Defining HCV Thresholds in Gabon:

ABCG B.2 High Conservation Value forest assessment

Interim progress report Year II: Sept 2012-Oct 2013. V2

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1. Introduction

1.1 The overall aim of the project

Emerging industry standards for good environmental practice in the agricultural and plantation sectors (e.g. RSPO) require that areas deemed important for biodiversity conservation are not converted to agricultural use. These certification schemes use the criteria for High Conservation Value (HCV), originally developed by the FSC, to orientate companies towards the conservation of such areas. HCV areas can be identified at the scale of an individual plantation concession. However in instances where land suitable for plantations conflicts with biodiversity conservation priorities, industry stakeholders require this information *before* land is allocated for forest conversion. Where possible, the identification of these High Conservation Value areas will occur at the national scale, through a process of land use planning.

WCS, MBG, WWF and CI are keen to ensure that future industrial agricultural developments take into consideration areas of important biodiversity. Plantation developments should be orientated to degraded lands and areas that are of low priority for biodiversity. The HCV criteria provide a useful framework for identifying such priority areas. But to use the criteria in the context of national land use planning, it is necessary to develop reliable and consistent methods for the delineation of HCV areas. The ***limits and thresholds*** for these HCVs need to be defined and agreed at the national level. For each HCV criteria, it is necessary for stakeholders to agree *when* a given value will be considered an HCV.

The aim of this project is to establish means and approaches to setting these thresholds for certain HCV attributes. The HCV attributes considered for this project will be those for which a reasonable amount of data exists, and those which will contribute added value to the process of land use planning currently underway in Gabon.

2. The themes addressed in year II

This report presents the results of the second year of work on this theme. In Year II of this project the team has continued and completed data collection on endemic plant distributions, forest habitat types, great ape abundance, and the aquatic diversity of river systems. It builds on the work completed in year I on the distribution and abundance of elephants, and priority elephant conservation zones.

The analysis of this data presented in this report shows how the use the data in a conservation planning can approach the question of critical thresholds for conservation. Each method described here enables a type of zoning, or classification by priority. These classifications allow for the adoption of a threshold in the spatial planning process, such as the level of coverage of differnet types of habitat, or the area of forest necessary to support a viable population of an endangered species. The choice of these threshold values and interplay between them can then be the subject of stakeholder debate.

An additional grant was made to WCS in Year II to complete a technical report on biodiversity metrics for potential application in offsetting decisions. This report is now available in draft form.

An important objective of Year II was to test the suite of methods in the landscape of a national park to provide a detailed case study of the identification of HCV areas around a core protected area.

Unfortunately this important objective has not yet been completed due to time delays in data analysis, and co-financing. It is hoped this exercise can be completed early in Year III, and the presentation of these results to the relevant stakeholders thereafter. This case study is critical to the presentation of the approach and its potential value in land use planning. The presentation of the results from this landscape case study is critical. The delay in its achievement has unfortunately had a knock on effect on the holding of the stakeholder workshop

Nevertheless, intermediate results from this project were presented at the ICCB meeting in Baltimore USA in July 2013, and at the IUCN great apes SSC meeting in Brazzaville in May 2013. A series of small expert meetings were also held in Gabon during the preparation of the biodiversity offsets report. However, an opportunity to bring together industry and government stakeholders in Gabon to discuss these findings in the context of palm oil certification is still being sought.

Specific objectives and achievements for year II are shown in table 1 below:

Table 1. Objectives and achievements for Year II

Activity	Organisation	Status
Improved abundance model for elephants in Gabon, with maps showing different conservation target thresholds	WCS & CI	
Completed abundance model for great apes in Gabon, with maps showing different conservation target thresholds	WCS & CI	
Improved training module on recommended techniques for faunal and botanical HCV identification	WCS/WWF/ MBG	
Aquatic biodiversity sampling and priority mapping	WWF	
Combined priority setting methodology field tested in the landscape of one national park	WCS	
Technical report on biodiversity metrics in offsetting decisions	WCS	
Stakeholder workshop to present intermediate results	WCS/WWF	

3. Activities and interim results

3.1 Forest type mapping:

The method used here use forest inventory data collected by the company Sylvafrica. Ordination and clustering methods made on the inventory plot data were used to define forest types based on the abundance of tree species. This approach has been tested by the Missouri Botanical Garden (MBG) in **14** forest concessions in Gabon. This phase of the project seeks to:

- Test the applicability of the approach for national scale habitat classification
- Use the approach with forest inventory from the target project landscape in the coastal forest zone

This work package has not yet been completely realized since only Sylvafrica data have been used, but immense progress has been made in the analysis of the available data.

The map below (Fig 1) shows the results of a forest typification based on the statistical analysis of forest inventory data from across the country. While the map does not cover the whole of the country, it already has a good representation of most forest types since concessions in all broad phytogeographical delimitations have been used. It can be improved through the addition of data from the Mayombe, and certain other sites. These preliminary results, which are shortly to be published by MBG, show that the approach has major implications for conservation planning (assuring representativity) and for the identification of spatially restricted or rare habitat types, consistent with HCV 3.

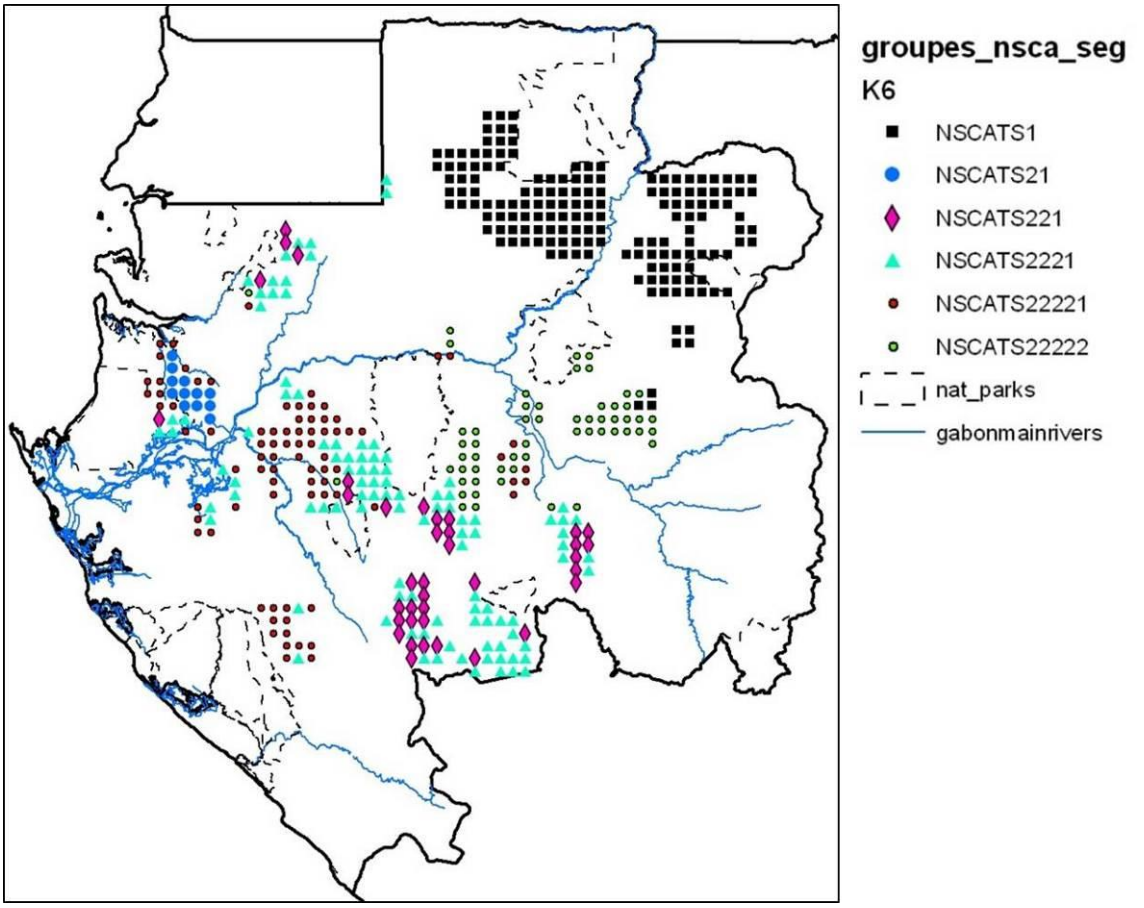

Fig 1. Preliminary results of the statistical analysis of forest inventory data from 14 companies provided by Sylvafrica to classify forest habitats based on vegetation diversity. The results clearly show distinct habitat types. These different types need to be considered in conservation planning work to ensure the representative coverage of conservation areas.

The categories of forest habitat that have been defined based on this sample are shown in the table below:

No	Designation	Description
1	NSCATS1	Continental Forest without Okoumé
2	NSCATS21	Estuary forest
3	NSCATS221	Mature Central forest rich in Okoumé
4	NSCATS2221	Mature Central Forest

5	NSCATS22221	Costal forest
6	NSCATS22222	Ivindo forest

3.2 Improvements in the mapping of endemic plants: areas of endemism

Funds from the USAID cooperative agreement have enabled the MBG team to expand their data field work in the Mayombe, the south western region of Gabon, where WCS hopes to conduct a landscape scale HCV analysis. The botanical analysis has improved our understanding of the diversity of forest habitats in the region, and has enabled the development of a map of endemism areas for the coastal region of Gabon.

A team of MBG botanists carried out two data collection missions in the Mayombe to add to data collected in the Evaro lakes area in 2011-2. Groups of plots were established at 2 sites, one on the the eastern and one on the western side of the Mayombe range of hills. In each of the 2 sites, 4 plots of 0.1 ha were positioned to take account of the local physiographical variation of the terrain. All plants with a DBH greater than 5cm were identified.

Results of the sampling were analysed through multi-dimensional scaling, using the PRIMER software, to identify vegetation types based on floristic composition. This enabled the team to identify 3 different forest types the area surveyed, and to distinguish a broader distinction between the dominant tree vegetation of the Mayombe and that of the Evaro area.

Of the 322 species inventoried, 88 were endemic or sub-endemic to Gabon. When the distribution of individual species is mapped, floristic groups emerge at the national scale, such that it becomes possible to identify 3 different zones of endemicity in the coastal part of Gabon. Endemic data confirmed that the western part of the area supports species found only narrow coastal band now being referred to as the Mayombe-Loango zone of endemicity (dark blue in Fig 2 below). The inland part of the Mayombe massif has vegetation consistent with the southern coastal zone (sky blue colour) which is more widespread. This information is useful in spatial planning to ensure representative samples of each forest type are included in conservation areas.

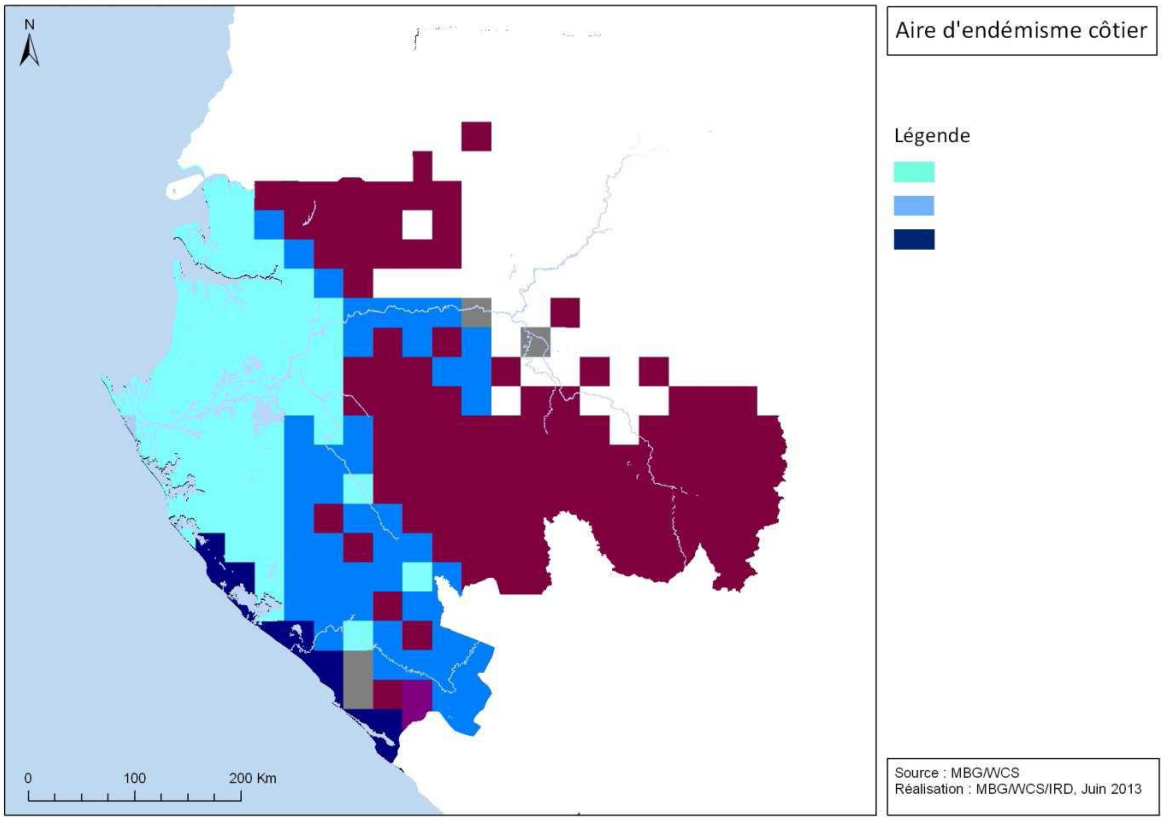

Fig 2. Areas of endemism in the coastal part of Gabon. The north coastal zone (turquoise) the south coastal zone (sky blue) and the Mayombe-Loango zone (dark blue) can be clearly distinguished from statistical analysis of endemic species ranges.

3.3 Landscape case study

The case study will use Marxan software to integrate national scale HCV threshold values with landscape scale features to delineate optimal conservation set asides around HCV areas. The approach assigns land units to different end uses based on user-defined priorities such as the predicted biodiversity value, and proximity to existing conservation areas or other irreplaceable features.

The case study is intended to provide a mode of HCV identification and mapping, making use of the data collected and analytical techniques developed for this project. The results of the case study will be presented to a workshop for businesses on the use of the HCV approach.

3.4 Conservation planning for endangered large mammals

3.4.1 Improved abundance model for elephants in Gabon

Following discussion of the results of the elephant population analysis carried out in year 1, the analytical approach has been revised and improved, and different techniques have been tested for the identification of priority zone.

In this example, we used a ***population target*** to define a 'significant concentration' of elephants at the national scale. The first analysis we tested the modelling process by defining ad hoc targets per population block.

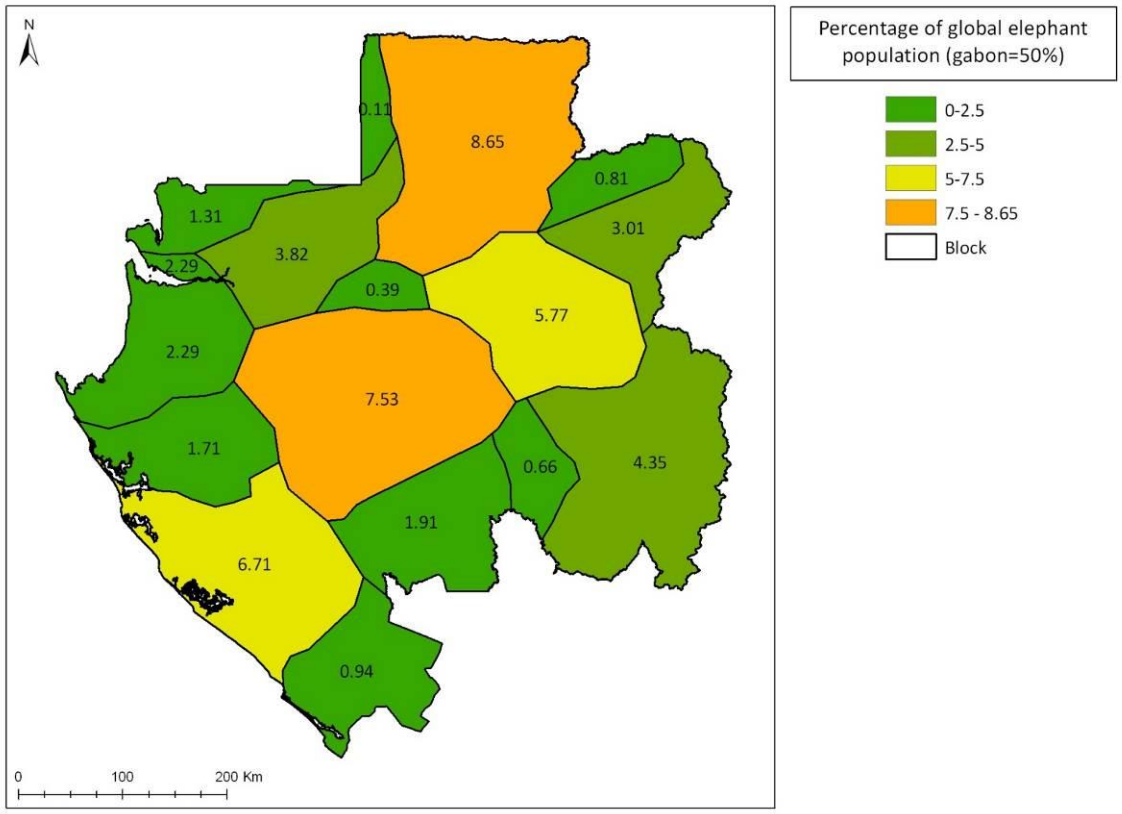

Fig 3. Overall importance of elephant blocks expressed as percentage of the global population

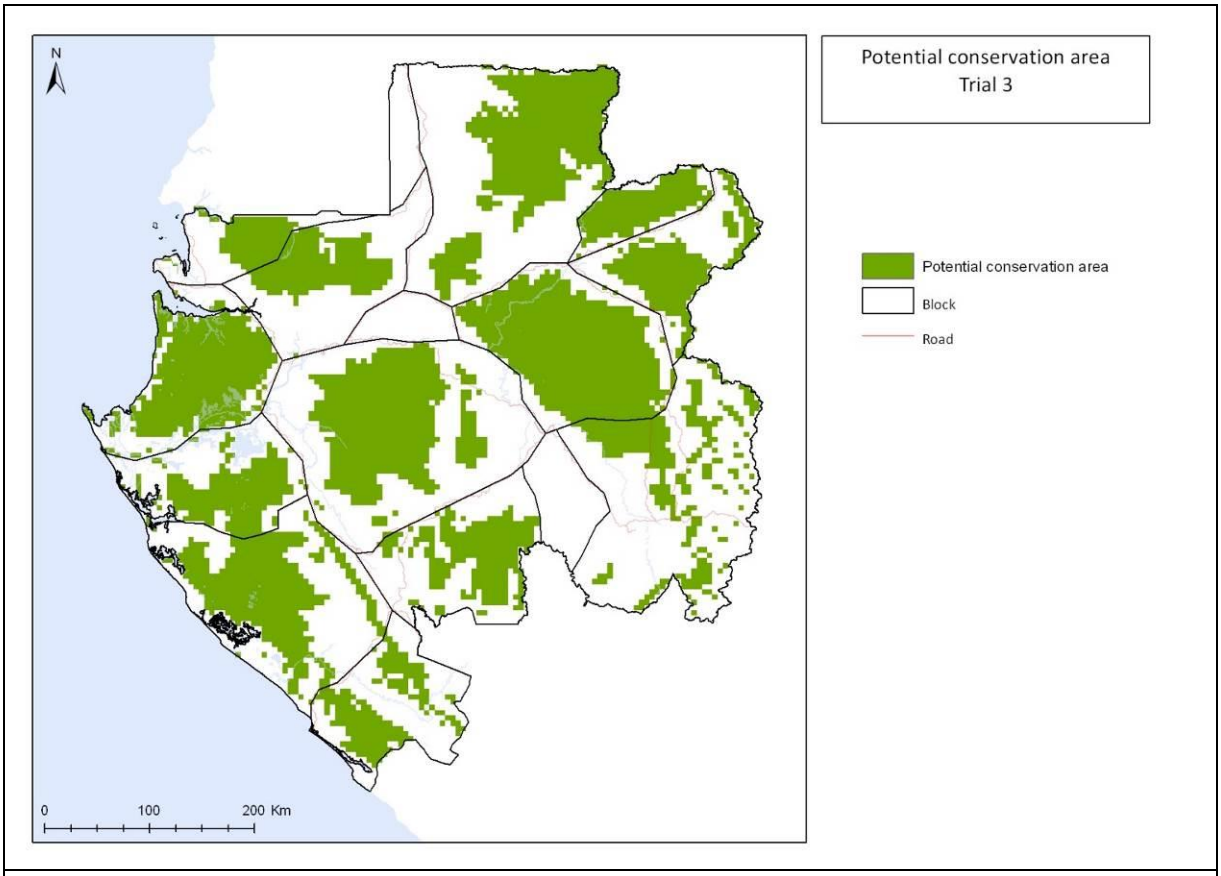

Fig 4. Example outputs from yr 1 trials: ad hoc targets per block based on overall population importance

However, this is only one potential approach to defining important concentrations, and conservationists can always argue over which blocks are the most important and the precise target population that should be set for each block.

To provide a counterpoint for this analysis, an alternative approach is to model the area necessary for a set percentage of the elephant population in *each* block. In the example below we show the optimal area of land required to conserve 70% of the elephant population in each block.

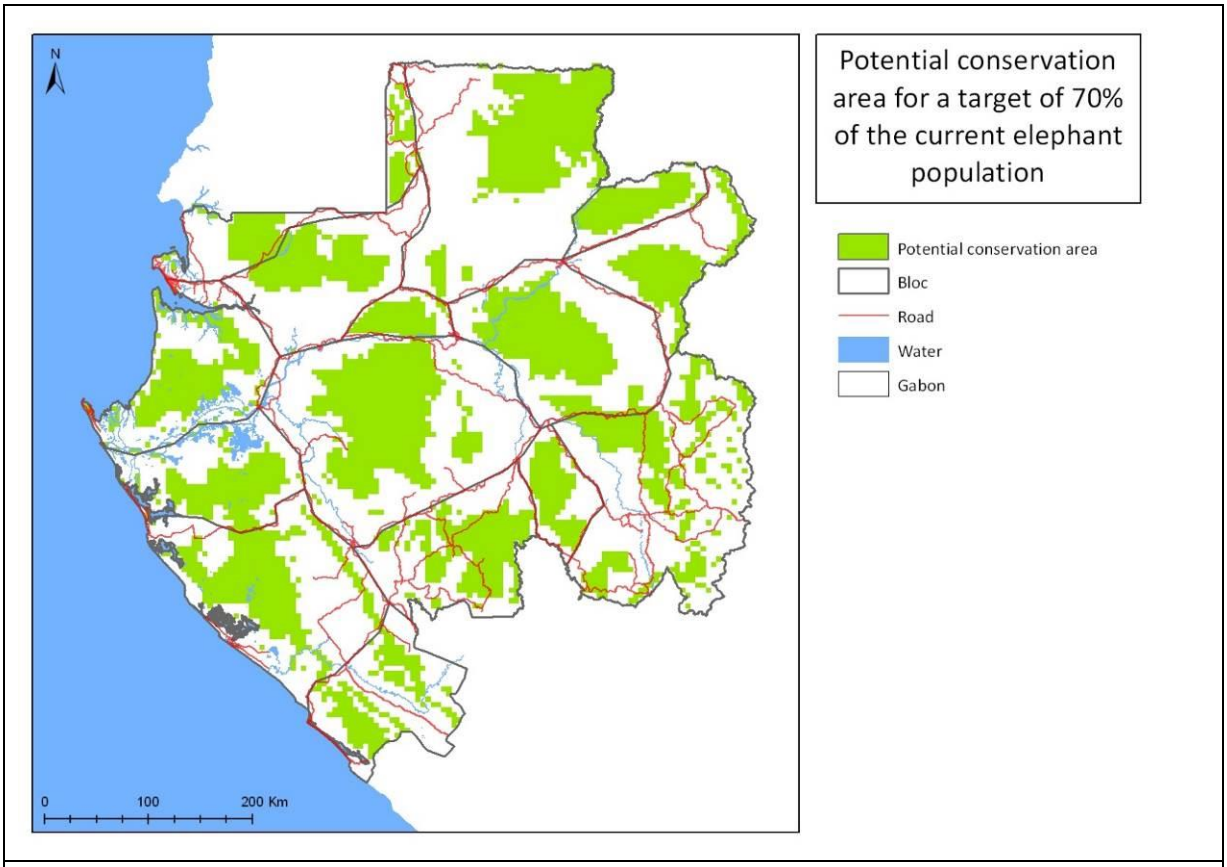

Fig 5. Area of land required to conserve 70% of the elephant population in each block

Repeating this analysis at different percentage target thresholds is informative, as it shows how much more land would be required under forest if the target percentage is increased. The example below shows the results of a zonation modelling exercise for 70, 80 and 90% of the total population of elephants in each block.

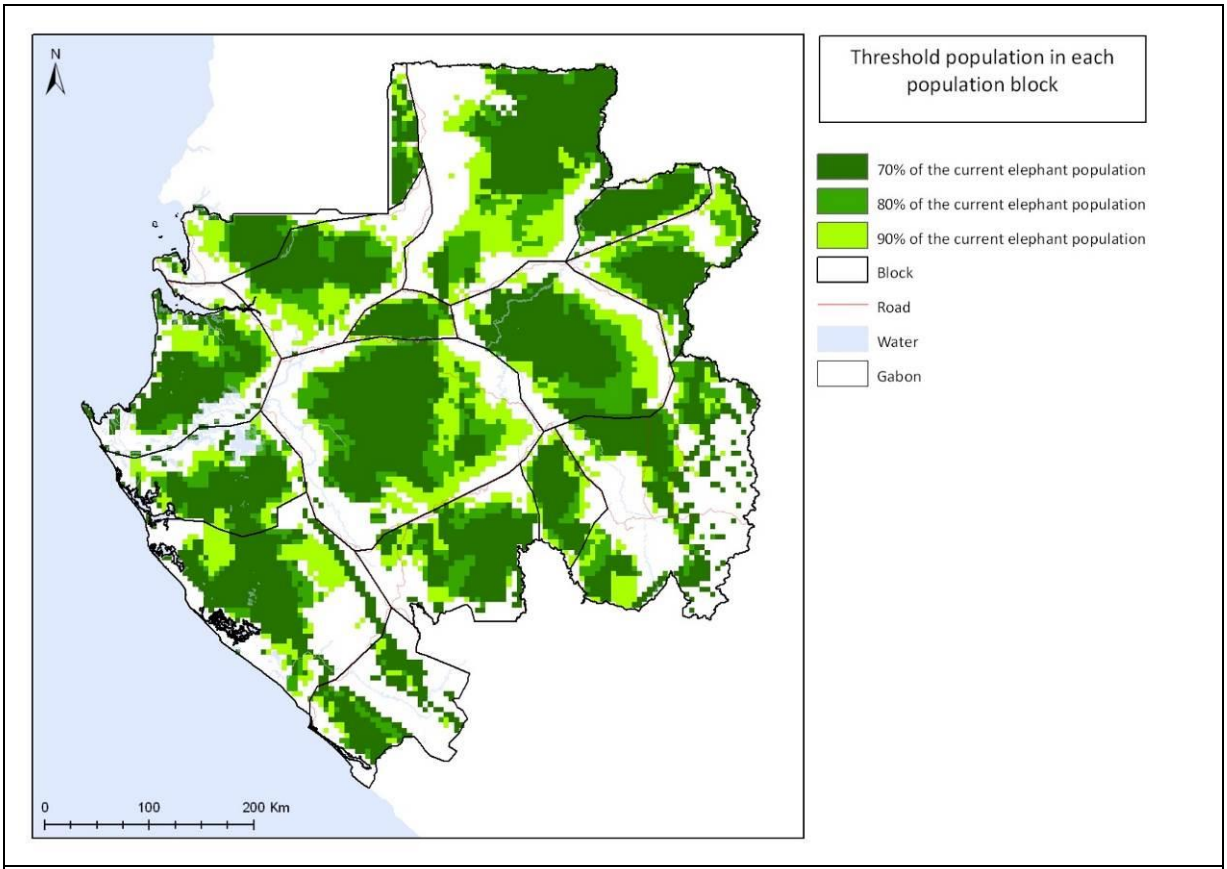

Fig 6. Overlay of different percentage thresholds: the area required to conserve 70, 80, and 90% of the elephant population in each block.

Note on publication of preliminary results

Please note that these results are preliminary, and based on tests of an analytical method. It is intended that these result be discussed with a wide stakeholder group and the modelling approach revised and improved with input from interested parties. The maps presented in this report are shown as example outputs and do not represent the definitive view of WCS, WWF and CI on conservation priority areas in Gabon.

3.4.2 Modelling the density of great apes across Gabon

A similar approach to the modelling of elephant populations has been undertaken for great apes by Fiona Maisels and Samantha Strindberg of WCS. This approach predicts the densities of great apes (gorillas and chimpanzees) based on data from field surveys that have taken place in Gabon over the past ten years. The model uses habitat type, condition, management status, various measures of human impact, and the effects of recent Ebola outbreaks, to model the density of great apes across their range. The initial results from this process were presented at the IUCN SSC great apes meeting in Brazzaville in May 2013. Separate analyses have been completed for gorillas, chimpanzees and both gorillas and chimpanzees together. In this report, we present only the combined 'great apes' layer, but further analysis that uses gorilla and chimpanzee results separately is envisaged in Year III of this project.

The density surface produced by the model gives a value in individuals per square km across the country, allowing the identification of high density areas. The initial model is somewhat less reliable

than the published elephant model. It achieves a lower explanation of the variance than the elephant model and suffers from certain artefacts due to the interaction of the parameters. The results of this initial model should therefore be regarded as 'demonstration only' or 'proof of concept' at the time of writing. WCS is working to refine the apes model and hopes to achieve a higher level of explanatory power. The revised model is likely to be available in Year III of this project.

Notwithstanding the draft nature of the ape density model, the results can be used to test and map thresholds for High Conservation Value criteria. The approach that has been used for this process follows a similar approach to that which was used in the elephant HCV mapping process described in the Year I report.

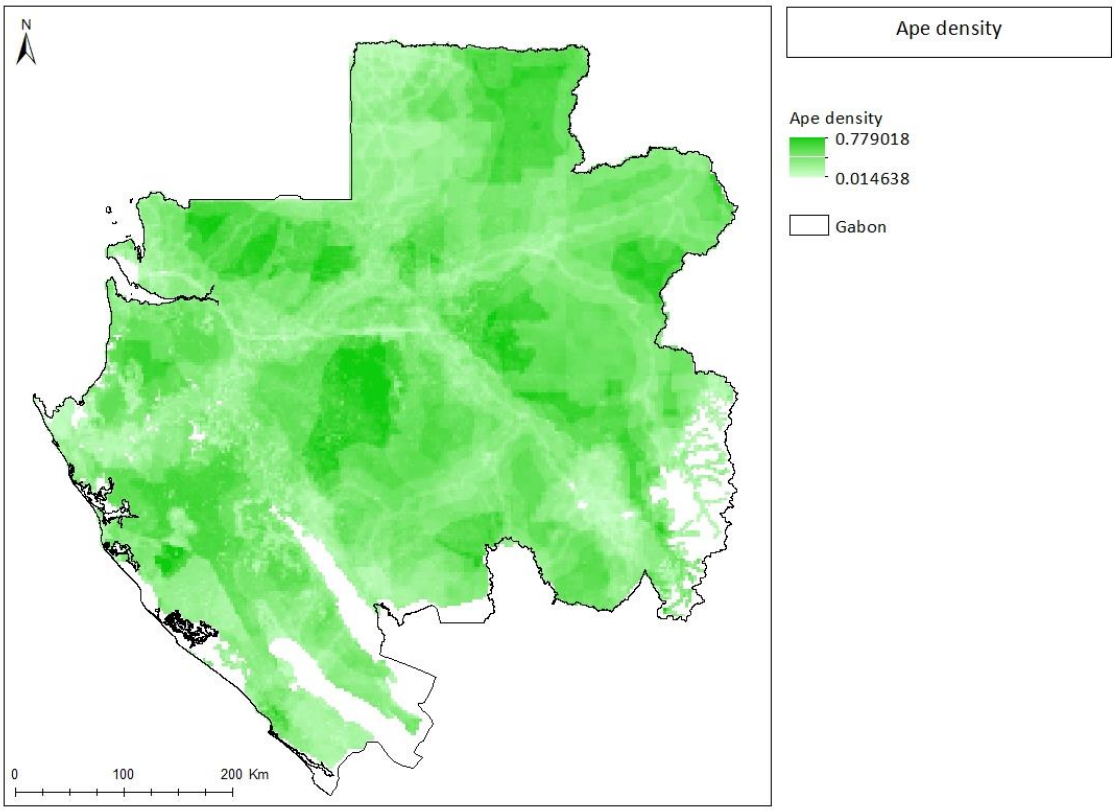

Fig 7. Basic density surface from the modelling of great ape densities (Maisels et al, *in press*). Densities are shown in individuals per square kilometre. Note: this model is currently being updated.

Identification of population units

The first step is to identify blocks of land that should be considered distinct population units, by defining and mapping geographical barriers that great apes are unlikely to cross. For this analysis, we combined major rivers and major roads (including those with high levels of continuous human presence) to divide the country into 19 blocks, a shown in Fig 8, below.

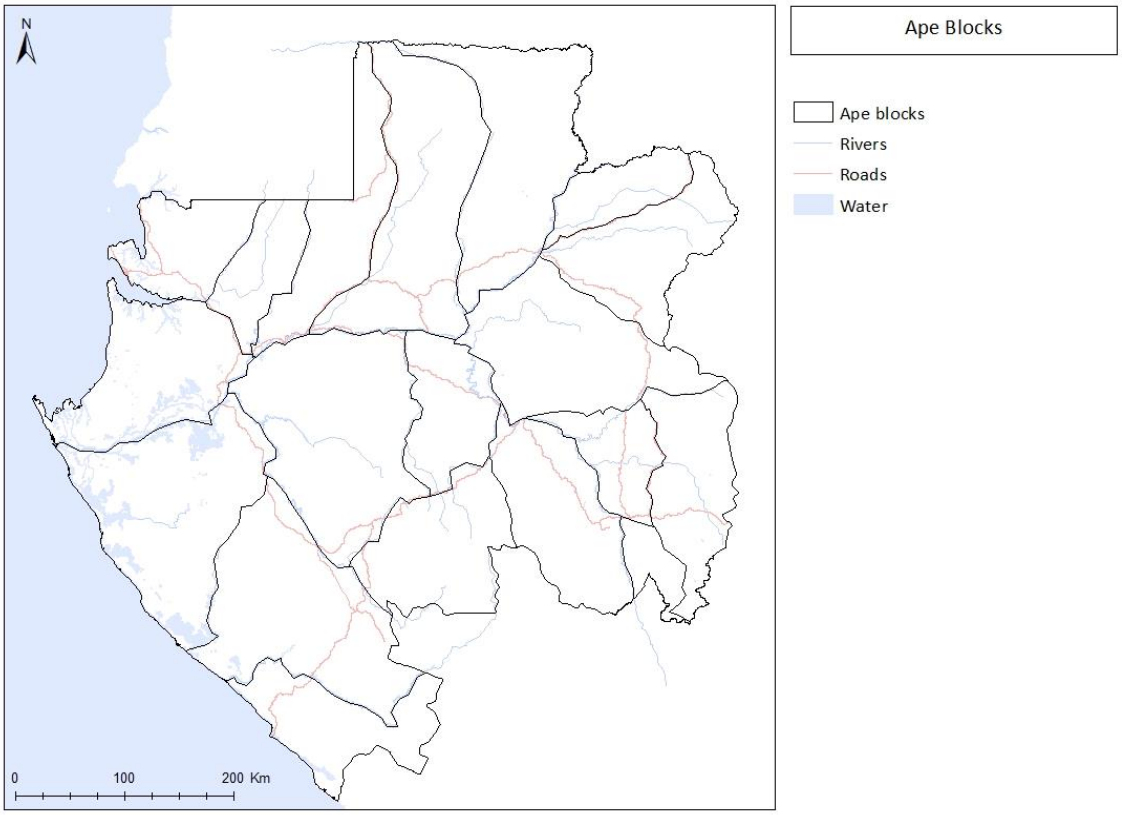

Fig 8. Ape population blocks, based on major rivers and major roads, which represent bio-geographic divisions between great ape populations. These divisions are largely speculative, and should themselves be subject of more detailed discussion.

Population size by block

Combing the map of population units and the predicted density surface, shows the expected number of great apes within each unit. This is already informative, at it shows the blocks that are likely to be able to sustain viable populations over the long term.

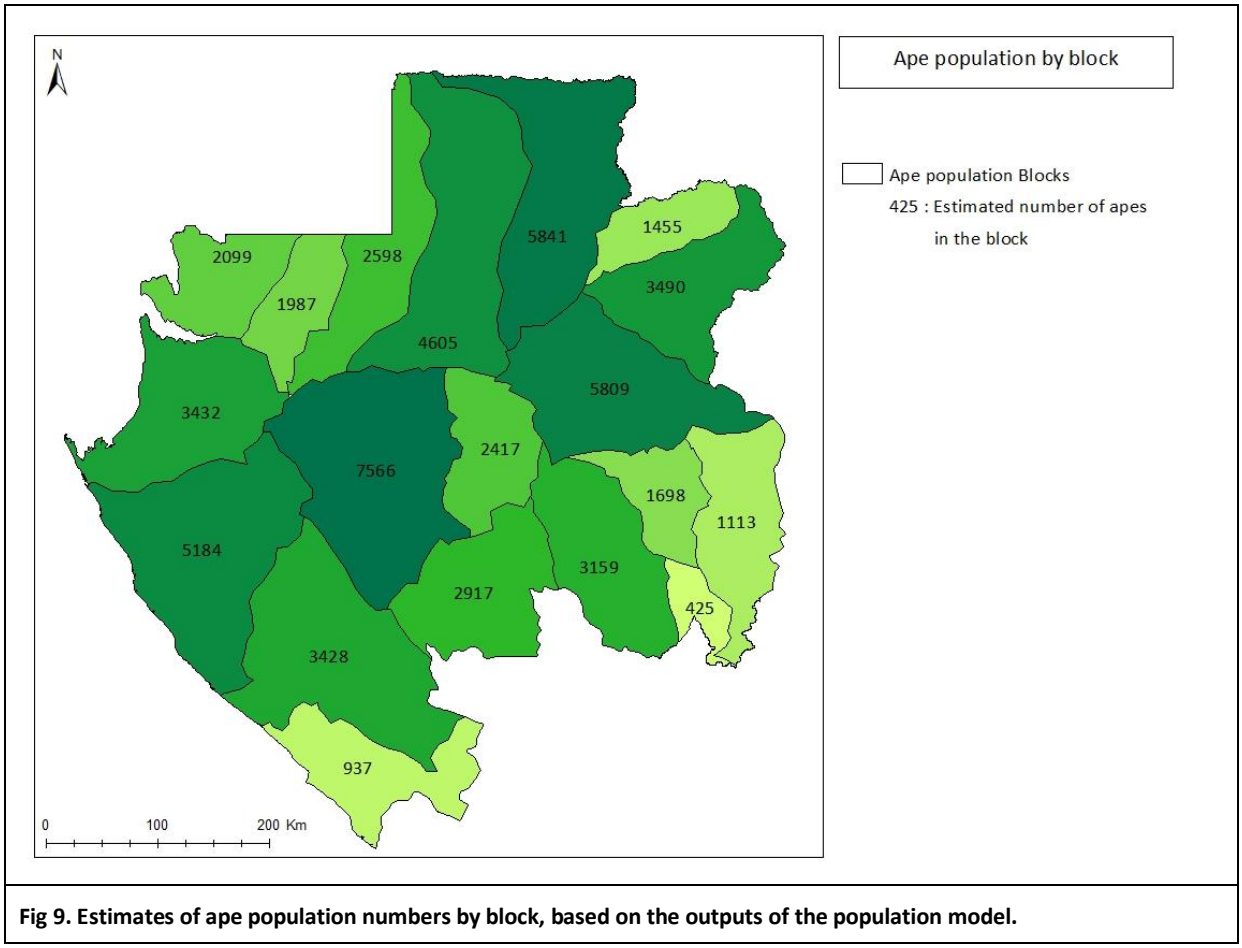

Fig 9. Estimates of ape population numbers by block, based on the outputs of the population model.

Setting population target thresholds

The map of population units can then be overlaid on the population density layer, and the human impact (cost) layer, and input into ZONATION planning software. ZONATION seeks to identify the highest density and least cost pixels until a target population is reached within that population unit.

A target population can be set *ad hoc* for each population block, or a standard overall threshold (e.g. 80% of the total population) can be used. In this example, we have used the latter approach, setting an equal percentage population target for each block, regardless of the overall size of the block's predicted population.

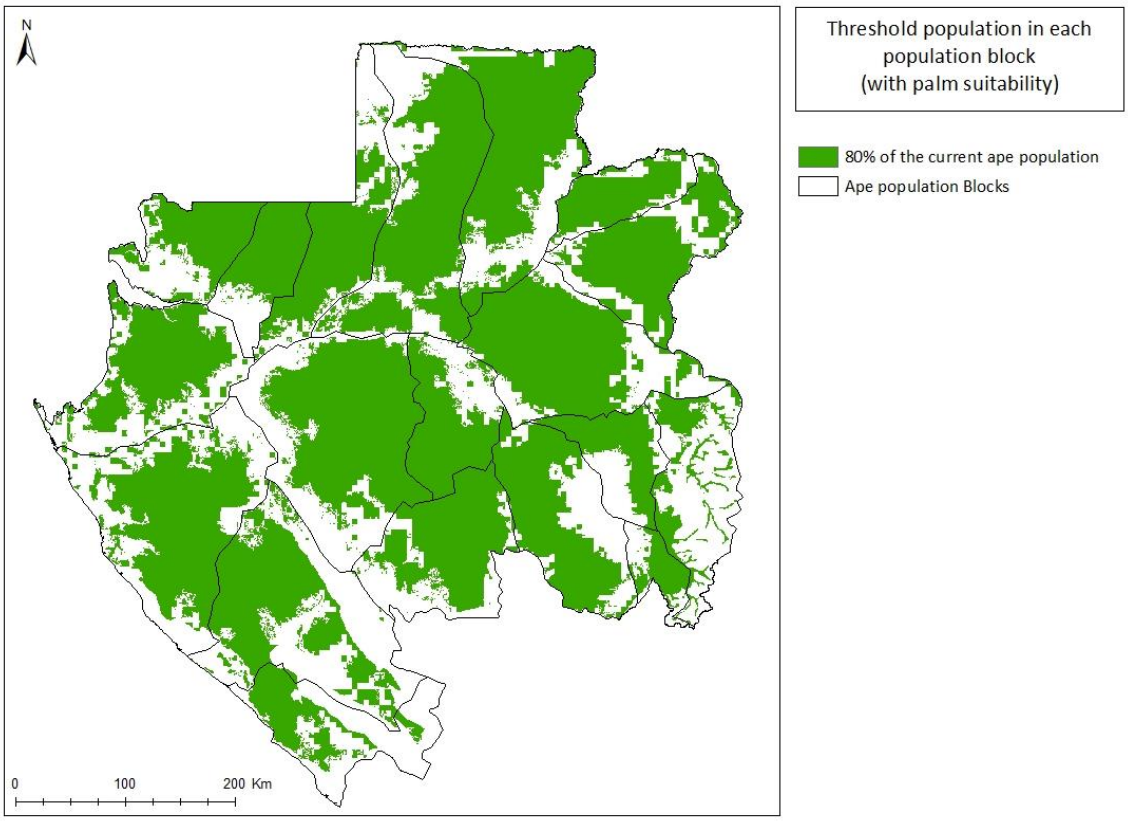

Fig 10. Map showing zonation results at a target population threshold of 80% for each block. These are the areas that the model suggests should be maintained under forest cover if 80% of Gabon's great apes are to be conserved in each population block. Note: the 'cost' layer used in the Zonation analysis includes Oil Palm suitability as a factor when selecting conservation areas.

Note on publication of preliminary results

Please note that these results are preliminary, and based on tests of an analytical method. It is intended that these result be discussed with a wide stakeholder group and the modelling approach revised and improved with input from interested parties. The maps presented in this report are shown as example outputs and do not represent the definitive view of WCS, WWF and CI on conservation priority areas in Gabon.

Combining threshold layers

Combining and superimposing several iterations of this modelling exercise, we can show the areas selected by ZONATION at different target population levels.

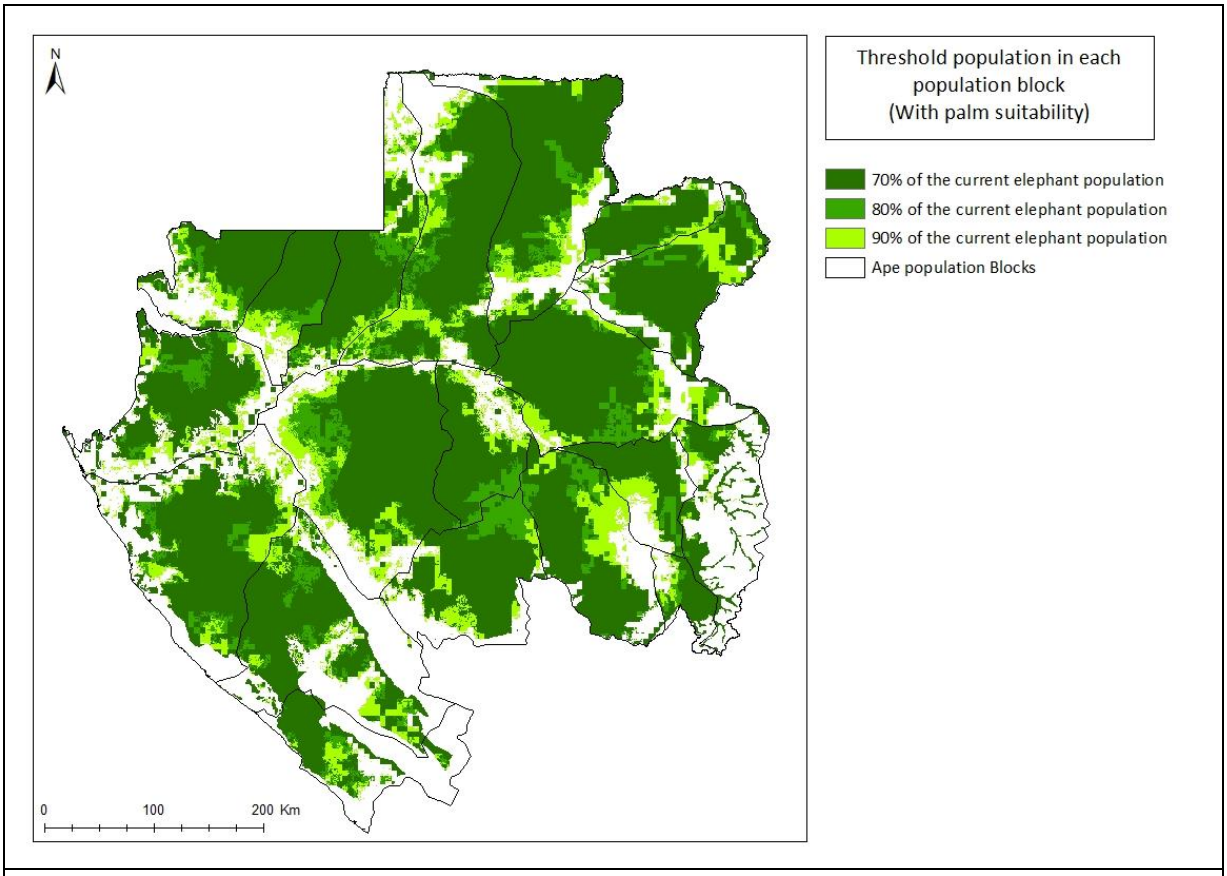

Fig 11. Map showing overlay of zonation results at a target population thresholds of 70, 80, 90% of the total great ape population.

3.5 Combining layers for HCV identification and spatial planning

Hitherto in this analytical approach we have considered the species models in isolation. We have modelled a population threshold target for an individual species, to investigate the potential implications of attaching HCV status to areas supporting a '*significant concentration*' of ***one*** endangered species.

However, now that density models are complete for great apes and elephants in Gabon, (and further models of ungulate density will soon be forthcoming from WCS) the next task is to investigate ways of *combining* these data sources to construct combined definitions of high Conservation Value areas.

A simple example of this approach is shown in figure 12, below. Here we combine the model results for elephants and great apes using an 80% target population threshold. Overlaying these results shows the areas necessary for elephants that are not selected for great apes, and vice versa.

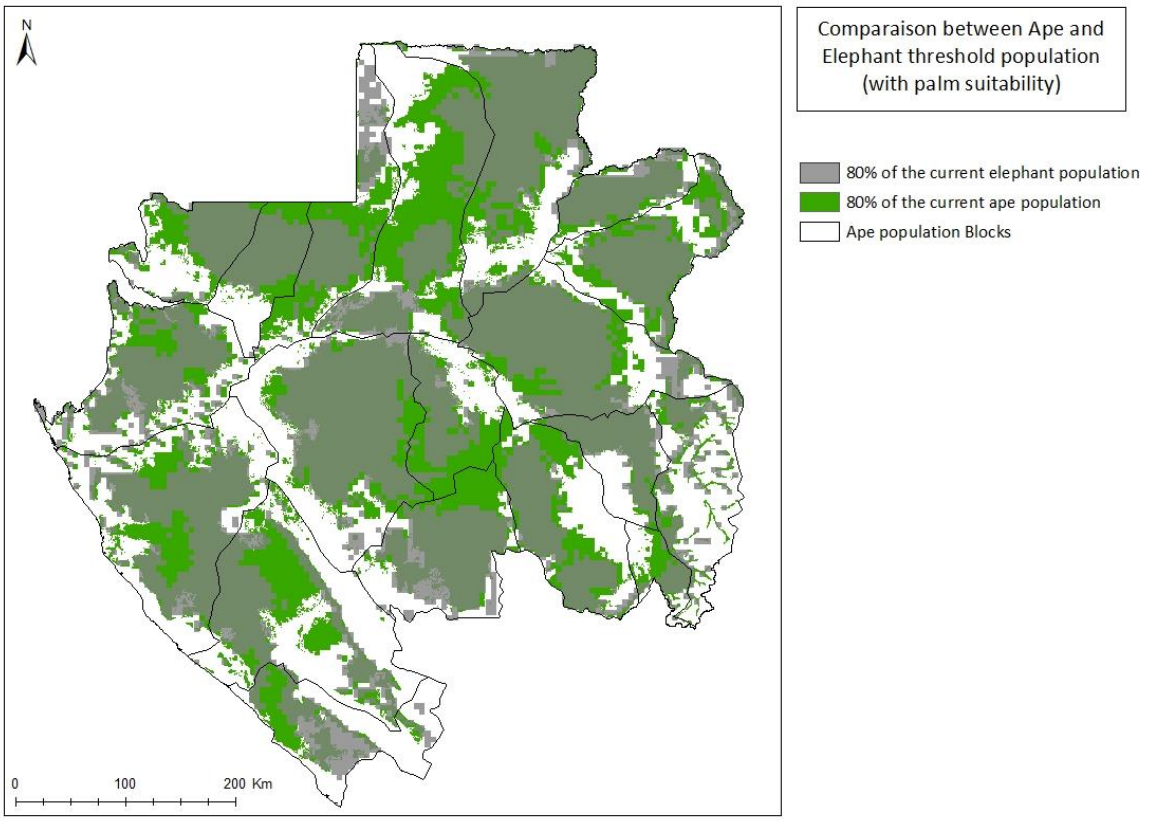

Fig 12. Combination of elephant and great ape results. This map overlays the areas selected by the model for 80% of the elephant population and 80% of the great ape population. Areas in light grey are necessary for elephants but not for apes. Areas in green are necessary for apes but not for elephants.

Further work under this project will develop this analysis further to investigate the implications of selecting areas that maximise the conservation potential for both species, while minimising costs.

3.6 Density versus cost trade-offs

Another way of using these results to inform land use planning is to combine the basic density surface with the 'cost' layer showing human impact and agricultural suitability. The overlay of these two layers highlights areas where high predicted elephant density overlaps with areas highly likely to be impacted by human development.

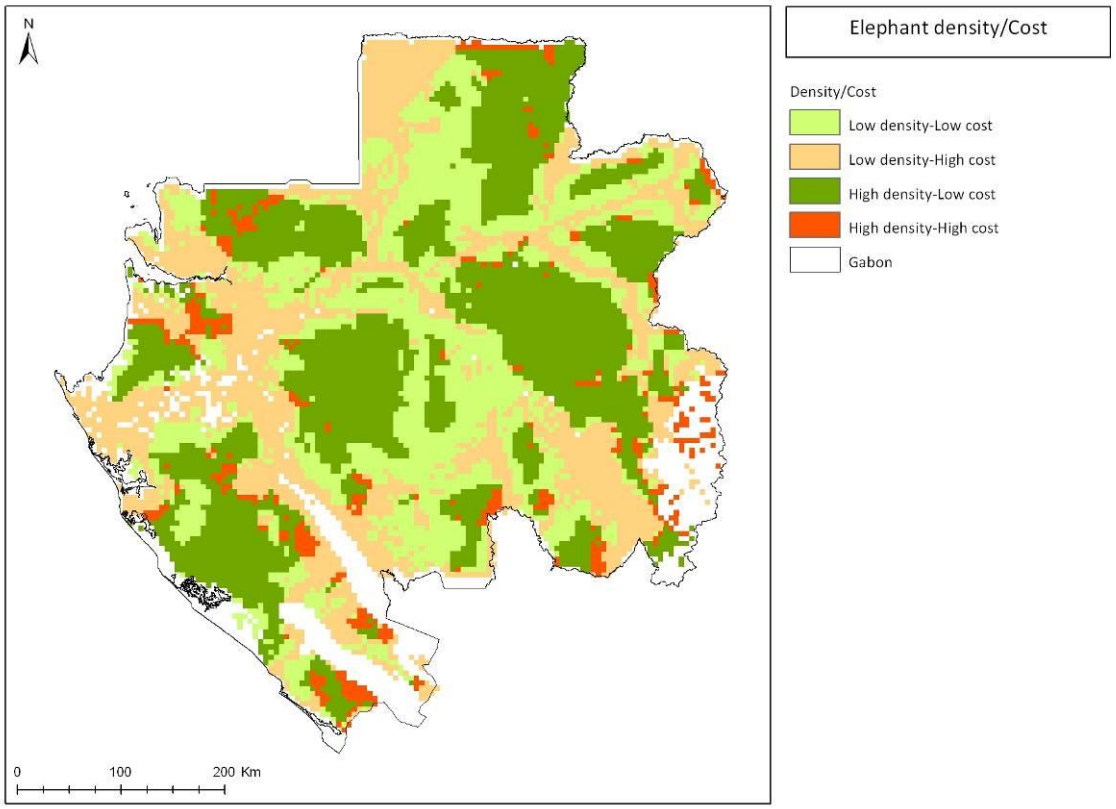

Fig 13. The overlay of predicted high elephant density with areas that are now, or are likely to be under heavy human influence due to their suitability for plantation crops such as palm oil. Areas that are both high density and high cost are highlighted in red on the map

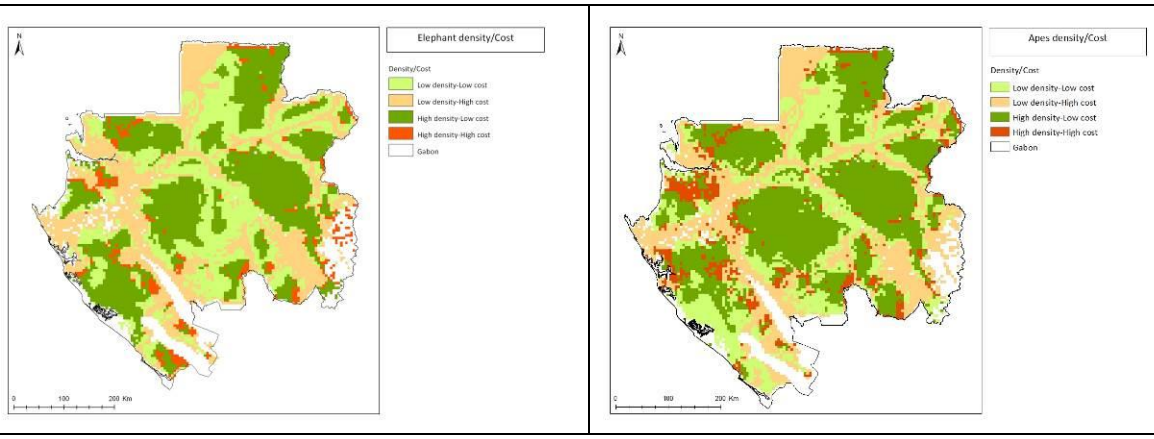

Fig 14. The overlay of high density elephant and great ape areas with human influence. Elephant density (l) and great ape density (r). The apes map shows a higher degree of overlap with human influence areas, and land suitable for plantation agriculture

3.7 Training module development

The draft training materials produced in the first phase of the project have been updated and improved using experience from Year II of this project. Modules showing the intermediate steps to producing the great ape results shown above have been added.

3.8 Prioritising river basins by aquatic diversity

The objective of this module of the project was twofold. Firstly to investigate how aquatic (fish species) diversity varies between Gabon's river basins, and secondly to evaluate the feasibility of classifying and prioritising river basins based on their the species richness and endemism.

3.8.1 Sampling methods

A review was undertaken of all aquatic biodiversity sampling in Gabon since 1859, including collections made by Paul deChaillu in 1862. To complete and update the state of knowledge from historical studies, some additional sampling missions were undertaken by Yves Fermon and a team from IRAF with funds from this project.

The final database on aquatic diversity comes from samples taken at 991 'stations' in Gabon, (with a total of 1644 sampling visits) since 1859. 88.3% of these stations were sampled only once or twice. The greatest density of sampling was carried out in the Ogooue and Ivindo River basins. 15 basins, only accounting for 0.01 % of the territory, were never sampled.

Data analysis: grouping basins by diversity/endemicity

To synthesize all the information collected, a hierarchical classification was conducted taking into account the weighted total species richness and endemism per basin/watershed.

3.8.2 Initial results

Overall diversity of fish fauna

Gabon belongs to the Lower Guinea fish zone. There are 407 described species in Gabon of which 31 are endemic and 5 were introduced. They are divided into 26 orders, 74 families and 181 genera.

Classification of river basins into zones

Form a detailed study of topographic maps and historical classifications, 73 river basins draining into the Atlantic Ocean or the Gulf of Guinea were determined. We used the combination of some of these basins made by Paugy et al. (2013), to regroup these basins into 33 'zones' (See Fig 15). These 33 zones are in fact made up of 1729 sub-basins of which the Ogooue is by far the largest, accounting for 1028.

A hierarchical diversity classification of these 33 zones resulted in the identification of five categories (including a category 0 for basins where no data was available).

The Ogooue which includes several important sub-basins as the Ivindo and the Ngounié all appear extremely important for overall diversity and endemicity.

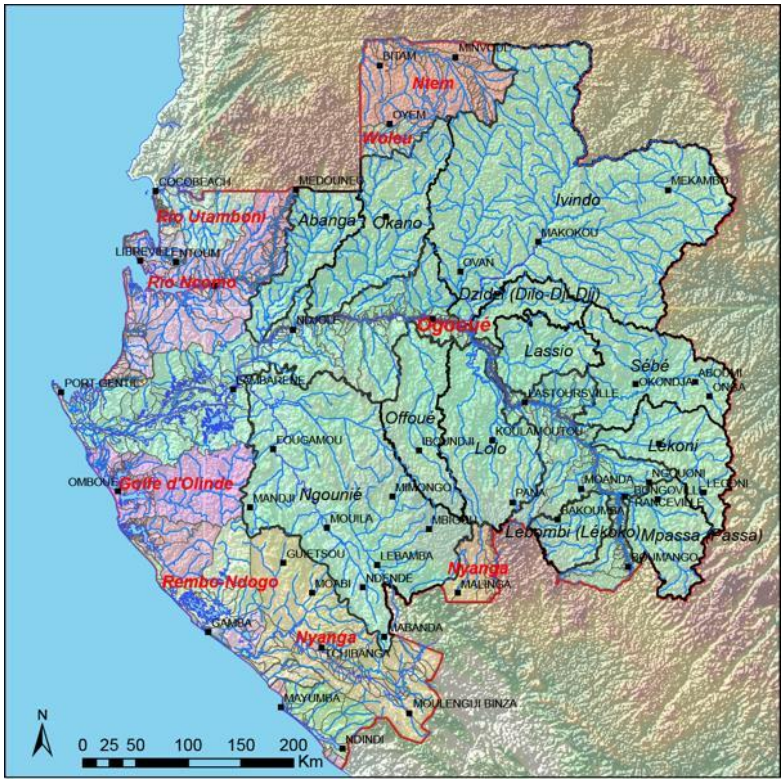

Fig 15. The regrouping of river basins into 33 zones following the classification of Paugy et al (2013)

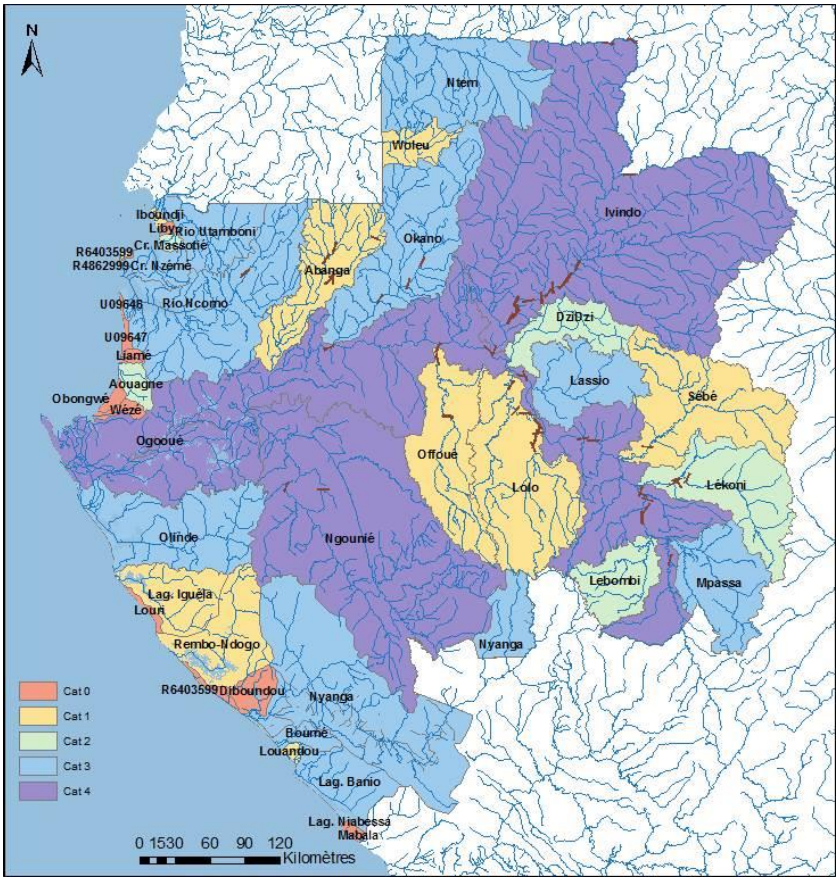

Fig 16. Hierarchical classification of river basins by aquatic diversity. Category 4 has the highest diversity. Basins in Category 0 have not yet been sampled.

The viability of the collected information

After data collection of samples, we had a database containing 9122 points. However, only 6401 points (70%) were used of with 5837 (64%) contained a date. There has been an undeniable loss of information that is related to :

(i) specimens poorly determined of the museum collections;

(i) partial information on the collection of specimens;

(iii) information from articles and grey literature were unusable because of their weakness and incomplete or inaccurate data (poorly defined species, not well defined data collection points...)

Due to their intrinsic quality, in conjunction with the general sampling effort, the findings obtained thus remain partial and need to be confirmed.

3.8.3 Recommendations and perspectives

Given the potentially rapid expansion of oil gas and mining infrastructure in Gabon, and the likely impacts of this on water quality and river basin integrity, this data represents an important reference point in time for many of Gabon's river basins. However, the majority of river basins were sampled only once, and some small river basins have not yet been sampled at all. Species diversity data plotted against the number of samples per basin shows that the full diversity Gabon's rivers has not

been determined. Further sampling, notably of the small coastal basins, tributaries and the upper reaches of the Ogooue is therefore likely to yield important revisions to the diversity hierarchy map.

It is further advisable that:

- Regular sampling is conducted at a set number of historically sampled stations to understand the full extent of diversity and any seasonal/temporal variation.
- A review is conducted of all preserved specimens from around the world to refine the database of the fish fauna of Gabon.
- A research institute or agency, with an equipped laboratory, is established dedicated to aquatic environments and associated research
- University education is improved for students motivated by questions of aquatic biodiversity
- The material available to IRAF, and its organisational structure and the training of technicians is improved to facilitate the emergence and management of this data and knowledge

3.9 Linking HCV and biodiversity offsets

In light of increasing extractive industry activity in Gabon, and the emergence of a new draft law concerning sustainable development, it has become important to address the use of biodiversity offsets in conjunction with HCV assessments for future industrial developments. WWF proposed the formation of an "offsets working group", with the aim of producing a "framework plan" for a practical application of the offset approach. An initial workshop on this subject was held in July 2012.

In this module of work, WCS convened a small group of biodiversity experts to develop the ideas discussed at the workshop into guidance for industry and government on three key aspects;

1. The impact mitigation hierarchy and the use of offsets
2. Assessing the biodiversity value of a project area (methods and approaches)
3. Identifying 'equivalence' and identifying the appropriate offset area

Additional funds from ABCG were secured at the end of FY 12 to support this activity. These extra funds supported the production of this guidance, and the participation of international experts, for example in the drafting of model TORs for biodiversity value assessment, impact assessment and threat assessment.

A draft report entitled "*Exploring the potential for biodiversity offsets to mitigate impacts of large-scale mining in Gabon: the Belinga case*" is now complete and will soon be published, following an expert review. The report is available from WCS Gabon. Technical briefing notes aimed at a wider audience will be circulated during Year III of this project.