A Decision Support System to Monitor and Inform Chimpanzee Habitat Management

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UNIVERSITY OF MARYLAND 1856 GLAD GLOBAL LAND ANALYSIS & DISCOVERY

FOUNDATIONS OF SUCCESS

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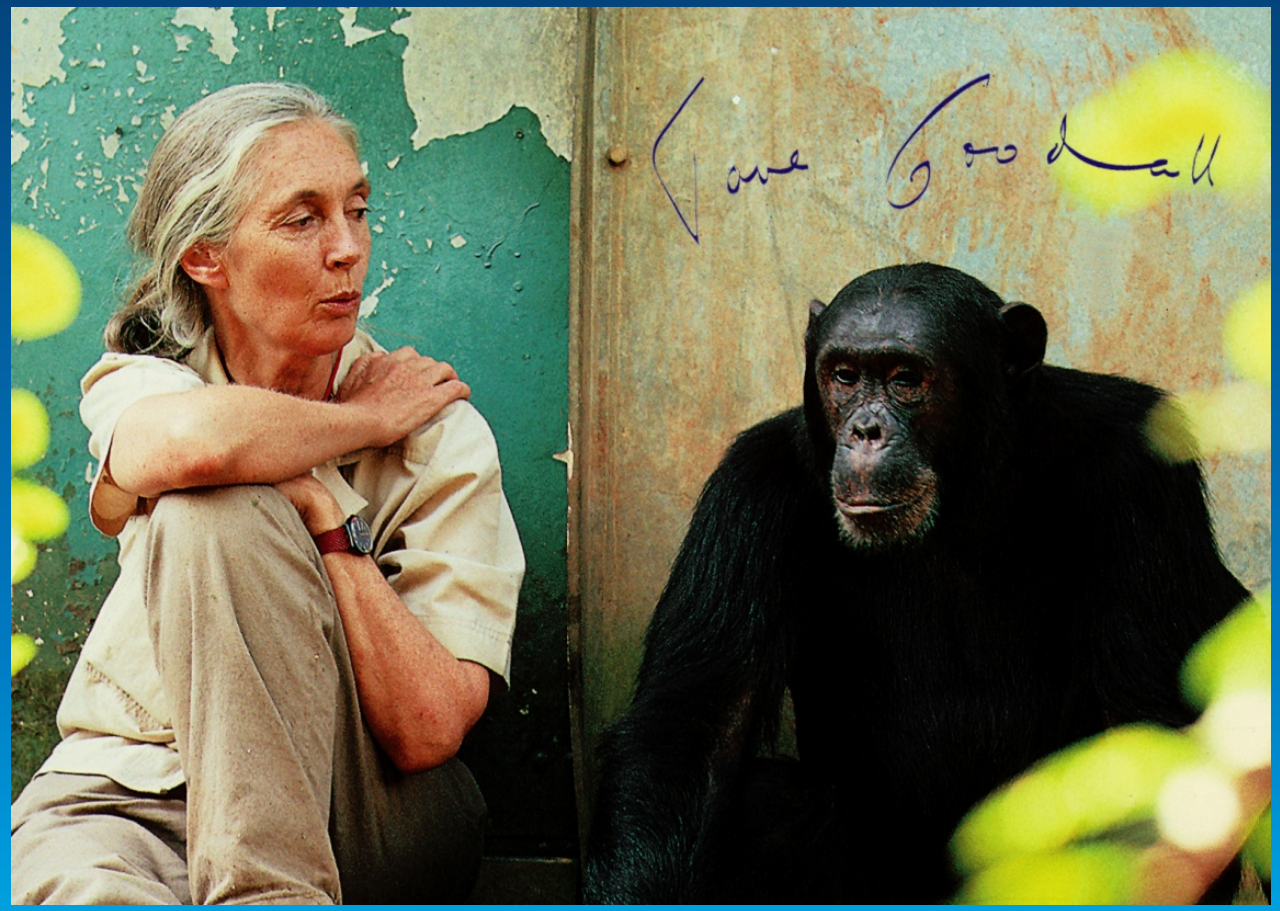
SSC Species Survival Commission

UNEP GRASP GREAT APES SURVIVAL PARTNERSHIP

CMP

The mission of the Jane Goodall Institute is:

to understand and protect chimpanzees, other apes and their habitats, and to work towards creating a critical mass of informed and compassionate citizens who will help to create a better world for people, other animals and our shared environment



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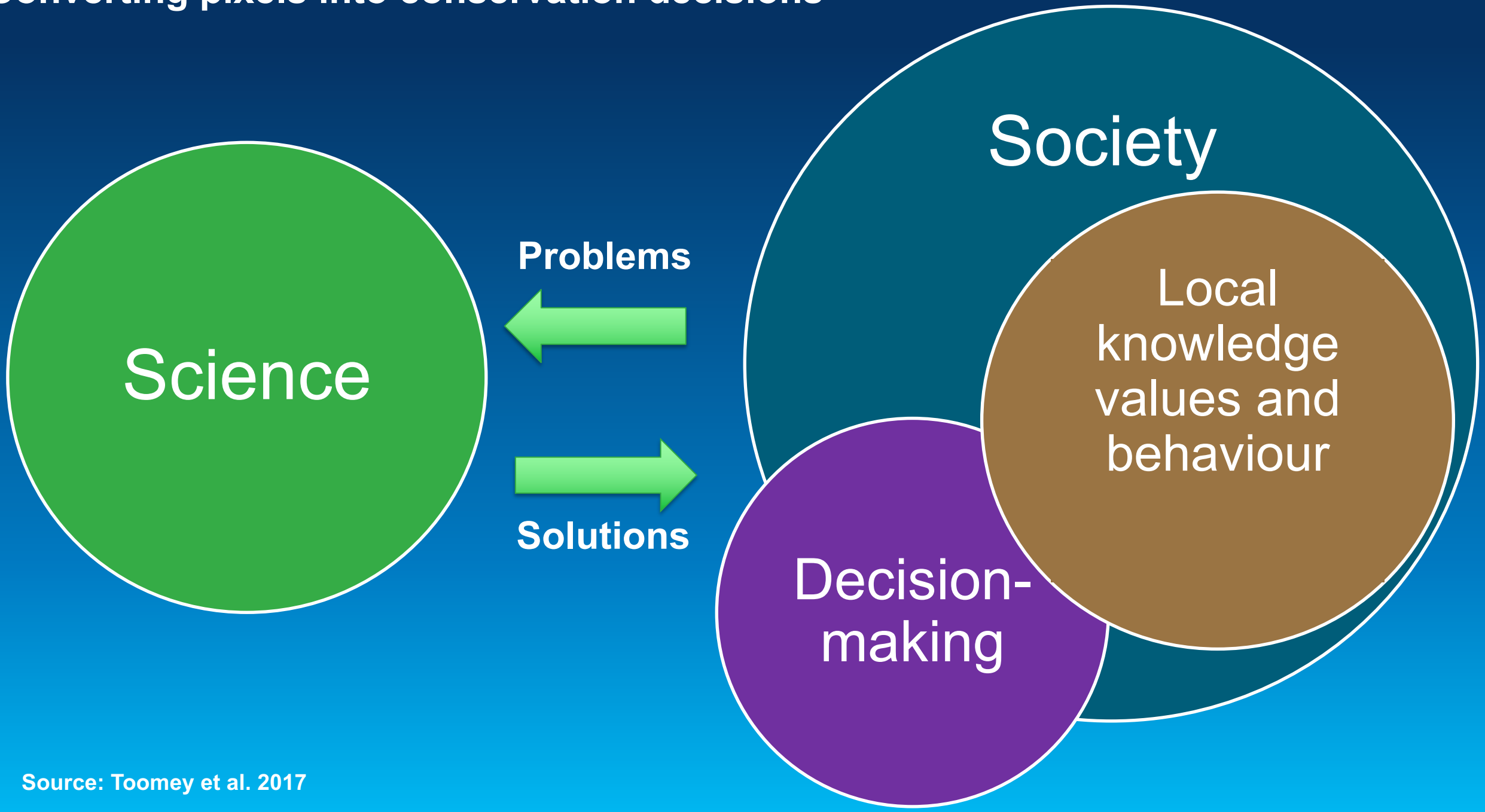
JGI's Conservation Challenges…

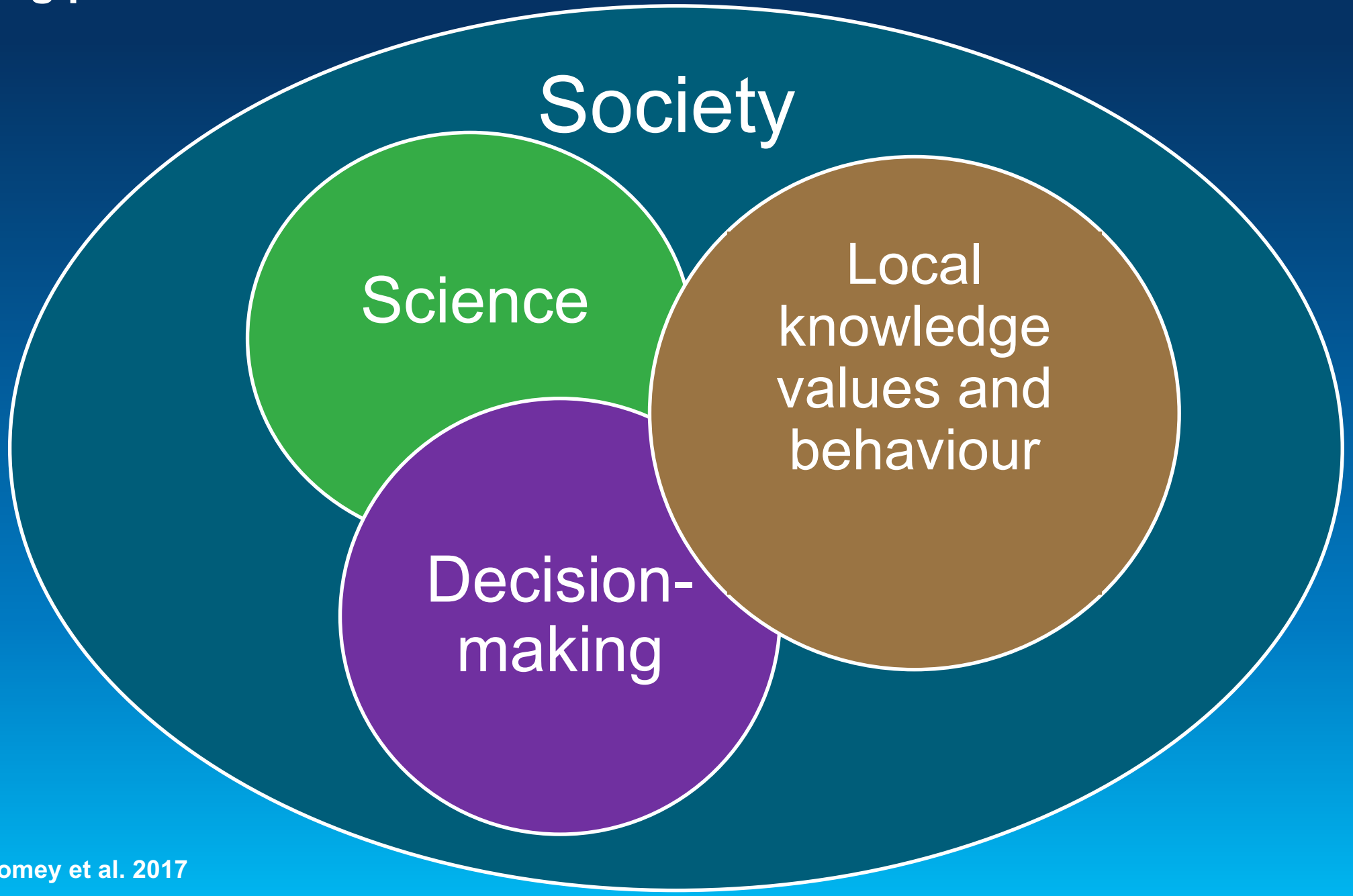
- Chimpanzee and other great apes are facing extinction
- Data and knowledge gaps hinder effective and long-lasting conservation decisions.
- Existing scientific data and information is not incorporated into conservation practice and does not influence the positions or change behaviors of decision-makers.
- Top down global solutions and on-the-ground social situations, capacities and needs in Africa are disconnected.
- Resources are disproportionately invested in developing new products and technologies and do not reach crucial "last mile" where users make choices and decisions impacting the environment.
- Technologies and tools are not developed with conservation applications and users in mind.
- Building capacity to use and maintain the technology and tools are not usually part of the technology development cycle.

Converting pixels into conservation decisions



Source: Toomey et al. 2017

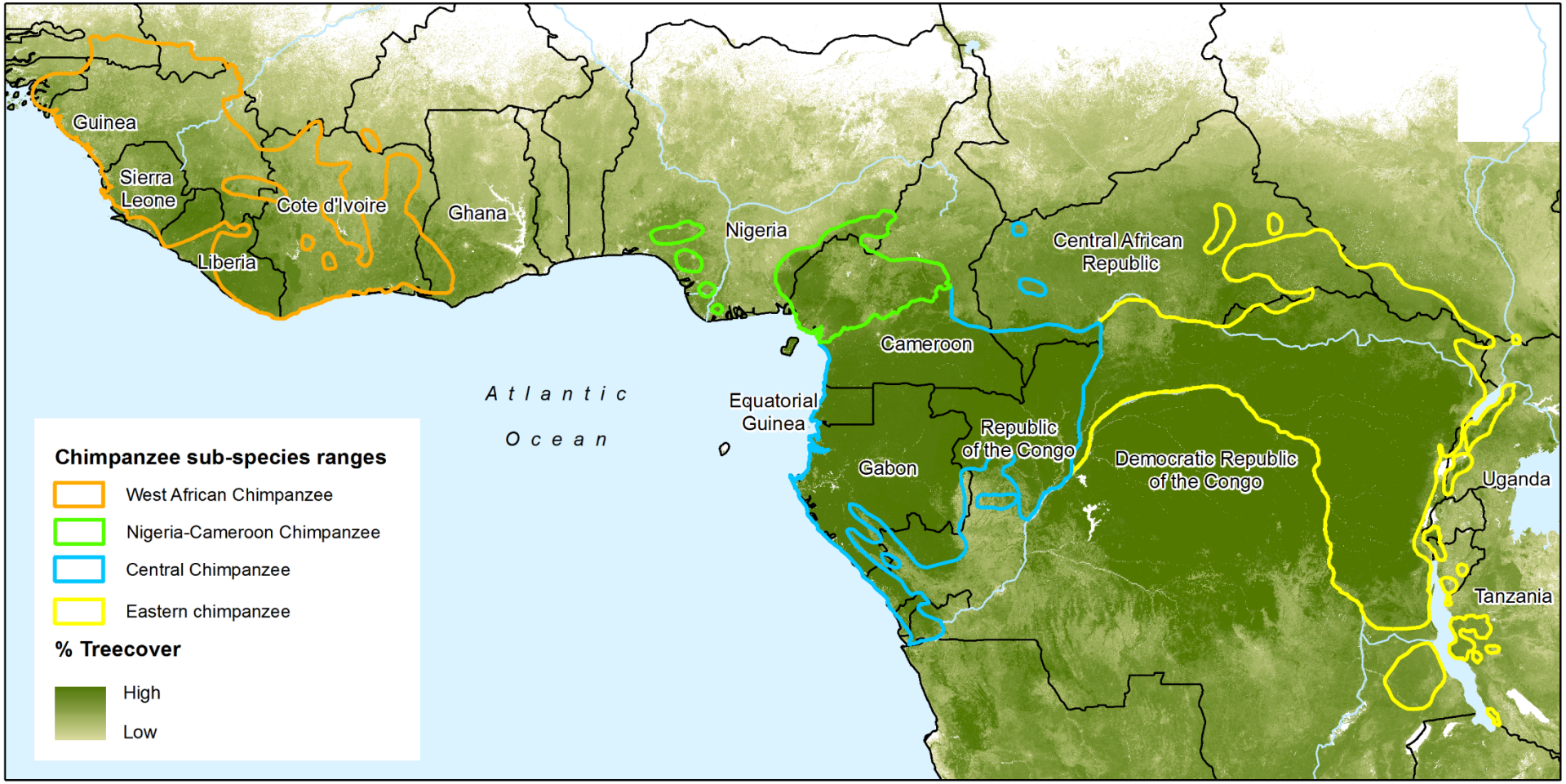
Converting pixels into conservation decisions



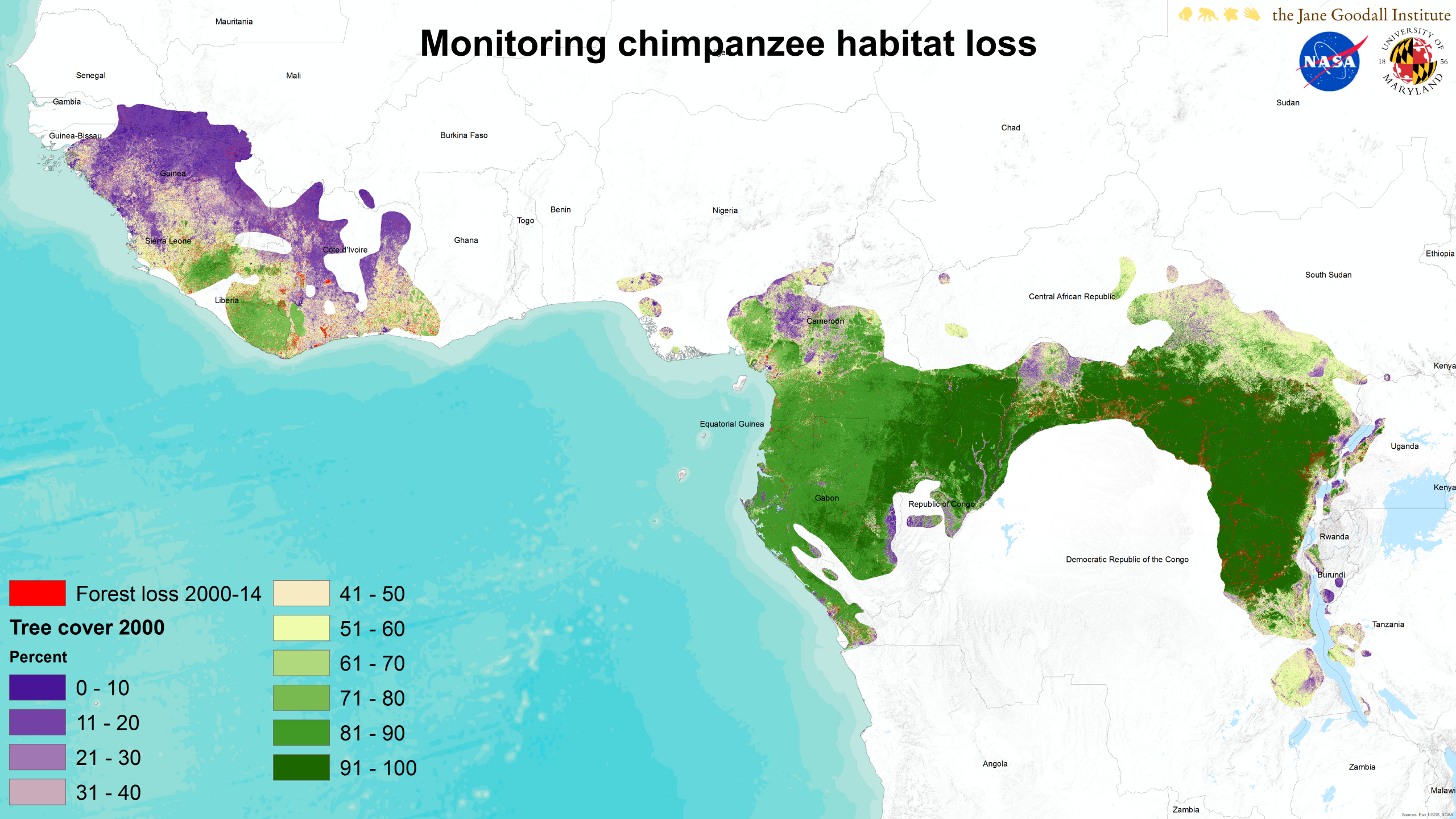
Source: Toomey et al. 2017

DSS Objective & Geographic Scope

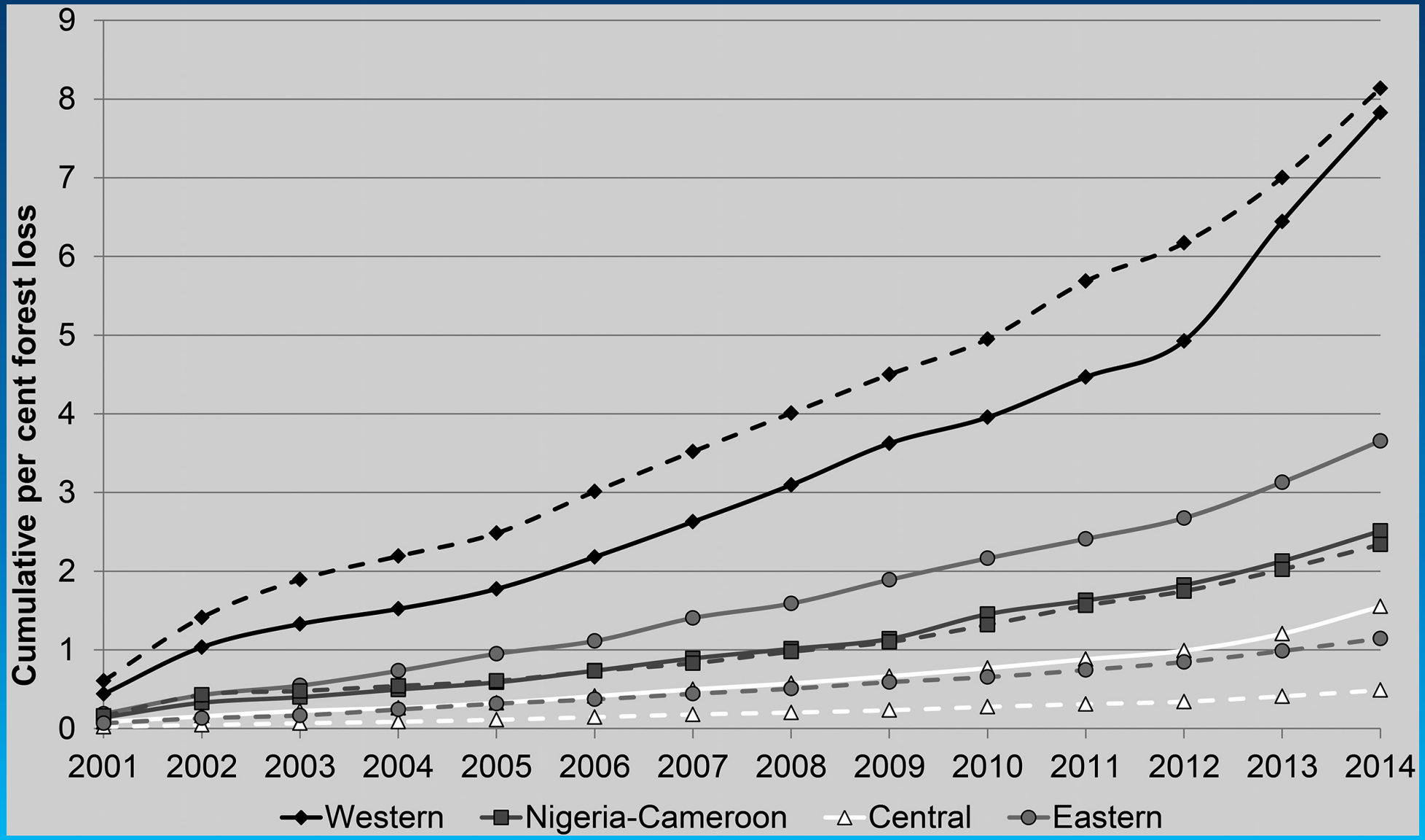
- Develop a practical DSS to be used by the Jane Goodall Institute and partners to annually monitor and forecast chimpanzee habitat conditions to support decision-making from local to species range scales in Africa.
- DSS covers geographic ranges of all four sub-species of chimpanzees.
- Will enable systematic monitoring of habitat change over time.

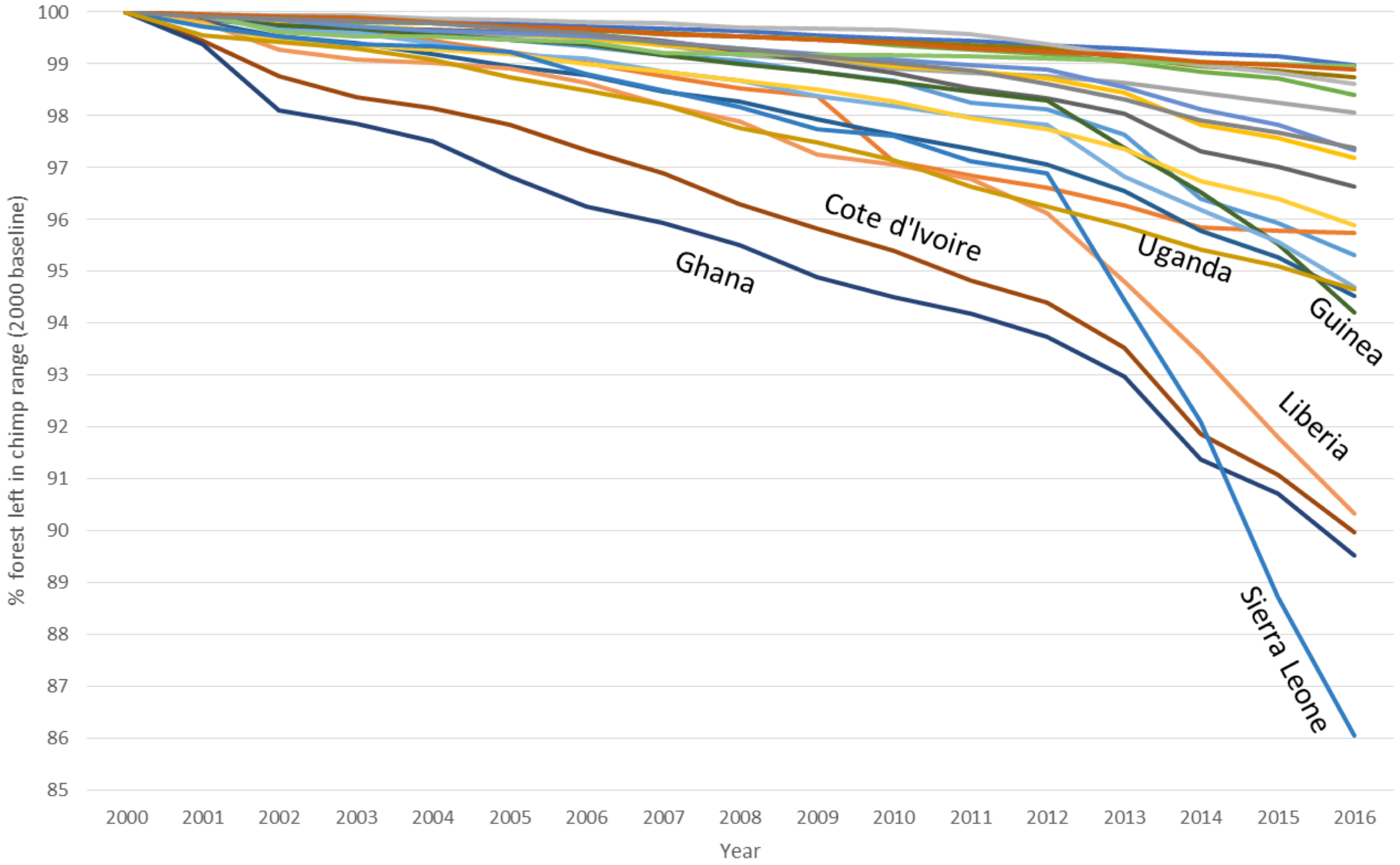


Monitoring chimpanzee habitat loss



Cumulative per cent of annual forest loss taking place within each chimpanzee sub-species' range. Solid lines refer to loss within a subspecies' entire range while dashed lines refer to forest loss taking place only within the protected areas located inside each species' range.




100
99
98
97
96
95
94
93
92
91
90
89
88
87
86
85
% forest left in chimp range (2000 baseline)
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Year
Ghana
Cote d'Ivoire
Uganda
Guinea
Liberia
Sierra Leone

remote sensing

Article

Modelling Range-Wide Chimpanzee (*Pan troglodytes*) Habitat Suitability Based on Landsat ETM+ and SRTM Data to Aid Conservation Efforts

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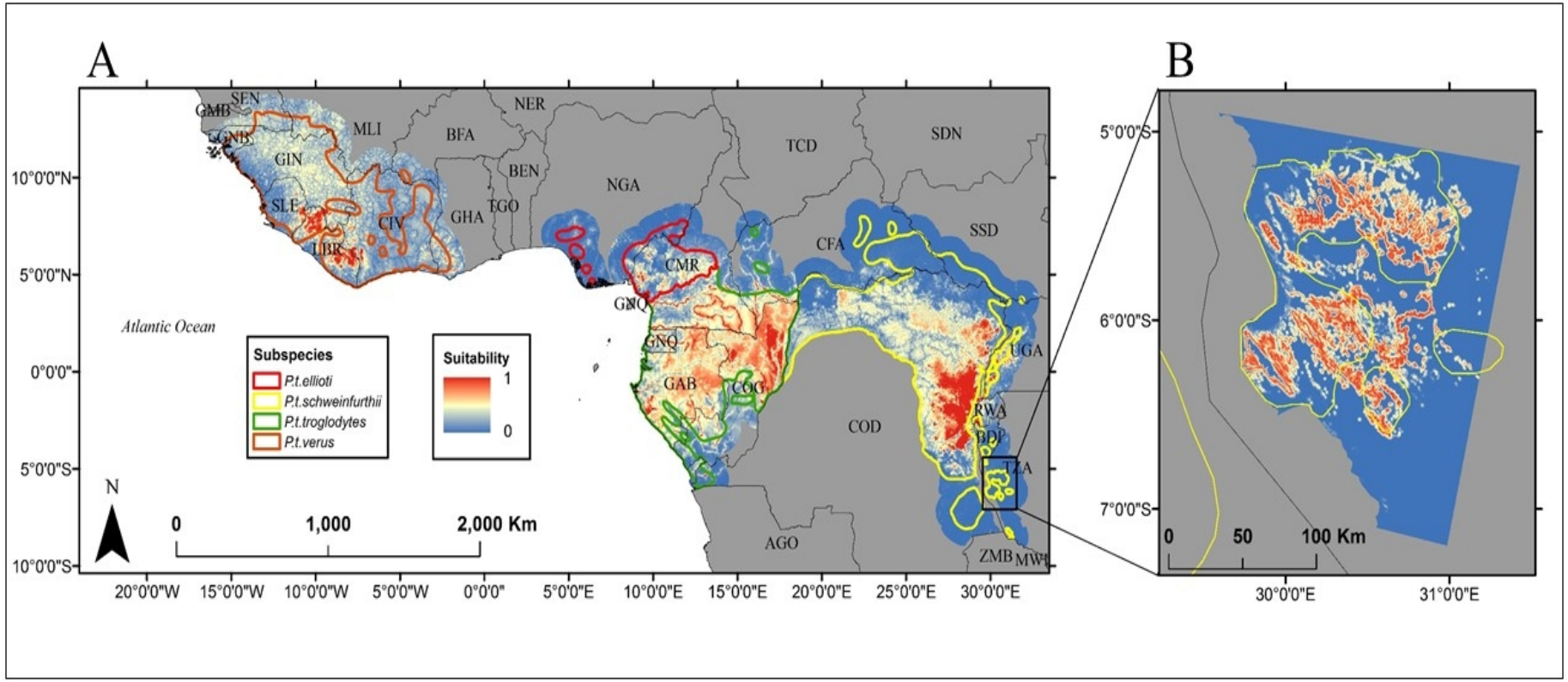
* Correspondence; E-Mail: sjantz@umd.edu



Satellite-derived Input Data

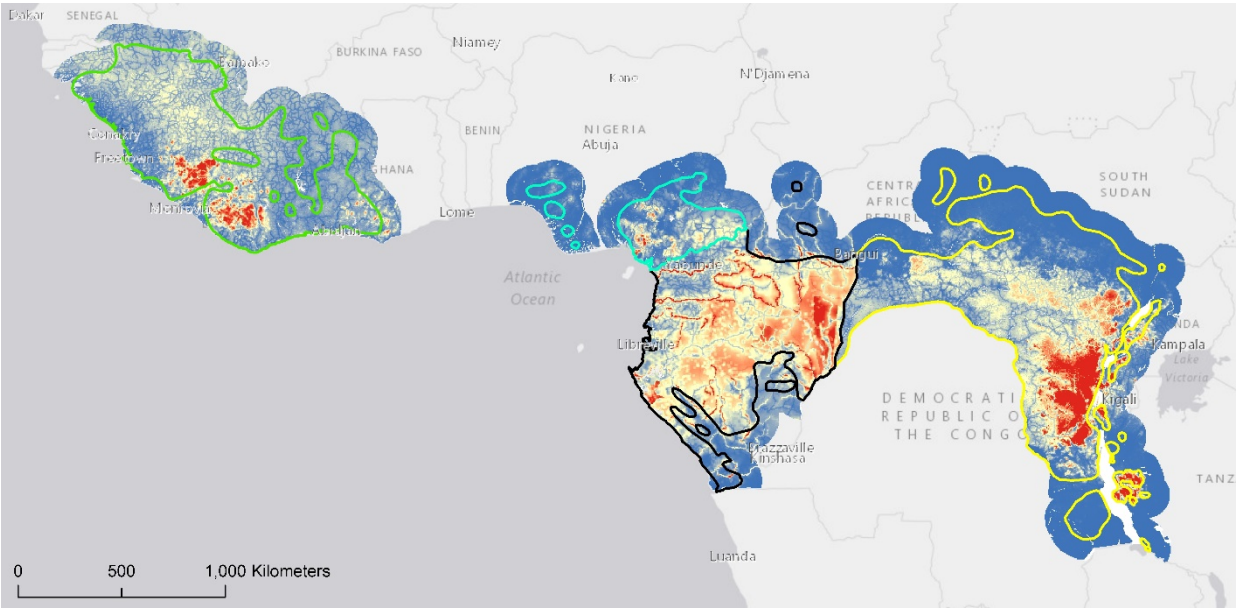
15 Landsat ETM+ based "dynamic" variables derived from Hansen et al. (2013) data.

Spectral
Band 3 median reflectance 2000-2005
Band 4 median reflectance 2000-2005
Band 5 median reflectance 2000-2005
Band 7 median reflectance 2000-2005
Normalized difference (band4/band3)
Normalized difference (band4/band5)
Normalized difference (band4/band7)
band3/band5
band3/band7
band5/band7
Forest structure
Percent canopy cover
Canopy height
Percent bare ground
Disturbance and fragmentation
Proximity to forest loss (minimum 0.5 ha)
Proximity of interior forest to forest edge (minimum 1 ha patch size)
Topographic
Elevation
Slope
Proximity to steep slopes (>15°)
Proximity to rivers

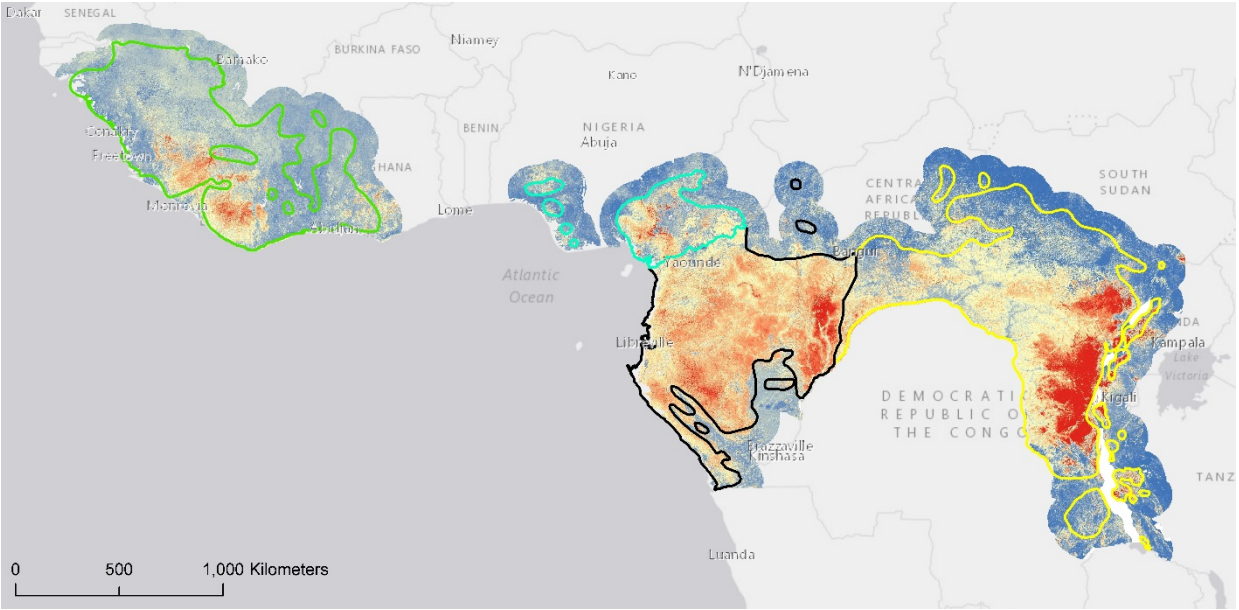
5 Shuttle Radar Topography Mission based "static" variables.

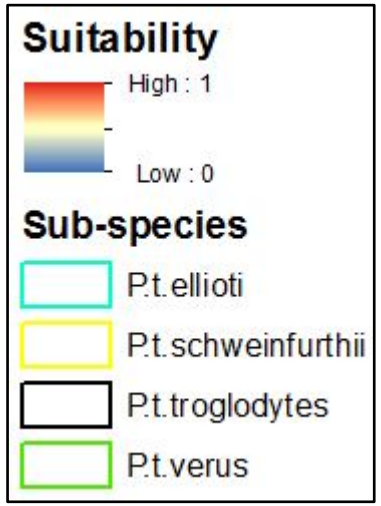
Crowdsourcing data from community monitoring, ranger patrols, research surveys, and UAVs)

5km resolution

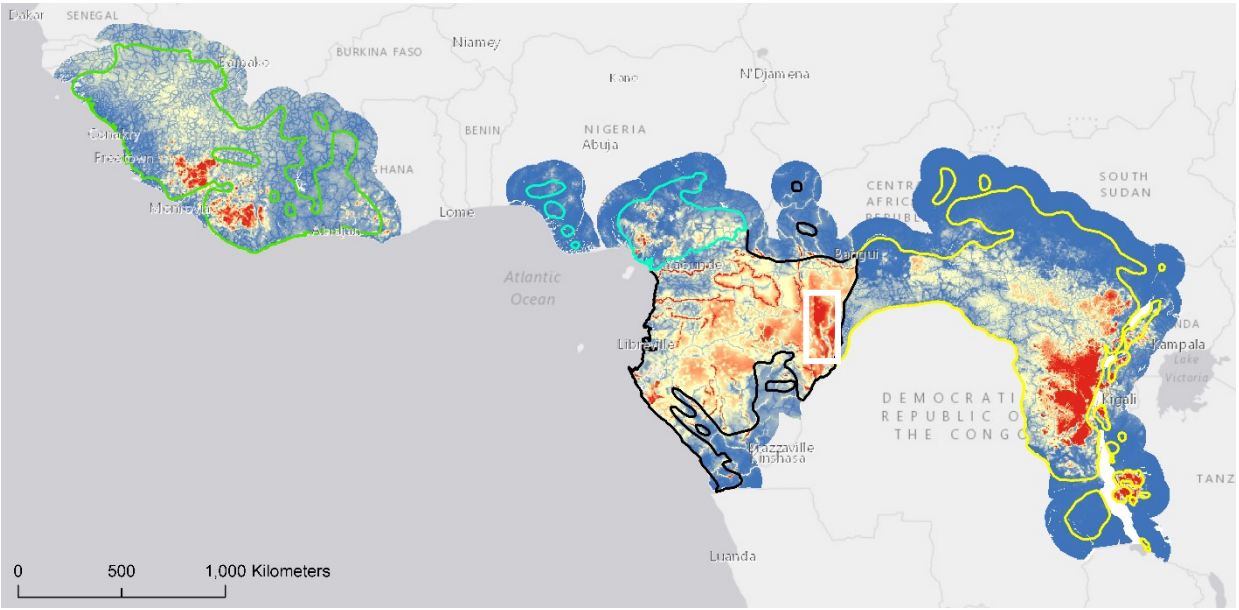


30m resolution

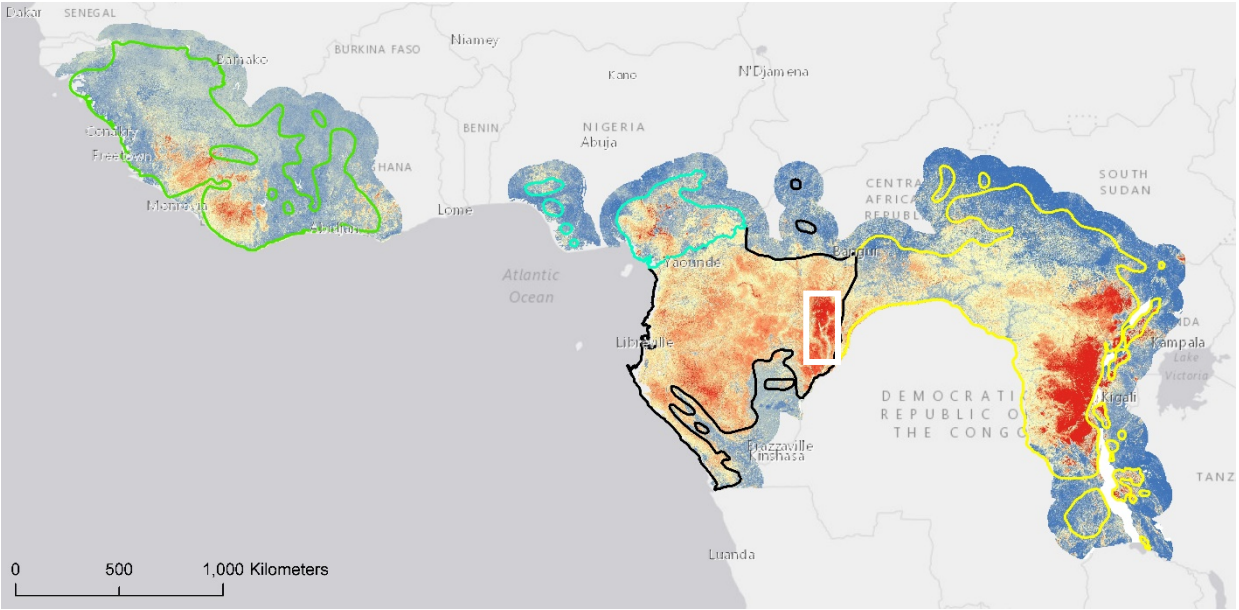


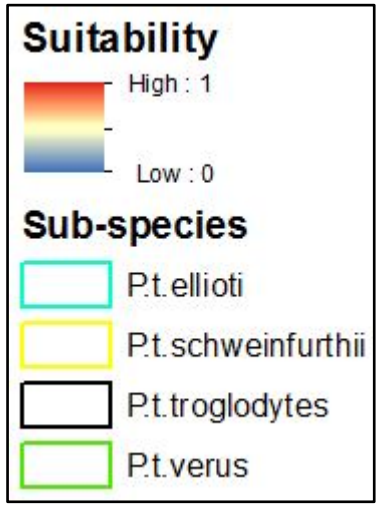


5km resolution

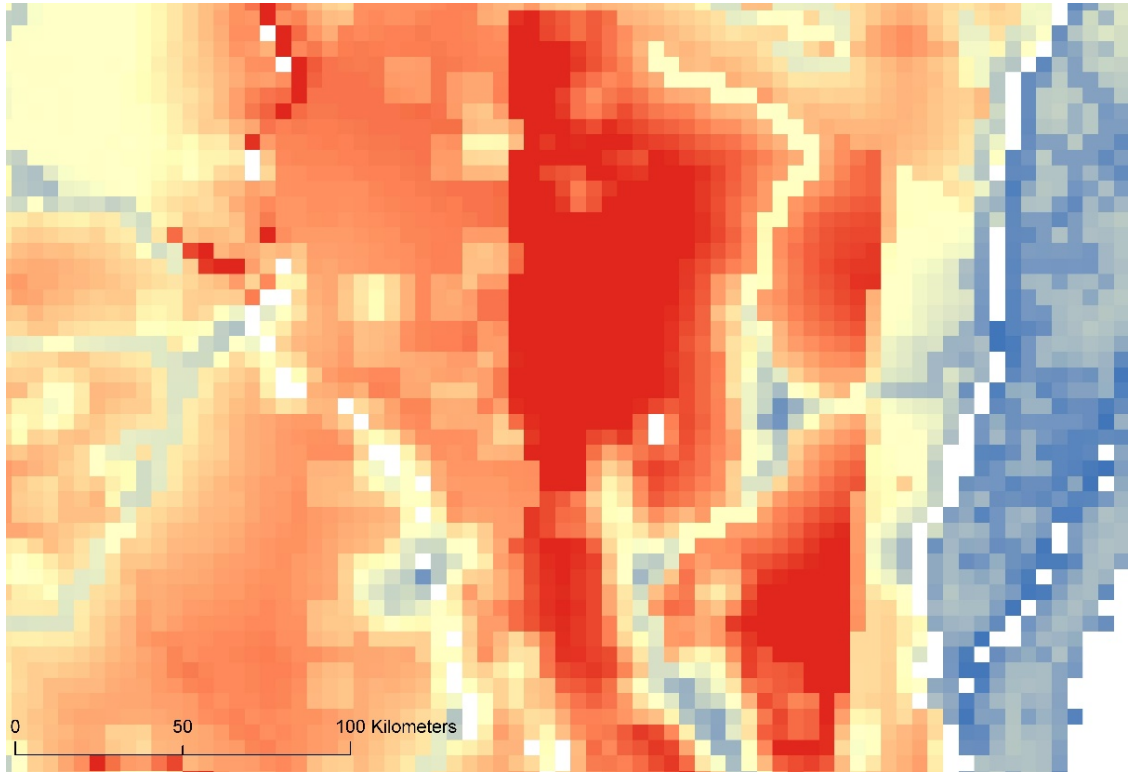


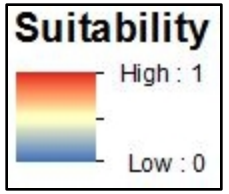
30m resolution



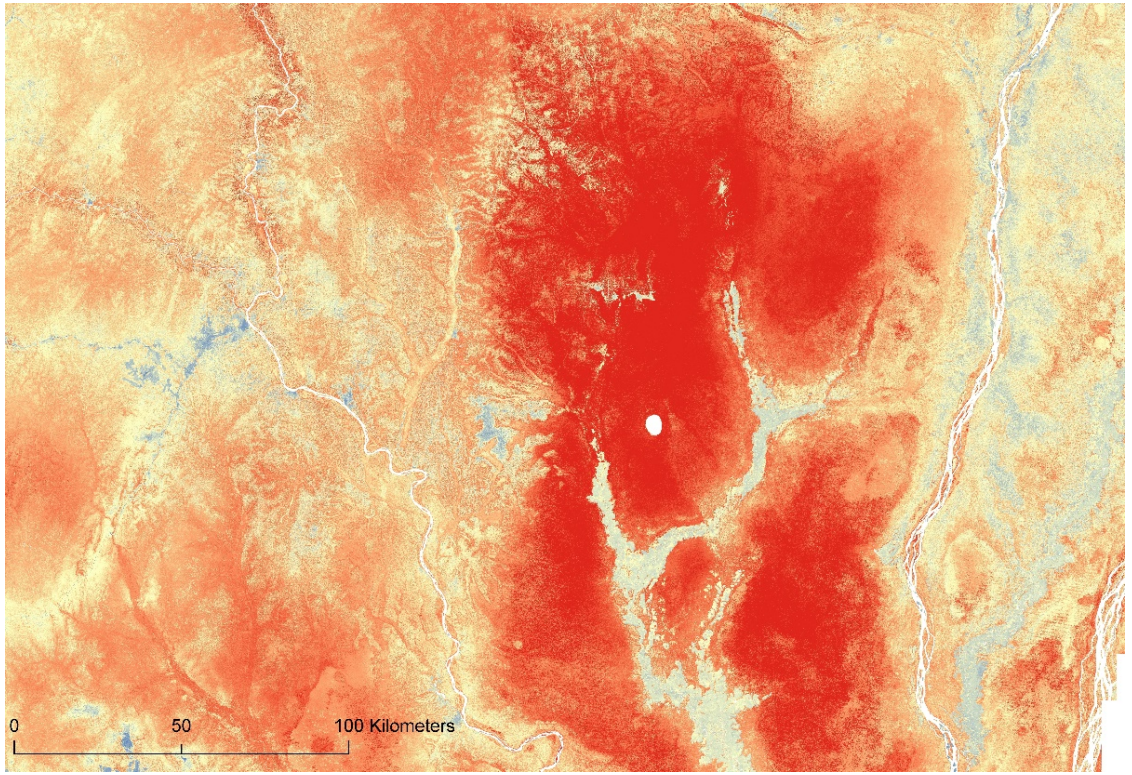


5km resolution

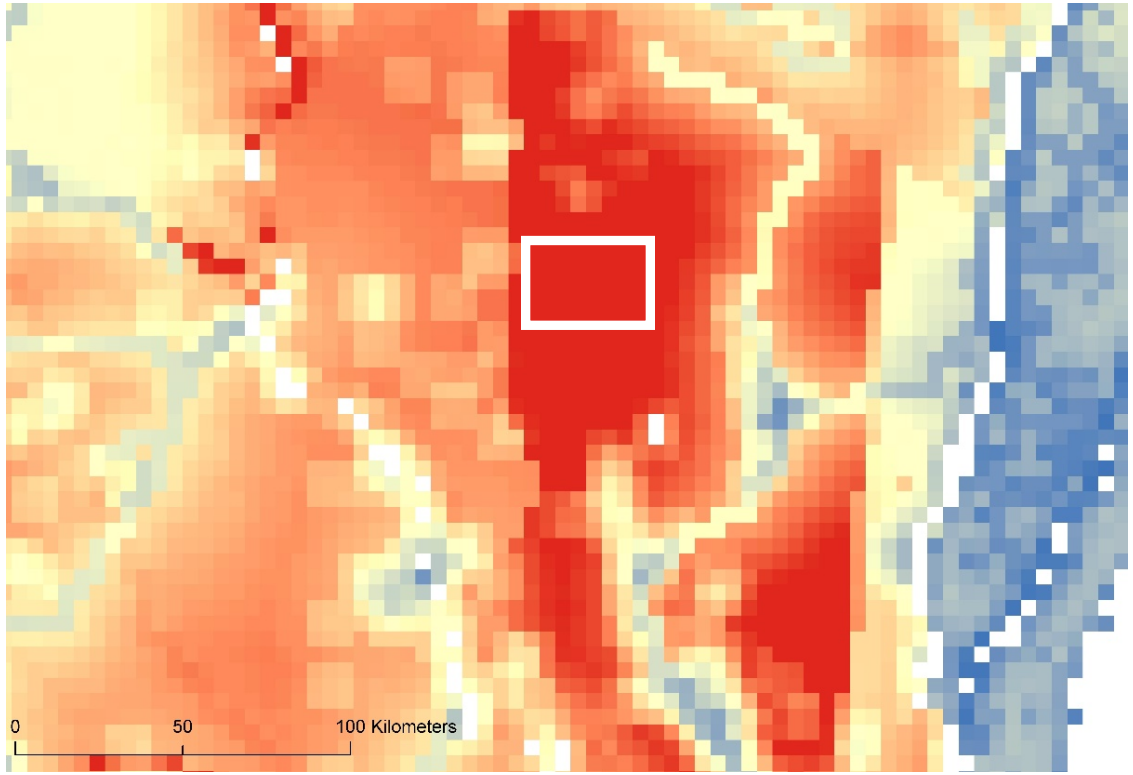


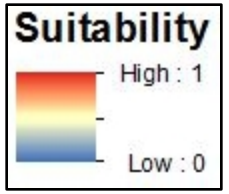


30m resolution

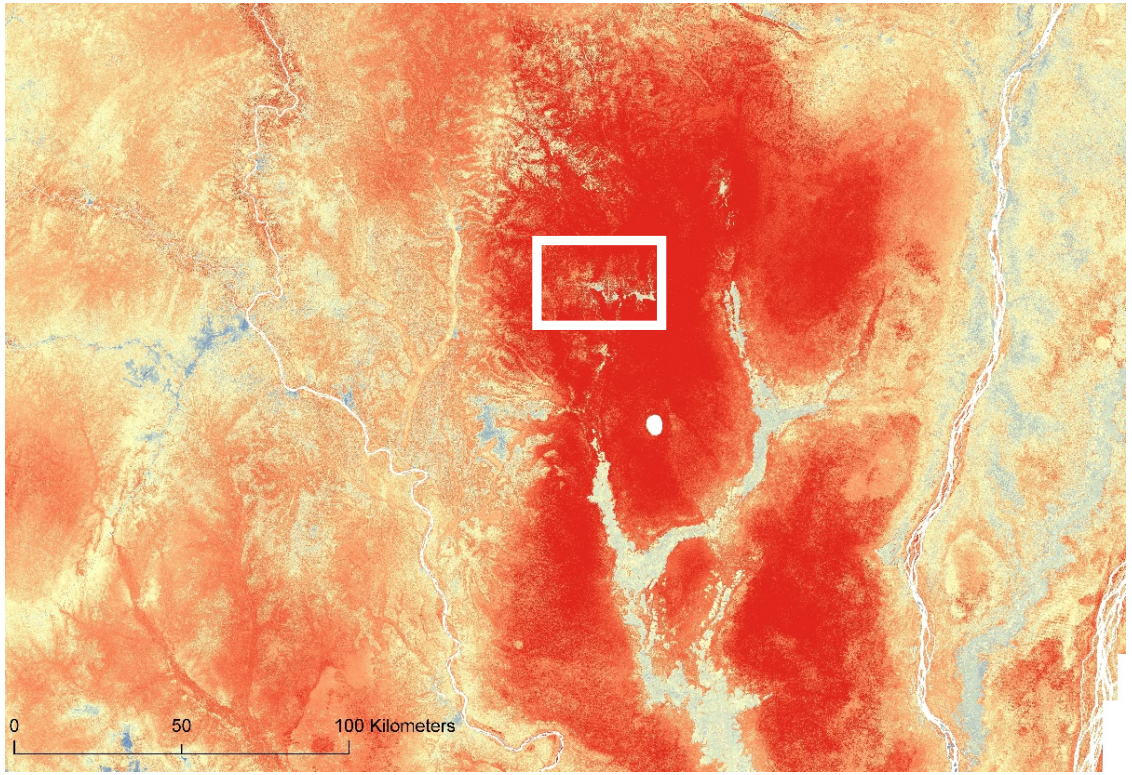


5km resolution

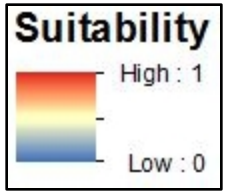




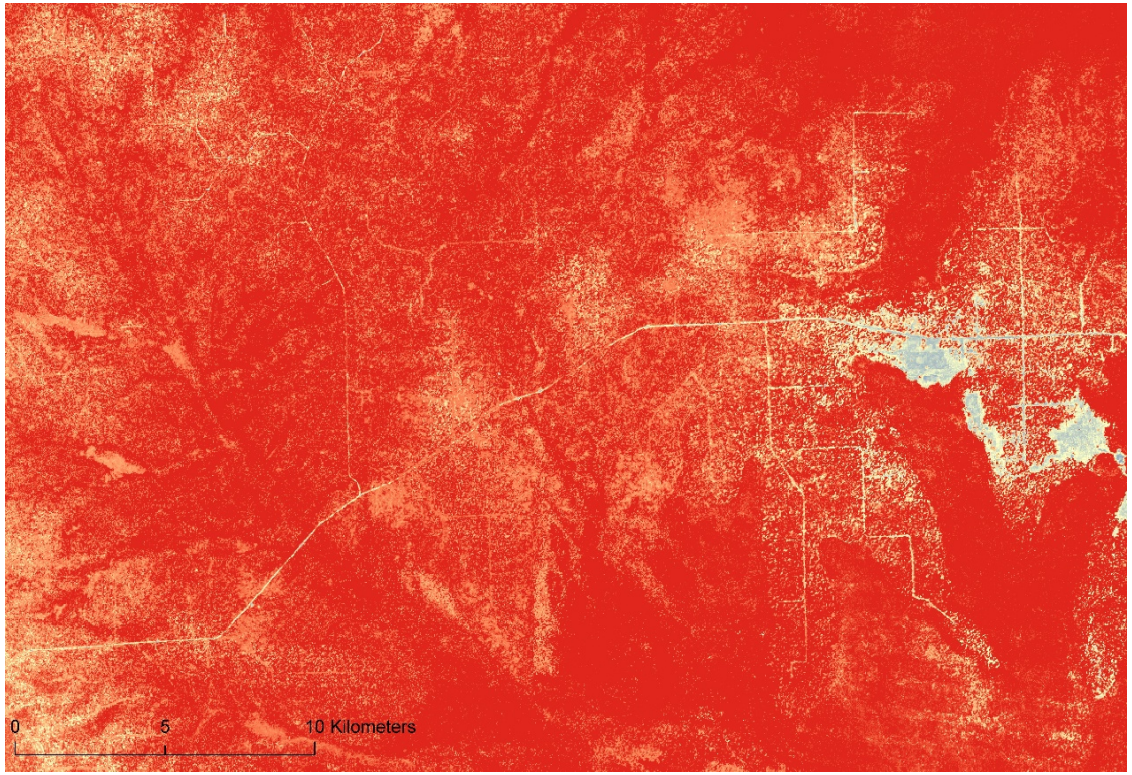
30m resolution

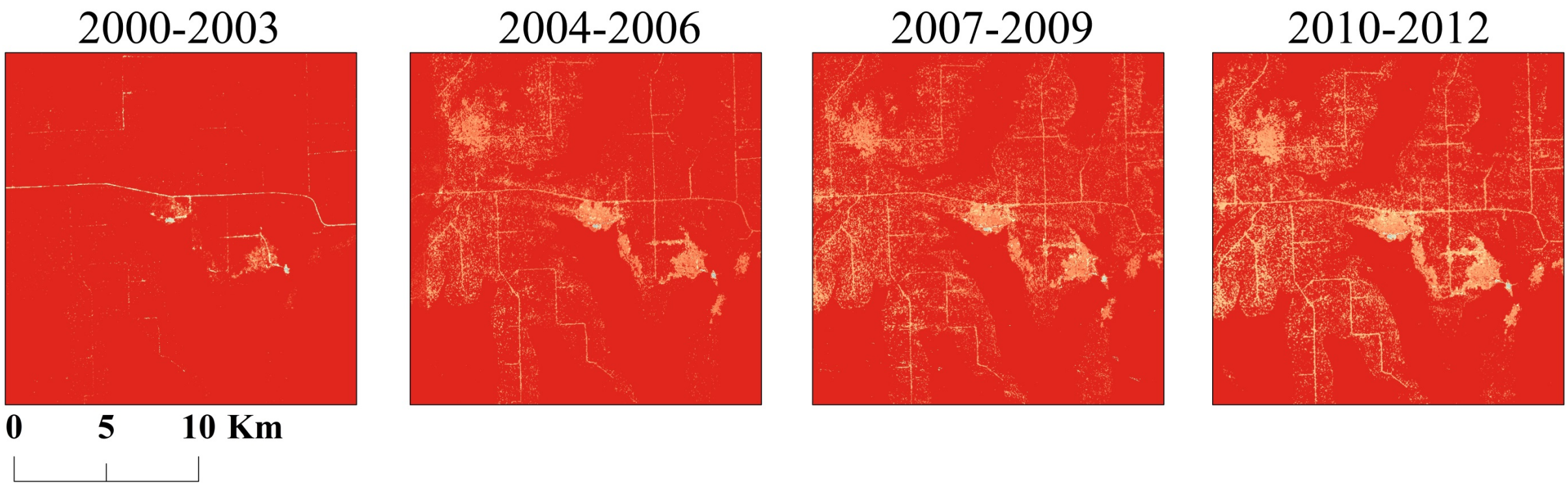


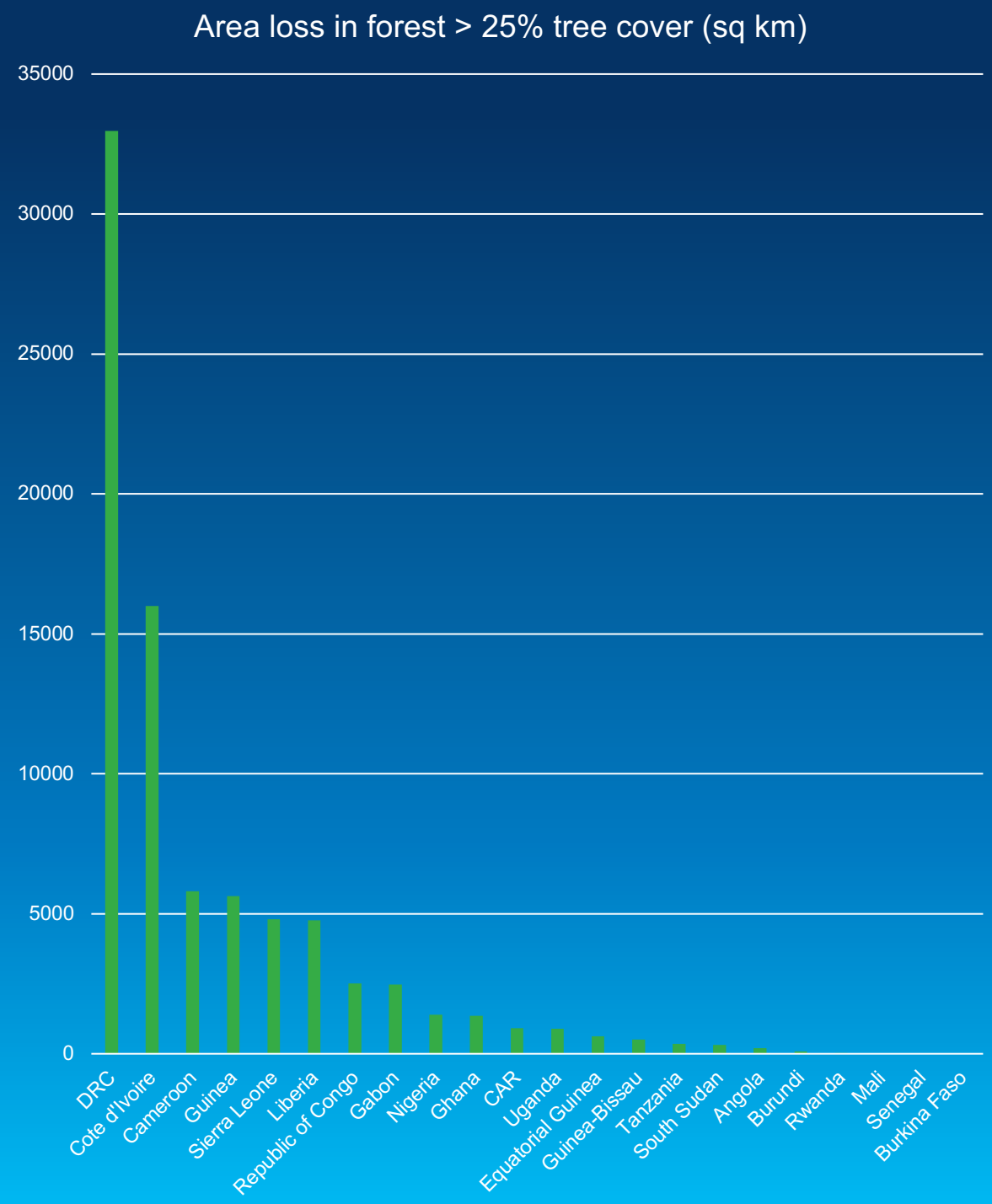
5km resolution

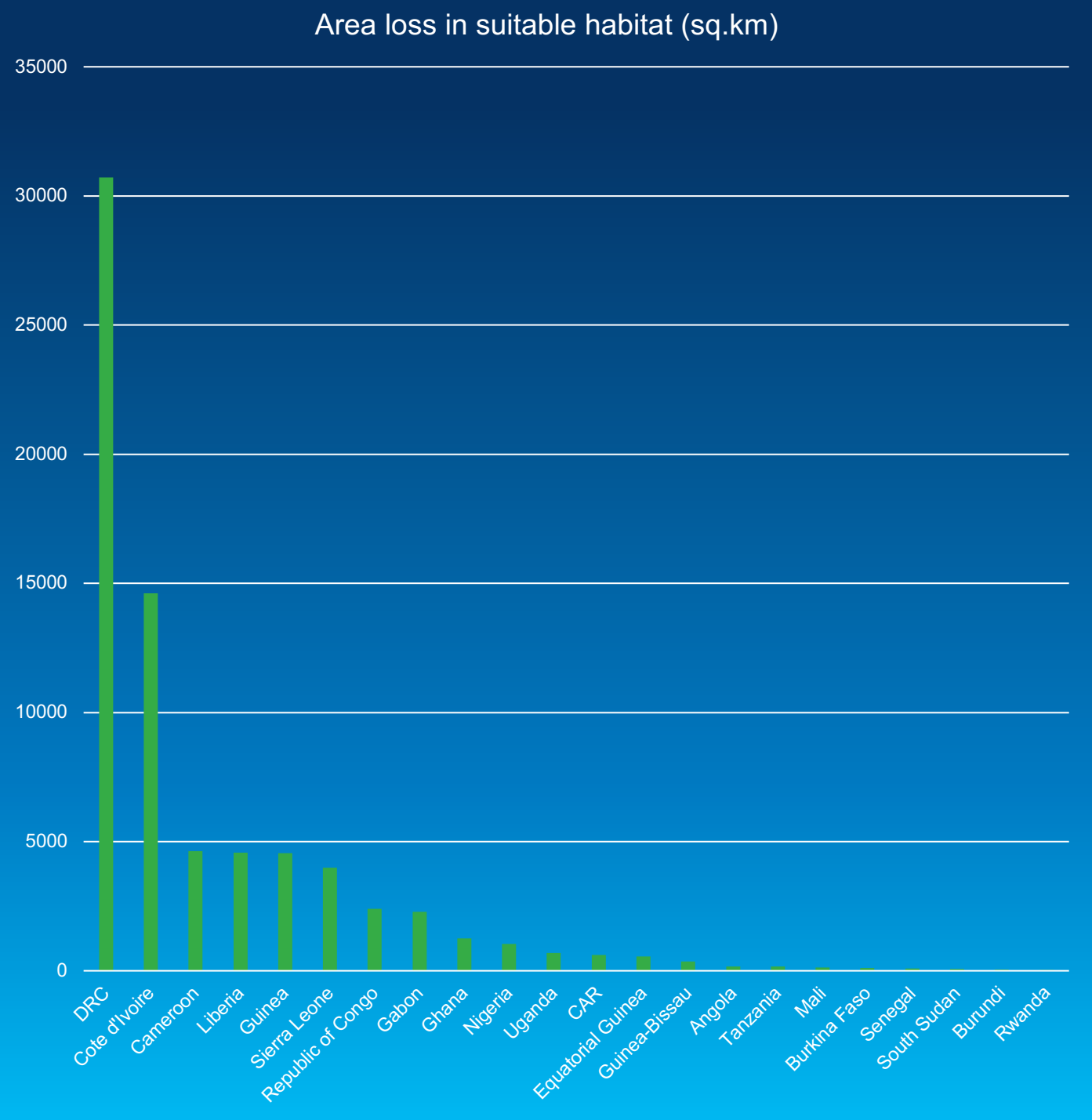


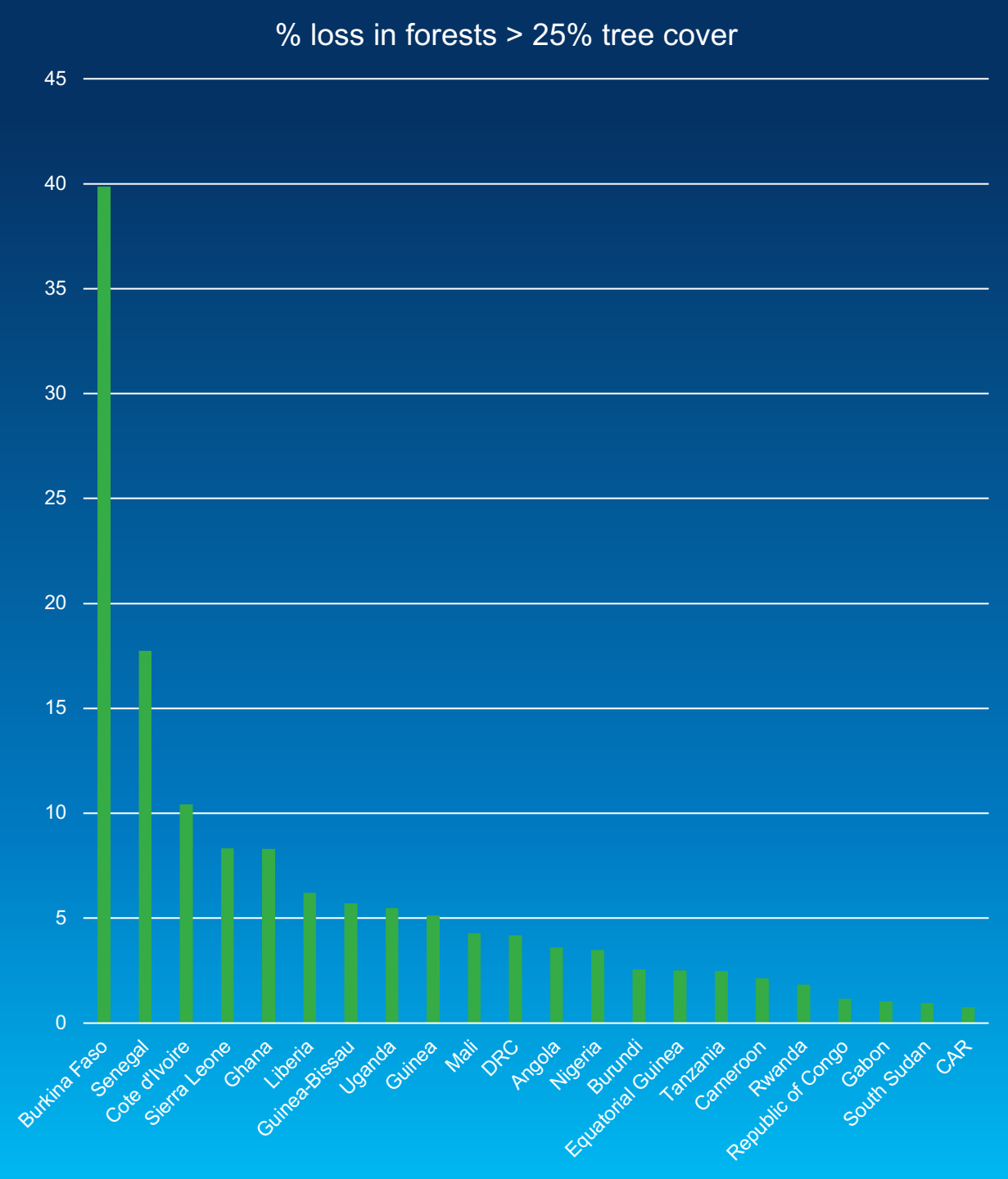
30m resolution

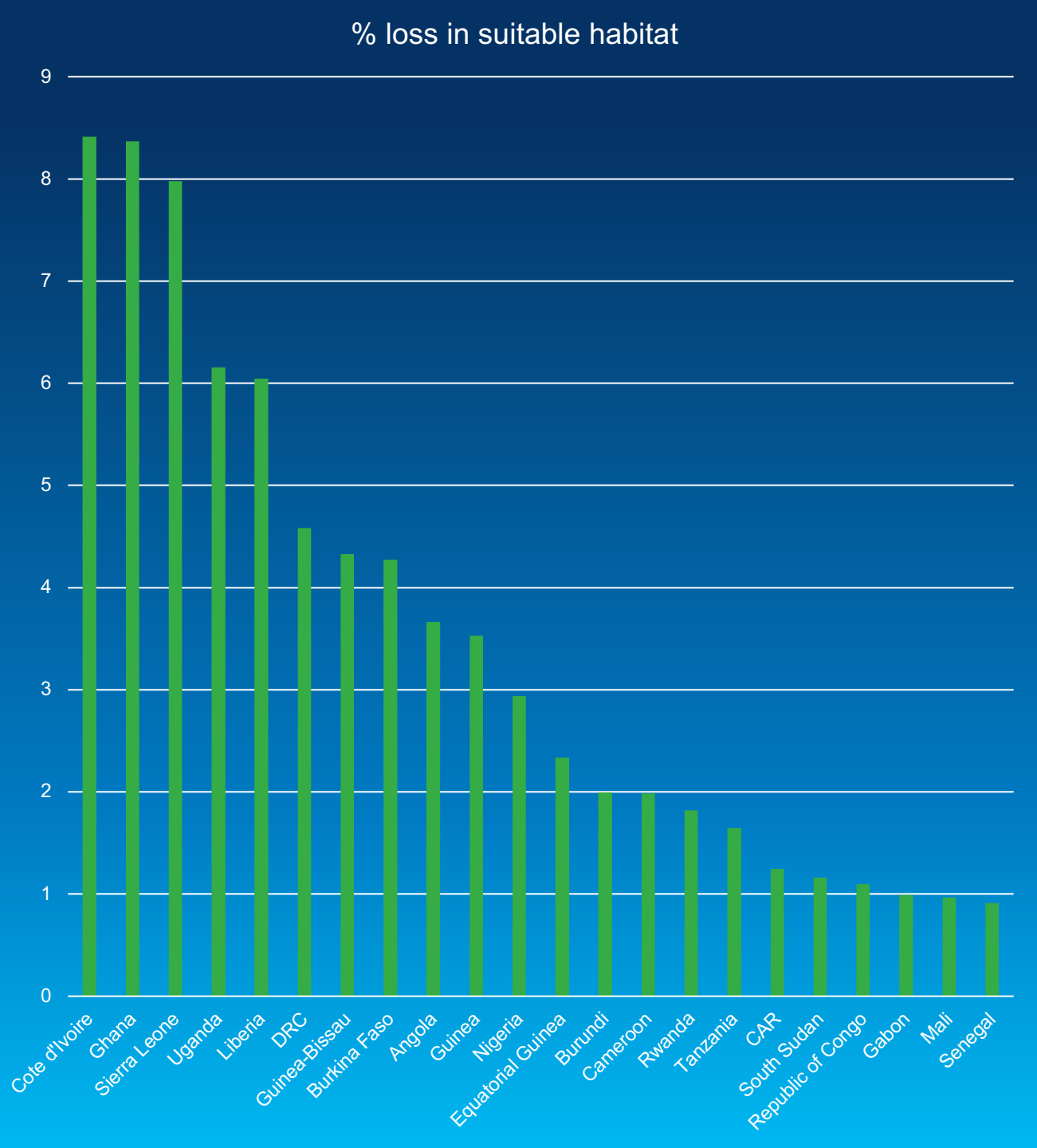



2000-2003
2004-2006
2007-2009
2010-2012
0
5
10 Km

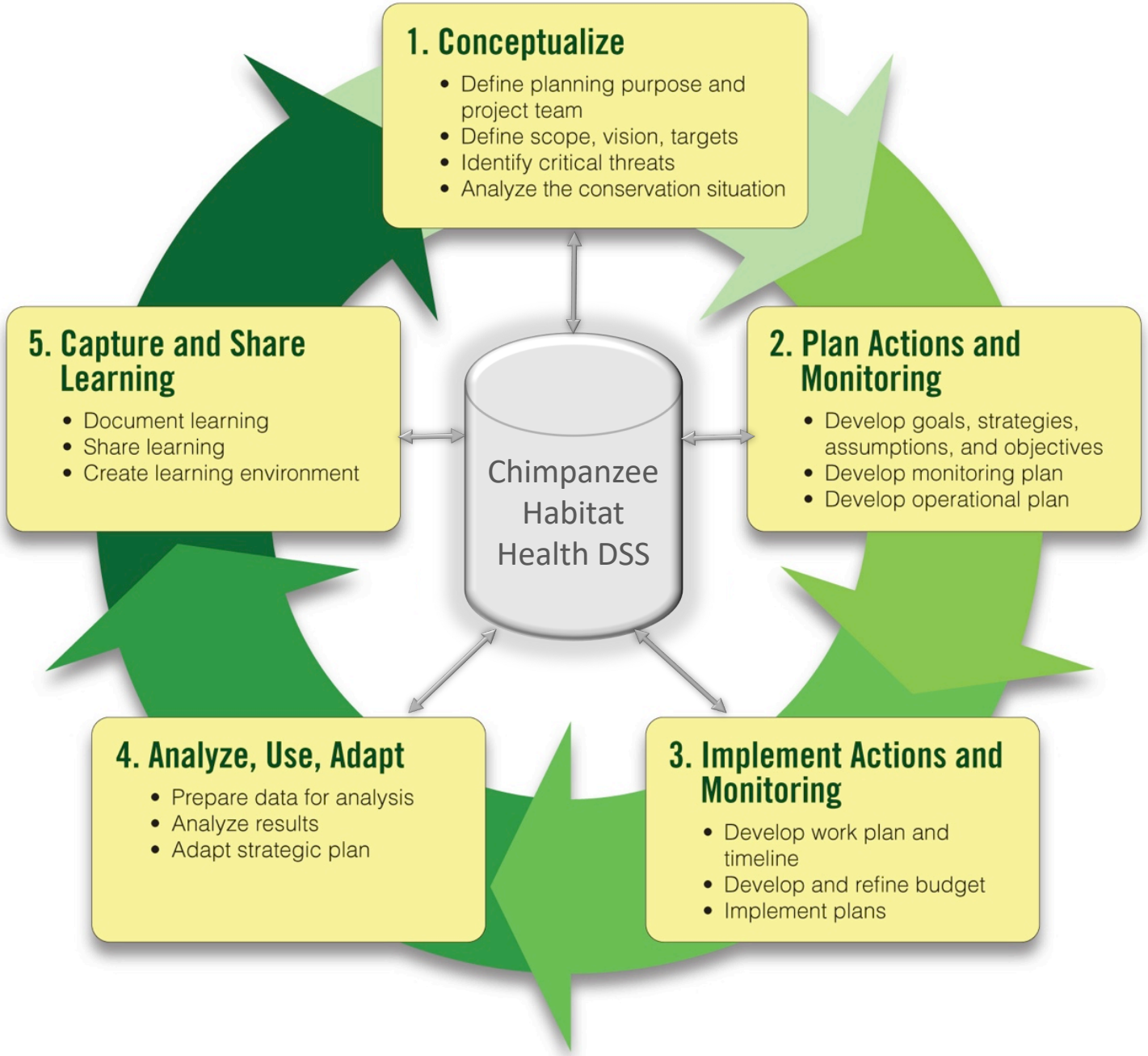

Area loss in forest > 25% tree cover (sq km)
35000
30000
25000
20000
15000
10000
5000
0
DRC
Cote d'Ivoire
Cameroon
Guinea
Sierra Leone
Liberia
Republic of Congo
Gabon
Nigeria
Ghana
CAR
Uganda
Equatorial Guinea
Guinea-Bissau
Tanzania
South Sudan
Angola
Burundi
Rwanda
Mali
Senegal
Burkina Faso


Area loss in suitable habitat (sq.km)
35000
30000
25000
20000
15000
10000
5000
0
DRC
Cote d'Ivoire
Cameroon
Liberia
Guinea
Sierra Leone
Republic of Congo
Gabon
Ghana
Nigeria
Uganda
CAR
Equatorial Guinea
Guinea-Bissau
Angola
Tanzania
Mali
Burkina Faso
Senegal
South Sudan
Burundi
Rwanda


% loss in forests > 25% tree cover
45
40
35
30
25
20
15
10
5
0
Burkina Faso
Senegal
Cote d'Ivoire
Sierra Leone
Ghana
Liberia
Guinea-Bissau
Uganda
Guinea
Mali
DRC
Angola
Nigeria
Burundi
Equatorial Guinea
Tanzania
Cameroon
Rwanda
Republic of Congo
Gabon
South Sudan
CAR


% loss in suitable habitat
9
8
7
6
5
4
3
2
1
0
Cote d'Ivoire
Ghana
Sierra Leone
Uganda
Liberia
DRC
Guinea-Bissau
Burkina Faso
Angola
Guinea
Nigeria
Equatorial Guinea
Burundi
Cameroon
Rwanda
Tanzania
CAR
South Sudan
Republic of Congo
Gabon
Mali
Senegal

1. From a single index to multiple indicators that inform a management process



2. Same EOS products can result in different indicators

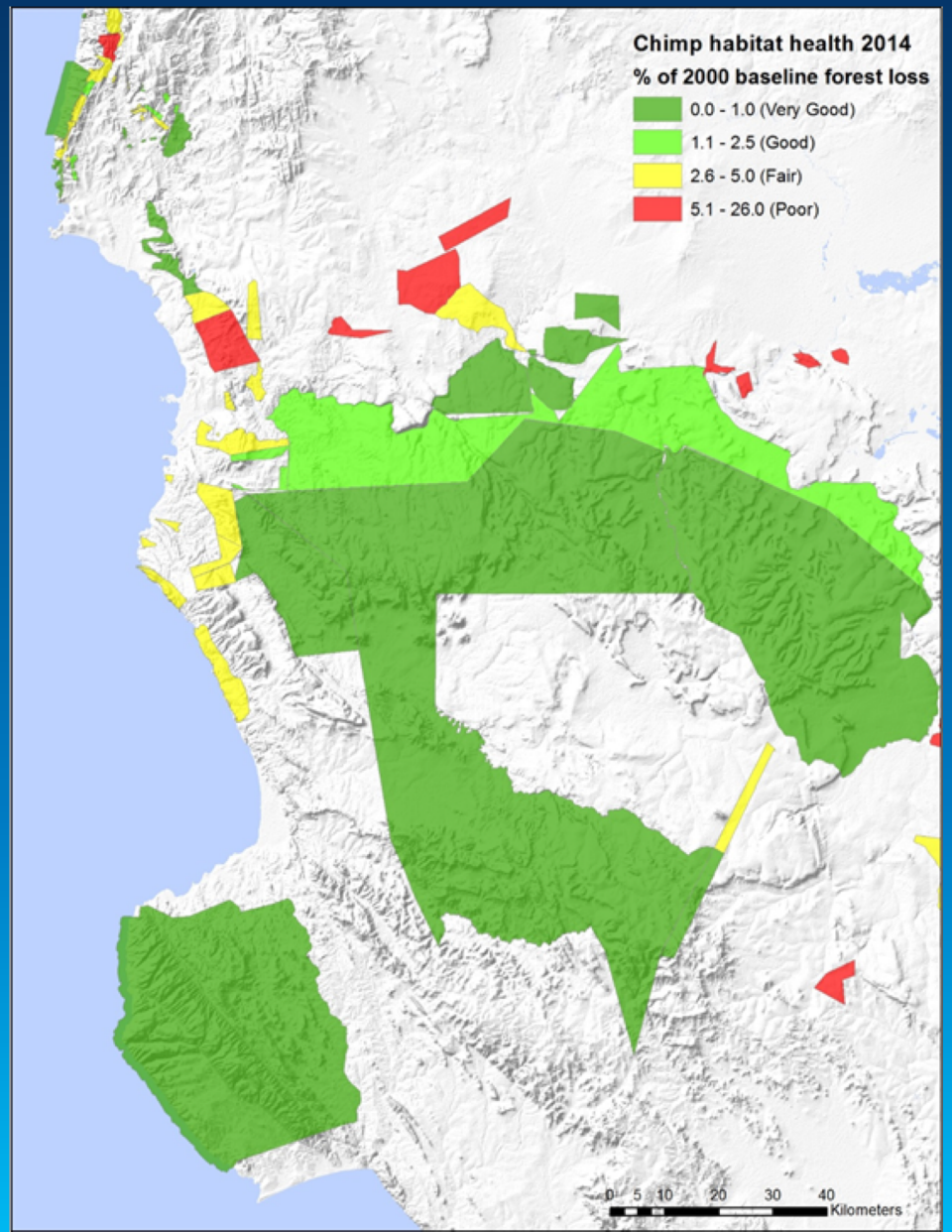
OS Viability Analysis: Markings to Interpret Target Health

Poor:	Fair:	Good:	Very Good:
Restoration increasingly difficult; May result in extirpation	Outside acceptable range of variation; Requires intervention to get to good	Within acceptable range of variation; Some intervention required to maintain	Ecologically desirable status; Requires little intervention to maintain

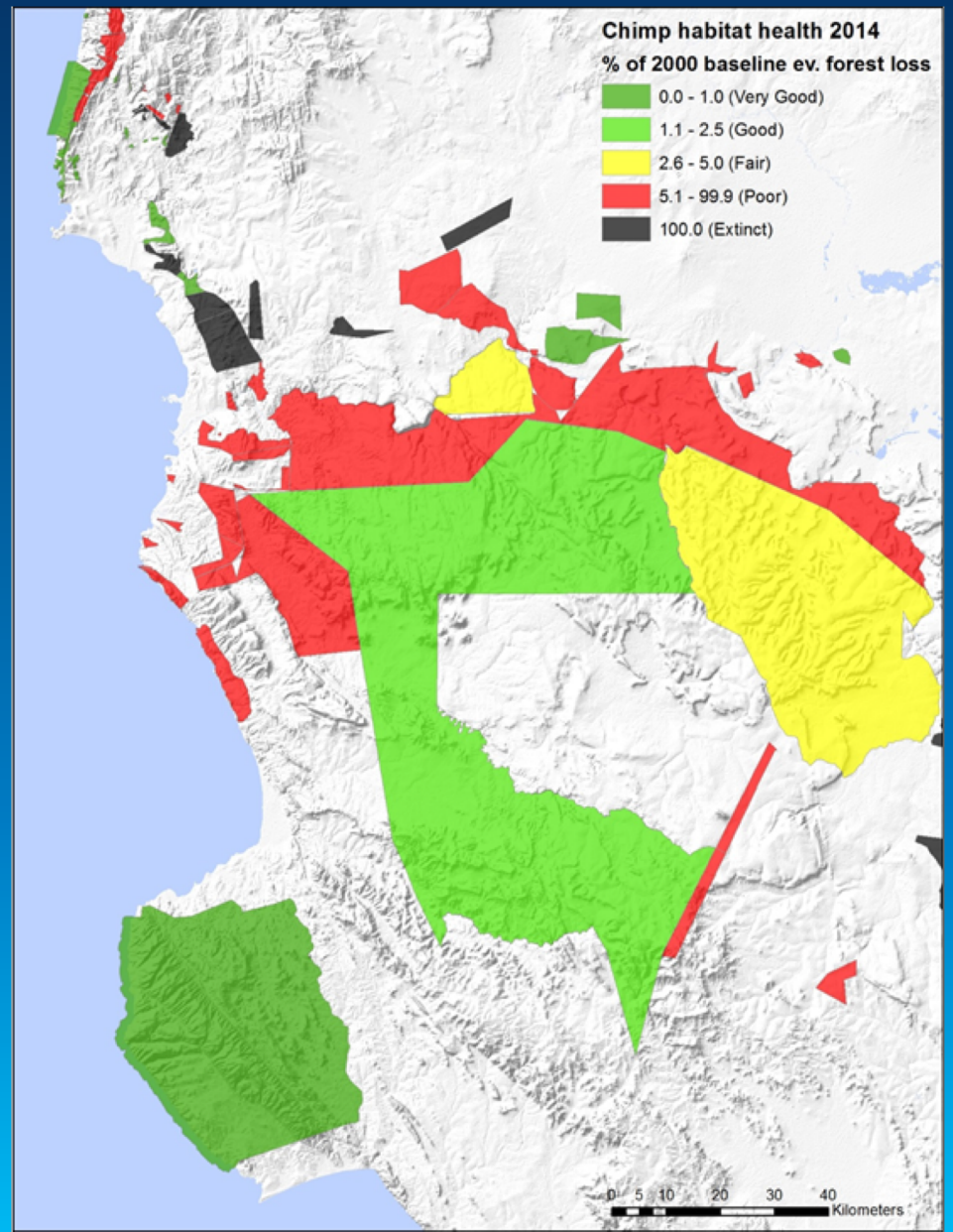
				Indicator Ratings			
Target	**Category**	**KEA**	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**
Chimp Habitat in Zambezian Miombo Woodland	Size	Area with tree cover	% of 2000 baseline area loss	> 5 % loss	2.5 - 5.0 % loss	1 - 2.5% loss	< 1% loss
	Condition	Evergreen forest	% of 2000 baseline area loss	> 5% loss	2.5 – 5.0% loss	1 – 2.5% loss	< 1% loss
	Landscape context	Distance to humans	Avg pixel dist to human feature	< 250 m	250 - 500 m	500 - 1000 m	> 1000 m

3. Focusing on the right indicators …

KEA: Size –Forest cover (Woodland & Evergreen Forest)

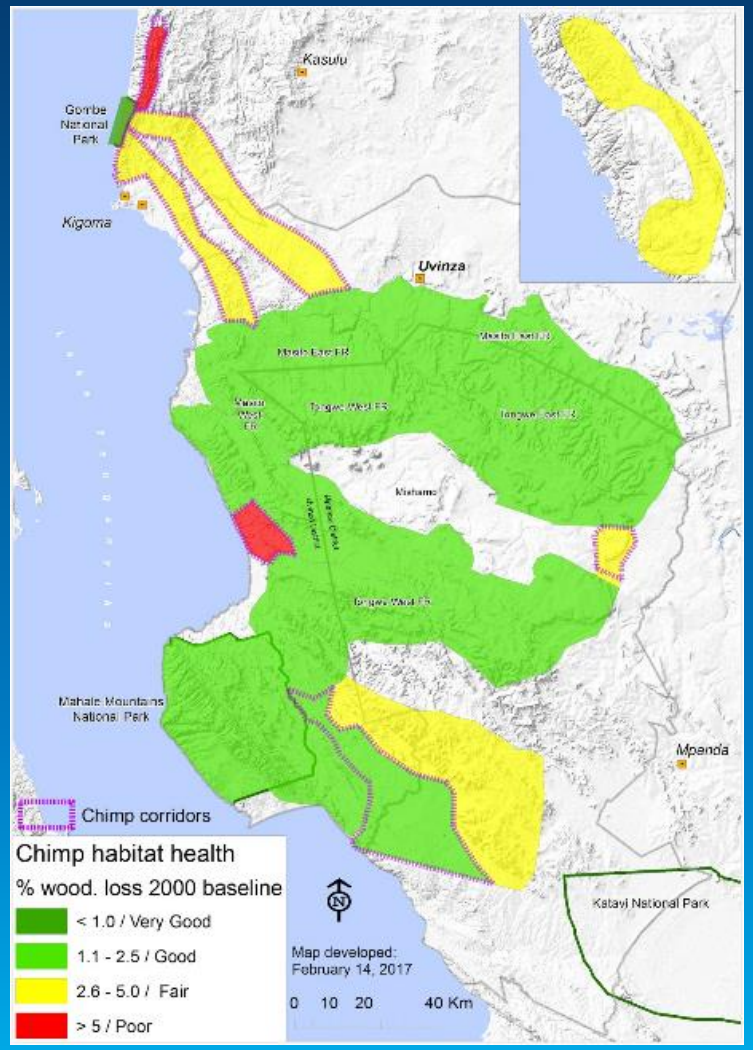


KEA: Condition – Evergreen Forest

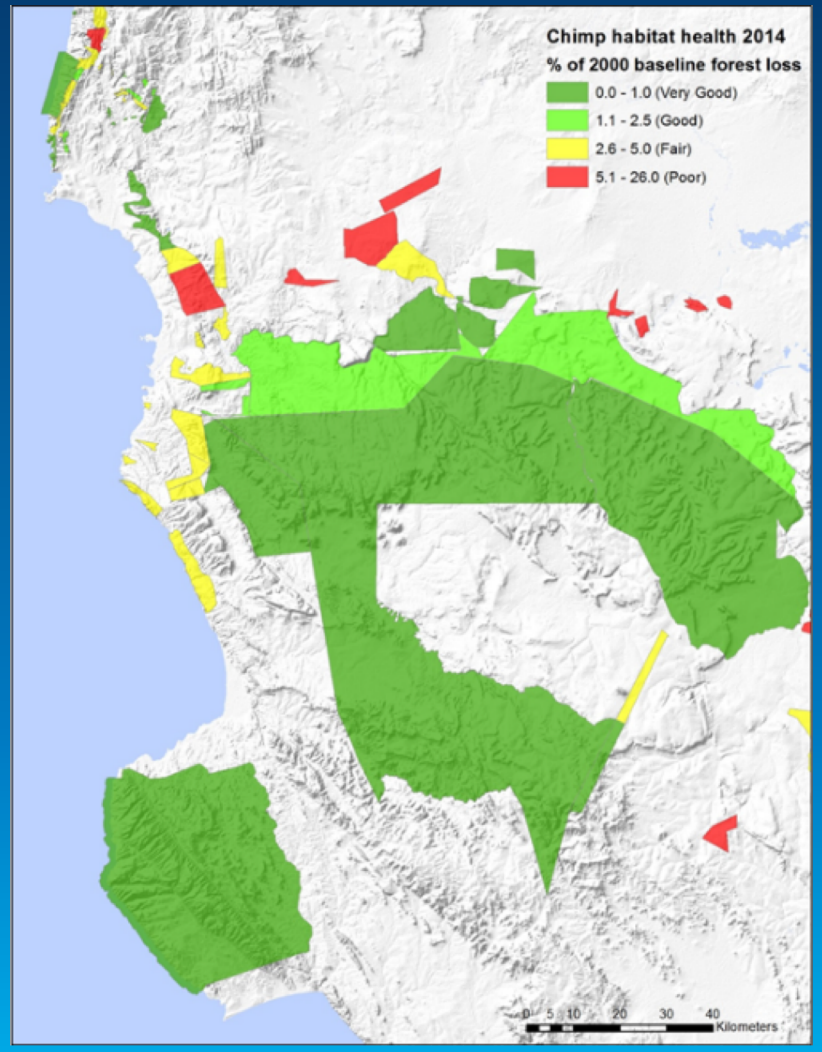


4. Focusing on the right indicators summarized by relevant management units

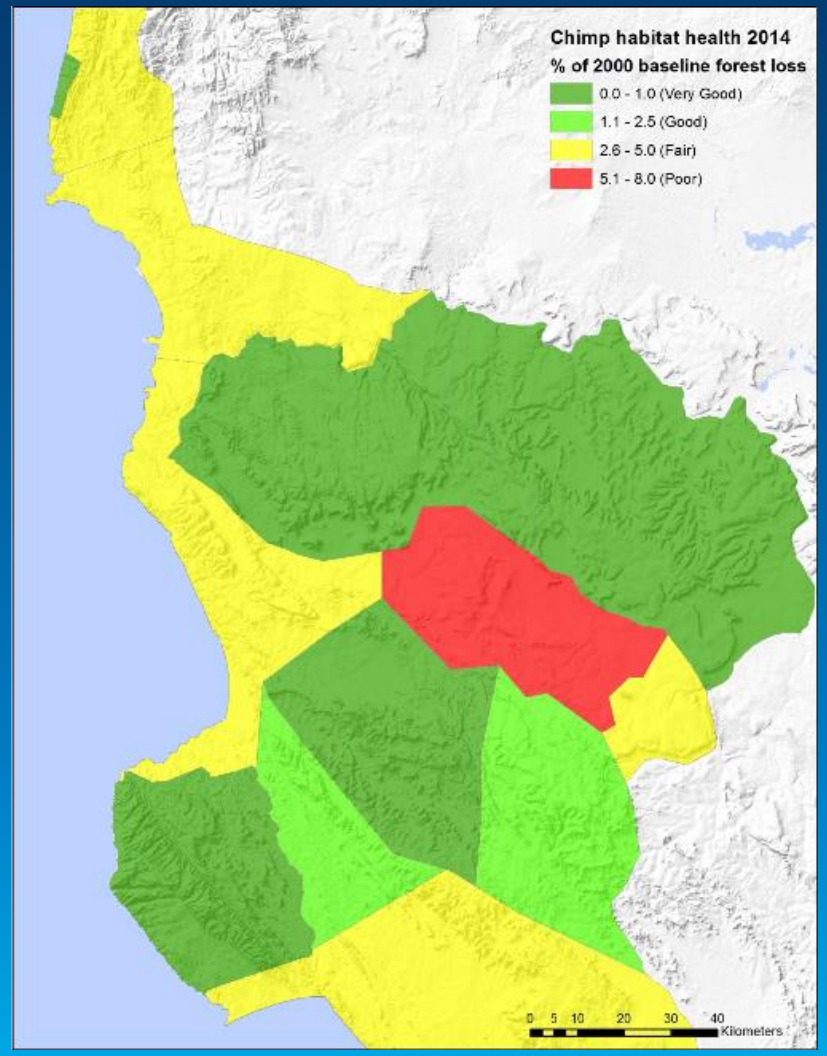
Chimpanzee Core Areas and Corridors

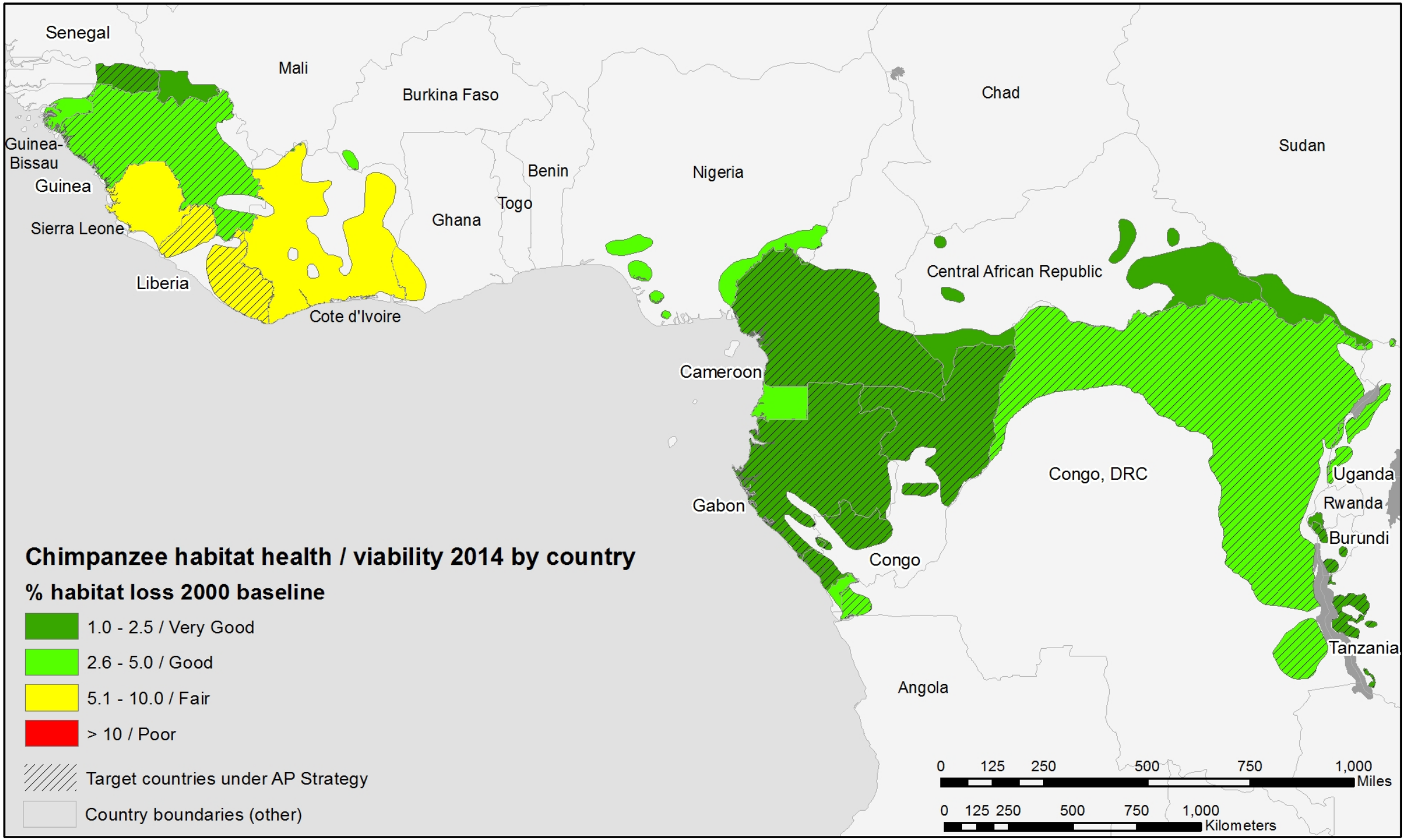


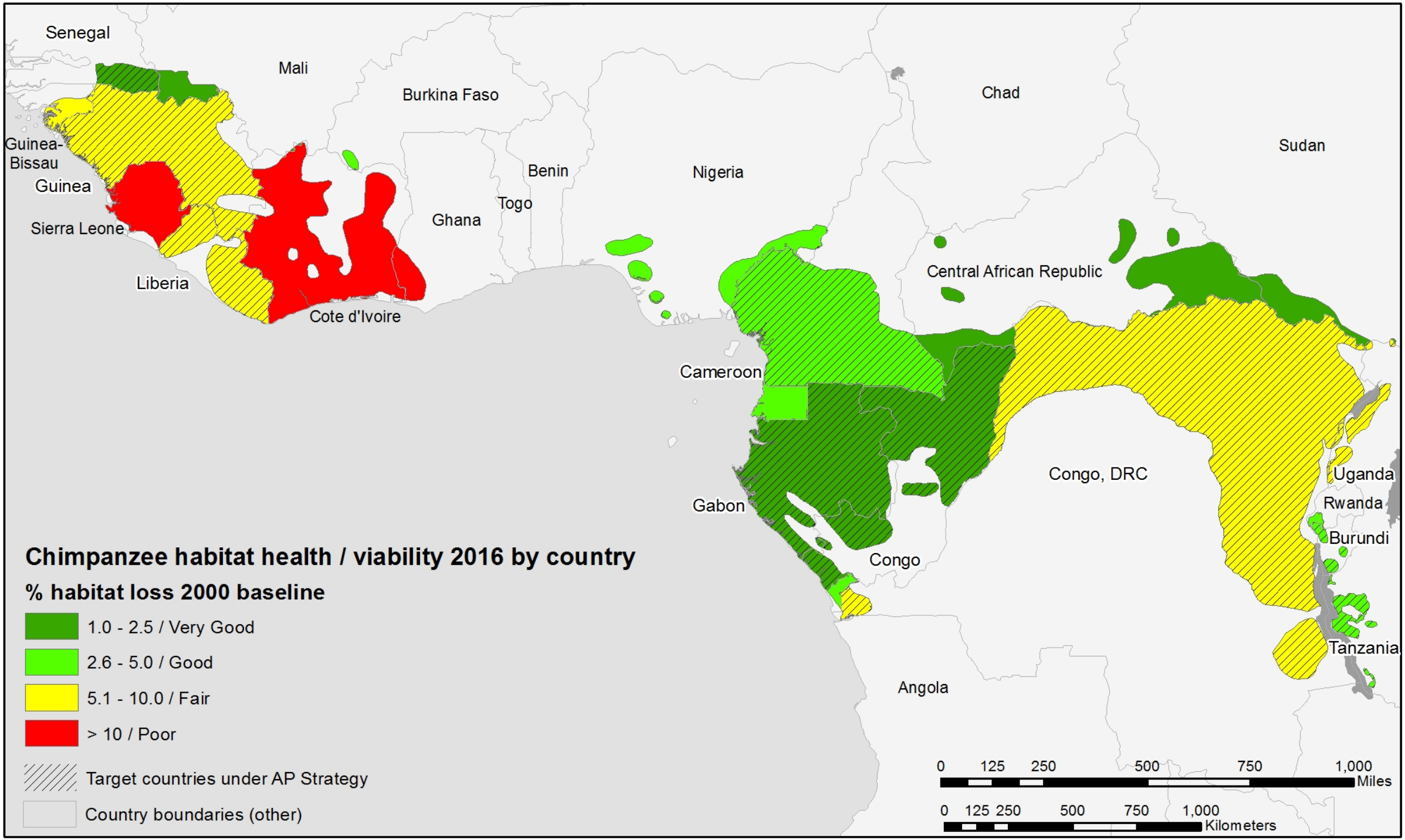
Protected Areas



Combination - National scale




Senegal
Mali
Burkina Faso
Chad
Sudan
Guinea-Bissau
Guinea
Sierra Leone
Liberia
Cote d'Ivoire
Ghana
Togo
Benin
Nigeria
Central African Republic
Cameroon
Gabon
Congo
Congo, DRC
Uganda
Rwanda
Burundi
Tanzania
Angola
Chimpanzee habitat health / viability 2014 by country
% habitat loss 2000 baseline
1.0 - 2.5 / Very Good
2.6 - 5.0 / Good
5.1 - 10.0 / Fair
> 10 / Poor
Target countries under AP Strategy
Country boundaries (other)
0 125 250 500 750 1,000 Miles
0 125 250 500 750 1,000 Kilometers


Senegal
Mali
Burkina Faso
Chad
Sudan
Guinea-Bissau
Guinea
Sierra Leone
Liberia
Cote d'Ivoire
Ghana
Togo
Benin
Nigeria
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Chimpanzee habitat health / viability 2016 by country
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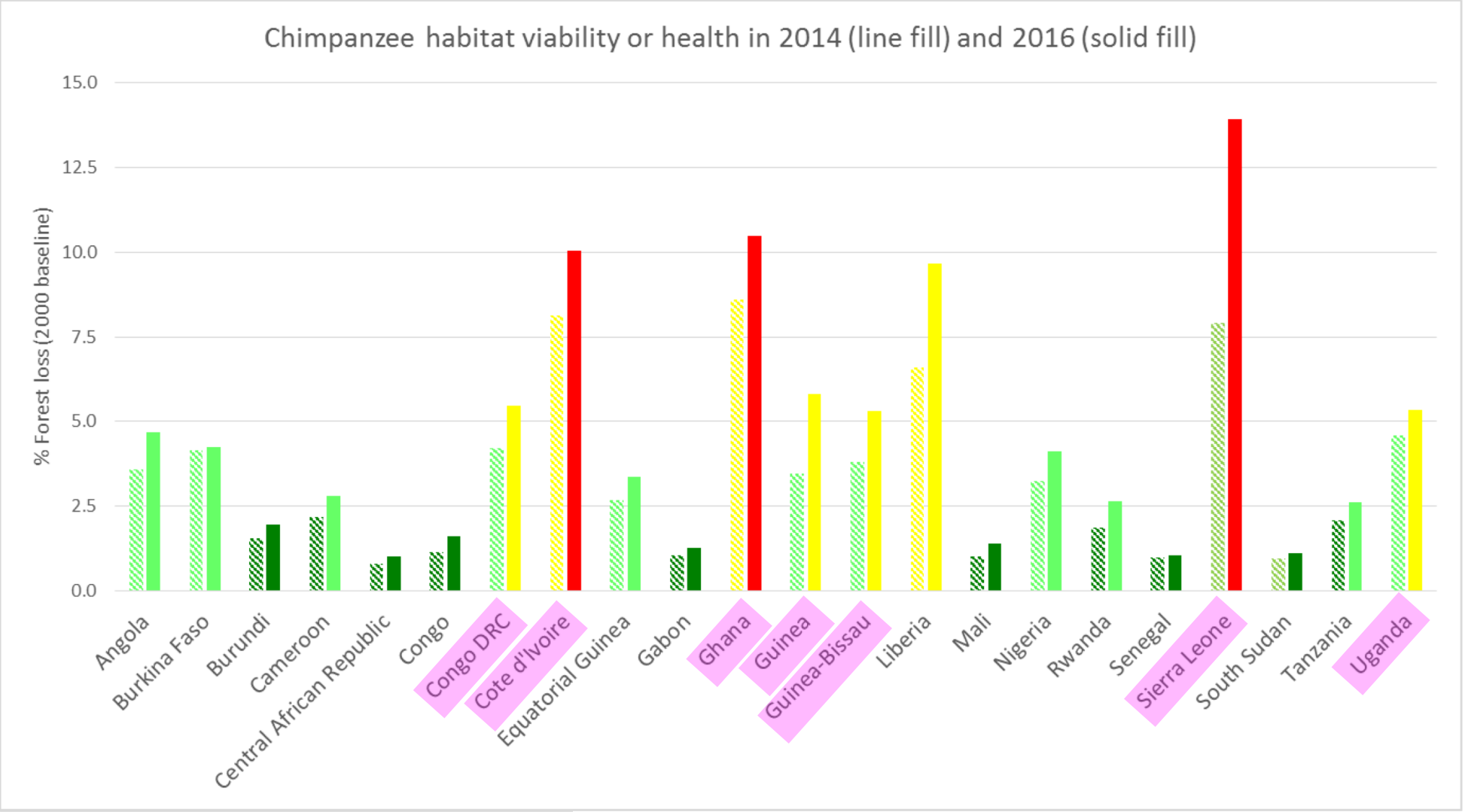
5.1 - 10.0 / Fair
> 10 / Poor
Target countries under AP Strategy
Country boundaries (other)
0 125 250 500 750 1,000 Miles
0 125 250 500 750 1,000 Kilometers

COUNTRY	H. HEALTH 2014	H. HEALTH 2016
Angola	GOOD	GOOD
Burkina Faso	GOOD	GOOD
Burundi	V. GOOD	V. GOOD
Cameroon	V. GOOD	V. GOOD
Central African Repub	V. GOOD	V. GOOD
Congo	V. GOOD	V. GOOD
Congo DRC	GOOD	FAIR
Cote d'Ivoire	FAIR	POOR
Equatorial Guinea	GOOD	GOOD
Gabon	V. GOOD	V. GOOD
Ghana	FAIR	POOR
Guinea	GOOD	FAIR
Guinea-Bissau	GOOD	FAIR
Liberia	FAIR	FAIR
Mali	V. GOOD	V. GOOD
Nigeria	GOOD	GOOD
Rwanda	V. GOOD	GOOD
Senegal	V. GOOD	V. GOOD
Sierra Leone	FAIR	POOR
South Sudan	V. GOOD	V. GOOD
Tanzania	V. GOOD	GOOD
Uganda	GOOD	FAIR

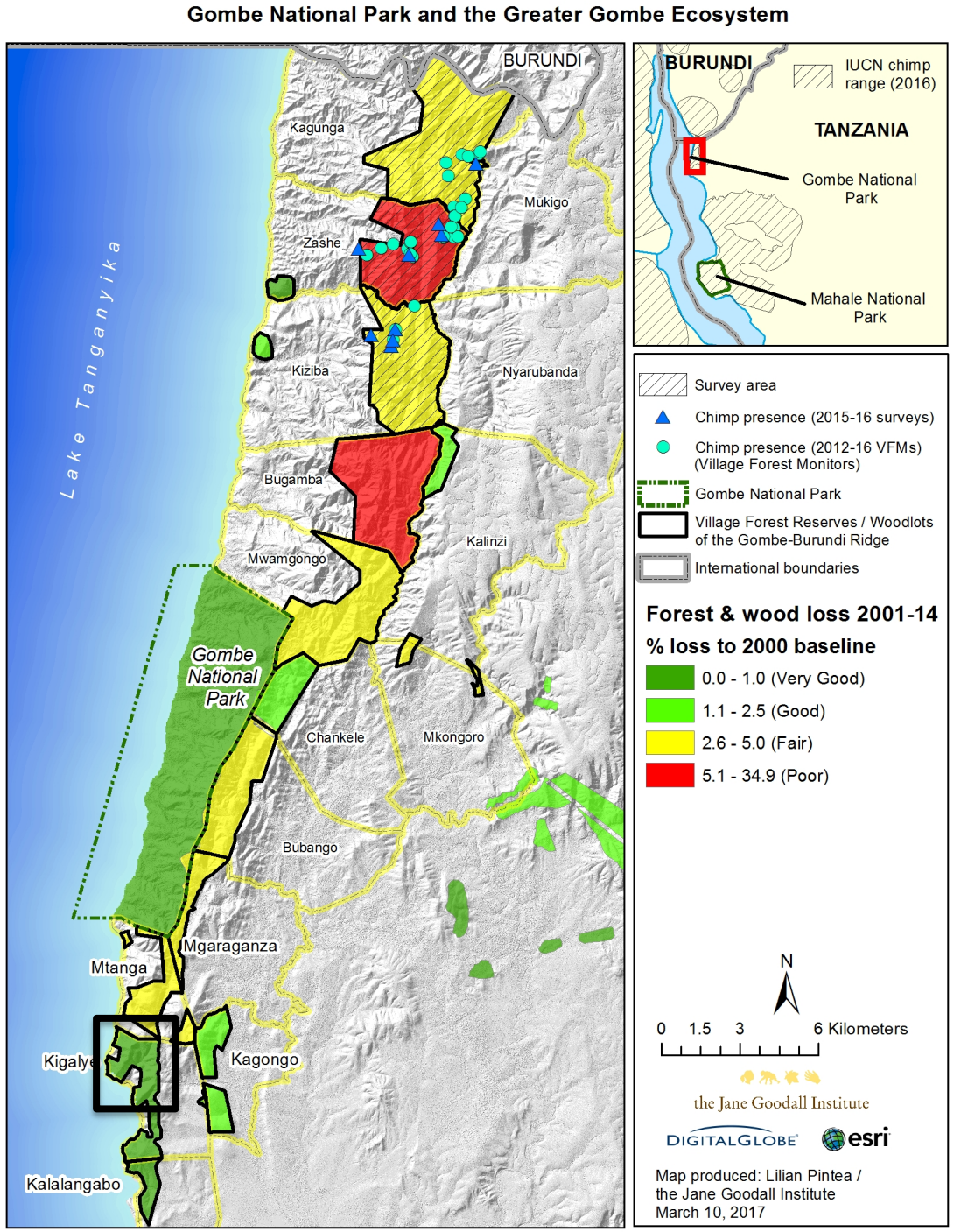


Chimpanzee habitat viability by country

% habitat loss 2000 baseline

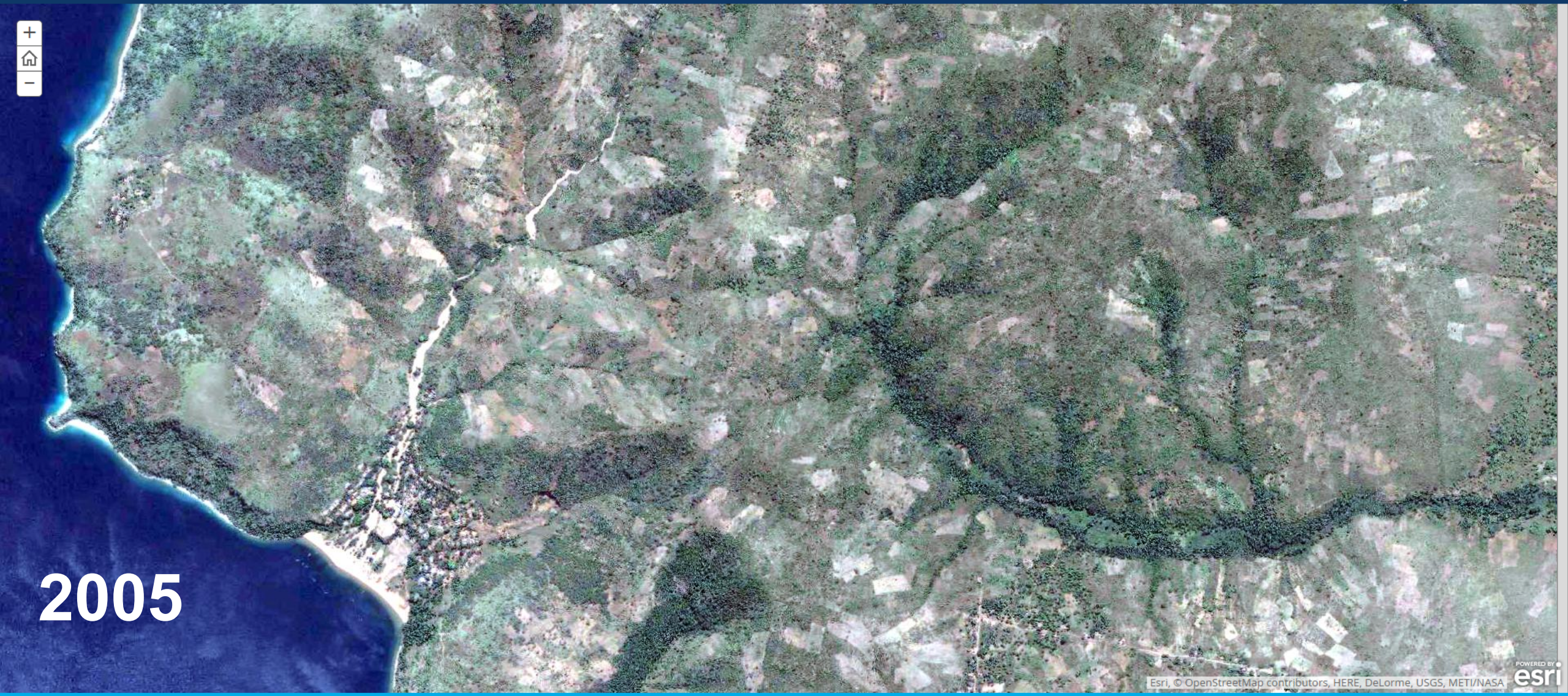
- 1.0 - 2.5 / Very Good
- 2.6 - 5.0 / Good
- 5.1 - 10.0 / Fair
- 10.1 - 11.0 / Poor

5. Balancing resolution with the management question



2005 - 2014 Digital Globe Imagery of Kigalye Village Forest Reserve

the Jane Goodall Institute

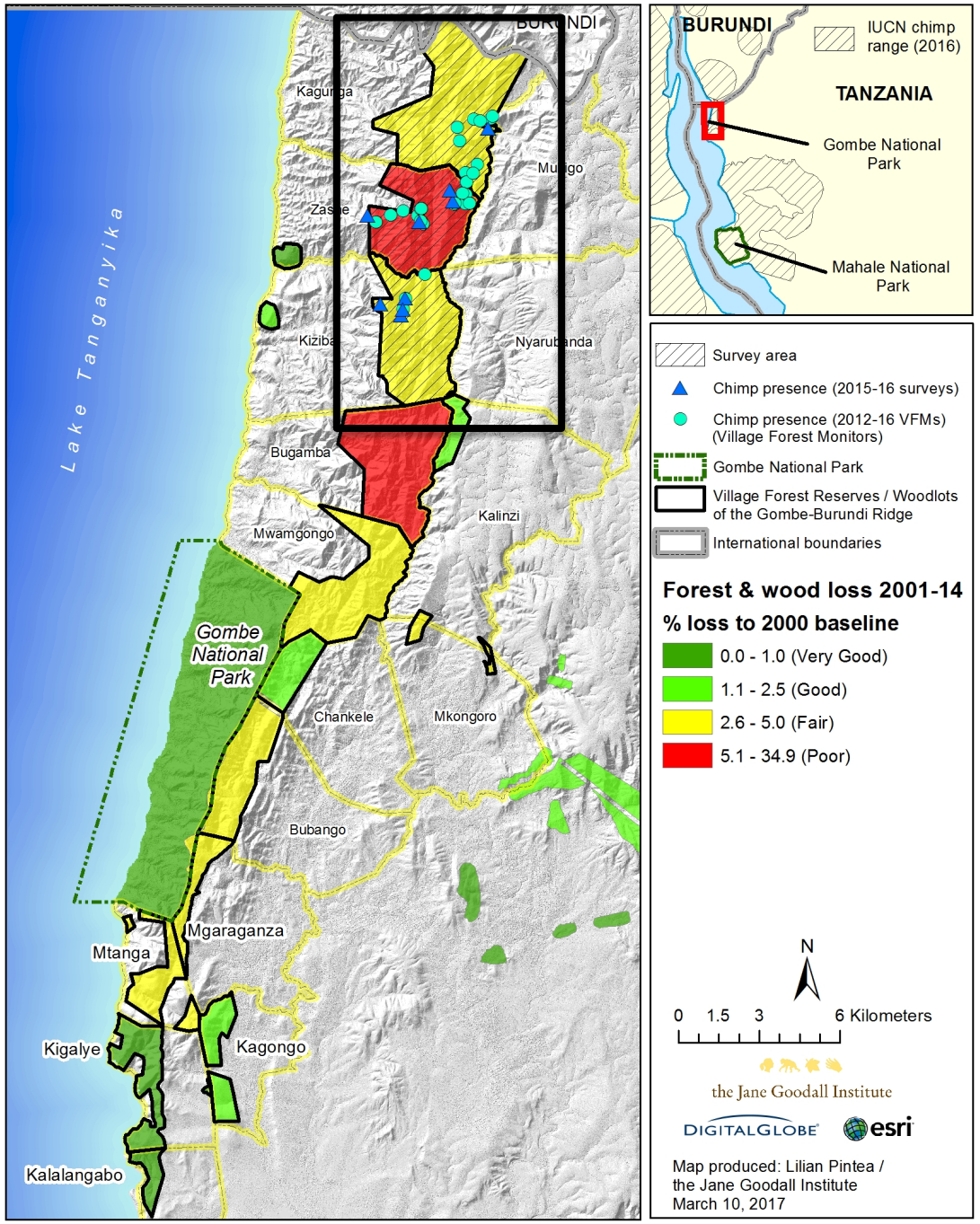


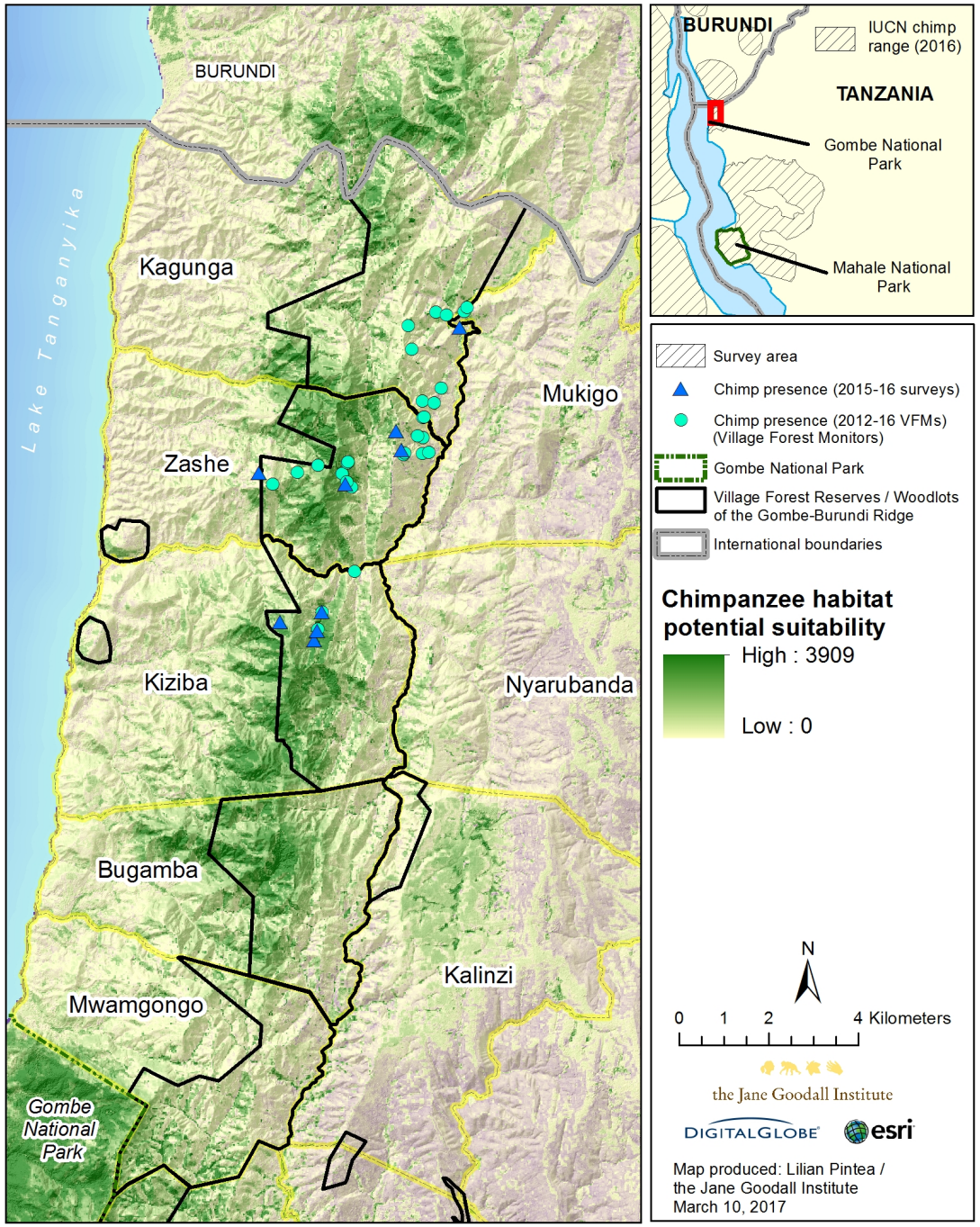
2005 - 2014 Digital Globe Imagery of Kigalye Village Forest Reserve

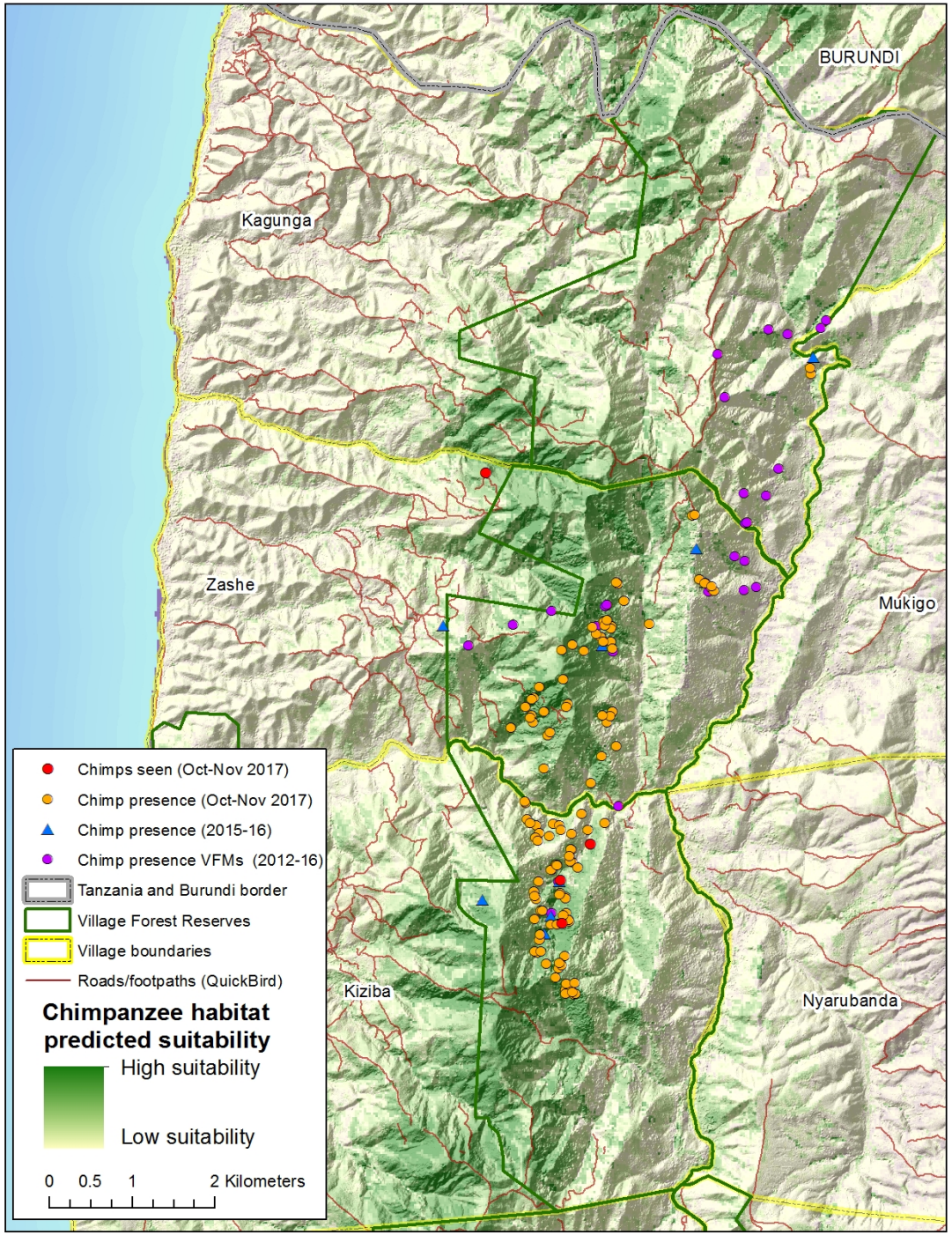
the Jane Goodall Institute

Goodall Institute
USAID
DigitalGlobe
2017
satellite image (DigitalGlobe)
Kilometers

5. Balancing resolution with the management question

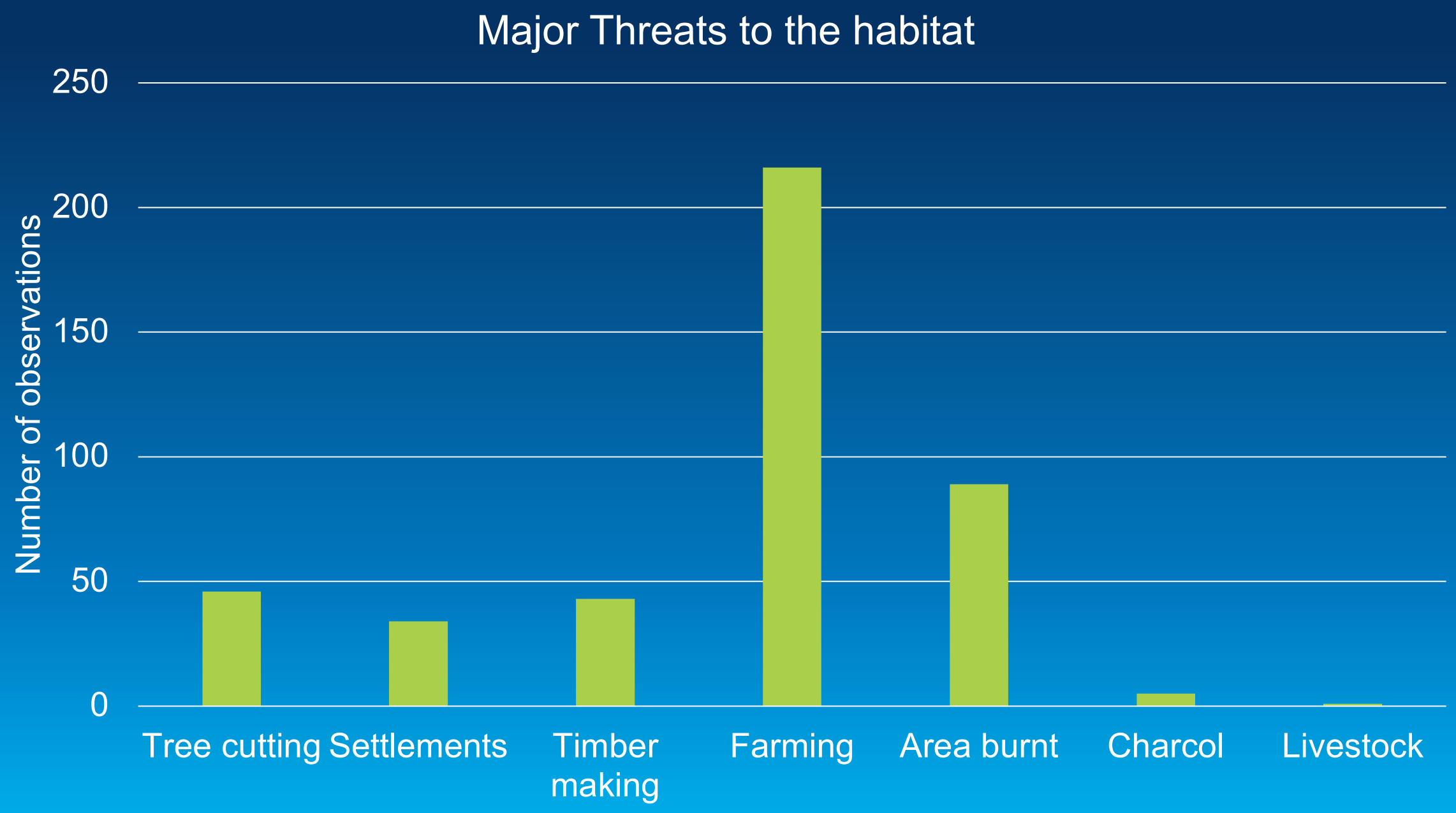




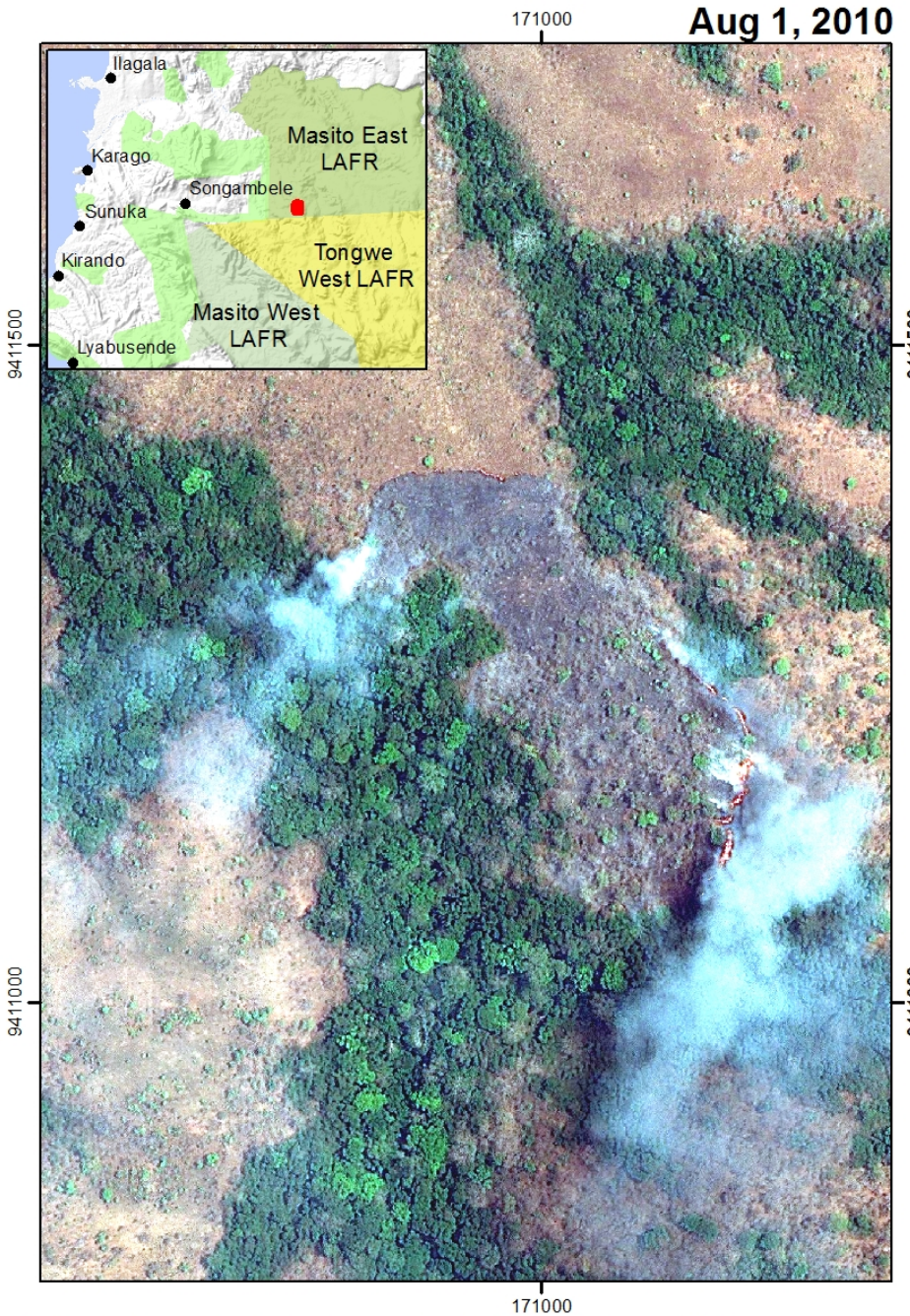

BURUNDI
Kagunga
Zashe
Mukigo
Kiziba
Nyarubanda
Chimps seen (Oct-Nov 2017)
Chimp presence (Oct-Nov 2017)
Chimp presence (2015-16)
Chimp presence VFMs (2012-16)
Tanzania and Burundi border
Village Forest Reserves
Village boundaries
Roads/footpaths (QuickBird)
Chimpanzee habitat predicted suitability
High suitability
Low suitability
0 0.5 1 2 Kilometers

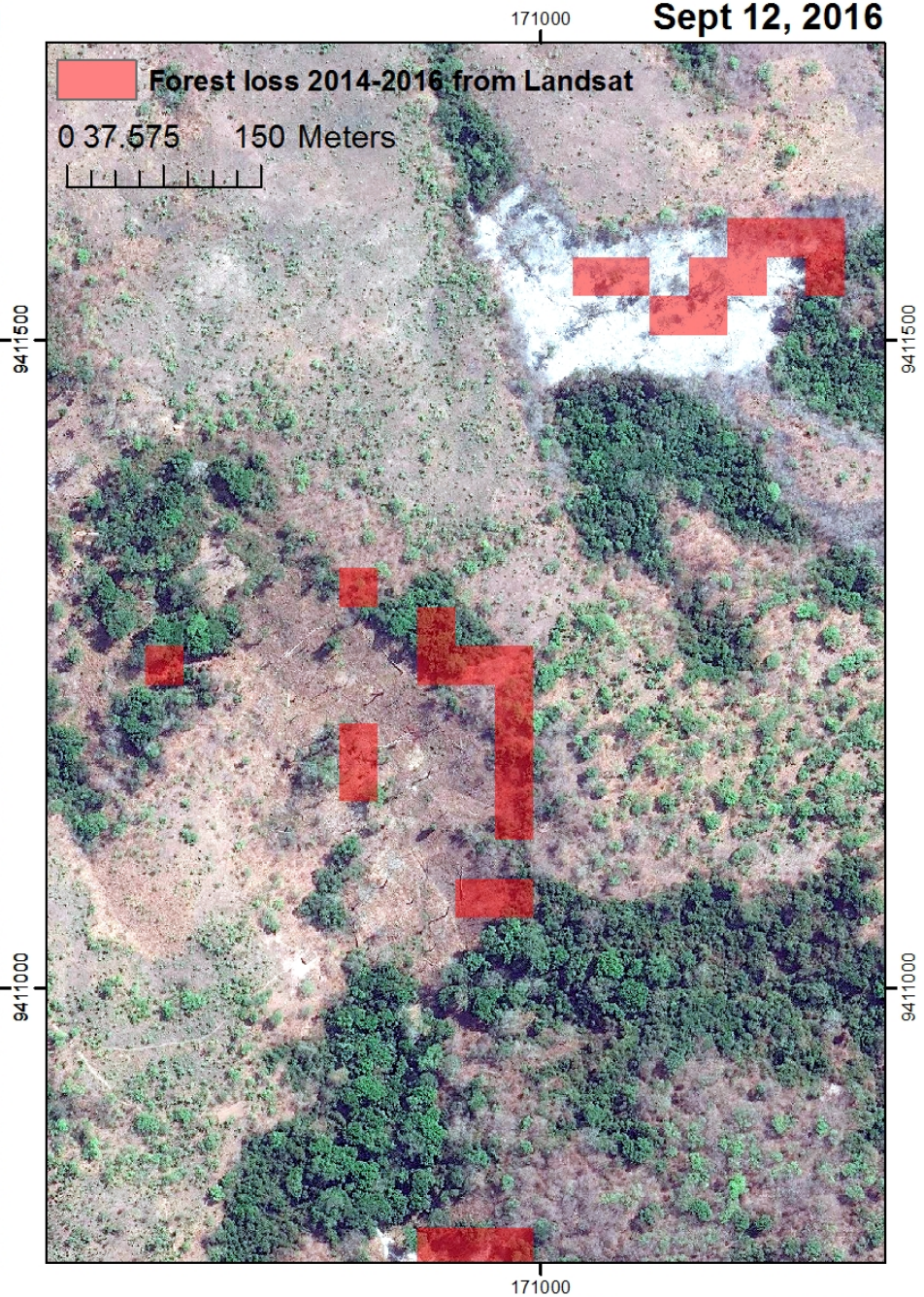
Total of 501 nests found; 4 sightings of chimps
15/11/2017 15:55

Threats to the habitat


Major Threats to the habitat
Number of observations
250
200
150
100
50
0
Tree cutting
Settlements
Timber making
Farming
Area burnt
Charcol
Livestock

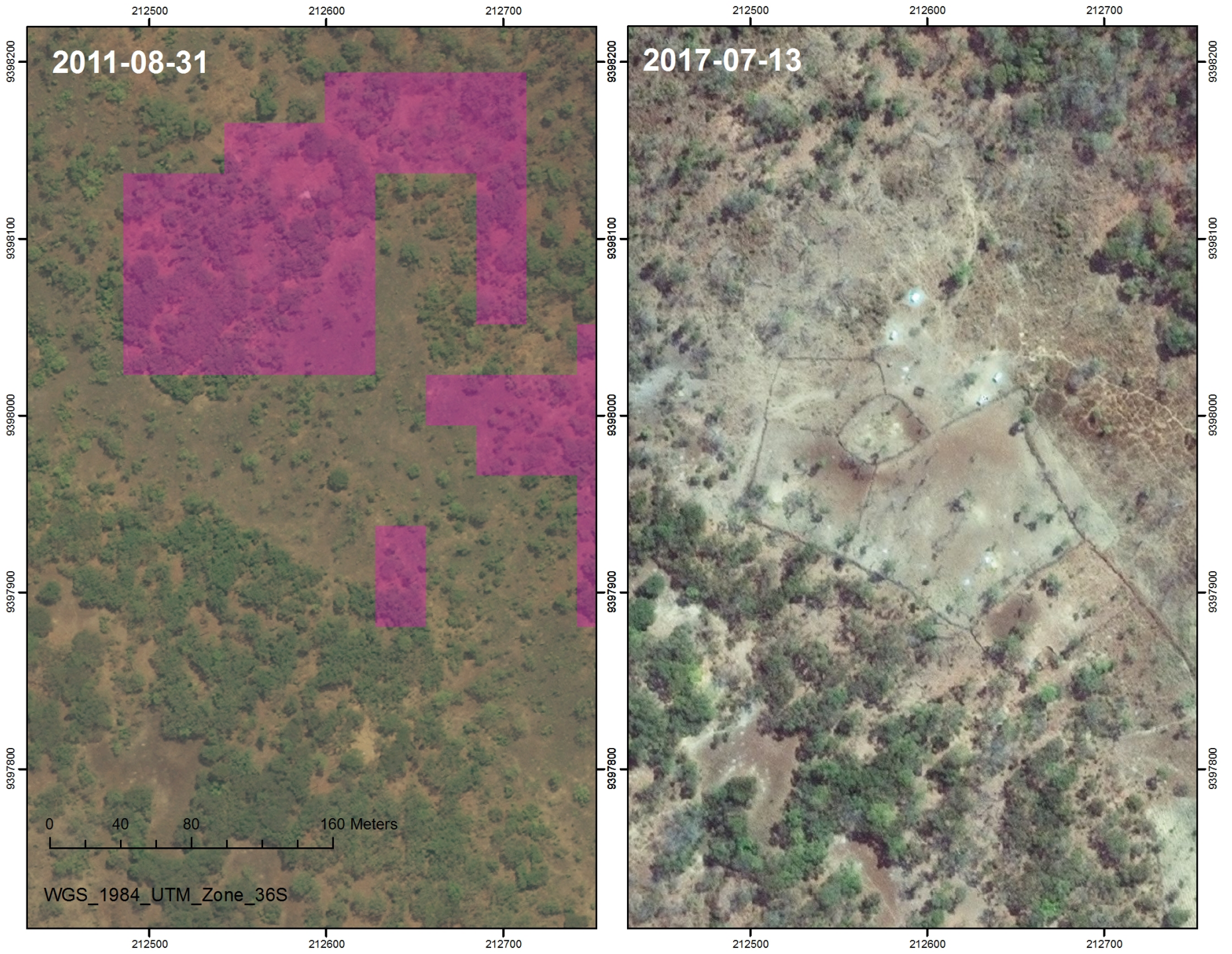
Illegal forest burning and conversion to farmland inside Masito East LA Forest Reserve as detected by GeoEye satellite 2010-2016





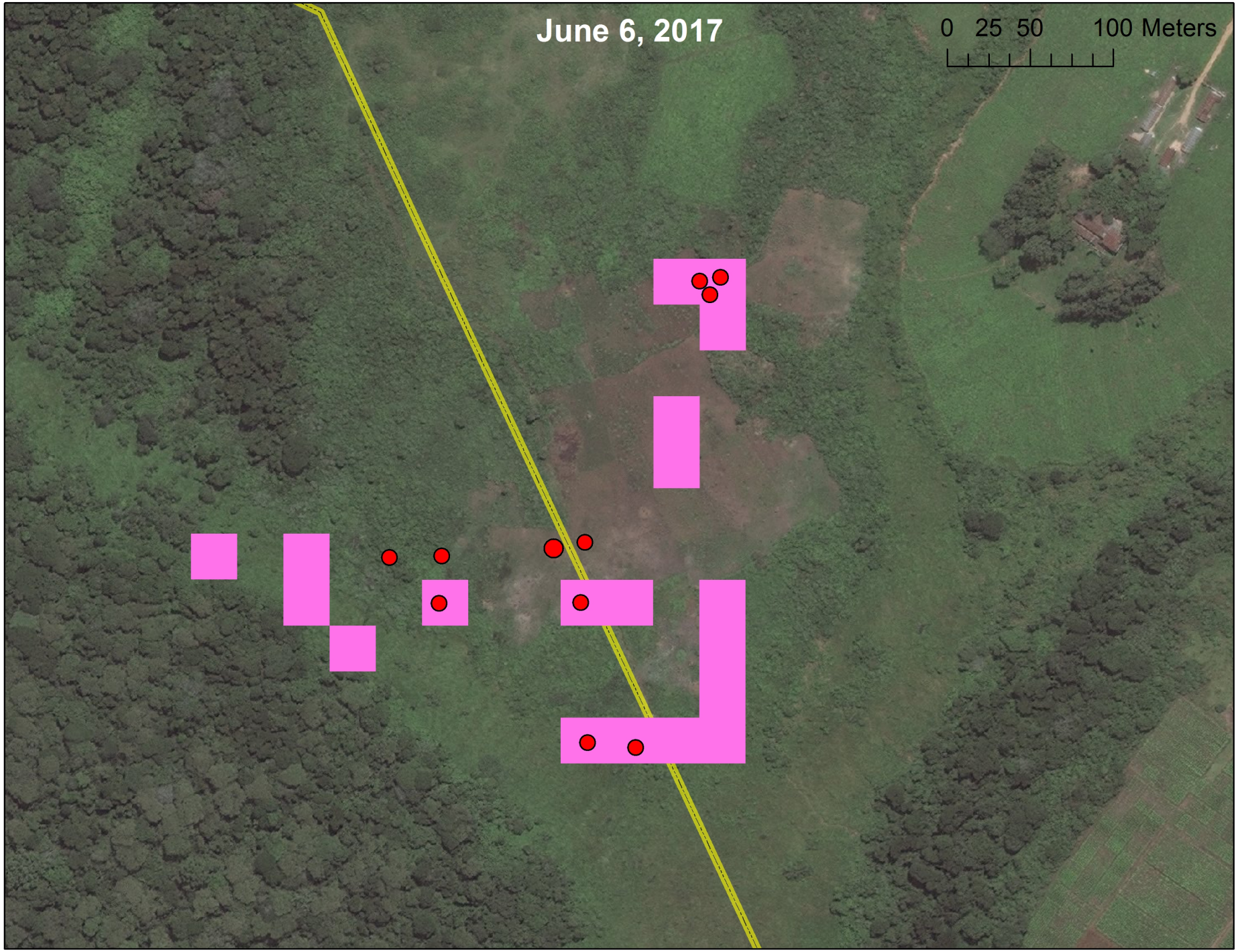
Projected Coordinate System: Arc_1960_UTM_Zone_36S

Satellite image source: DigitalGlobe


2011-08-31
2017-07-13
212500
212600
212700
9398200
9398100
9398000
9397900
9397800
0
40
80
160 Meters
WGS_1984_UTM_Zone_36S

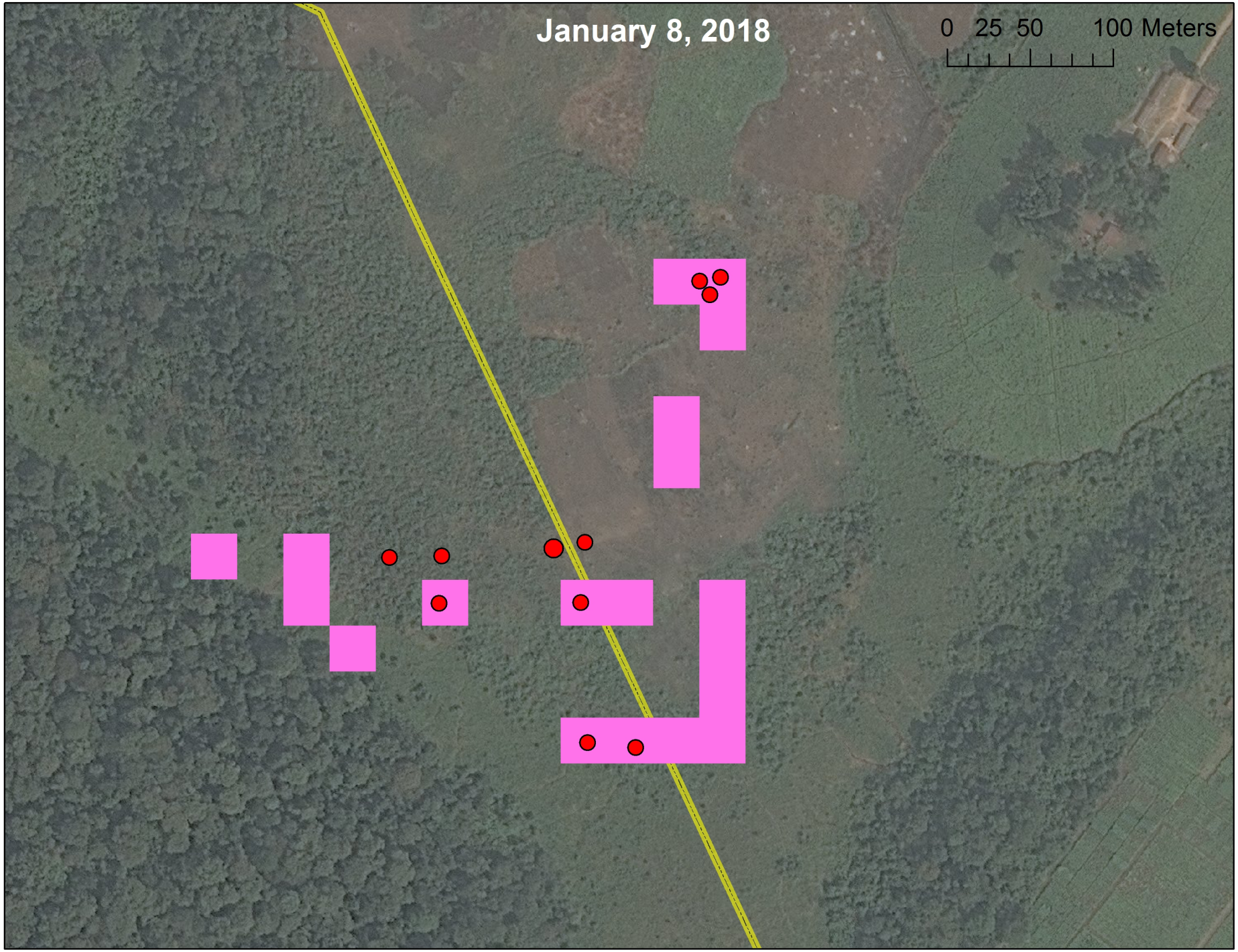
Field operations

Encroachment in Kibale National Park stopped by Uganda Wildlife Authority rangers using weekly GLAD forest loss alerts and Forest Watcher mobile app.



Field operations

Encroachment in Kibale National Park stopped by Uganda Wildlife Authority rangers using weekly GLAD forest loss alerts and Forest Watcher mobile app.



the Jane Goodall Institute Habitat Health DSS

A Complete Geospatial Platform using Esri's ArcGIS Enterprise and Microsoft Azure Cloud

the Jane Goodall Institute | GeoPlanner for ArcGIS

geoplanner.arcgis.com/#

Apps | Bookmarks | My DigitalGlobe | ArcGIS - Sign In | Landsat Explorer | JGI Forest Mapper | Natural Regeneration | JGI ODK | ODK Tanzania | ODK Uganda | ODK USA | ODK REDD Uganda | Google Earth Engine | Earth Engine Playgro | Fusion Tables | Google Geo | Other bookmarks

JGI Screen Caps Test / Evergreen Forest Loss

Rob Stauder

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Layers | Legend | Jobs

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  - Chimp Core Areas and Corridors
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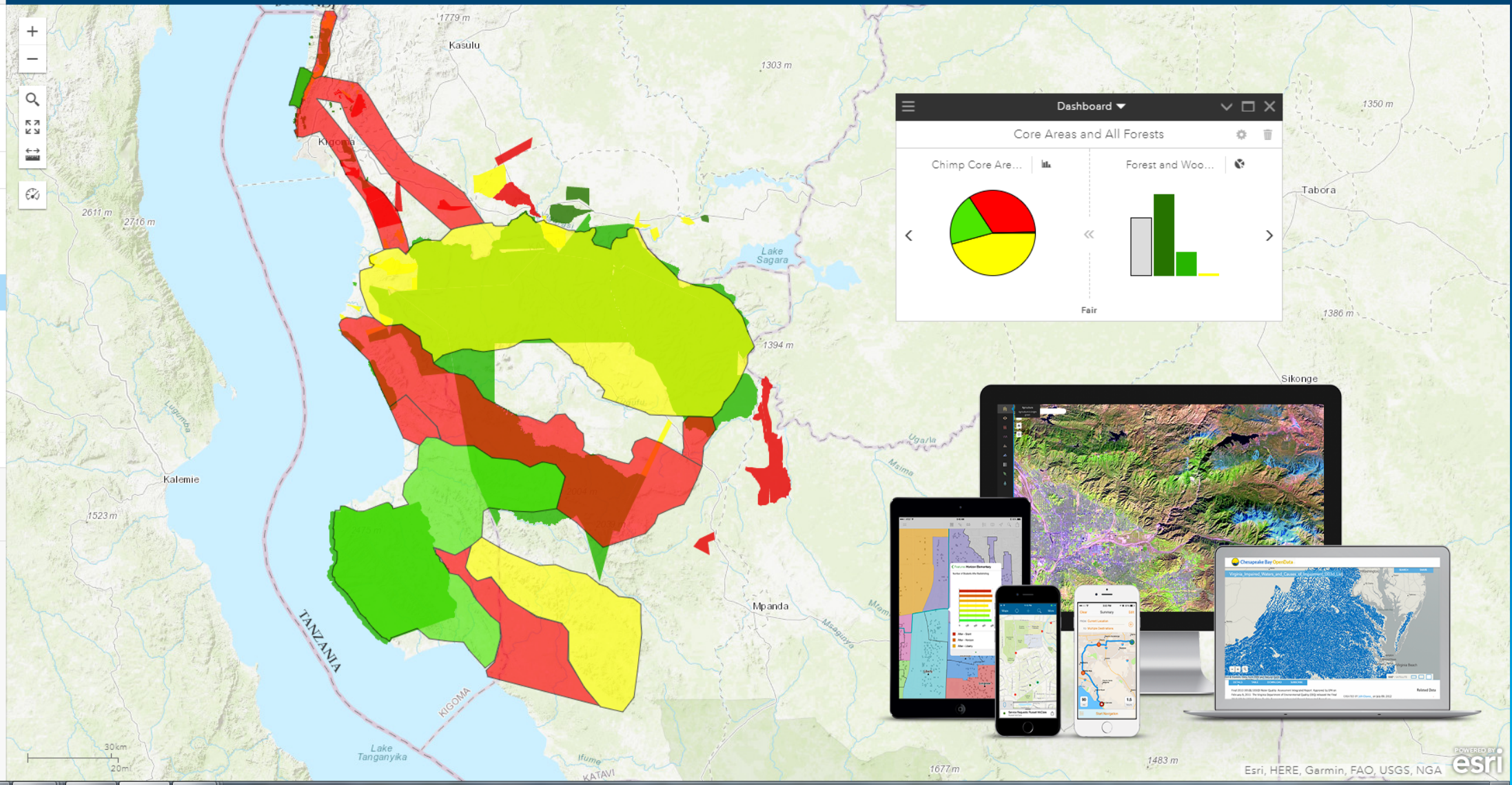
  - Forest and Woodland Delta Classification
  - Evergreen Classification
  - Protected_areas
  - for_wood_loss_in_chimpMU
  - forest_evergreen_loos_in_chimp MU
- 3D Layers
- Basemap
  - Topographic

EXPLORE | DESIGN | EVALUATE

Add Data | Analysis | Modeler



Local communities and Governments of Tanzania, DRC, Uganda and Republic of Congo

THANK YOU!

the Jane Goodall Institute