Tools and approaches to support countries in incorporating multiple benefits, green economy, and green investment approaches in REDD+ planning

Final Report

1. Identification

- **<u>Partner's name</u>**: Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany; United Nations Environment Programme, Narobi, Kenya
- **<u>Budget line</u>**: 2014-RED-5060-2F67-1111-22300
- **<u>POW 2014-2015 Sub-programme</u>**: Climate change
- **<u>Expected accomplishments</u>**: Transformative REDD+ strategies and finance approaches are developed and implemented by developing countries that aim at reducing emissions from deforestation and forest degradation and bringing multiple benefits for biodiversity and livelihoods.
- **<u>Outputs</u>**: Tools developed and technical services provided for promoting multiple benefits, green economy and green investments approaches in REDD+ planning
- **<u>Title of the approved PRC project</u>**: Tools and approaches to support countries in incorporating multiple benefits, green economy, and green investment approaches in REDD+ planning
- **<u>SSFA starting date</u>**: 23/05/2014
- **<u>Reporting period</u>**: 01/08/2014 to 31/05/2015
- **<u>Date</u>**: 19/06/ 2015

2. Executive Summary

The project started with a delay of three months in 09/2014 and not as originally planned in 06/2014, due to unexpected shortage of staff

Since then, we have completed the following three objectives (please see also attached figures and tables)

(i) Compilation and processing of data on great ape distribution and density, carbon stocks, protected area corridors, protected areas.

(ii) Development of an online module for visualizing great ape distribution and carbon stock data and for extracting information on the abundance of great apes and carbon for regions of interest (ROI), such as subspecies ranges, countries, protected area corridors.

(iii) Analyses of the co-benefits of climate carbon stocks for African and Asian great apes and sympatric biodiversity across their range and across different spatial scales.

More specifically, we compiled information on great ape density and abundance for 260 resource management units (RMAs) from more than 300 field survey reports. Based on this information we generated a data layer and developed an African ape range wide density distribution model at 5x5km resolution. The model revealed some misspecifications on which we are currently working. This predictive model in combination with information on suitable environmental conditions will allow identifying those areas within ape habitat which have the greatest co-benefits of climate carbon stock for great apes.

We further developed the online mapping and analysis tool (http://primatdbext.eva.mpg.de/redd/#) that illustrates how a dynamic assessment of the co-benefits of climate carbon stocks for great apes across their range can be done. The tool focuses on protected areas and on corridors between them, as well as on other landscapes and administrative units such as countries, logging concessions and any self-defined selection area.

We have also overlaid ape distribution and carbon stock data to evaluate the likely co-benefits of climate carbon stocks for great apes. For this assessment we also took the level of human impact into account and evaluated each subspecies and country.

We have extended the evaluation of the co-benefits of vegetation carbon stocks for great apes to areas other than protected areas and corridors and we finalized the assessment of the co-benefits. The results achieved in this project have been used to prepare a multi-author manuscript, involving all partners of the project. The publication has been submitted to the Journal Nature Climate Change on June 13, 2015.

We are very grateful to the donors and to the UNEP-GRASP for providing funding and support for this project.

3. Activity delivery status

Activity	Description of work undertaken during reporting period	Deliverables	Delivery date	Status of activity (complete/ ongoing/ delayed)	Comments
Compilation of ape abundance information	Screening of > 300 field survey reports for 260 resource management areas to extract great ape density and abundance (Table 1)	GIS layer on great ape abundance	31.05.2015	Complete	This layer will be continuously extended by adding newly available information
Selection of carbon layer	Requesting carbon layer (Baccini et al. (2012) (Table 1, Fig. 1)	Layer included in online tool	31.05.2015/ 28.02.2015	Complete	-
Selection of additional layers	Requesting corridor layer (Jantz et al. (2014) (Table 1, Fig. 1)	Layers included in online tool	15.12.2014	Complete	-
Development of concept for online tool	A concept has been developed for the online mapping and analysis tool that is based on related modules in the A.P.E.S. Portal	See next two lines	31.05.2015	Complete	-
User-friendly interface for online tool	A user-friendly interface has been developed to host the online tool	User-friendly interface	31.05.2015	Complete	-
Development of online prototype	Design of online tool and programming of prototype ((http://primatdbext.eva.mpg.de/redd/#)) by focusing on protected area corridors (Fig. 2)	Fully functional online mapping and analytical tool	31.05.2015 (final version)	Beta-version complete. Final version in progress after feedbacks from users.	The tool will be permanently improved
Evaluation of the co-benefits of climate carbon stocks for great apes	Statistical analyses have been performed to extract abundance of great apes and carbon for selected entities (Fig. 3&4)	Publication in a peer-reviewed journal	13.06.2015 (paper submitted to Nature Climate Change)	Complete	This publication was jointly written with all partners of this project

4. List of attached documents

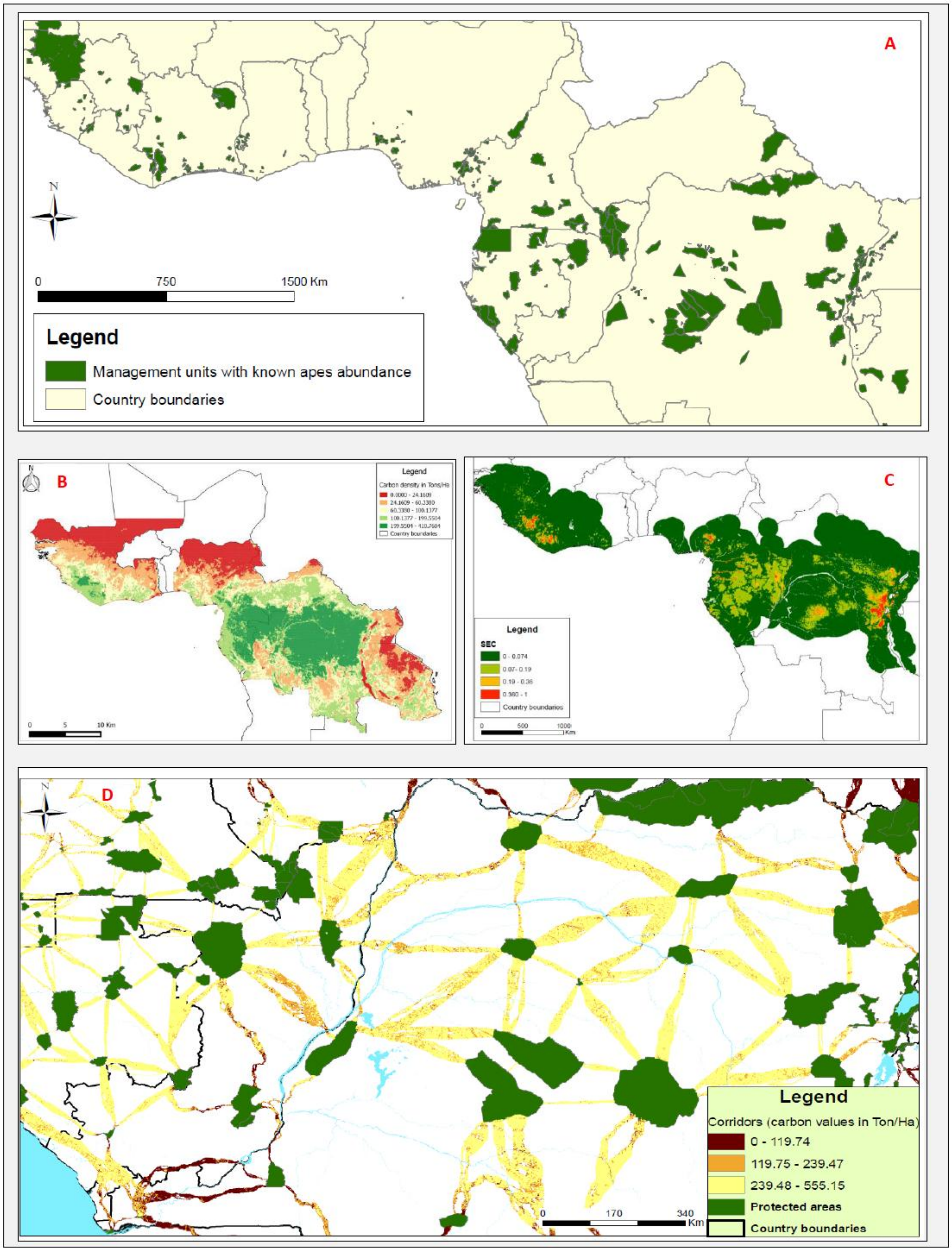
4-1. List of data compiled for this project

Table 1: List of datasets generated or compiled for this project. See also Fig. 1

Category	Layer	Type of layer	Description	Unit/Value	Year	Source
Great apes	African apes abundance	Vector	This is the first pan-African layer compiling in a single dataset, information from various sources (scientific publications, published and unpublished NGOs reports), data on apes populations at site level. This layer provides for each of the 365 polygons, representing 260 management units (protected areas, forest reserves, logging and mining concessions, etc.) information on abundance class, abundance estimates and population density for all African great ape taxa, as well as the survey method used. The dataset shows the spatial and temporal variability of ape populations at a continental scale. The layer will be updated on a regular basis and new sites or new population estimates received by the IUCN SSC A.P.E.S. DB will be added.	Number of apes per skm-1 or number of apes per site.	2014	IUCN SSC APES database
	Suitable Environmental Conditions	Raster	This layer presents the probability of ape occurrence at a resolution of 5km x 5Km, across the entire range of African ape. The model was derived from a combination of ape presence information, various environmental variables and human impact	SEC values vary from 0 to 1	2011	Junker et al. (2012) Recent decline in suitable environmental conditions for African great apes. *Diversity and Distributions*, 18: 1077–1091.
	African apes range	Vector	This layer was generated using presence localities where ape sightings and indirect signs such as sleeping nests, dung, vocalization were recorded		2008	UNEP-WCMC, 2008
	Apes density distribution	Raster	This layer will make a prediction of ape population abundance at 5 x 5 Km resolution, based on the African apes abundance layer, combine to environmental conditions (vegetation cover, climatic factors and human impact impact). The layer is under calibration.	Number of apes per skm-1 or number of apes per site.	2015	IUCN SSC APES database

Carbon	Global Pantropic Biomass	Raster	This layer provides an estimate of the above ground living woody vegetation carbon density for pan tropical ecosystems using multi-sensor satellite data. The resolution of the data is 500 x 500 m. This layer was chosen over because it is the most recent and covers all the tropics.	The pixel values are in megagrams (Mg) of aboveground live woody biomass per hectare (Mg/Ha) or Ton/Ha	2011	Baccini et al. (2012) Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. 2012 Nature Climate Change, http://dx.doi.org/10.1038/NCLIMATE1354
Area of Interest (AOI)	World database on Protected areas (WDPA)	Vector	Dataset presenting all protected areas with their IUCN categories.		2009	UNEP-WCMC (2009): World Database on Protected Areas (WDPA) Annual Release 2009 (web download version), February 2009. http://www.protectedplanet.net
	Carbon stock corridors	Vector and Raster	Represents areas with high carbon stocks between protected areas as potential connectivity pathways between protected units in the landscape. Resolution is 500 x 500 m.	megagrams (Mg) of Aboveground Live Woody Biomass per Hectare (Mg/Ha) or Ton/Ha	2014	Jantz et al. (2014). Carbon stock corridors to mitigate climate change and promote biodiversity in the tropics. 2014. Nature Climate Change, http://dx.doi.org/10.1038/NCLIMATE2105
Human impact	Human Footprint Index	Raster	The Human Footprint Index expresses as a percentage the relative human influence in each terrestrial biome. The value ranges between 0 (least influenced) and 100 (most influenced). The resolution is 30 arc seconds (1km).	0 to 100	1995-2005	Last of the Wild Data Version 2, 2005 (LTW-2): Global Human Footprint Dataset (Geographic). Wildlife Conservation (WCS) and Center for International Earth Science Information Network (CIESIN). http://dx.doi.org/10.7927/H4BP00QC.

Fig. 1: Selected layers showing available abundance data on great apes, carbon stocks and protected area corridors. (A) Resource management areas with known ape abundance; (B) Carbon layer from Baccini; (C) Suitable environmental conditions for great apes; (D) Protected area corridors

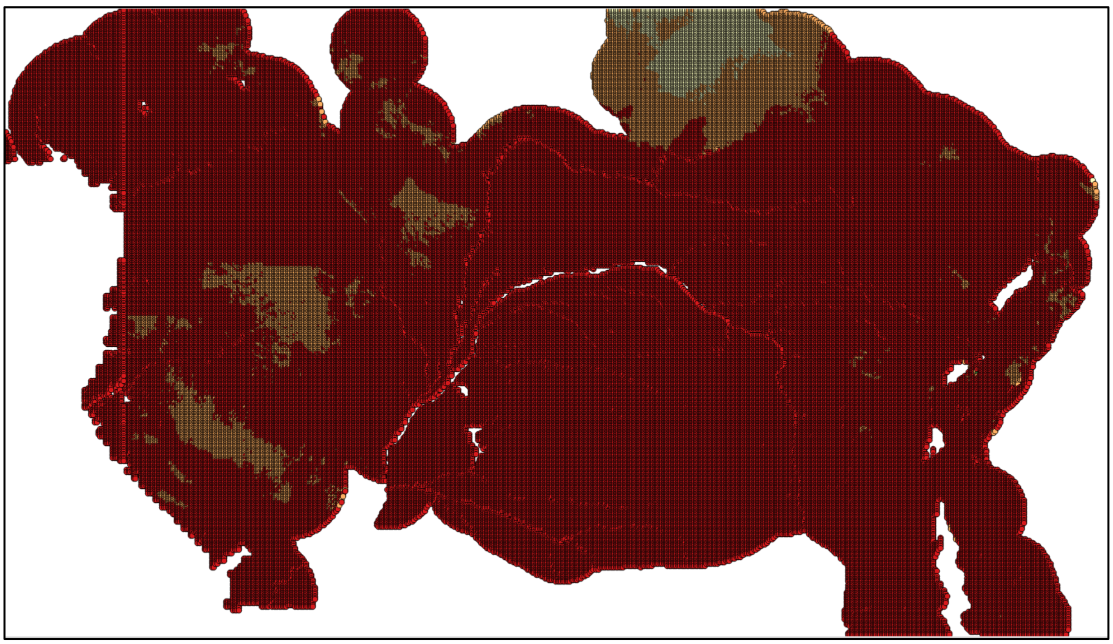


4-2. Online tool

4-2-1. Data and layers included

Figure 1 shows the layers that were used for the tool. Additionally the African great ape distribution layer that is currently under calibration.

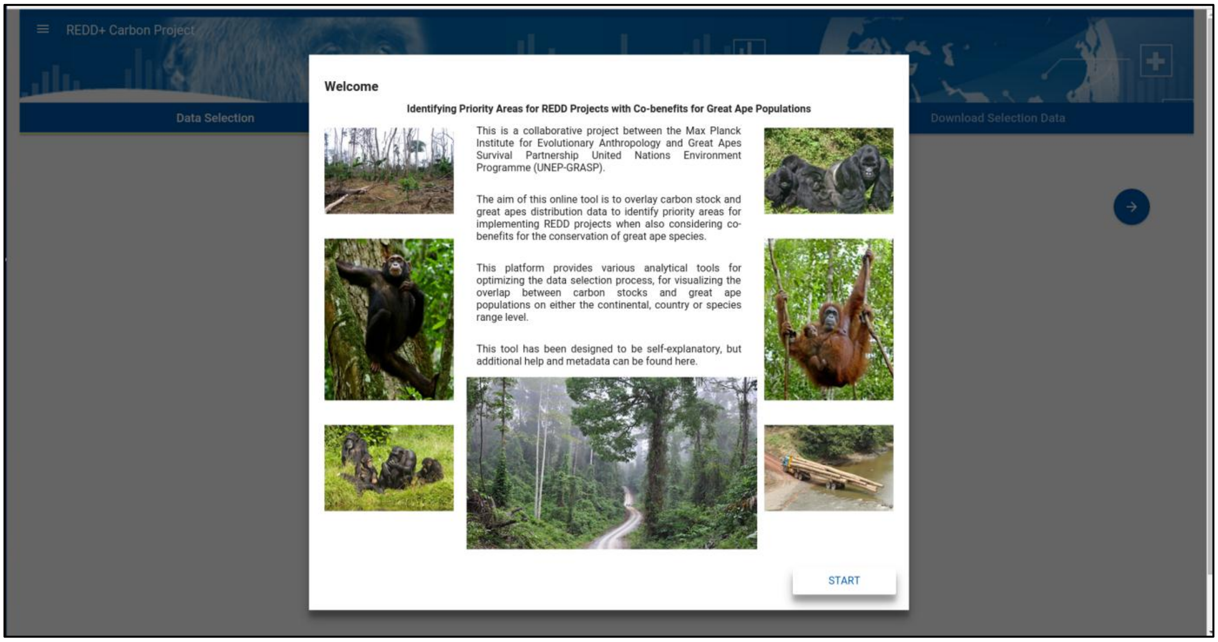
Figure 2: African great ape distribution layer



4-2-2. How does the tool function?

Fig. 3: Step-by-step instruction to use online tool (http://primatdbext.eva.mpg.de/redd/#)

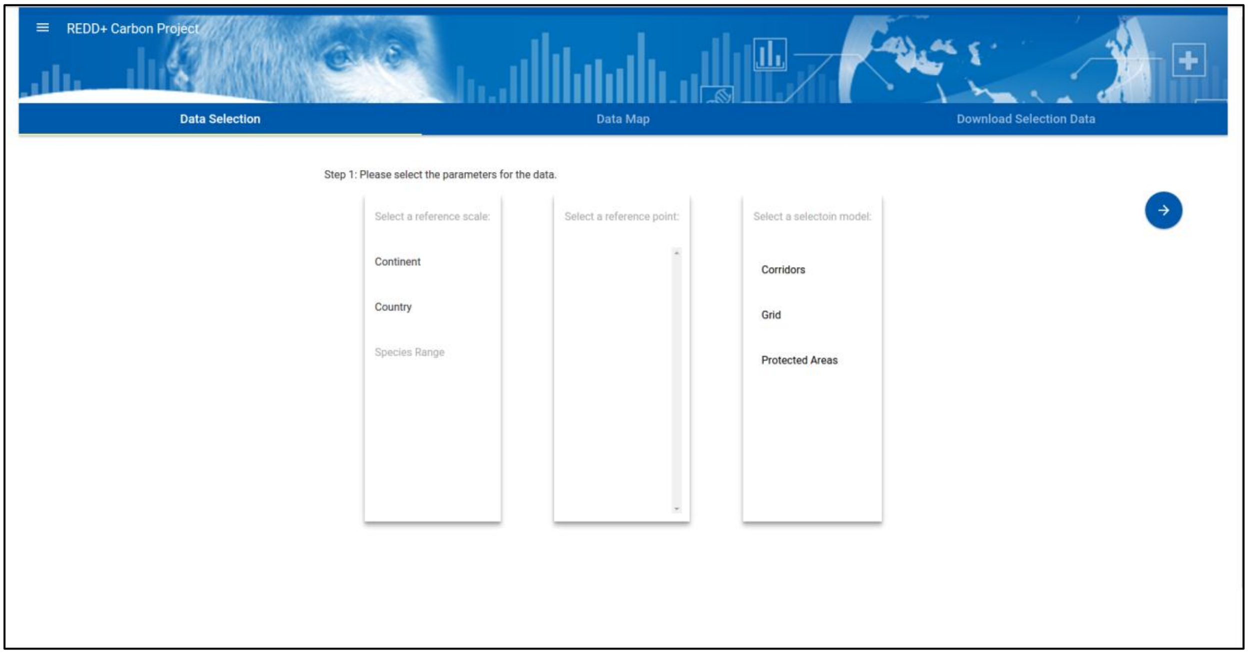
1-Start/ Welcome page



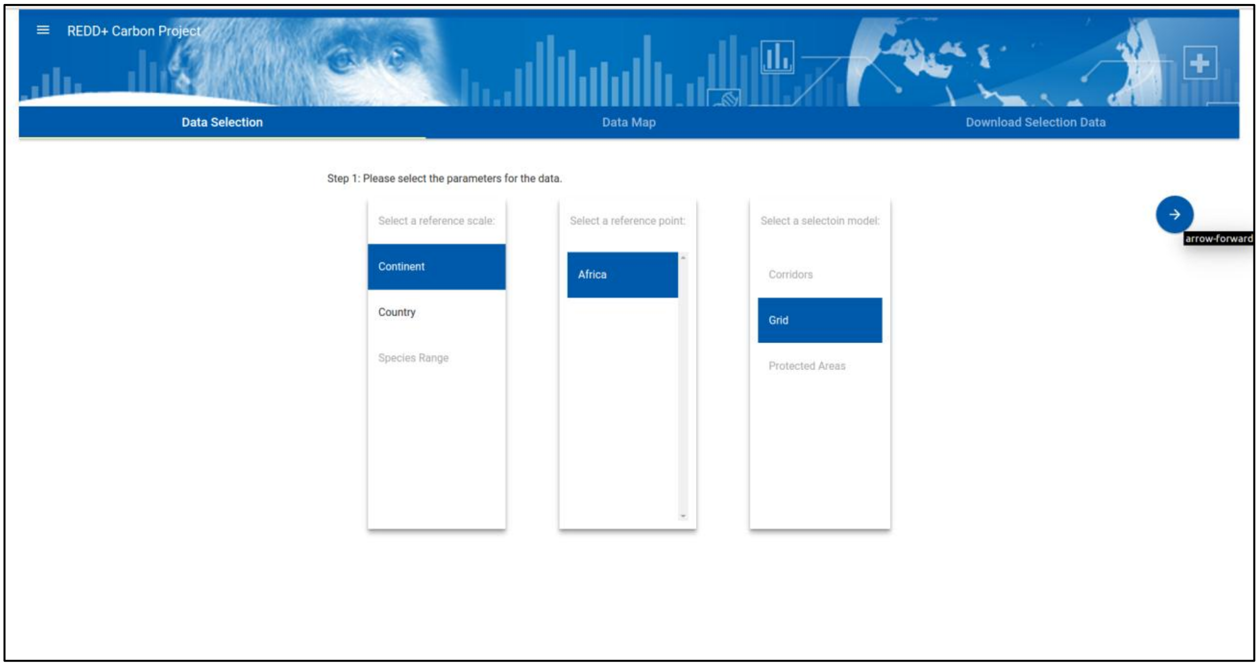
2- a) User selects a "Reference Scale" - Continent, Country or Species

b) User selects a "Reference Point" - Depending on selection - continent, country or species

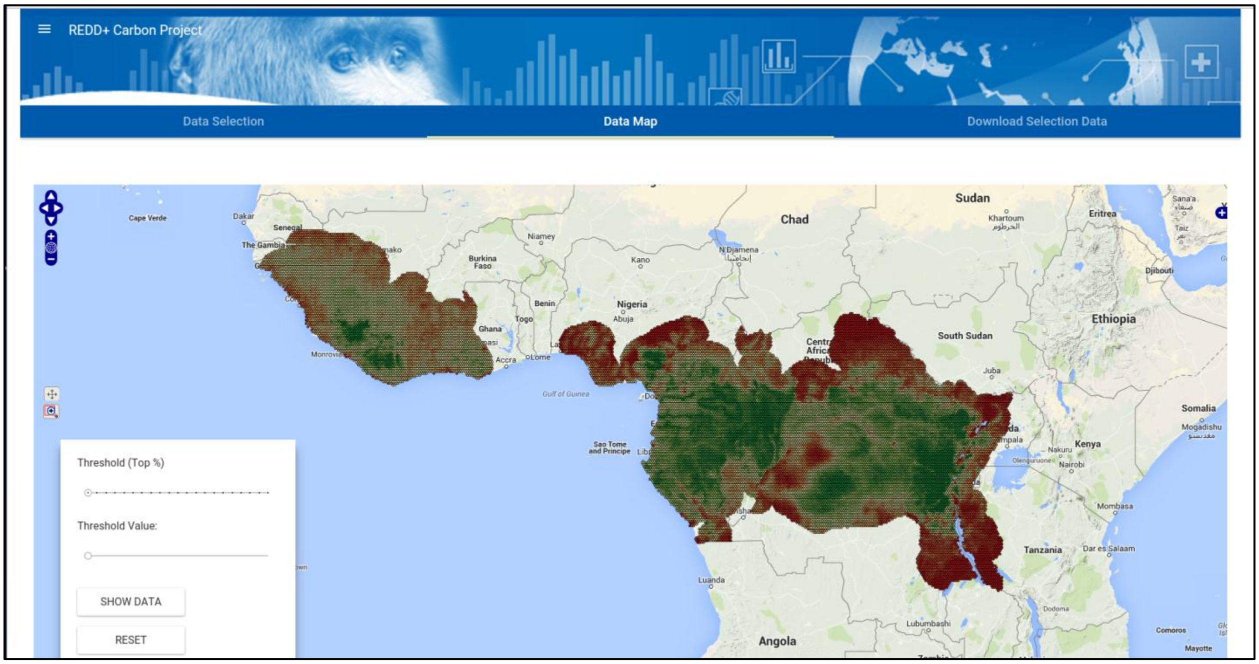
c) Select the "Selection Model" - This is either Grid, Corridors or Protected Areas



3 – Example to show selection on Continental scale

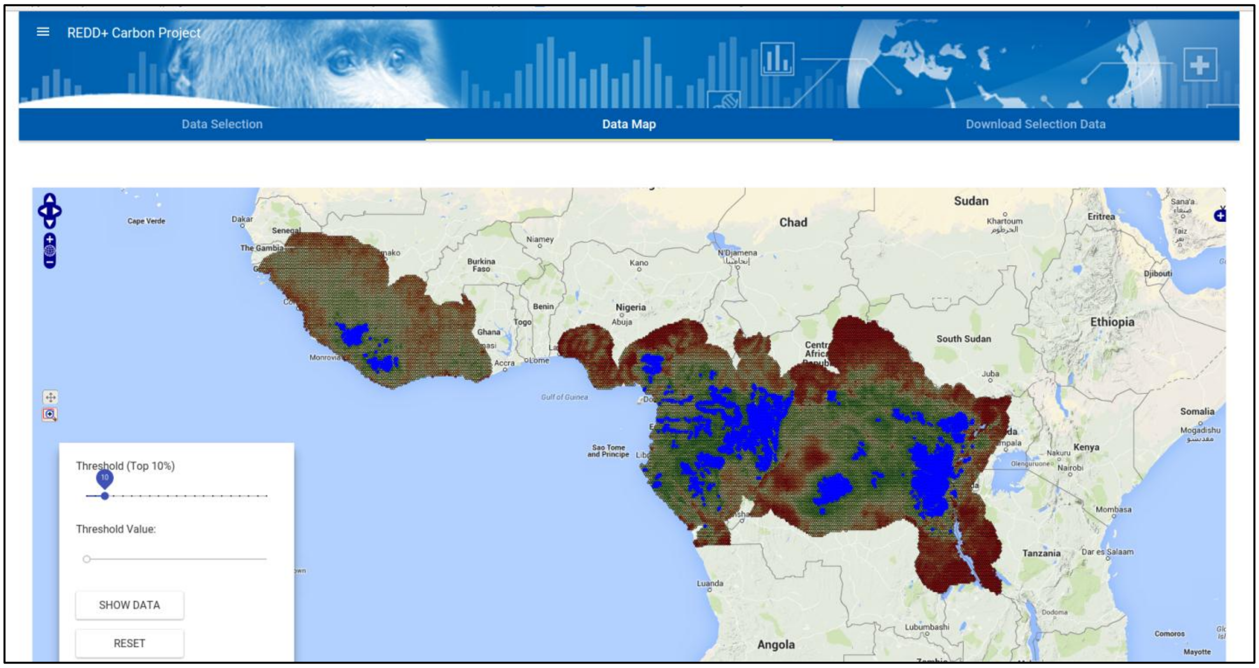


4- Example showing selected map data

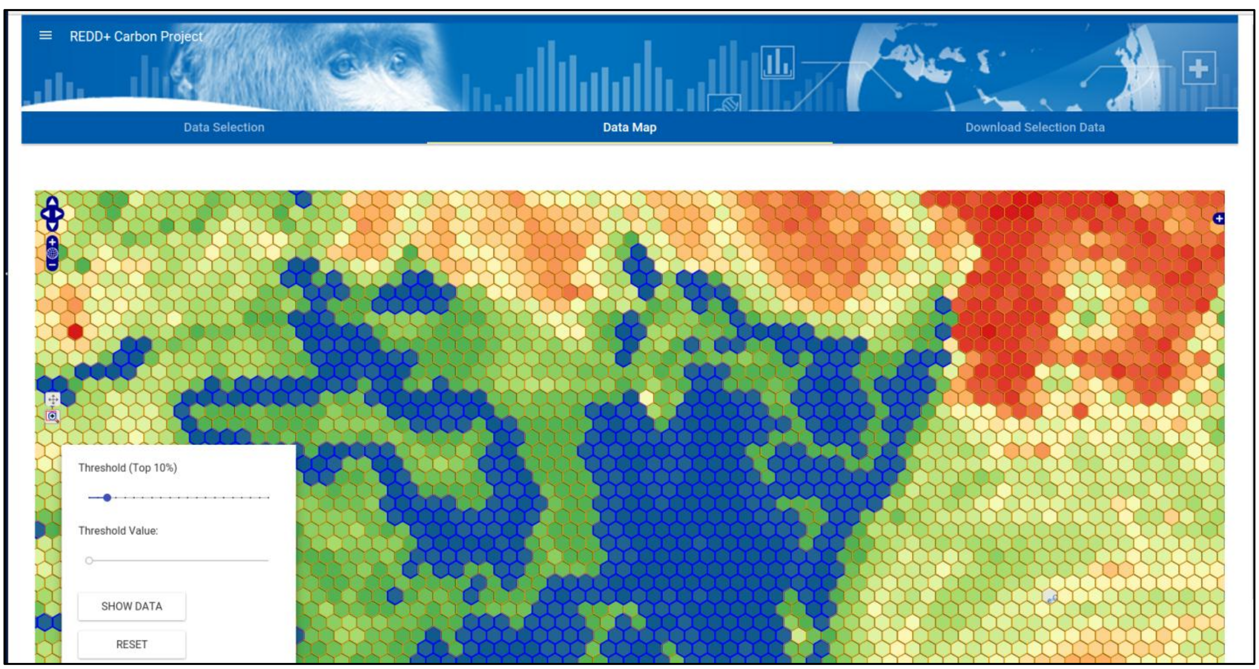


5- a) Move one of the sliders to the desired value; either threshold of top x% of locations or simply a specific threshold

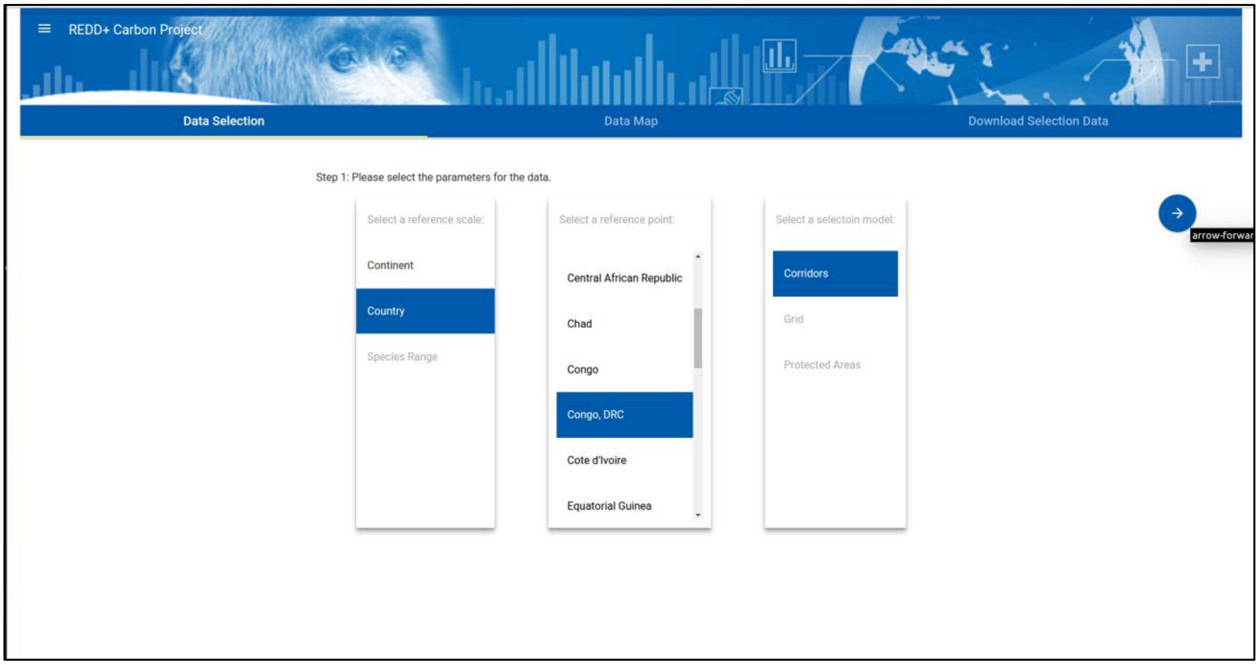
b) The selected Data (product of **SEC** X **carbon values**) are shown on map



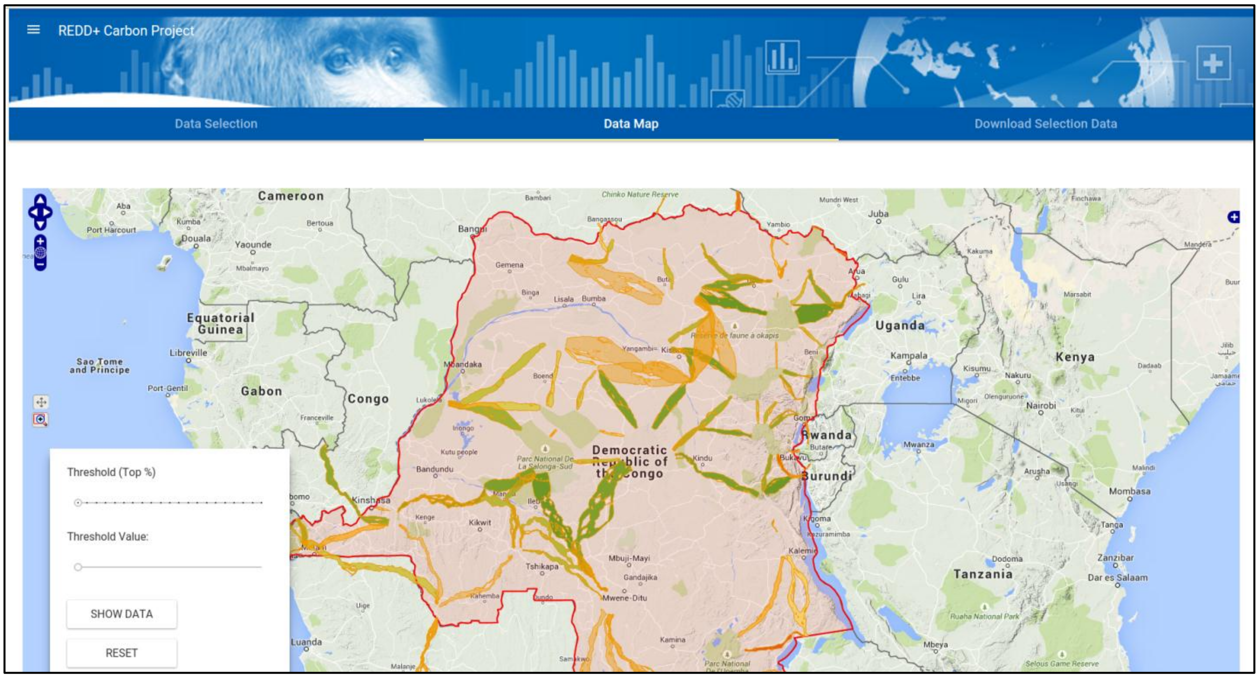
6 – Same setting as previous but zoomed in on selection. Now individual data layers are selectable. The highlighted cells in blue indicate locations that fulfill the selected conditions; i.e. co-benefits of carbon storage and ape presence. In this example, the selected cells indicate the top 10% of areas with the maximum Product SEC X Carbon



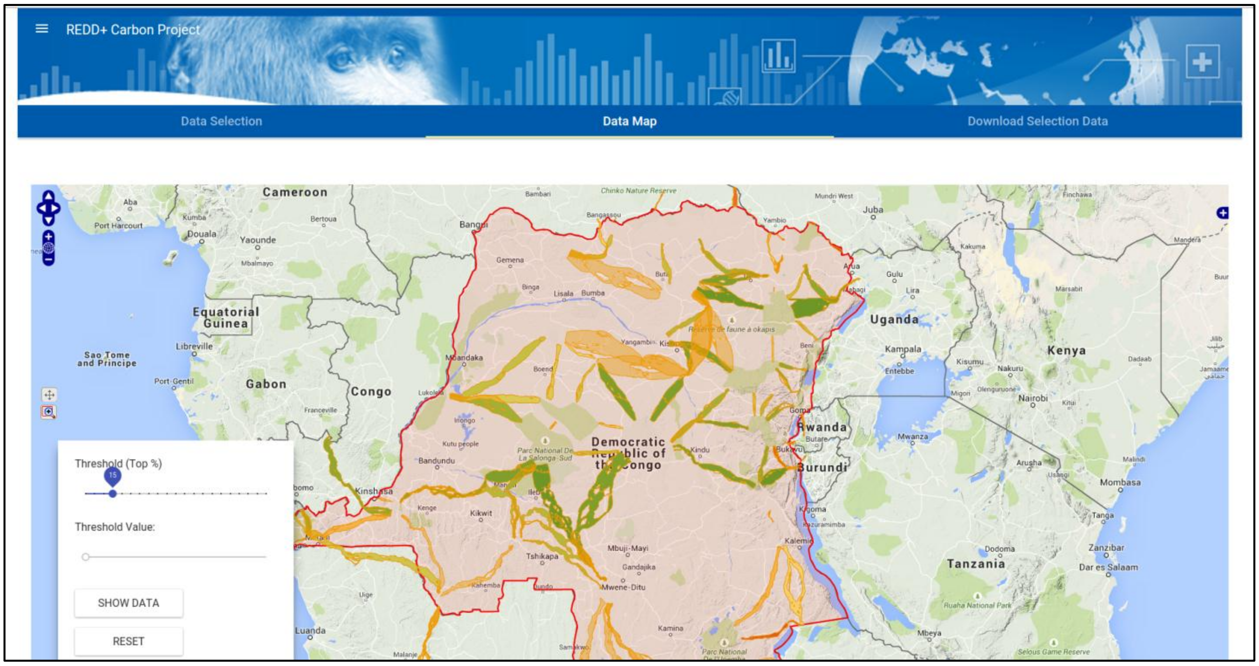
7- Another example showing selection on the country scale and corridors between protected areas



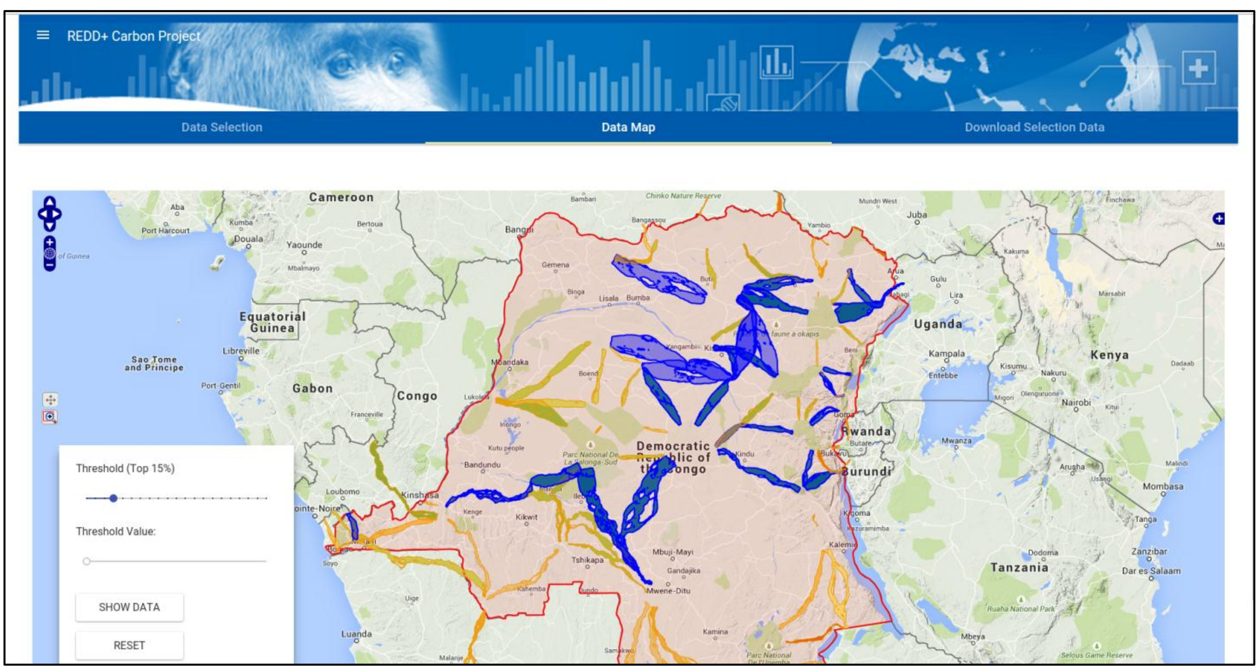
8- Selected map data for DRC. Coloring indicates worst (red) to best (green)



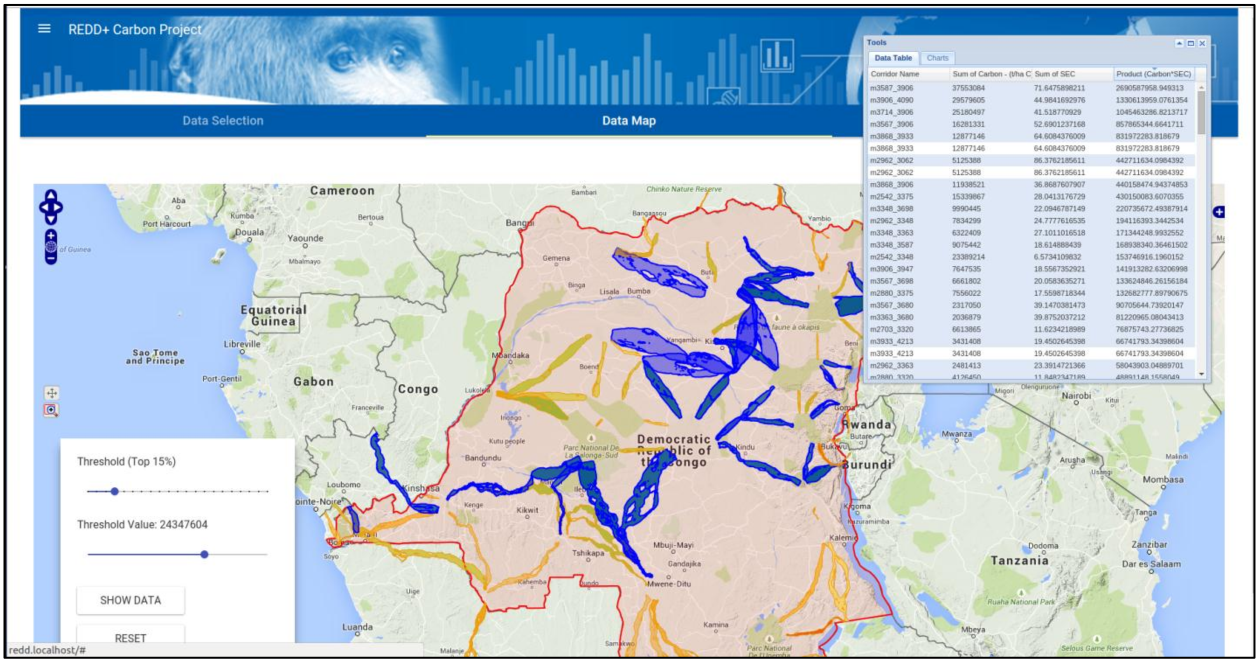
9- Shows selected map data. The slider can be moved to the desired value



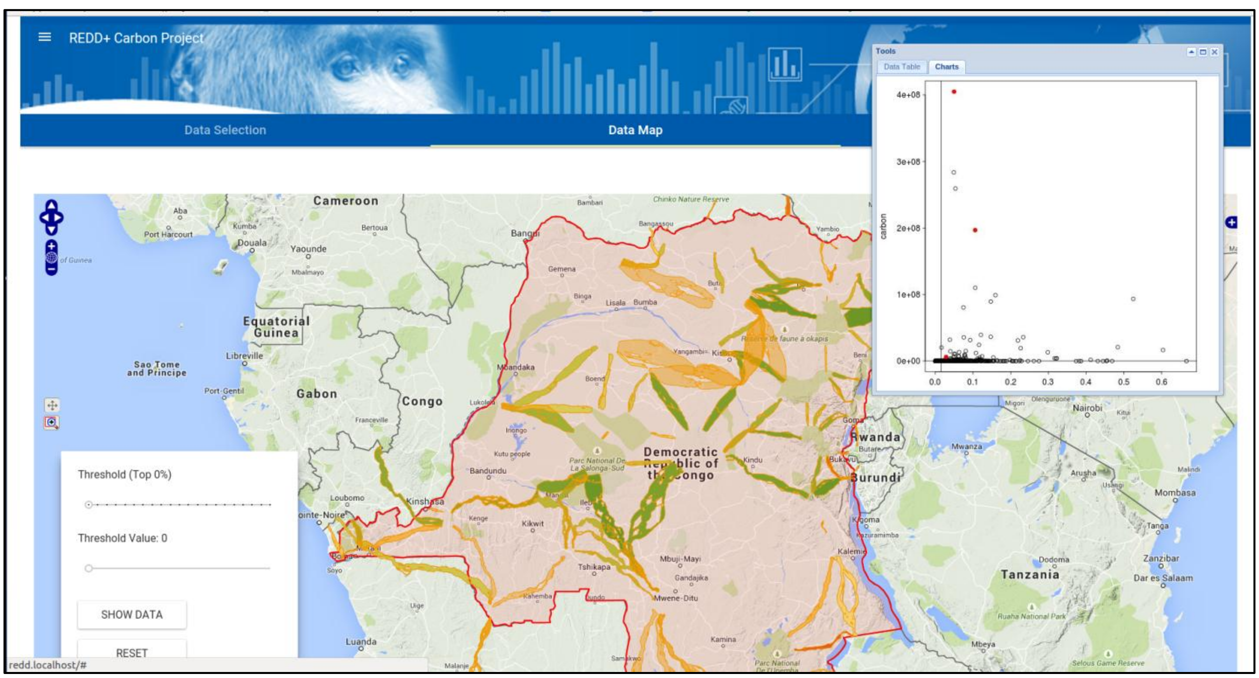
10- Move sliders to desired value. Here the user has selected the top 15% of locations with maximum Carbon and SEC values.



11- After selection is made, the "Show Data" button can be used to see the actual data of the selection



12 - After selection is made, the "Chart" data can be seen by clicking on the "Show Data" button and selecting the "Charts" tab.



4-2-3. Outlook regarding the online tool

The online tool is currently in a beta version. This means that the software is ready for initial use, although, some of the functionality might not work as expected or have some performance issues due to factors such as differences between the different browsers, browser versions or general real world implementation issues. The tool will continually be updated and optimized until such time that all users are satisfied with the overall performance and functionality of the tool. This is a standard procedure for developing online applications.

Some of the outlooks for this tool will be the following:

*Incorporate all the selection models to all scales - i.e to be able to compare/show data for all reference scales.

*The ability to select on which of the data columns to do the comparisons - i.e Carbon stocks, SEC or the product between Carbon stocks and SEC (the latter is how it is implemented at the time of writing)

*Integration of other useful data such as socio-economic data for the specified range

*Integration of Abundance Model data to more accurately display the species information such as distribution

*Downloading of the selected data in different formats - PDF, Excel, CSV

*Further improve the overall design of the tool.

*General performance optimization of tool

*Standalone server for database and application hosting

The tool was designed in such a way that the data layers can easily be adjusted and re-uploaded to show future adjustments/improvements when such data become available. New selection models can also be easily added should the need arise.

4-2-4. The co-benefits of climate carbon stocks for great apes

Note: The following information is contained in a publication currently in review with Nature Climate Change. This part of the report should therefore not be publicly communicated.

Great ape conservation and carbon storage are two very frequently discussed topics that have not yet been linked together. In this study, we propose a new framework for biodiversity conservation in great ape habitat based on management areas and ecosystem services. We first identify the gaps in the existing protected area network with regard to great ape distribution and highlight the importance of weakly protected areas and corridors (as defined by Jantz et al. 2014). Assessing spatial overlap between great apes and above-ground carbon stocks, we then show how conservation benefits under REDD+ can help to protect important areas for great apes, with high carbon values but low protection status.

All data was aggregated at a ~25km² hexagonal grid applied to the whole study area and corresponding in 374743 cells. For each subspecies, we used the presence points recorded in the IUCN SSC A.P.E.S database and the normalized suitable environmental conditions - SEC values above 0.3. Such distribution therefore corresponds to grid cells for which the presence of apes was recorded and the additional ones for which there is a high probability to find them. Note that great ape range in Sudan and Angola was excluded from analysis because no spatial data on ape presence has been documented in these countries.

Overall, only 32% of great ape range is covered by strictly protected areas (IUCN category I-IV). However, our analysis highlights the importance of those management areas classified as weakly protected (IUCN category V-VI) as well as corridors, which cover 22% and 15% of the great ape range, respectively. Focusing future conservation efforts on these management areas would contribute to the overall protection of 70% of the entire great ape range.

Since great apes occur mainly in forest ecosystems and woody savannas, REDD+ could provide financial incentives to protect habitat outside of strictly protected areas. Comparisons of the average value of carbon reveal significantly higher values in areas where great apes occur, suggesting that REDD+ could potentially contribute to great ape and biodiversity conservation. Moreover, 23% of great ape range is included in areas that harbor the largest carbon stocks within ape range countries (Fig. 1). Carbon is, however, unequally distributed across the great ape range (Fig. 2): moving from West Africa to Central Africa, we observe a gradient of increasing levels of carbon stock. Thus different species in different countries occur in different level of carbon.

Our study highlights areas with high carbon value and great ape populations that can direct where REDD+ investments should be made. Such conservation priority areas occur across a wide range of management areas. Whether priority for new investments should be given to corridors, already protected, or non-protected areas remains a complicated issue.

Furthermore, our analyses reveal various geographical contexts relating to ape distribution and carbon stocks but as well to human threat on ecosystems (see complete analysis in appendix 3), in which a coherent strategy for great ape conservation and co-benefit should be implemented. In West African countries such as Sierra Leone, and as well in some areas of eastern Africa, chimpanzees and associated biodiversity occupy human-dominated landscapes in which there are few, small patches of old-growth forest. Ensuring the presence and availability of suitable habitat to connect these patches, even if the connecting habitat is used by humans, will likely be key to the long-term survival of these fragmented wildlife populations. The REDD+ instrument could focus on corridors with, by construction, high densities of carbon. In comparison, conservation strategies in Central Africa need to be adapted to the specific conservation challenges in that region. Here, apes occur within a matrix of forest and lightly to moderately-disturbed landscapes. Large carbon stocks are common and widely-distributed. In this region, linking protected areas through corridors is not the main issue. Conservation strategies should rather focus on protecting large populations of great apes. The benefit of REDD+ there could be to upgrade and enforce the status of weakly protected areas, but also to promote the sustainable use of resources in logging concessions. The effective conservation of Asia’s orangutans may require an intermediate approach. There, ape habitat is small and fragmented. The landscape is nearly binary, with either patches of remaining tropical forest or large oil-palm plantations spread across the landscape. Connecting the few remaining natural areas is certainly important, especially on Borneo. However, in addition to enforcing the status of high carbon stock corridor areas, REDD+ could encourage more sustainable oil-palm cultivating activities, such as agro-forestry or by promoting the conservation of corridors within concession areas.

Figure 1. Distribution of great ape species in different management areas and relation with carbon stocks. The color indicates the median values of carbon for all the grid cells where apes occur according to the gradient on the scale. "Carbon" pie represents the 5% largest carbon-stock values in the study area. The area of the pies is proportional to the size of the considered species range. Black: strict protection (IUCN cat I-IV). Grey: weak protection (IUCN cat V-VI). Color (stripes for "Carbon" pie): corridors. White: out (outside of any protected areas or corridors). The numbers correspond to the range proportion of the considered species included in the 5% highest values of carbon.

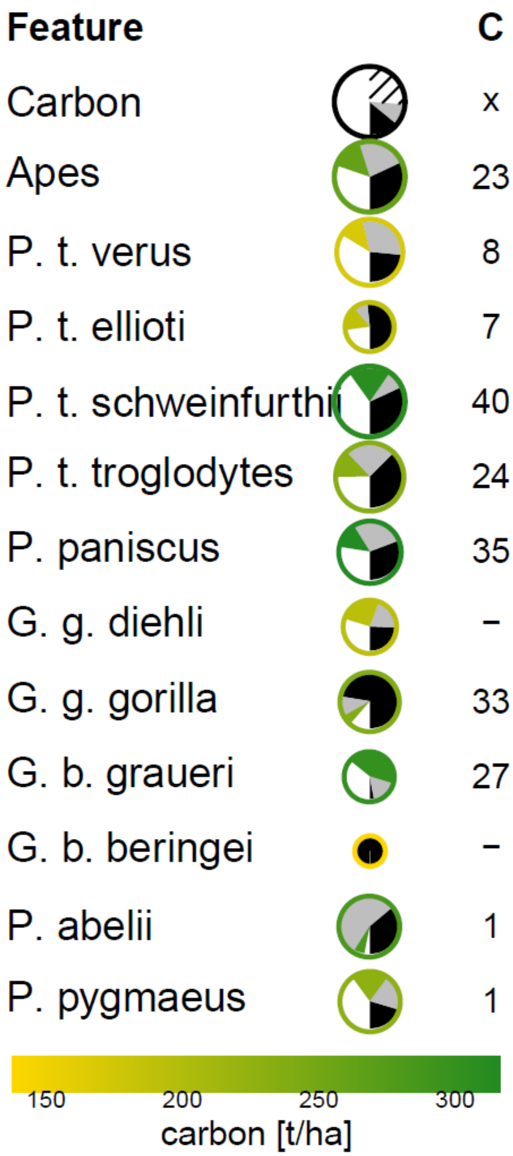
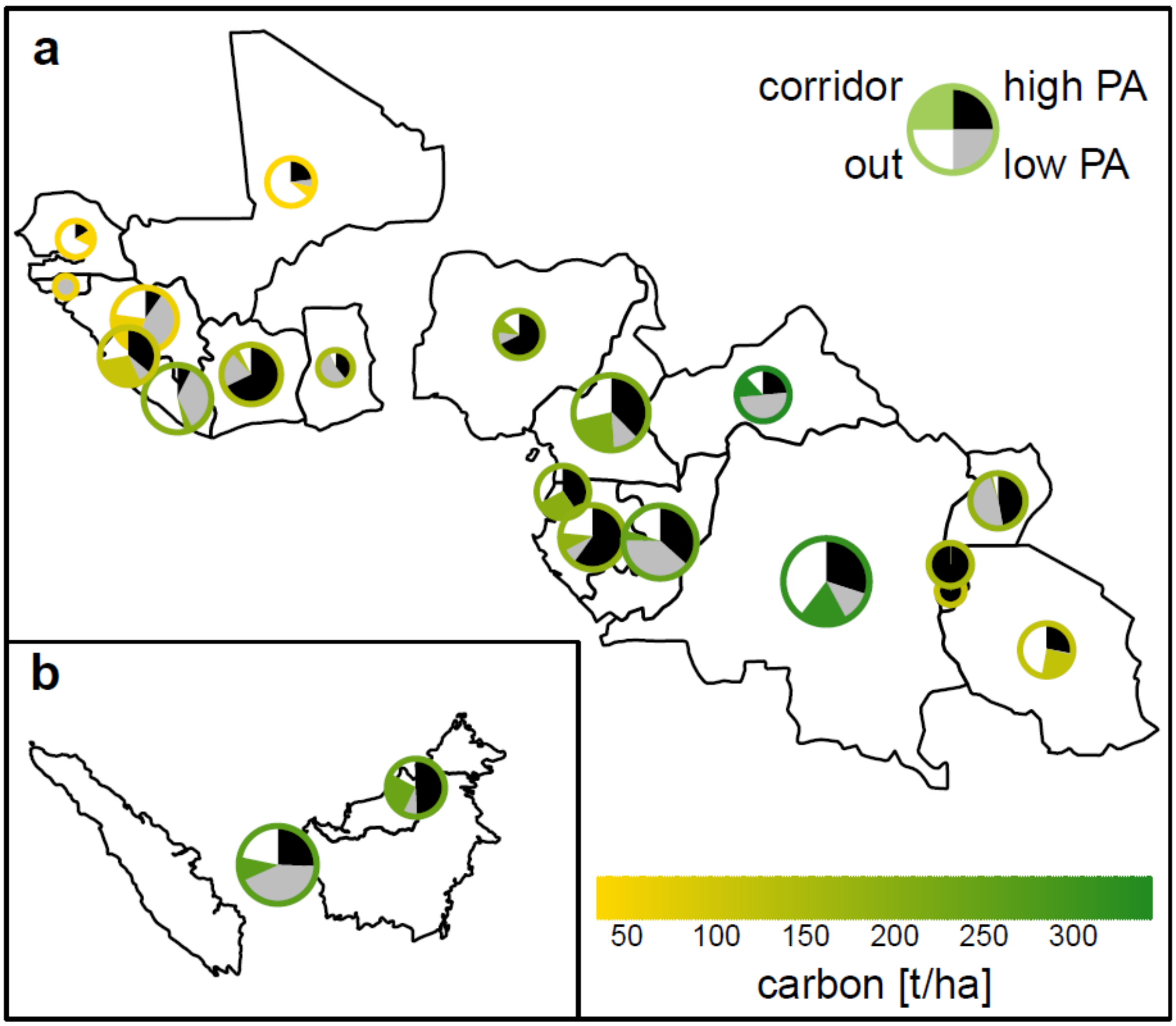


Figure 2. Great ape distribution in different management areas and relation to carbon stocks for each country in a) Africa and b) Southeast Asia.
The color indicates the median values of carbon for all the grid cells where apes occur according to the gradient on the scale. The area of the pies is proportional to the size of the considered country's ape range. The numbers correspond to the proportion of the country's apes range coinciding with the 5% highest values of carbon ("C").



	GNB	SEN	SLI	GIN	LBR	CIV	MLI	GHA	NGA	GNQ	GAB	CMR	COG	CAF	COD	RWA	BDI	UGA	TZA	IDN	MYS
C	–	–	–	8	18	–	–	–	–	–	–	22	26	76	43	–	–	3	–	1	1

5. Acknowledgements

We would like to thank Dr. Johannes Refisch for his invaluable contribution and his permanent support during the realization of this project. We are grateful to Dr. Roger Mundry and Ms. Colleen Stephens for providing statistical support during the project. We acknowledge the institutional support of the German Centre for Integrative Biodiversity Research (iDiv) and the Max-Planck-Institute for Evolutionary Anthropology .We want to thank all people who contributed to the success of this project.

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Date: 19/06/2015