Broadleaf Yes No
 Needle leaf Yes No
 Allophytic Yes No
 Evergreen Yes No
 Deciduous Yes No

Vegetation structure*:
 Other description:
 Herbaceous annual: Yes No

Land ownership: Private Communal Government Don't Know

Impact on habitat:
 Impact of tree cutting
 Impact of agriculture
 Impact of grazing/browsing
 Impact of fire
 Impact of urban activities
 Impact of industry
 Impact of erosion
 Impact of alien vegetation
 Impact of firewood collection
 Other: _____

The LDSF databases and data entry screens have been developed for various mobile devices and smartphones for direct data entry in the field. The data entered is uploaded to the central database in Nairobi, Kenya, after the completion of a survey. These systems increase efficiency and reduce potential errors in the data capture process.

CyberTracker
 The CyberTracker (<http://www.cybertracker.com>) software is a free and efficient method for geotagged data collection and can be used on smartphones or handheld computers. CyberTracker is primarily a data capture tool, but also has some basic GIS functionality. It was originally developed to record wildlife movement in the Central African rain forest. We developed a CyberTracker application for LDSF field data entry.

LDSF START NEW PLOT

NAME
START LOGGING

Sentinel Site ID
 Enter Site Name (or first 4 letters)
 Tap to Edit

Sub-plot - Topsoil Field Texture

Soil ribbon (length in mm)			
1	2	3	4
None	None	None	None
Ball	Ball	Ball	Ball
< 25	< 25	< 25	< 25
25 - 50	25 - 50	25 - 50	25 - 50
> 50	> 50	> 50	> 50
Gritty	Gritty	Gritty	Gritty
Smooth	Smooth	Smooth	Smooth
Neither	Neither	Neither	Neither



SUB PLOT (100 m ²)		2		3		4	
Rock/stone, Gravel cover (%)		<input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40	<input type="checkbox"/> <5 <input type="checkbox"/> 5-40 <input type="checkbox"/> >40
Visible erosion		<input type="checkbox"/> None <input type="checkbox"/> Sheet <input type="checkbox"/> None <input type="checkbox"/> Sheet	<input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass	<input type="checkbox"/> Rill <input type="checkbox"/> Gully/Mass
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Herbaceous Cover rating (%)		<input type="checkbox"/> Absent <input type="checkbox"/> 15-40 <input type="checkbox"/> Absent <input type="checkbox"/> 15-40	<input type="checkbox"/> < 4 <input type="checkbox"/> 40-65 <input type="checkbox"/> < 4 <input type="checkbox"/> 40-65	<input type="checkbox"/> 4-15 <input type="checkbox"/> > 65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> 4-15 <input type="checkbox"/> > 65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> 4-15 <input type="checkbox"/> > 65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65	<input type="checkbox"/> 4-15 <input type="checkbox"/> > 65 <input type="checkbox"/> 4-15 <input type="checkbox"/> > 65
Auger depth restriction (cm)		cm		cm		cm	
Topsoil	Texture: (*Gritty/Smooth/Neither)	Length: mm	*Texture:	Length: mm	*Texture:	Length: mm	*Texture:
Subsoil	Texture: (*Gritty/Smooth/Neither)	Length: mm	*Texture:	Length: mm	*Texture:	Length: mm	*Texture:
Notes:							

LDSF Database-FileMaker mirrored in MSQL

FileMaker Pro Advanced File Edit View Insert Format Records Scripts Tools Window Help 98% Tue Mar 4 6:19 Leigh Winowiecki

AFSIS_sites

316 / 12736 Found (Unsorted)

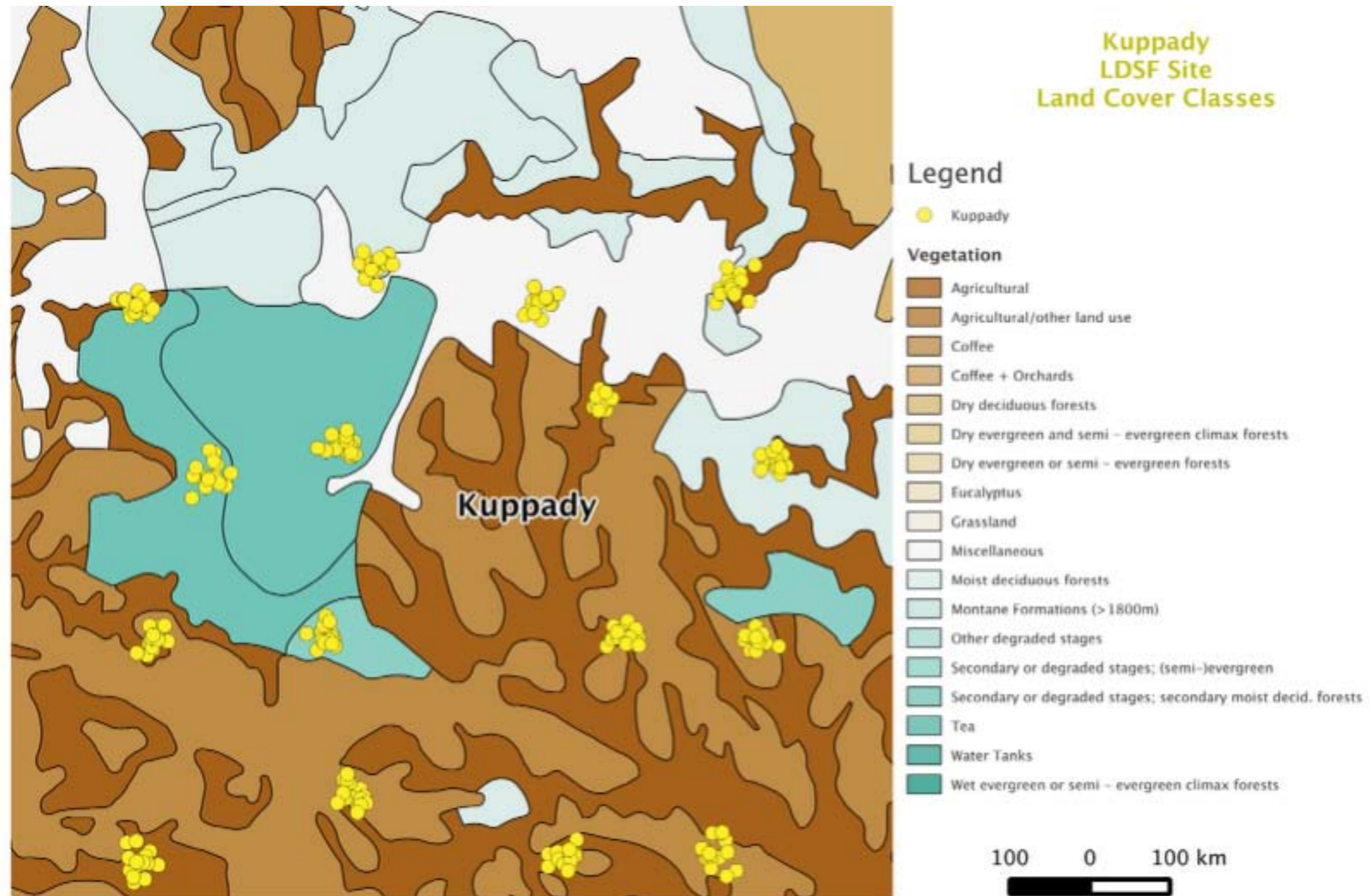
Records Show All New Record Delete Record Find Sort

Layout: table_PlotProperties View As: Preview Modify...

VegCovLT40	PlotFlood	PlotCultMgd	Trees	Shrubs	Graminoids	Forbs	VegOther	Broadleaf	Needleleaf	Allophytic	Evergreen
No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes
No	No	Yes	No	No	Yes	Yes	No	Yes	No	No	No
No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes
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No	No	No	Yes	Yes	No	Yes	No	Yes	No	No	Yes
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No	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes

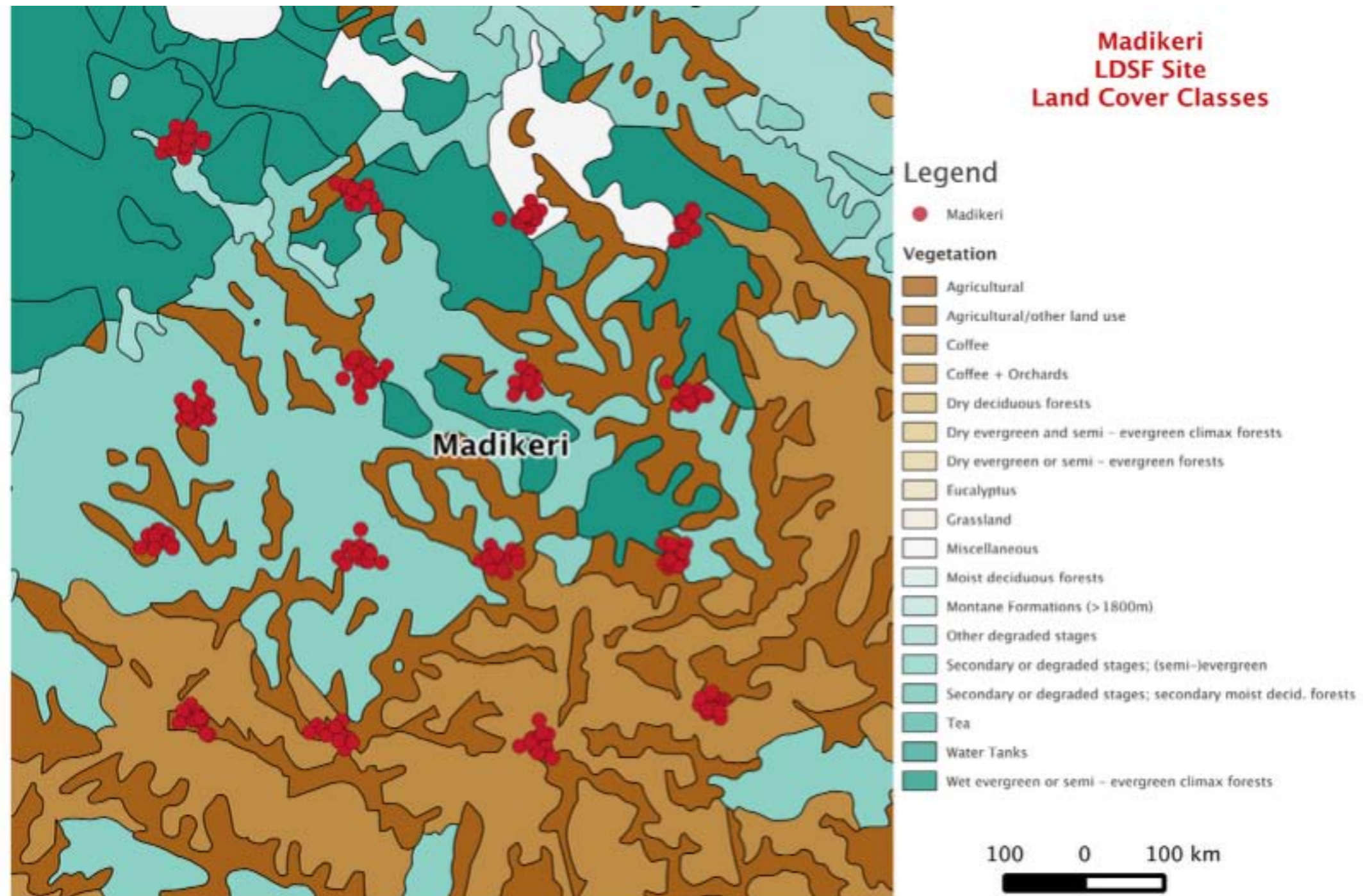
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Sampling a Landscape-WGSL



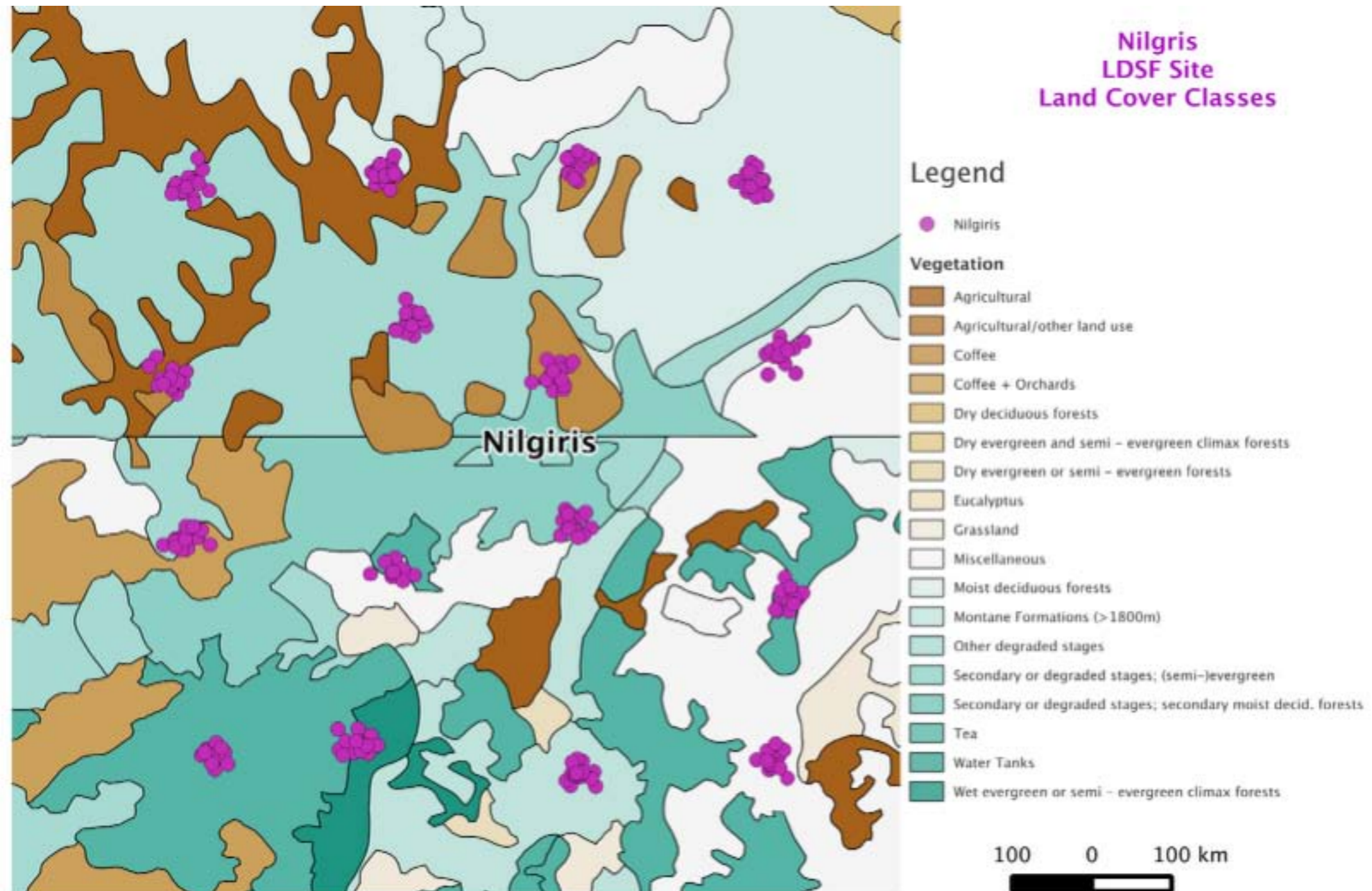
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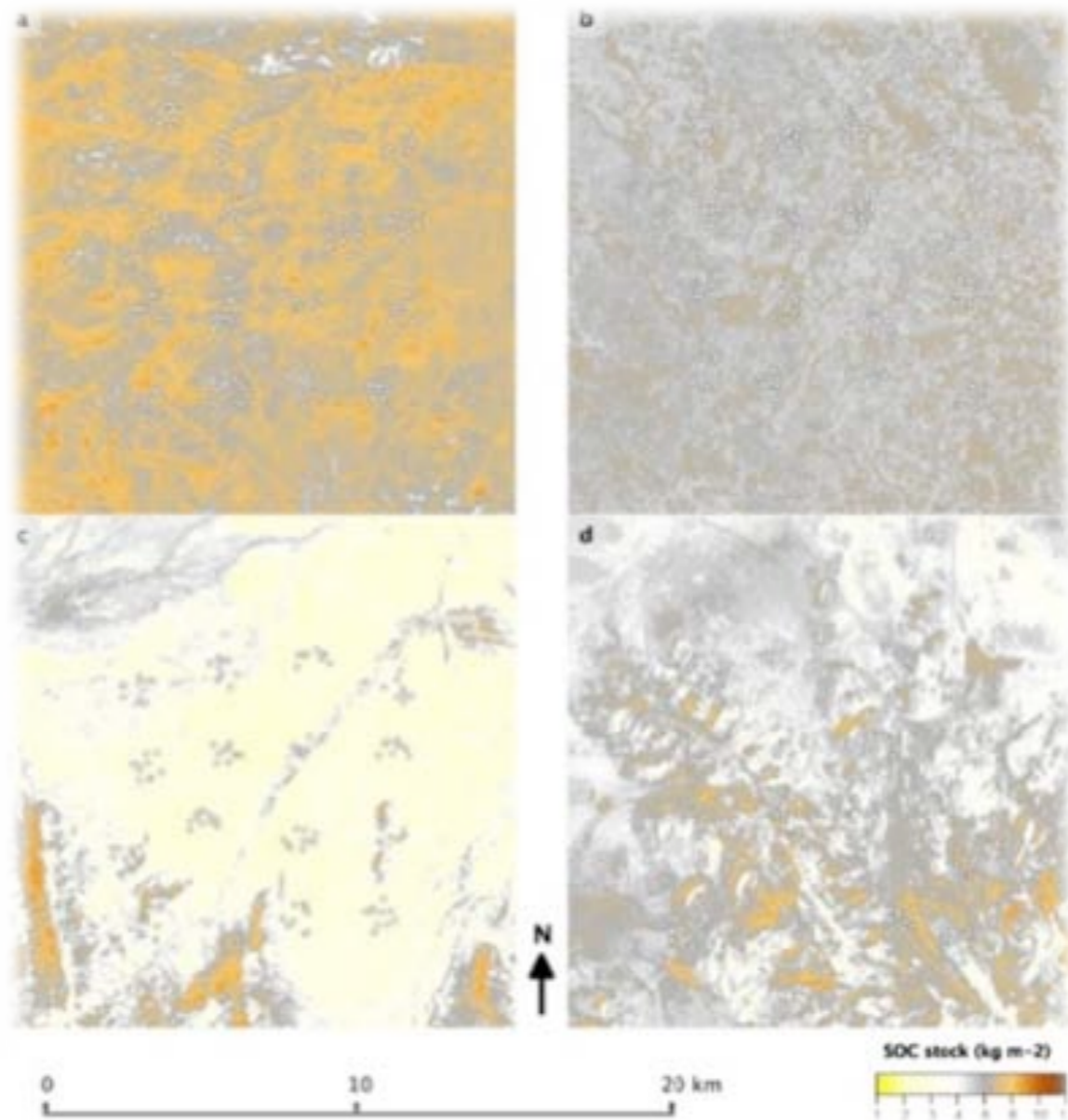
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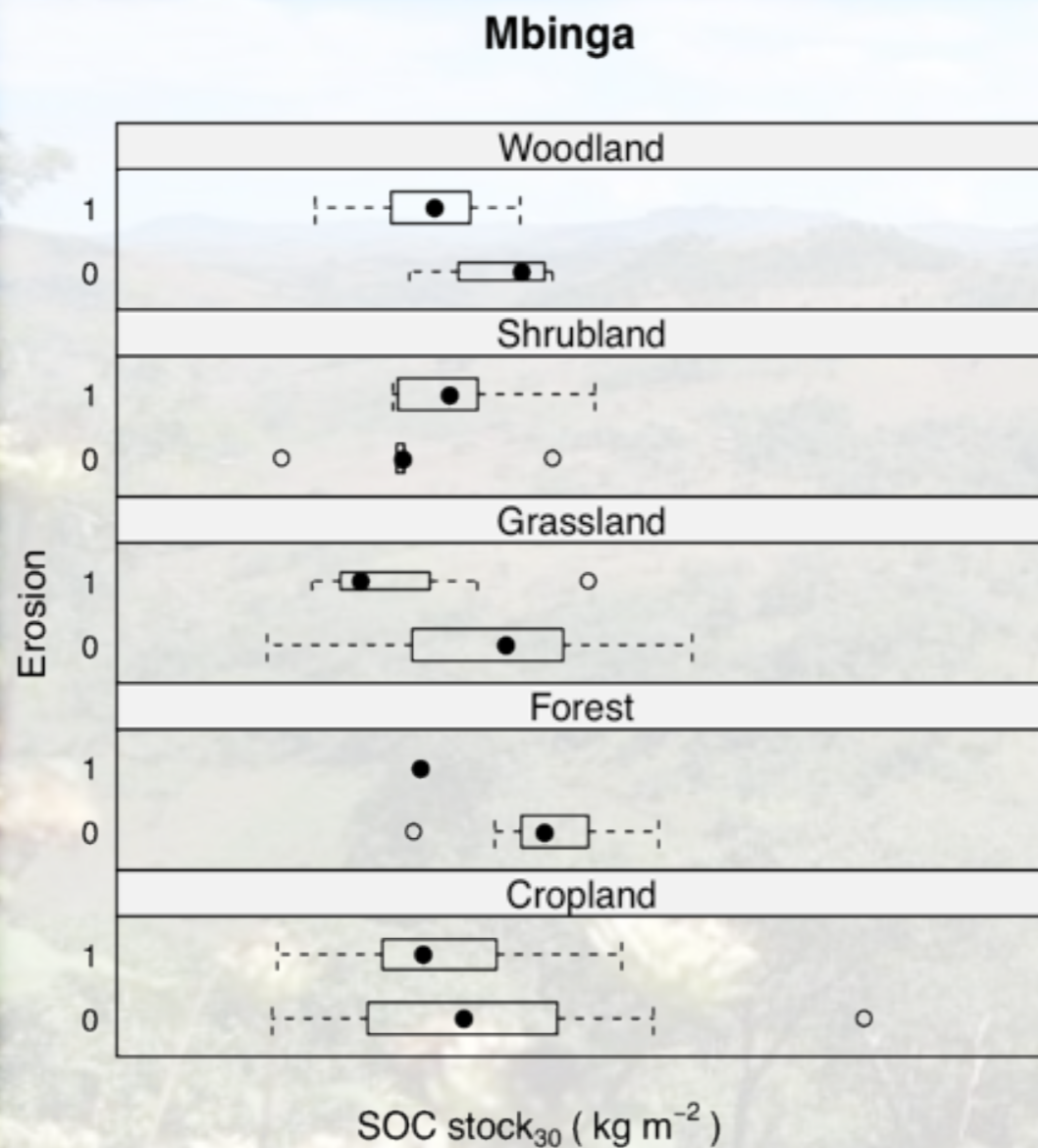
Assessing Soil Carbon Storage as Potential Climate Change Mitigation Strategy



- Soil organic carbon is an indicator of soil health
- Contrasting sites in Tanzania, Ethiopia and Kenya to demonstrate utility of method: SOC stocks to 30 cm
- To understand landscape patterns of SOC stocks
- To target areas for SOC strategies

Vågen and Winowiecki, 2013. Mapping of SOC stocks for spatially explicit assessments of climate change mitigation potential. *Environmental Research Letters*. 8

Assessing Soil Carbon Storage as Potential Climate Change Mitigation Strategy

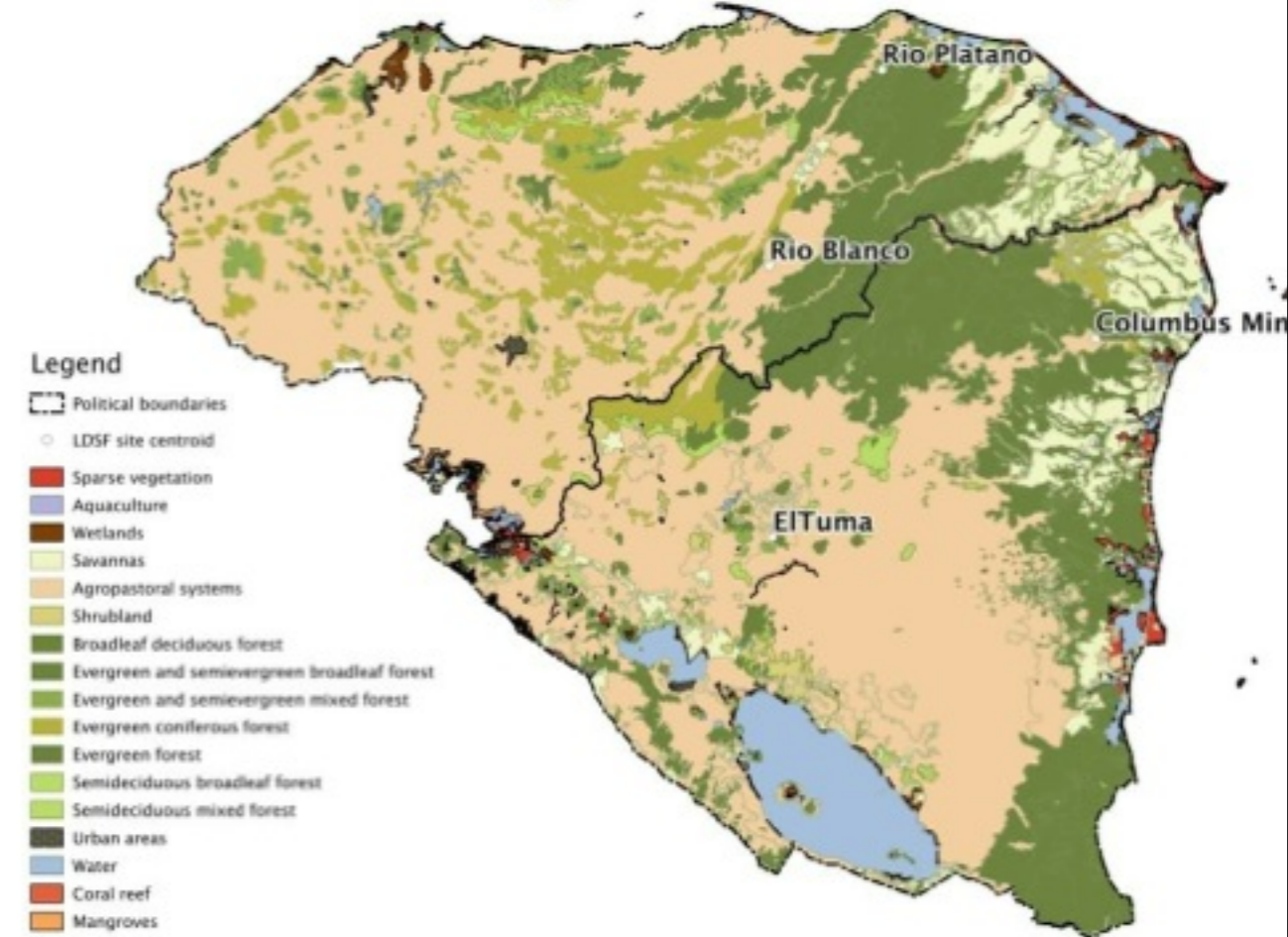


- Climate and texture explained only 47 % of the variation
- Cross-site comparison to include land cover and land degradation
- 0.9 kg m⁻² less C in eroded plots
- Most pronounced in Mbinga woodland/grasslands

Vågen and Winowiecki, 2013. Mapping of SOC stocks for spatially explicit assessments of climate change mitigation potential. Environmental Research Letters. 8

Cross site comparisons: SL -Nicaragua & Honduras

- Two LDSF sampled in Nicaragua - 2013: Columbus Mine and El Tuma La Dahlia
- Two LDSF sampled in Honduras - 2013: Rio Platano and Rio Blanco
- Nicaragua soil samples at ICRAF lab



Working with Local Partners - CATIE, National Agricultural University (UNA) in Catacamas, Foundation of Madera Verde (FMV) in La Ceiba, Institute of Forest Conservation (ICF) in Tegucigalpa

The Nicaragua team, led by Dr. Norvin Sepulveda and Dra. Jenny Ordonez of CATIE, will sample both LDSF sites in Nicaragua. The Honduran teams are led by Dr. Juan Carlos Flores of CATIE working together with Dr. Kenny Najera of UNA and Jaime Enrique Peralta of FMV. The UNA team will sample the Rio Blanco site near Catacamas and the FMV team will sample the remote Rio Platano site in the north. Field training was extended to students, local farmers, NGOs, CGIAR centres and others. Participants were trained in navigation with the GPS units to locate the randomly generated LDSF plots (160 per site); all aspects of the LDSF, including soil sample collection, tree and shrub measurements, erosion observations, among other variables; and electronic data entry. Preliminary data analysis was conducted on the newly collected data, including infiltration capacity curves and tree density estimates. Students from UNA will use the LDSF data for undergraduate theses.



Honduran team in the Brachiaria-dominated Rio Blanco landscape. UNA students were also included in the training!

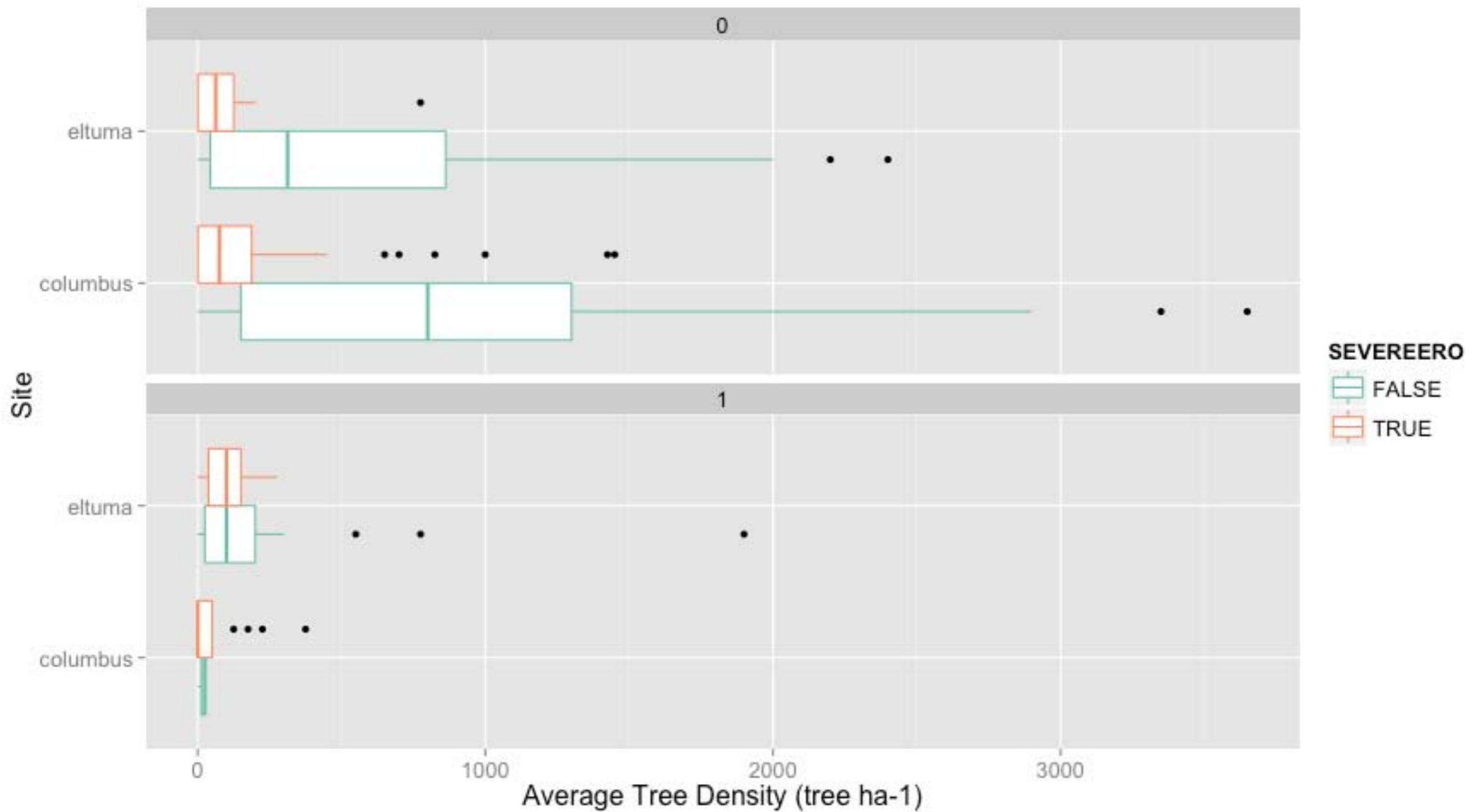


Nicaragua team in a coffee and cacao AF plot in cluster 12 of the El Tuma landscape, about 30 km from Matagalpa.



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Tree Densities and Erosion Prevalence - Cultivation in El Tuma and Columbus Mine, Nicaragua



Cross site comparisons: SL - South Africa

- Two LDSF - 2013: Agincourt and Bushbuck, South Africa
- Soil samples are in the ICRAF Laboratory
- Link to Agincourt social-economic surveys



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Field training at WRF sites in Agincourt (South Africa)

Tor-G. Vågen (ICRAF)

Leigh Winowiecki (CIAT)

December, 2012

Trip Summary

Background

The University of Witwatersrand Rural Facility (WRF) is conducting several long-term studies, including health and demographic surveillance of communities in Agincourt and Bushbuckridge as part of the INDEPTH network. Building on these studies, a team from WRF led by Dr. Wayne Twine has been conducting vegetation surveys and assessments in these sites for the last two years.

Following a workshop at WRF in December 2011, it was agreed that it would be worthwhile to explore synergies between the methods used by WRF and the LDSF methodology developed at ICRAF. Dr. Leigh Winowiecki (CIAT) and Dr. Tor Vagen (ICRAF) visited WRF in March 2012 to learn more about the WRF methods and discuss possible collaboration. As a follow-up to this visit, two 10 by 10 km sites were proposed that are co-located with existing WRF vegetation plots and INDEPTH network villages.

Funding was made available from CRP6 for WRF to conduct LDSF surveys of these sites, including training from CIAT/ICRAF scientists. This report is a short summary of the field training and action points following this field training.



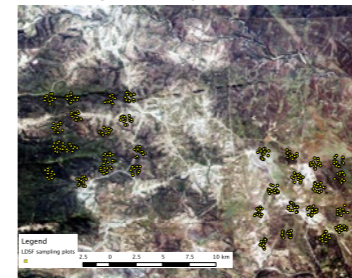
Teaching field texture methods.

Field training at Agincourt

A team of scientists, Ph.D. students and field technicians from WRF were trained on the LDSF methodology during the week of December 10th, 2012. Field surveys were initiated at the Agincourt sites (map below) as part of the training.

The team was trained on vegetation survey methods following a modified version of the FAO Land Cover Classification System (LCCS), field assessments of land degradation risk factors and soil sampling (standard composite samples and cumulative soil mass).

These data will be used to conduct a comprehensive soil health assessment of the area and will be linked to both WRF vegetation surveys and INDEPTH data.



Map of the Agincourt (left) and Bushbuck (right) LDSF sites. The background is a Landsat ETM+ image from 2009.

Synergies between the LDSF and WRF vegetation monitoring methods

One of the primary objectives of this exercise was to look at synergies between the methods applied by WRF and the LDSF for monitoring of rangelands and open woodlands. The LDSF has been applied across all major climate zones in Africa as part of several initiatives, including the Africa Soil Information Service project. The framework has been shown to be very effective for landscape level assessments of soil and land health.

The WRF has implemented very detailed methods for assessment of vegetation composition, structure and trends and it is clear from this collaboration that the LDSF will benefit from incorporating additional methods based on those developed by WRF, specifically for improved assessments of grasslands and woody biomass. These methods are currently being adapted and incorporated into the LDSF framework and will be applied as part of the CRP6 sentinel landscapes initiative (see action points on the right).



The WRF and CIAT/ICRAF team.

Action points:

WRF team completes LDSF surveys in two sites (Agincourt and Bushbuck).

Order WorldView2 imagery.

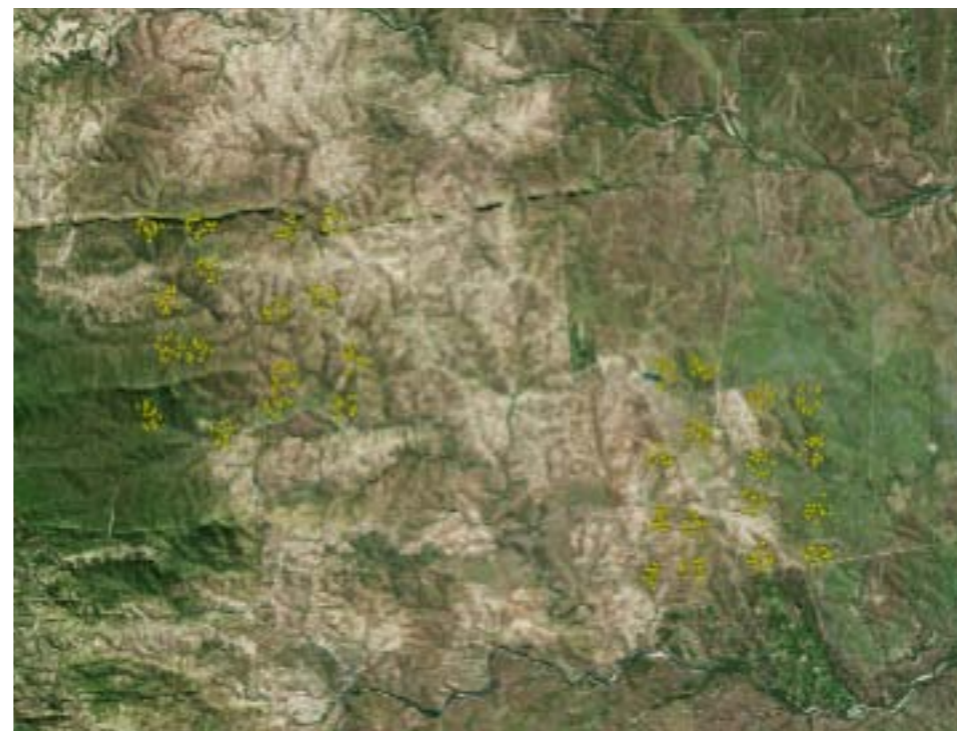
Remote sensing analysis of Landsat and WorldView2 imagery.

Development of a module for range-land health monitoring for incorporation into the LDSF.

Development of a module for improving the assessment of woody cover and biomass in open woodlands, including "trees on farm" for incorporation into the LDSF.

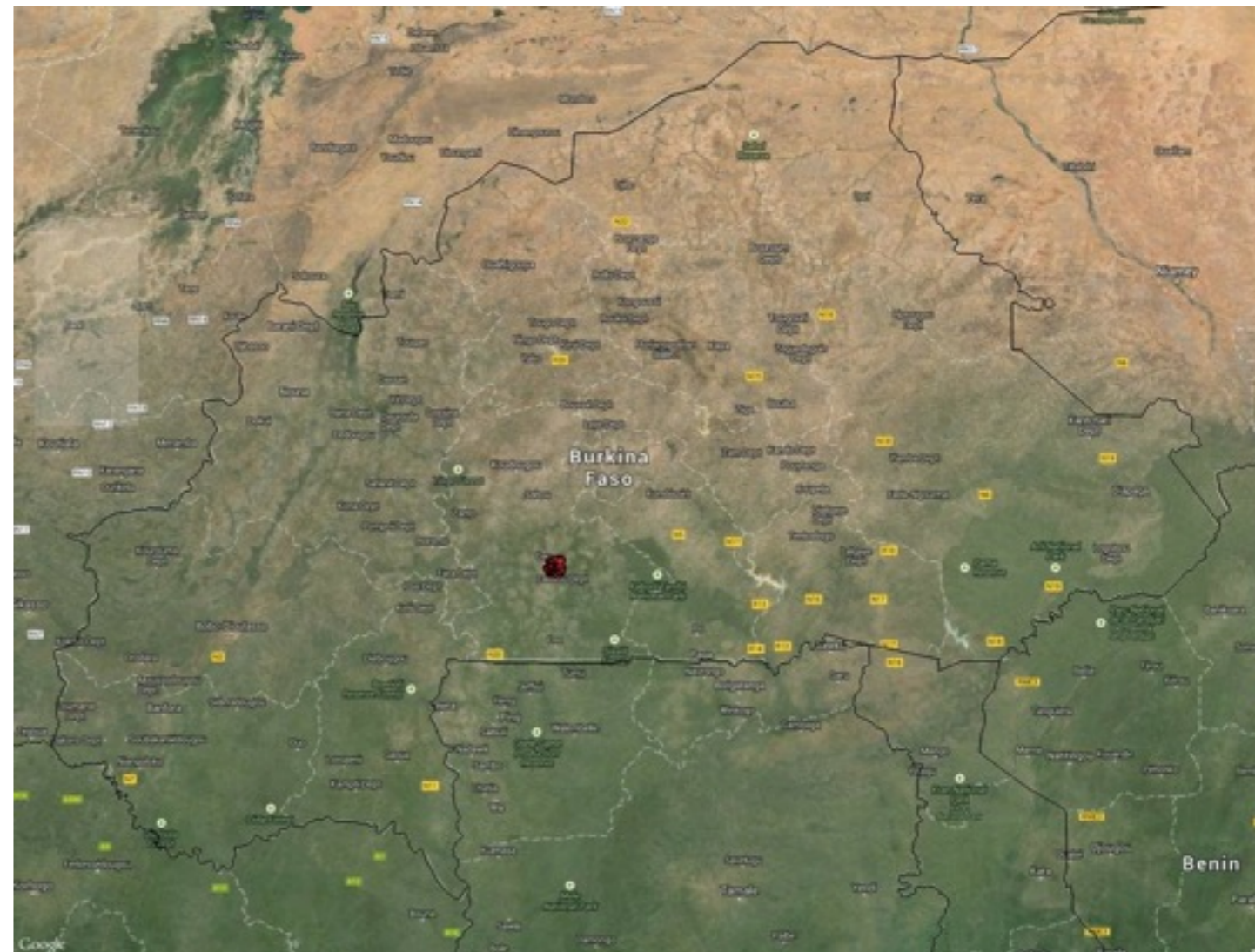
Development of a module for grass and tree biodiversity assessments for incorporation into the LDSF.

Proposal development to support a "work package" on land health assessment as part of the collaboration between ICRAF and SUCSES (Sustainability in Communal Socio-Ecological Systems).



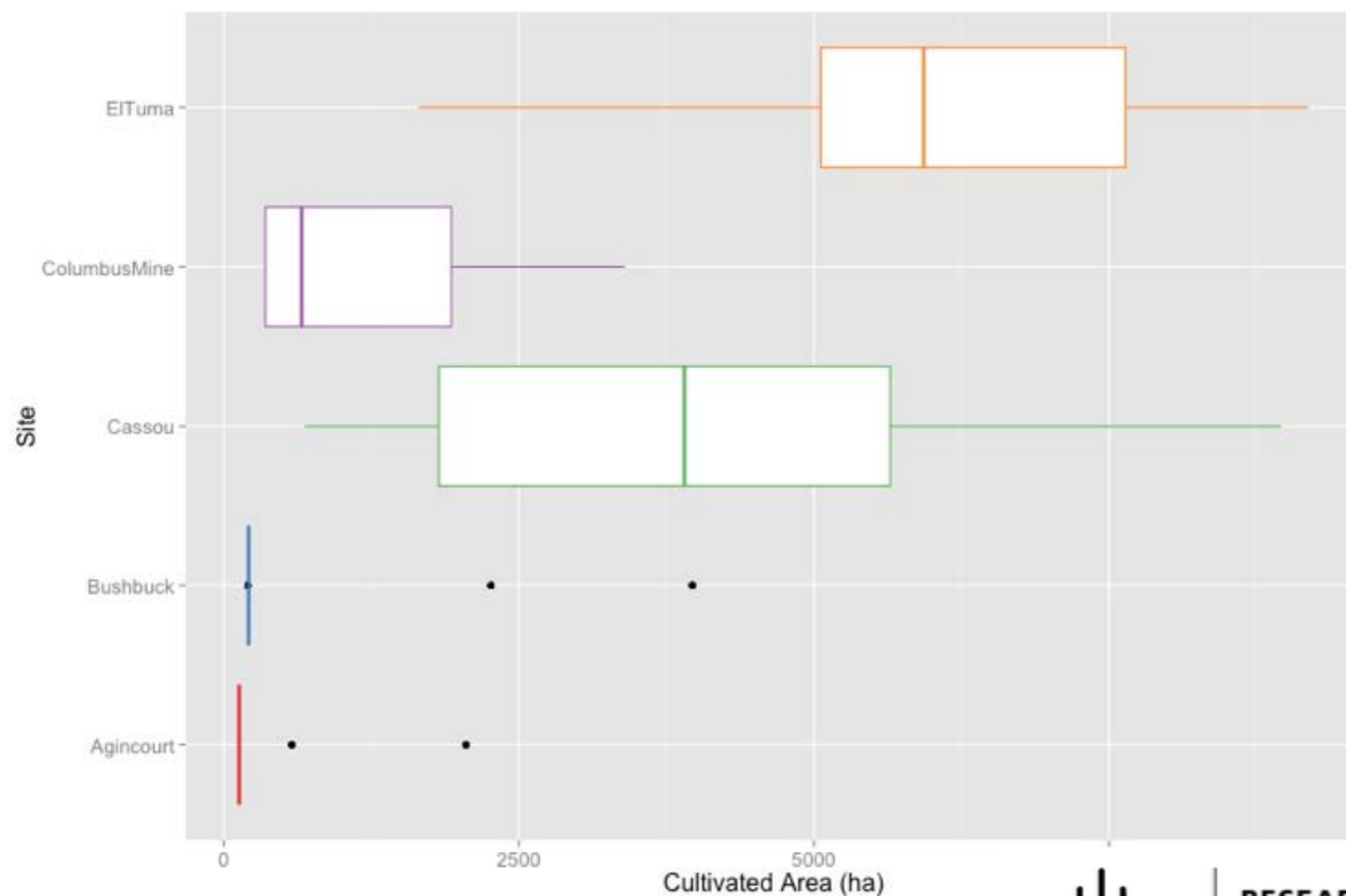
Cross site comparisons: SL - Burkina Faso/WGSL

- One LDSF - 2013:
Cassou, Burkina Faso
- Soil samples are being processed by WASL
- WGSL - March 2014



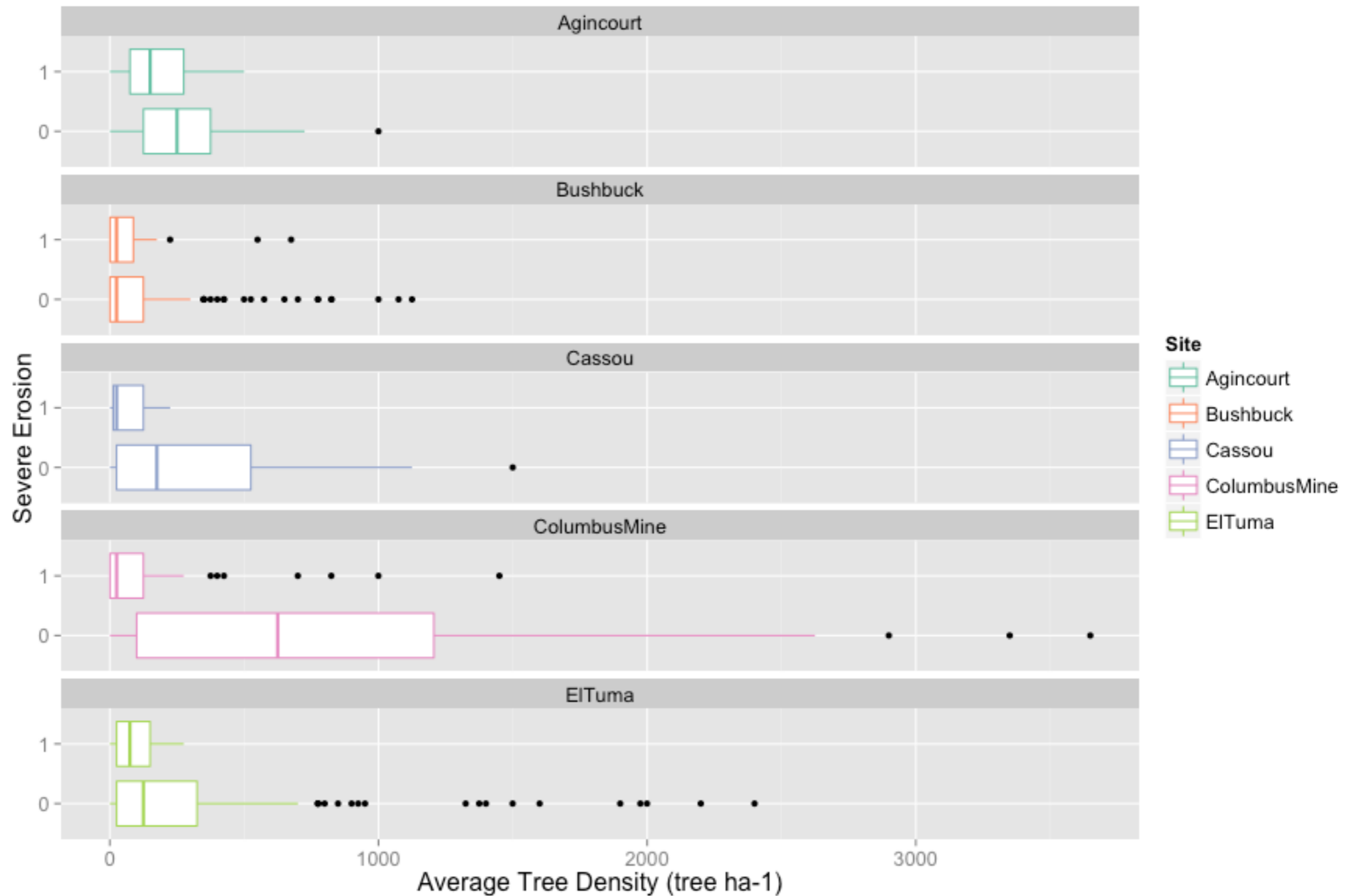
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Cross site comparisons: Cultivated area within the five LDSF sites in the SL

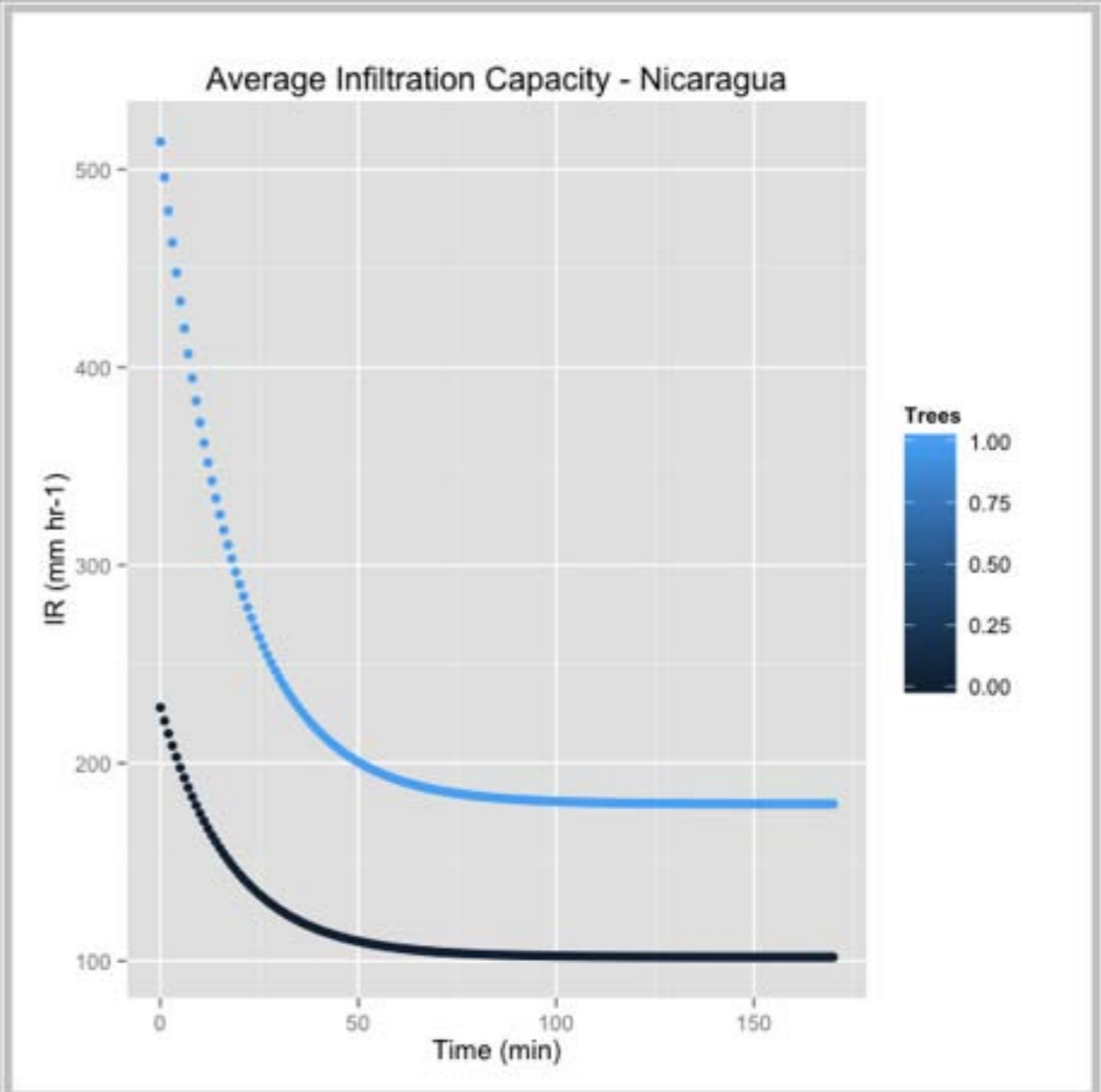
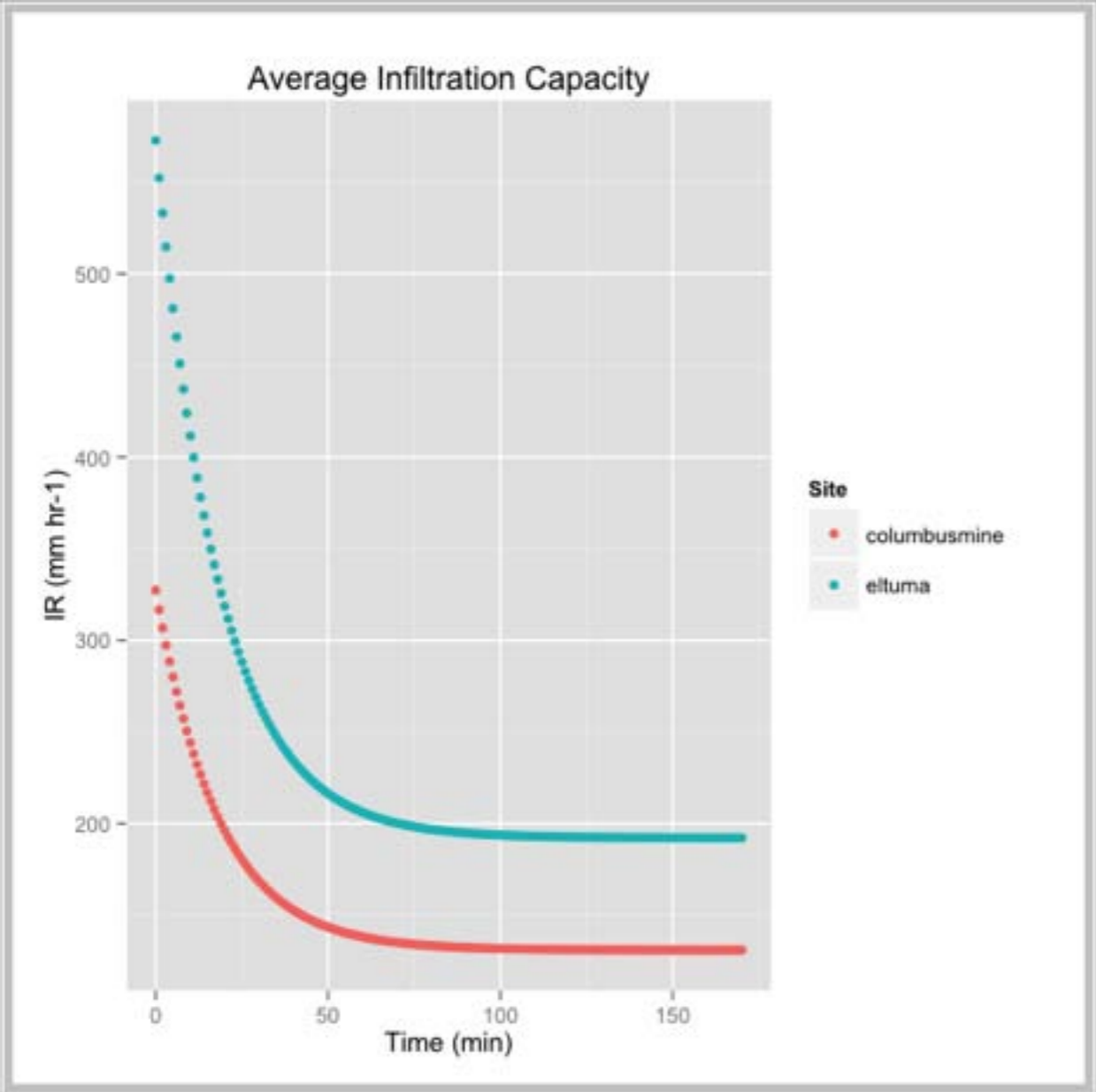


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Cross site comparisons: Trees and Erosion



Nicaragua Infiltration Capacity- Effect of Trees



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What's next.....

- Linking interdisciplinary datasets
- Understanding and linking land health with socio-economic assessments/analysis
- ..
-
- ..Let's open R




Let's Download R & RStudio

Safari File Edit View History Bookmarks Window Help

The R Project for Statistical Computing


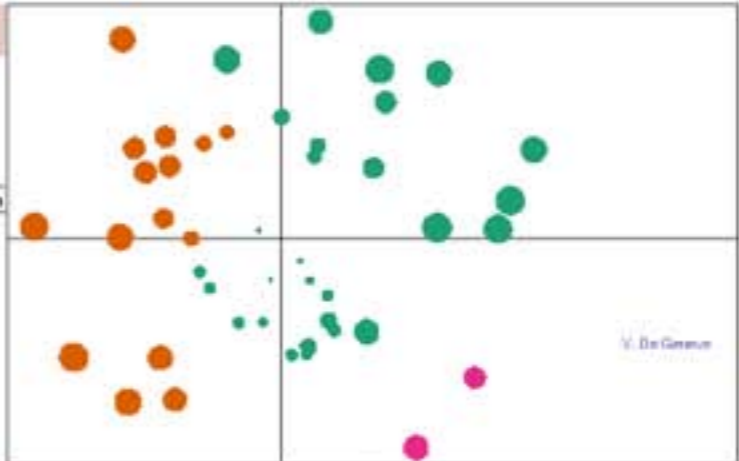
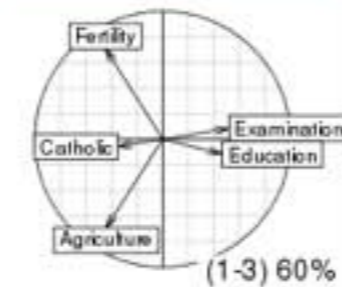
www.r-project.org

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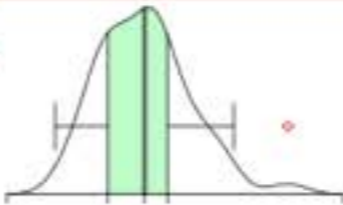
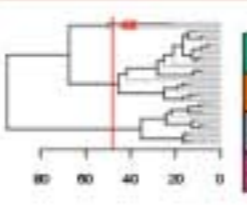


The R Project for Statistical Computing

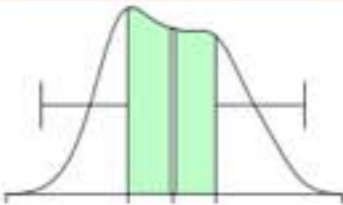
PCA 5 vars
`princpml(x = data, cor = cor)`



Clustering 4 groups



Factor 1 [41%]



Factor 3 [19%]

Groups

28
16
2

Getting Started:

- R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To [download R](#), please choose your preferred [CRAN mirror](#).
- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

News:

- [R 3.0.3 \(Warm Puppy\) prerelease versions](#) will appear starting February 24. Final release is scheduled for March 6, 2014.
- [The R Journal Vol.5/2](#) is available.
- R version 3.0.2 (Frisbee Sailing) has been released on 2013-09-25.
- [useR! 2013](#), took place at the University of Castilla-La Mancha, Albacete, Spain, July 10-12 2013.
- R version 2.15.3 (Security Blanket) has been released on 2013-03-01.

About R
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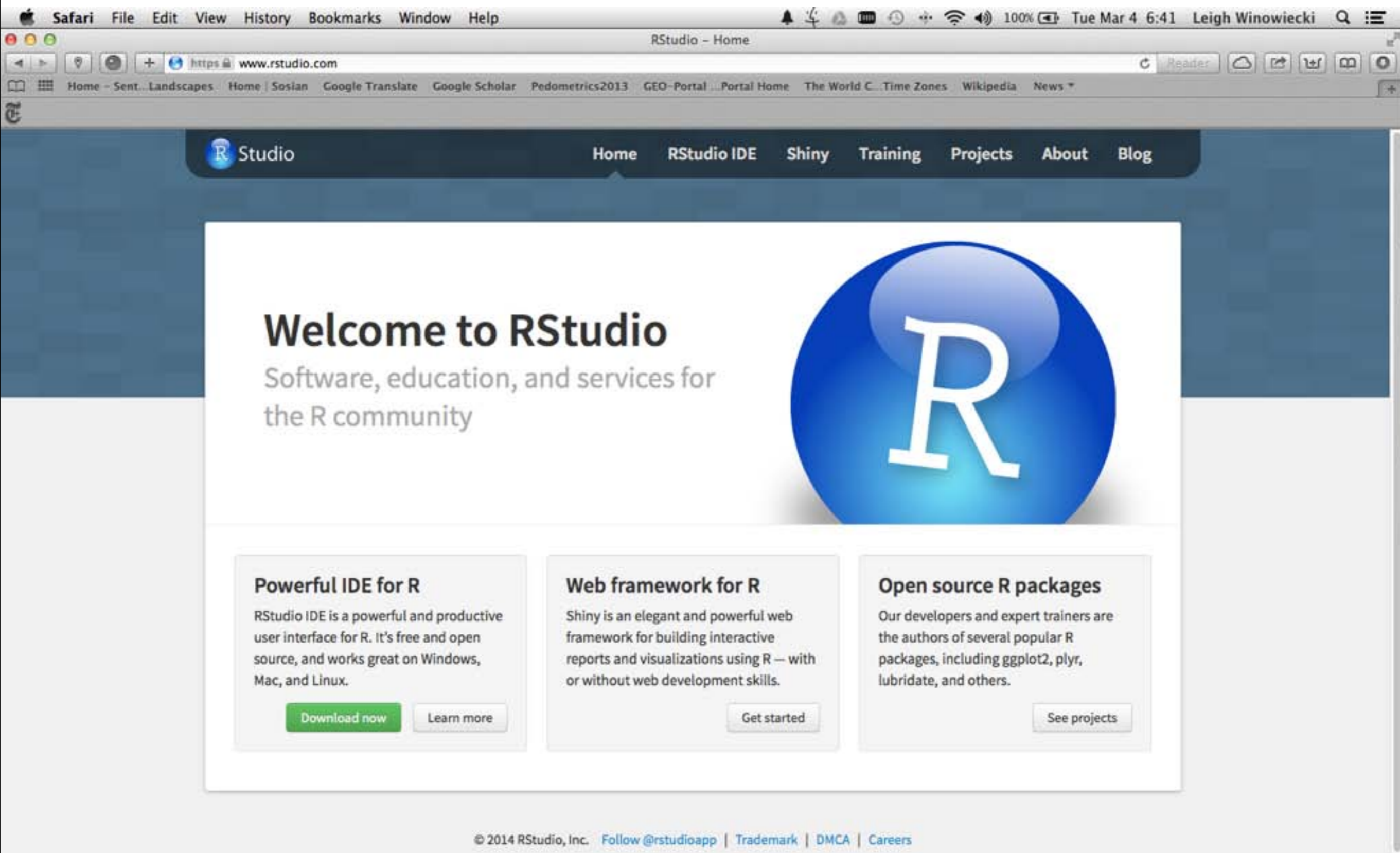
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Let's Download R & RStudio




The image shows a Safari browser window displaying the RStudio homepage. The browser's address bar shows the URL <https://www.rstudio.com>. The page features a dark blue header with the RStudio logo and a navigation menu with links for Home, RStudio IDE, Shiny, Training, Projects, About, and Blog. The main content area is white and contains a large blue circular logo with a white 'R' on the right. On the left, the text reads 'Welcome to RStudio' followed by 'Software, education, and services for the R community'. Below this, there are three columns of text, each with a title and a description, and a corresponding button.

R Studio Home RStudio IDE Shiny Training Projects About Blog

Welcome to RStudio

Software, education, and services for the R community



Powerful IDE for R
RStudio IDE is a powerful and productive user interface for R. It's free and open source, and works great on Windows, Mac, and Linux.
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Web framework for R
Shiny is an elegant and powerful web framework for building interactive reports and visualizations using R — with or without web development skills.
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Open source R packages
Our developers and expert trainers are the authors of several popular R packages, including ggplot2, plyr, lubridate, and others.
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Let's Open R - RStudio - Install Packages

The screenshot shows the RStudio interface with the following components:

- Console:** Displays the R version 3.0.2 (2013-09-25) -- "Frisbee Sailing" and copyright information. It also shows the R license text and workspace loading status.
- Source Editor:** Contains R code for a presentation slide titled "LDSF Infiltration Data Analysis". The code includes a header with author and date, an introduction, and a plot command.
- Install Packages Dialog:** A window titled "Install Packages" with a "Check for Updates" button. It lists various R packages with their descriptions and versions. A red circle highlights this dialog box.

Package Name	Description	Version
abind	Combine multi-dimensional arrays	1.4-0
agricolae	Statistical Procedures for Agricultural Research	1.1-8
agg	Algorithms for Quantitative Pedology	1.6
archetypes	Archetypal Analysis	2.1-2
bitops	Bitwise Operations	1.0-6
boot	Bootstrap Functions (originally by Angelo Canty for S)	1.3-9
car	Companion to Applied Regression	2.0-19
class	Functions for Classification	7.3-9
classInt	Choose univariate class intervals	0.1-21
cluster	Cluster Analysis Extended Rousseeuw et al.	1.14.4
codetools	Code Analysis Tools for R	0.2-8
colorRamps	Builds color tables	2.3
colorspace	Color Space Manipulation	1.2-4
compiler	The R Compiler Package	3.0.2
datasets	The R Datasets Package	3.0.2
deldir	Delaunay Triangulation and Dirichlet (Voronoi) Tessellation.	0.1-1
dichromat	Color Schemes for Dichromats	1.0-0
digest	Create cryptographic hash digests of R objects	0.6.4
dismo	Species distribution modeling	0.9-3
drc	Analysis of dose-response curve data	2.3-96
e1071	Misc Functions of the Department of Statistics (e1071), TU Wien	1.6-2
evaluate	Parsing and evaluation tools that provide more details than the default.	0.5.1
fields	Tools for spatial data	6.9.1
foreign	Read Data Stored by Minitab, S, SAS, SPSS, Stata, Systat, Weka, dBase, ...	0.8-59
formatR	Format R Code Automatically	0.10
Formula	Extended Model Formulas	1.1-1
fossil	Palaeoecological and Palaeogeographical Analysis Tools	0.3.7
gbm	Generalized Boosted Regression Models	2.1
geoR	Analysis of geostatistical data	1.7-4

Install Packages

- lme4
- lattice
- ggplot2

Save the Dataset


- Save the .csv file somewhere on your computer- where you will remember!!!
- IdsfNicaSAWA

Open a New Project in R Studio!!

Project - New -

Set Working Directory

Let's explore the data

A close-up photograph of a Protea flower, likely a Protea nana, showing its characteristic dense, rounded inflorescence. The flower is a vibrant pink color, with numerous stamens protruding from the center. The surrounding foliage consists of thick, green, lance-shaped leaves. A dark rectangular box with a thin white border is centered over the flower, containing the text "Asante!".

Asante!