PROPOSED FOREST REFERENCE EMISSION LEVEL FOR THE NATIONAL SYSTEM OF PROTECTED AREAS OF GUINEA-BISSAU

Reducing Emissions from Deforestation in the National System of Protected Areas
- REDD+ Results-Based Payments under the UNFCCC -

Bissau | December 2019

Submission

SEAB – Secretariat of State for the Environment and Biodiversity

Acknowledgements

The development of this Forest Reference Emissions Level has enlisted the assistance, participation and cooperation of key-stakeholders and experts. I would like to express my appreciation to all stakeholders who were involved in the preparation of this document, which reflects the current situation of the most important conservation areas in Guinea-Bissau and is based on many different previous efforts by several public and private, national and international, institutions. I would like to take this opportunity to thank the Protected Areas and Biodiversity Institute for the continued development of the necessary technical activities and for supporting the compilation of this document in the context of the Global Climate Change Alliance project funded by the European Union; ONGD RSeT; and the Forest Research Centre of the College of Agriculture of the University of Lisbon for their technical assistance. Namely, Prof Maria Vasconcelos and her team for their technical and scientific assistance in the compilation, which raised the technical quality of this FREL.

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EXECUTIVE SUMMARY

Approach	Historical average of emissions associated with gross deforestation in the reference period 2007-2015
Scale	Subnational: terrestrial component of the National System of Protected Areas (approximately 750 000 hectares)
Forest definition	*"…a land of more than 0.5 hectares, with trees that have reached, or with a capacity to reach, a height of more than 5 meters and a crown cover degree greater or equal to 10%. It does not include predominantly agricultural or urban land."*
Stratification	Closed Forest, Open Forest, Savanna and Mangrove
REDD+ Activities	Deforestation
Carbon Pools	Above-Ground Biomass and Below-Ground Biomass
Gases	CO_2
Reference Period	Eight years, two data points (2007 and 2015)
Data used for Activity Data	Landsat 7 TM, Landsat 8 OLI and ancillary Forest Cover Maps
Data used for Emission Factors	Field inventories from CARBOVEG (2007 and 2009), CBADP (2009 and 2010) and DBT (2013 and 2014)
FREL	67 805.5 tCO_2-e yr^{-1}
Future Improvements	– Expanding scope: national scale and reference period – Cover additional REDD+ activities: forest degradation and enhancement of carbon stocks – Improvement of Activity Data – Implementation of Tier 3 uncertainty assessment – Inclusion of emissions from omitted carbon pools and GHGs

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ACRONYMS

AD	Activity Data
AGB	Above-Ground Biomass
AMPCIU	*Área Marinha Protegida Comunitária das Ilhas de Urok*
BGB	Below-Ground Biomass
BUR	Biennial Update Report
CF	Closed Forest
DBH	Diameter-at-Breast-Height
DBT	*Complexo Dulombi, Boé e Tchetche*
EF	Emission Factor
ETM+	Enhanced Thematic Mapper Plus
F	Forest
FAO	Food and Agriculture Organization
FCC	Forest Cover Change
FREL	Forest Reference Emissions Level
GHG	Greenhouse Gas
GIS	Geographic Information System
GTR	Working Group on REDD+
IBAP	Protected Areas and Biodiversity Institute
IICT	Tropical Research Institute of Portugal
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
M	Mangrove
MMU	Minimum Mapping Unit
NC	National Communication
NF	Non-Forest
OA	Overall Accuracy
OF	Open Forest
OLI	Operational Land Imager
PA	Producer's Accuracy
PNC	*Parque Nacional de Cantanhez*
PNLC	*Parque Nacional das Lagoas da Cufada*
PNMJVP	*Parque Nacional Marinho João Vieira e Poilão*
PNO	*Parque Nacional das Ilhas de Orango*
PNTC	*Parque Natural dos Tarrafes de Cacheu*
REDD+	Reducing Emissions from Deforestation and Forest Degradation, and the role of Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks
SIS	Safeguards Information System
SA	Savanna
SNAP	National System of Protected Areas
TM	Thematic Mapper
UA	User's Accuracy
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard

1 INTRODUCTION

In response to Decision 1/CP.16, paragraphs 70 and 71, Guinea-Bissau aims at providing a positive contribution to mitigation actions in the forest sector by reducing emissions from deforestation, in accordance with its national circumstances and respective capability. Guinea-Bissau therefore welcomes the opportunity to submit a proposed Forest Reference Emission Level (FREL) for deforestation in the National System of Protected Areas (SNAP) for a technical assessment in the context of results-based payments for reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) under the United Nations Framework Convention on Climate Change (UNFCCC), in accordance with Decision 13/CP.19 and its Annex.

The submission of this FREL, and of the subsequent Technical Annexes to the Biennial Update Report (BUR) in which the emission reductions of results-based actions may be reported, are voluntary and exclusively for the purpose of obtaining results-based payments for REDD+ actions, as per Decisions 1/CP.16, paragraph 71, 13/CP.19, paragraph 2, and 14/CP.19, paragraphs 7 and 8. This submission, therefore, does not modify, revise or adjust in any way other submissions (e.g. Nationally Appropriate Mitigation Actions, Intended Nationally Determined Contributions - INDC and National Communications - NC) made by the country.

1.1 National context

Guinea-Bissau is a Small Island State and Least Developed Country in West Africa with globally relevant coastal and marine ecosystems, as well as terrestrial forests and woodlands. Forests and agriculture represent a main pillar of the economy and are the basis of local subsistence. However, due to economic and population pressures, there has been indiscriminate and uncontrolled conversion of natural vegetation and former agricultural fields into permanent cashew plantations (monoculture), with relevant loss of forest cover. This process has been promoting the expansion of agriculture into ever more marginal areas, with further loss of forest cover impacting hydrologic stability, soil quality, and land productivity. Additionally, forest degradation resulting from fuelwood collection and illegal logging also seriously threaten the sustainability of the country's ecosystems.

As such, the following objectives have been identified as essential for the country: 1) Reduce deforestation and forest degradation and thus contribute to global efforts to mitigate Greenhouse Gases (GHG) emissions; 2) Contribute to the sustainability of renewable natural resources, especially forests and their natural assets, with consequent maintenance and improvement of agricultural soil productivity; and 3) support green development measures to improve the living conditions of communities, especially those that depend directly and indirectly on forests.

1.2 Relevant policies and plans

Guinea-Bissau became a Party to the UNFCCC in 1995, has submitted its Third NC on January 2018 (Republic of Guinea-Bissau, 2018) and is now in the process of submitting the first BUR. Guinea-Bissau adopted the Paris Agreement on October 2018 and submitted its iNDC (Republic of Guinea-Bissau, 2015) in September 2015 identifying deforestation and change in the use of land and forests as the "main responsible for emissions in Guinea-Bissau". Climate change is also included in many national strategies, namely in the National Strategy for Poverty Reduction, and in local development plans, namely in the agriculture, hydrologic resources, and livestock sectors. In this context, the reorganization of the forest sector with promotion of sustainable forest management; the development of an intelligent agricultural system for increments in productivity and climate resilience; and the development of clean energy solutions, are important priorities for the government. Moreover, the National Environmental and Sustainable Development Policy also highlights the continued national commitment to the global effort of combating climate change, and particularly in the effort of reducing the emission of GHG.

Predictions of climate change for West-Africa show that Guinea-Bissau is a high-risk area. Aware of the potential negative impacts and of the associated food security problems, as well as of the need to induce low carbon development, the country has been devoting sustained efforts to mainstream climate change adaption, mitigation and resilience into its strategies, policies and sectoral plans, namely in its Development Strategy Plan 2025 (*Terra Ranka;* Republic of Guinea-Bissau, 2015b). The main objective of *Terra Ranka* was to present a strategy to rebuild the country by 2025, to consolidate democratic institutions and to lay the foundations for stability and sustainable socio-economic development. One of the ambitions listed is to have Guinea-Bissau has a model for sustainable development. Aligned with this ambition is the establishment of the protected area network (SNAP), which is now managed by IBAP and guided by its updated Strategic Plan for the Protected Areas 2014-2020 (Republic of Guinea-Bissau, 2015c). The long term vision of the Strategic Plan for the Protected Areas is the same identified in *Terra Ranka*: "*Up to 2025 Guinea-Bissau will be a model of sustainable development, whose biodiversity will be preserved and regenerated to maintain in a durable way the potential of value creation of its precious and its renewed resources, offering services to the local communities, to the country and the whole subregion group and contributing significantly to the great environmental balances of the planet*". The strategy has a list of goals, including: reducing the degradation of forests; strengthening, consolidating and extending the SNAP to 26% of the national territory (which was already achieved); and increasing the sink effect of forests through promotion of biodiversity in degraded ecosystems. Some specific actions to achieve these goals are related with the implementation of REDD+ and REDD+ activities.

Recognizing that REDD+ is a mechanism under the Convention that can directly support the country´s low-carbon development strategy delineated in *Terra Ranka*, the Government of Guinea-Bissau initiated a preparation process for REDD+. For that, the Government established the inter-ministerial Working Group on REDD+ (GTR; Order Nº. 8/ SEA/15) with the mandate to drive the initial steps and produce a multi-stakeholder Roadmap for REDD+. The REDD+ Roadmap (REDD+ Working Group, 2016[1]) consists of a gap analysis and action plan to initiate and implement REDD+ readiness activities in the country. The development of the proposed FREL was listed as a priority by the GTR. So was the implementation of a National Forest Monitoring System and Safeguards Information System (SIS), which are already in the design and implementation phase in the SNAP. REDD+ and the implementation of a REDD+ national strategy anticipated in the document is aligned with the objectives of *Terra Ranka* of aiming for national sustainable development with the protection and enhancement of Guinea-Bissau's biodiversity and natural capital. The Roadmap also highlights that the development and implementation of a REDD+ strategy would enable the country to achieve financial support through a mechanism under the UNFCCC for the implementation of actions that simultaneously promote forest and biodiversity conservation, reduce poverty and increase the well-being of communities.

[1] The Roadmap (in Portuguese), and a policy brief (in English) which was written when the Roadmap was concluded and summarizes its priority action areas, are available at: https://www.rset.eu/gb-frel

2 SCOPE AND BOUNDARIES OF THE PROPOSED FREL

In defining the scope and the boundaries of its proposed FREL, Guinea-Bissau recalls paragraph 71(b) of Decision 1/CP.16 and paragraph 11 of Decision 12/CP.17 that states that Parties may elaborate a subnational FREL, as an interim measure, while transitioning to a national FREL. Guinea-Bissau also recalls paragraph 10 of Decision 12/CP.17, which indicates that a step-wise approach to a national FREL development may be useful, enabling Parties to improve their FREL by incorporating better data, improved methodologies and, where appropriate, additional pools, noting the importance of adequate and predictable support as referenced by Decision 1/CP.16, paragraph 71.

2.1 Geographical boundary

Guinea-Bissau developed a subnational FREL for the terrestrial component of the SNAP (Figure 1) comprising seven protected areas: *Parque Natural das Lagoas da Cufada* (PNLC), *Parque Nacional de Cantanhez* (PNC), *Complexo Dulombi, Boé e Tchetche* (DBT), *Parque Nacional das Ilhas de Orango* (PNO), *Parque Natural dos Tarrafes de Cacheu* (PNTC), terrestrial part of *Parque Nacional Marinho João Vieira e Poilão* (PNMJVP) and *Área Marinha Protegida Comunitária das Ilhas de Urok* (AMPCIU). With an extension of approximately 750 000 ha, the SNAP corresponds to about 26% of the national territory and represents the areas identified by the Government as priority areas for conservation because they comprise the most relevant and most endangered forest, woodland and mangrove patches of the country. These include the "Matas do Cantanhez", considered to be High Conservation Value areas, with the highest tree species diversity and carbon stocks in the country, and habitat for endangered chimpanzee species and of the CITES listed *Pterocarpus erinaceus*.

The proposed subnational FREL relied on IBAP's resources and capacity for forest monitoring including a Forest Monitoring System and SIS being piloted by IBAP in the SNAP. Compared with the CARBOVEG national programme (used in the Third NC) these pilot systems in the SNAP included some technical tasks that improved the quality of the Activity Data (AD) and Emissions Factors (EFs) used in the proposed FREL, namely: (1) development of a more recent land cover map (2015) to overcome the limitation of using a reference period ending in 2007 (from the most recent national programme CARBOVEG and Third NC), which was considered too far back; (2) manual correction of the Forest Cover Change (FCC) map of areas known in the SNAP to be wrongly classified as change (e.g. change in cashew plantations, meandering rivers, fire scars in forests remaining forests); (3) compilation of a reference dataset based on very high-resolution imagery to correct AD estimates and overcome the limitations of classifying Landsat imagery and of using those classifications as a proxy to forest cover; (4) additional field measurements in the SNAP to reduce the variability of the estimates and increase the accuracy of the derived EFs (almost 70% of the plots with biomass data used to derive EFs in the FREL were measured in the SNAP).

This subnational FREL, covering the most endangered forest patches of the country and relying on available higher quality data and methodologies, is presented as a first step towards the construction of a future national FREL.

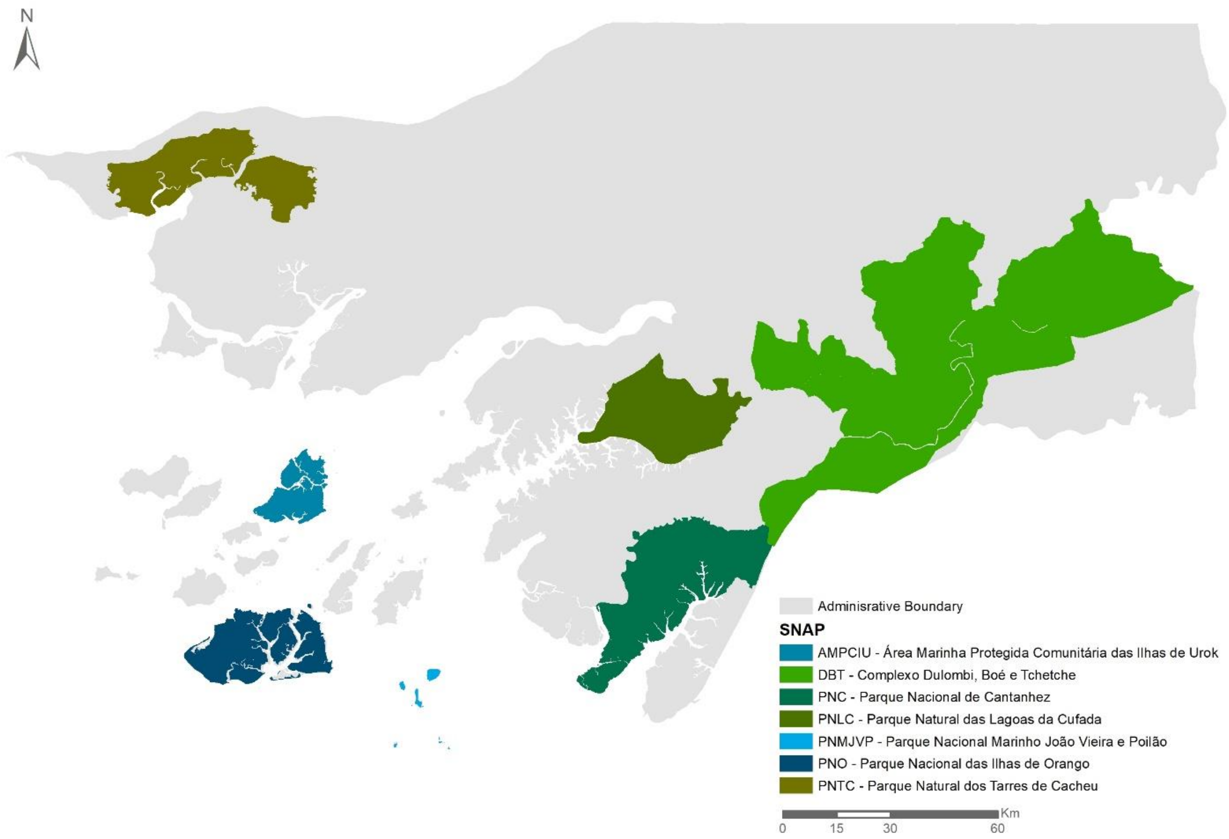


Figure 1 - Terrestrial component of the National System of Protected Areas.

2.2 Forest definition and forest stratification

Forest carbon stocks vary across the landscape depending on many natural and anthropogenic factors. Therefore, the stratification of the Guinea-Bissau forest in homogeneous units of carbon density is a fundamental step to extract information for the development of the forest cover maps and to collect data for the forest inventories.

Guinea-Bissau comprises two major ecoregions: the Guinean forest-savanna mosaic and the Guinean mangroves. The former is a transitional habitat between the rain forests of the Guinean-Congolian region and the dry savannas of Sudan. In this ecoregion the flora diversity in the country is relatively high, with occurrence of around 1 500 species and subspecies. In southern areas with higher rainfall, in the south of the territory, particularly in the PNC, the *stratum* Closed Forest (CF) can reach 30 meters with *Anisophyllea laurina*, *Dialium guineense*, *Hunteria umbellata* and *Strombosia pustulata* being the most characteristic species. Open Forest (OF) can be found throughout the territory, with forest cover between 40% and 60%. The most common species in this *stratum* are *Afzelia africana*, *Daniellia oliveri*, *Detarium senegalense*, *Khaya senegalensis*, *Parkia biglobosa* and *Pterocarpus erinaceus*. Palm groves develop in deep soils around wet valleys, with dominance of *Elaeis guineensis*. Savanna (SA) can be found all over the country but it is more relevant in the northern and eastern parts of Guinea-Bissau, with a forest cover ranging from 10% to 40%. Amongst the most common species in this *stratum* are *Erythrina senegalensis*, *Guiera senegalenses*, *Piliostigma thonningii*, *Strychnos spinosa* and *Terminalia macroptera*. *Borassus aethiopum* can also be found in deeper soils. The mangroves of Guinea-Bissau are of global relevance, being the largest contiguous Mangrove (M) forest in West Africa. The most common species are *Avicennia germinans* and *Rhizophora mangle*, which can be found along the coastline and on river estuaries.

Currently, Guinea-Bissau is applying the forest official definition from the *Food and Agriculture Organization* (FAO) for international reporting. According to the FAO definition a **Forest** is *"… a land of more than 0.5 hectares, with trees that have reached, or with a capacity to reach, a height of more than 5 meters and a crown cover degree greater or equal to 10%. It does not include predominantly agricultural or urban land*" (FAO, 2015)

2.3 REDD+ activities, carbon pools and greenhouses gases

Decisions 12/CP.17 and 13/CP.19 indicate that significant activities and pools should be included in the FREL, and that Parties have some flexibility not to include other pools and activities, considered not to be significant. According to the Third NC to the UNFCCC, deforestation is responsible for emitting large amounts of CO_2 into the atmosphere. Deforestation is defined as the conversion of a forest land into another type of land use or the long-term reduction of the crown cover of trees below the minimum limit of 10%. For the purpose of this FREL only gross deforestation is accounted for (gross deforestation implies accounting only the area deforested in a period inside the area classified as "forest" at the beginning of the monitoring and reporting period and not considering the area afforested/reforested or naturally regenerated and the loss of the area afforested/reforested or naturally regenerated in the same period). Given the limited information on subsequent land-use after deforestation and its dynamics, the biomass immediately after forest conversion is assumed to be zero; i.e. post-deforestation CO_2 removals are not considered.

The proposed FREL includes CO_2 emissions from Above-Ground Biomass (AGB) and Below-Ground Biomass (BGB) of living trees, which are considered the most significant pools. Preliminary information from the national forest inventory (CARBOVEG programme) was collected in 2008 to estimate emissions from litter. However, an institutional decision to prioritize AGB and BGB pools was taken both during the CARBOVEG programme and during the preparation of the FREL submission as emissions from tree AGB and BGB were more accurate considering the available data. The inclusion of emissions from omitted carbon pools is considered an area for future improvement to be covered under the step-wise approach.

Although burning is present in slash-and-burn practices, non-CO_2 gasses were excluded from the FREL. This decision has been made due to the absence of spatially explicit and complete data on burned areas in forests cleared between 2007 and 2015. Future improvements include mapping burnt areas in forests remaining forests and separate those from fires in areas converted to agriculture (deforestation) to consider the future inclusion of non-CO2 emissions from the latter.

2.4 Reference period

The FREL has been established considering the historical data on annual CO_2 emissions from gross deforestation in the period 2007-2015. As such, efforts were made to obtain information corresponding to a more recent period than that available for the Third NC, which refers to the period between 1990 and 2007 from the most recent national programme CARBOVEG. This approach allows for the demonstration of results in the period 2015-2020 (Figure 2). The decision on the reference period was also based on the fact that the 2015-2020 period corresponds to the activities included in the second National Strategy for Protected Areas and Biodiversity Conservation in Guinea-Bissau is implemented. The historical reference period chosen for the construction of the FREL therefore represents a good approximation to a scenario without the enhanced mitigation actions of the post-2015 period. To ensure consistency with the FREL, subsequent submissions to the UNFCCC (NCs and BUR) will include this additional information for the year 2015 when available at a national scale.

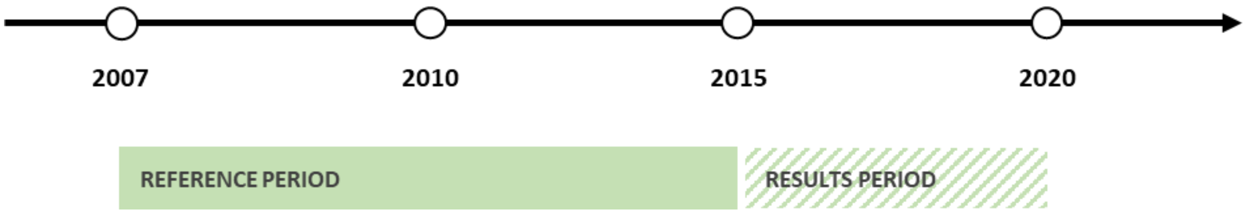


Figure 2 - Reference and results periods of the proposed FREL.

3 INFORMATION ON THE PROPOSED FREL

3.1 Description of the FREL

The historical average of emissions associated with gross deforestation between the years 2007-2015 in the area of the SNAP is estimated at **67 805.5** tCO2-e yr^{-1}. The data and methodological approaches used for the estimation are summarized in this section of the submission.

3.2 Transparent, complete, consistent and accurate information

In accordance with paragraph 2(c) of the Annex to Decision 13/CP.19, the information provided in relation to the submission of a FREL should be transparent, complete, consistent and accurate, and should include methodological information, description of data sets, approaches, methods and the assumptions used. Guinea-Bissau followed these principles in the construction of this FREL by using:

- Transparent information. Data, assumptions and methodologies used for establishing the FREL are clearly explained to facilitate the technical assessment of the reported information.

- Complete information. All data and information used in the construction of the proposed FREL was made available for the technical assessment of the proposed FREL. At the moment, Guinea-Bissau does not have the technical means to publically share all this information but is planning to do so in the future dependent on the availability of resources for the establishment of a national forest monitoring system.

- Consistent information. The FREL proposed for the SNAP has been constructed using one consistent methodology and source of data for estimating the annual historical AD. The historical emissions from deforestation were estimated using the same EFs for every year.

- Accurate information. The accuracy of activity data, emission factors and of the proposed FREL has been estimated and methodologies were used to ensure that estimates are systematically neither over nor under true emissions or removals. See sections 3.3.1.3, 3.3.2.2 and 4.2.

3.3 Information used for the construction of the FREL

3.3.1 Activity Data

For the construction of the proposed FREL, AD is the historic annual gross deforestation (in ha/yr, considering the initial 2007 forest area within SNAP: 539 225 ha) in the SNAP shown in Table 1 for the following FCC categories: Closed-Forest (CF) to Non-Forest (NF), Open-Forest (OF) to NF, Savanna (SA) to NF and Mangrove (M) to NF. When comparing national AD estimates with available global data sets of forest-cover changes, big differences are found (Melo *et al*. 2018). While these disagreements don't mean lack of accuracy of the produced estimates, they highlight possible limitations of the satellite data used. To address these possible limitations and produce more accurate AD estimates, the methodology described in Olofsson *et al*. (2014) was followed to adjust the estimates using the classification errors (described in section 3.3.1.3). The areas presented in Table 1 represent the adjusted AD estimates. The original areas are shown in Annex I.

Table 1 - Activity data (ha/yr) for the SNAP after the procedure of area adjustment, measure of error as percentage of mean (margin of error at 95% confidence interval) and deforestation rate (in % per year) for the 2007-2015 period.

FCC Category	Activity Data (adjusted, ha/yr)	Error (%)	Deforestation rate (%/yr)
CF to NF	30	23	0.05
OF to NF	108	27	
SA to NF	64	42	
M to NF	65	27	

3.3.1.1 Source of data

The Third NC reports on GHG data for the period 2006-2012 is based on emission inventory statistics from 2010 produced by the national CARBOVEG programme. Under this programme satellite imagery were used to produce forest cover maps for the entire country. The latest year included in the CARBOVEG was the year 2007. Using similar data and methodologies, a new forest cover map for the year 2015 was produced for this FREL covering the SNAP. These two forest cover maps (2007 and 2015) were then used to produce the FCC map between 2007-2015 using map algebra operations in a Geographic Information System (GIS). The fundamental technical steps are described in section 3.3.1.2.

3.3.1.2 Methodology used to create the Forest Cover Change map

The forest maps of 2007 and 2015, needed to obtain the FCC map, were derived from several images of different sensors onboard the Landsat satellites. These images cover the entire national territory for each of the mentioned years. The methodologies used to produce both maps were the same and include the pre-processing of the images, their classification, and the respective post-processing as described below.

Satellite data

The satellite images used were obtained from Landsat 5 Thematic Mapper (TM) and Landsat 8 Operational Land Imager (OLI). The scenes were taken from the United States Geological Survey (USGS - earthexplorer.usgs.gov/) and from Google Earth Engine (GEE - earthengine.google.com/). In total, 13 images covering all the paths and rows of Guinea-Bissau were obtained (Table 2). The selection of the images was, as much as possible, bound by the same set of criteria in order to maintain the same level of quality (e.g. cloud cover below 5%) and in the same period of the dry season.

Table 2 - Landsat imagery used in CARBOVEG (2007) and obtained for the FREL (2015).

Landsat sensor	Spatial Resolution (m)	Path	Row	Acquisition date (yy-mm-dd)	Source
2007 (CARBOVEG)					
TM	30	205	51	2007-02-07	USGS
		204	51	2007-02-28	
		204	52	2007-02-28	
		203	51	2007-03-09	
		203	52	2007-03-09	
2015					
OLI	30	205	51	2015-02-25	GEE
		204	51	2015-02-18	
		204	52	2015-02-18	
		203	51	2015-01-26	
		203	52	2015-01-26	

Pre-processing

The pre-processing phase included the following steps:

- Selection of spectral bands: blue (Landsat 5: 0.45-0.52 µm, Landsat 8: 0.45-0.51 µm), green (Landsat 5: 0.52-0.60, Landsat 8: 0.53-0.59 µm), red (Landsat 5: 0.63-0.69 µm, Landsat 8: 0.64-0.67 µm), NIR (Landsat 5: 0.77-0.90 µm, Landsat 8: 0.85-0.88), SWIR1 (Landsat 5: 1.55-1.75 µm, Landsat 8: 1.57-1.65 µm) and SWIR2 (Landsat 5: 2.08-2.35 µm, Landsat 8: 2.10-2.29 µm) bands.

- Projection: Landsat TM images were geometrically corrected through control points, while Landsat OLI images were downloaded with the L1TP (Precision and Terrain) processing level. All images were projected in UTM Zone 28 North, WGS84.

- Calibration: TM images were radiometrically calibrated. The L1TP processing level of Landsat OLI images represents the highest quality available data set. The data represent the surface reflectance corrected radiometrically and inter-calibrated with the different Landsat instruments.

- Quality evaluation: a dark object subtraction and cloud mask were applied to the imagery of 2007. The OLI sensor images are atmospherically corrected using *LaSRC* and include a cloud mask, shadow, water and snow created from the *CFMask* algorithm.

- Resampling: the mosaic for the year 2015 was built in the ENVI software with the *Mosaicking -> Georeferenced* command. These images were aggregated in order to make the mosaic homogeneous in the overlap zone of the scene through the option *feathering distance = 100* of the same command. All the mosaics were later spatially resampled to a resolution of 25 meters in the selected projection.

Classification

The resulting mosaics for the years 2007 and 2015 were classified with the Maximum Likelihood classification algorithm of the ENVI version 4.5 and 5.0[2] software, respectively, which is a supervised classification technique that includes the selection of training areas and the construction of a classifier. This type (supervised) of classifier automatically sorts all the pixels of an image based on examples learned about the pixels of the training areas, i.e. areas with homogeneous characteristics that are representative of the different forest types. The selection of training areas was based on a combination of direct ground observations, high-resolution images from Google Earth, Landsat images, and vegetation maps of Guinea-Bissau based on aerial photographs. Additionally, training areas covering the non-forest (NF) class (including water) were also collected.

The final forest cover maps depicting the four forest *strata* identified in 2.2 section were then subject to a map algebra operator in a GIS to derive the final FCC map for the reference period 2007-2015.

Post-processing

The post-processing phase included the following steps:

- Water mask: the water class was masked in each classification; a single water mask was derived from the combination of the two masks and subsequently applied to each individual forest cover map to exclude all water.
- Minimum Mapping Unit (MMU): an MMU of 0.5 ha (equivalent to 8 Landsat pixels with 25 m resolution) was applied to the classifications obtained to be consistent with the minimum area of the national forest definition.
- Post-classification: the FCC map was obtained by the difference between the 2007 and 2015 classifications (Figure 3). The resulting FCC categories are: Stable Forest (F to F), CF to NF, OF to NF, SA to NF, M to NF, Stable Non-Forest (NF to NF) and Non-Forest to Forest (NF to F).
- Map edition: the FCC map was manually/visually corrected, mostly aiming for classes that are more prone to errors: forest loss classes (CF to NF, OF to NF, SA to NF, M to NF) and forest gain (NF to F). Post-classification increases the frequency of errors in the FCC map thus resulting in areas of false forest loss and forest gain. Nevertheless, the stable classes (F to F and NF to NF) were also corrected where obvious errors were found. Those corrections were done based on field expert knowledge and on visual inspection of the Landsat imagery and of very high-resolution imagery available in Google Earth. Only the categories that were easily identified as a certain category were manually corrected.

  The correction process for both forest loss, forest gain and stable classes was undertaken by visually comparing the FCC map with VHR imagery available in Google Earth for the time period between 2007 and 2015. For the manual edition of the FCC map, the QGIS *Semi-Automatic Classification* plugin was used (using the command *Postprocessing* -> *Edit raster*). The plugin allows for selecting an input raster (in this case the FCC map) and to edit the raster values that fall within a region of interest selected by the user. The process revealed that many of the mapped change areas were in fact stable classes (either F to F our NF to NF). For example, 41% of the manually reclassified pixels corresponded to reclassifications from NF>F to NF>NF, and 33% from SA>NF to NF>NF. Many of these cases were identified as cashew plantations which were present both before 2007 and in 2015.

[2] Exelis Visual Information Solutions, Boulder, Colorado

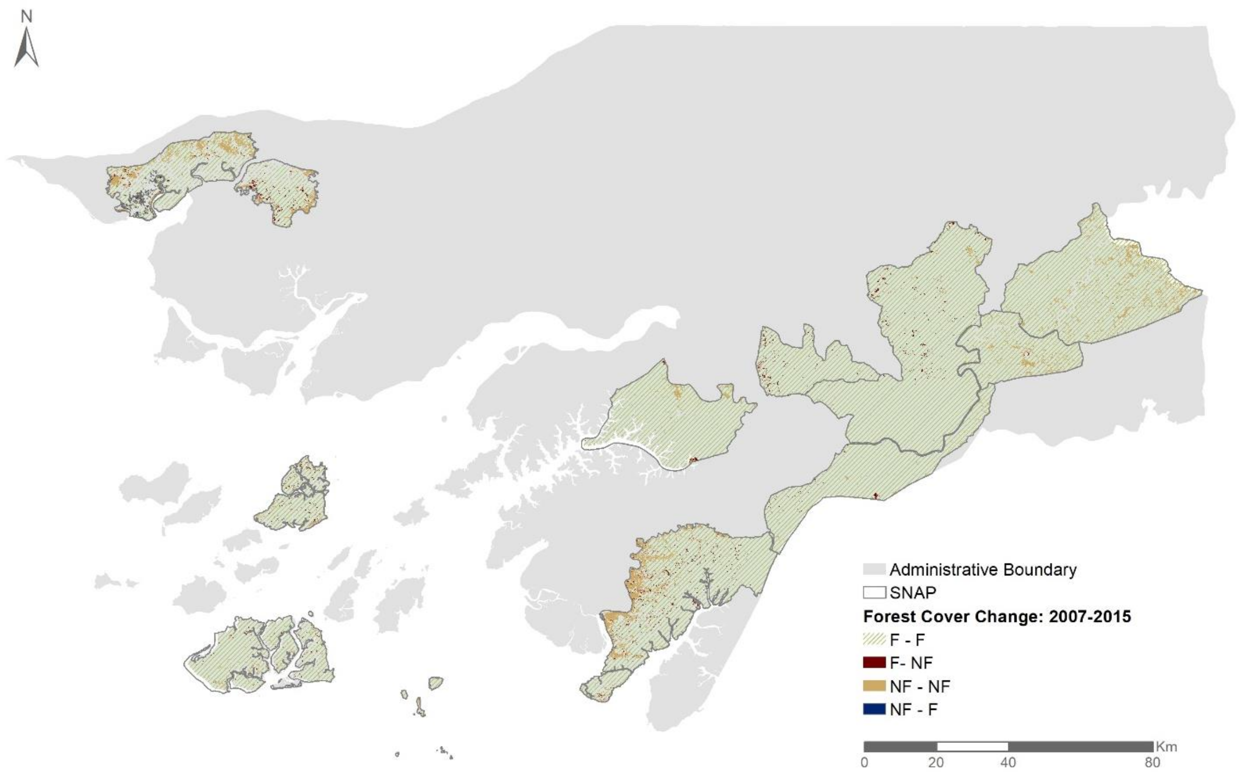


Figure 3 - FCC map for SNAP between 2007 and 2015. White areas correspond to water bodies.

3.3.1.3 Validation and correction of the Forest Cover Change areas

The validation of the FCC map followed a random stratified sampling method for the selection of the reference data. The FCC categories were the ones mentioned in the previous section (3.3.1.2): Stable Forest (F to F), CF to NF, OF to NF, SA to NF, M to NF, Stable Non-Forest (NF to NF) and Non-Forest to Forest (NF to F). The minimum sample size (number of reference data locations) for all categories was calculated using equation 13 from Olofsson *et al*. (2014). This equation takes as input the FCC map areas, a target standard error for Overall Accuracy (OA), and the expected User's Accuracy (UA). A target standard error for OA of 0.01 was used in this computation. The expected UA was set to 0.9 (higher expected UA) for stable categories (F to F and NF to NF), and to 0.7 for non-stable categories (lower expected UA). The selected parameters resulted in a minimum sample of 910 reference locations (Figure 4). The minimum sample size was distributed proportionally between the FCC categories, but applying a minimum sample size of at least 100 samples per category to ensure that rare transition classes were sufficiently sampled.

The spatial assessment unit was the pixel, the same spatial resolution of the FCC map (25x25 m). The pixel was chosen as the minimum area of land to assess deforestation with the objective of using these data to identify and quantify the impact of different drivers of forest loss, including shifting cultivation and mining which typically occur in smaller scales. While the choice of the best size for the assessment unit is not widely consensual, Czaplewski (2003) criticised accuracy assessments using data aggregated into blocks of pixels when the map is not similarly aggregated and Stehman & Wickham (2011) note that for an area-based accuracy assessment a pixel assessment unit is a legitimate and practical option. Olofsson *et al*., 2014 make no recommendation regarding the spatial assessment unit to be used in the response design. Guinea-Bissau followed an area-based accuracy assessment where the per-class area of agreement and area of disagreement were summarized by a population error matrix, where the cells of the error matrix represent the proportion of area of agreement for each class and the proportion area misclassified for each type of error. Consequently, the selected spatial assessment unit to perform the validation of the FCC map was chosen in order to match the minimum possible area of deforestation that is present in the map (pixel of 25x25m). However, Guinea-Bissau acknowledges that the IPCC in the *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (IPCC, 2003) considers that the MMU of FCC and land cover should be the same. Therefore, producing AD information with the same minimum area of land of the national forest definition is considered by Guinea-Bissau as an area of improvement for future submissions.

For reference data collection, a custom survey in Open Foris Collect Earth[3] (Figure 5) was used. Collect Earth facilitates access to freely available archives of satellite imagery, including very high spatial resolution imagery (Google Earth and Bing Maps). Each reference unit was visually interpreted and assigned to the respective FCC category (Annex II). The decision of assigning a unit to the corresponding FCC category was based on the most representative *stratum* in each 25x25-m validation plot. If the most representative *stratum* was not clear or no images were available, the reference unit was excluded from the analysis (in total 69 plots were eliminated). All samples were distributed randomly between the interpreters in order to avoid bias.

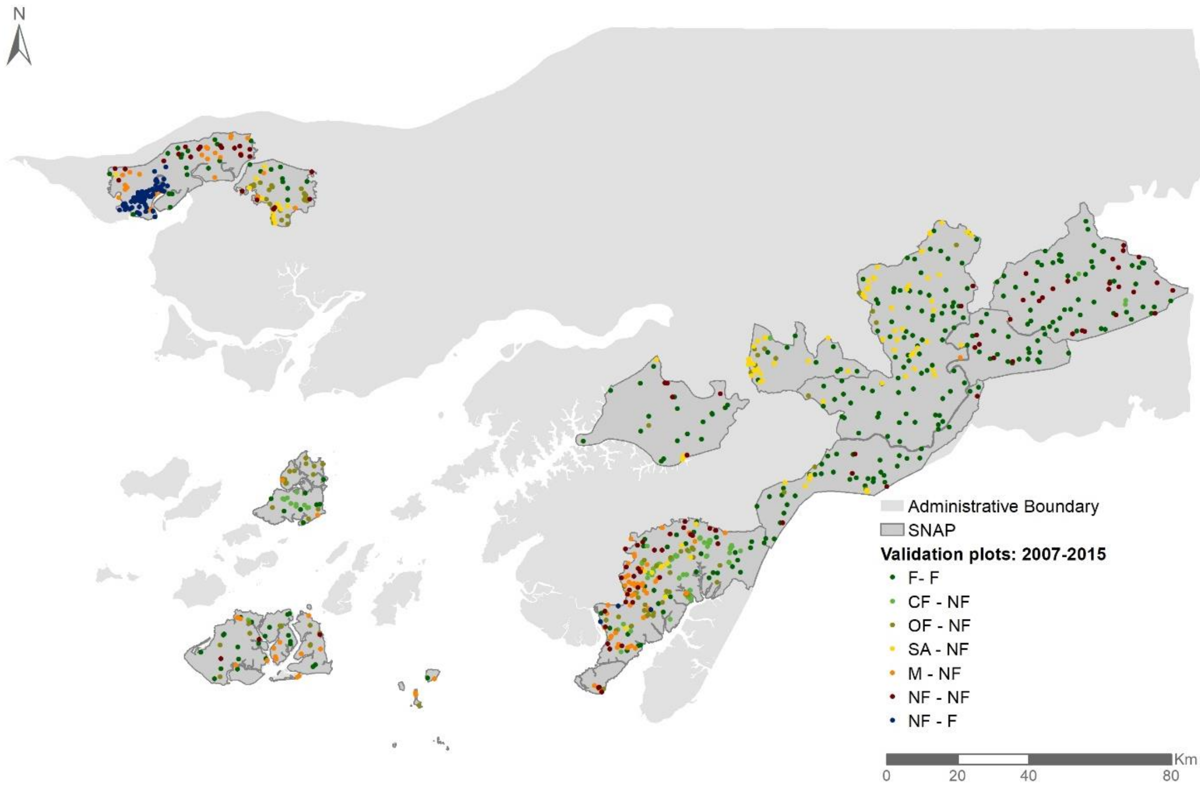


Figure 4 - Location of reference units for each category of FCC.

[3] www.openforis.org/tools/collect-earth.html

Figure 5 - Example of deforestation in Mangrove by observing high-resolution images available in Google Earth between 2007 and 2015. The reference unit (yellow square), 25x25 m, was identified in Collect Earth as a transition from Mangrove to Non-Forest. The points within the plot help to characterize the percentage of forest cover and assess if there was a change in the proportion of forest cover.

The error matrix, obtained by the cross-tabulation of the categories allocated by the classification of the FCC map data against the reference data, in terms of area proportions, is shown in Table 3. The matrix is produced with the information from the comma-separated value file that is exported from Collect Earth after the operator finalizes the collection of reference data and which contains: the location of the validation plots (X, Y coordinates), the mapped class that is present on the FCC map, and the reference class that was assigned by the operator for each location. The diagonal highlights the correct classifications where map and reference data agree in their classification. All cells off-diagonal show omission and commission errors. Three types of accuracy estimates are derived from the confusion matrix: Overall accuracy (OA), User's Accuracy (UA – commission error evaluation), and Producer's Accuracy (PA – omission error evaluation). Results are also presented in Table 3.

Table 3 - Error matrix in area proportions and precision estimates including overall accuracy (OA, %), and User's Accuracy (UA, %) and Producer's Accuracy (PA, %) for each FCC category.

		Reference								
	FCC Category	F to F	CF to NF	OF to NF	SA to NF	M to NF	NF to NF	NF to F	**Total**	UA (%)
Map	F to F	0.7799	0.0000	0.0000	0.0000	0.0000	0.1574	0.0000	0.9373	83
Map	CF to NF	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	72
Map	OF to NF	0.0011	0.0000	0.0011	0.0001	0.0000	0.0011	0.0000	0.0035	33
Map	SA to NF	0.0011	0.0000	0.0001	0.0006	0.0000	0.0021	0.0000	0.0039	16
Map	M to NF	0.0006	0.0000	0.0000	0.0000	0.0008	0.0007	0.0000	0.0021	35
Map	NF to NF	0.0054	0.0000	0.0000	0.0000	0.0000	0.0462	0.0000	0.0516	89
Map	NF to F	0.0003	0.0000	0.0000	0.0000	0.0000	0.0001	0.0007	0.0011	67
	Total	0.7885	0.0003	0.0013	0.0008	0.0008	0.2077	0.0007	OA = 83%	
	PA (%)	99	90	90	81	100	22	97		

The error matrix highlights some interesting facts, namely that the FCC class Forest remaining forest (F to F) covers a considerably larger extent in the FCC map estimate than in the bias-corrected area estimates. This is mainly due to a limitation of the optical remote sensing data used in separating natural forests from plantations and the fact that cashew plantations were classified as forest by the supervised Maximum Likelihood algorithm. This resulted in an underestimation of the area of non-forest remaining non-forest (NF to NF) and an overestimation of the overall deforestation in the FCC map. I.e. some areas mapped as forest in 2007 were in fact cashew plantations (i.e. NF) and therefore any changes in these areas should not be accounted as deforestation. Savanna to Non-Forest was the category with the highest error, precisely because cashew plantations are mostly mistaken with this *stratum*.

The main aim of the validation assessment was to use the error matrix to provide bias-corrected area estimates of the FCC map (shown in Table 1) and consequently derive accurate AD estimates. The bias-corrected areas were calculated using formula 8 to 11 provided by Olofsson *et al*. (2014).

3.3.2 Emission factors

The emission factors used for the construction of the proposed FREL are the forest carbon stocks per hectare (expressed in tCO2-e ha^{-1}) estimated for the total tree biomass as the sum of tree AGB and BGB. Gross emission was calculated based on the assumption that the biomass immediately after forest conversion is zero, i.e. post-deforestation CO_2 removals are not accounted for.

The AGB was calculated using the equations of Chave *et al.* (2005) for terrestrial and mangroves trees, and with the equation from Delaney *et al.* (1999) for palm trees. The BGB of CF, OF and SA was estimated using a linear relationship between root biomass and shoot biomass (root-to-shoot ratio) reported by Mokany *et al.* (2006) for tropical dry forests. To estimate BGB in mangroves relevant data reported by Komiyama *et al.* (2008) was compiled and the half-width of the 95% confidence interval was used. Conservatively, BGB of palm trees was excluded. A default carbon fraction of 0.47 was used to convert from biomass (dry matter) to carbon (as indicated in the 2006 Intergovernmental Panel on Climate Change – IPCC – Guidelines), and a stoichiometric ratio of 44/12 was used for the conversion of tons of carbon to tons of carbon dioxide equivalent. The calculated average carbon stocks per hectare and their corresponding margin of error at 95% confidence interval are shown in Table 4. The mean values of the total biomass per *stratum* are used as emission factors for each FCC class Table 5.

Table 4 - Average carbon stocks for each stratum (in tCO_2-e ha^{-1}) and measure of error as percentage of mean (margin of error at 95% confidence interval)

Stratum	**AGB** (tCO_2-e ha^{-1})		**BGB** (tCO_2-e ha^{-1})	
	Mean	Error (%)	Mean	Error (%)
CF	299.2	18.5	81.8	19.1
OF	279.8	15.4	77.3	15.8
SA	130.0	20.2	36.3	20.2
M	78.5	19.9	36.0	19.9

Table 5 – Emission factors (in tCO_2-e ha^{-1}) for each stratum and measure of error as percentage of mean (margin of error at 95% confidence interval)

FCC Category	Emission Factors (tCO_2-e ha^{-1})	
	Mean	Error (%)
CF to NF	381.0	18.8
OF to NF	357.1	15.6
SA to NF	166.3	20.3
M to NF	114.5	20.0

3.3.2.1 Source of data

The emission factors were obtained based on a set of field data collected at national and subnational level. To the national dataset collected in the CARBOVEG project between 2007 and 2009 and used in the Second and Third NCs, new data collected in the SNAP between 2010 and 2014 was added to update the information on forest carbon stocks. The SNAP samples were collected in PNC, PNTC and PNO in the context of the "Community Based Avoided Deforestation Project in Guinea-Bissau" (CBADP) project under the Verified Carbon Standard (VCS) program with support from the World Bank, and in the DBT for the project "Support for the Consolidation of a Protected Areas System in Guinea-Bissau's Forest Belt" sponsored by the United Nations Development Program and the Global Environment Facility. All inventories used the same methodological approach for data collection.

Field data collection followed a stratified sampling process. Data were collected in sampling plots in the forest *strata* identified on a random origin systematic grid of 250 x250 m. In order to optimize the sampling of trees and palms, the inventories applied circular nested plots. The plots are circular with a 20 m radius from the centre. In each plot, three subplots with radius of 4, 14 and 20 m are considered. In each subplot different Diameter-at-Breast-Height (DBH) classes are measured. The measurement criterion of the trees to be measured in each subplot is a function of its DBH (Table 6). The DBH of each tree was measured with a calliper or a diametric tape and its height with a *Vertex* hypsometer. In the case of palm trees only the height of the crownshaft was measured. All palm trees with stem height equal to or greater than 1.3 meters are measured in the larger plot (radius of 20 m). All inventories followed the same operational procedure. Exceptions include the measurement of terrestrial forest plots (CF, OF and SA) in 2010 where tree heights were not measured, and mangroves in 2012 where the DBH thresholds were slightly different from that described in Table 6 (see Note). As a consequence, the terrestrial forest plots measured in 2010 were excluded from the sample, and the scale factors (biomass extrapolation to 1 hectare) for mangrove plots measured in 2012 was adjusted accordingly. Another exception was in the forest inventory carried out in the DBT which included an additional forest *stratum*: "riparian forest". The riparian forest is the vegetation formation that occurs in wet or flooded soils of riverbanks and lagoons and because it has carbon densities corresponding to OF, the plots measured in this *stratum* were considered OF.

Quality control procedures were implemented when analysing the data. These included independent third party audit of field data to select only those plots that met the quality standards required to estimate carbon stocks. There was no bias in the elimination of plots, these were eliminated regardless of the strata. The reasons for excluding plots during the quality control phase included: 1) location problems (lack or wrong coordinates); 2) lack of information (plots with no sufficient data to calculate carbon stocks); 3) errors in the data (plots with evident errors in the measurements); 4) misapplication of the protocol; 5) plots located outside the forest (for instance, predominance of cashew trees) or when the identification of the *stratum* was not clear. A total of 338 plots were eliminated and 364 analysed (Figure 6), of which 50 are in CF, 158 in OF, 86 in SA and 70 in M. The proportion of eliminated plots per strata is 0.3% in CF, 73.6% in OF, 15.6% in SW and 10.3% in M. The 364 plots analysed provide estimates of terrestrial carbon stocks in the SNAP that meet a target precision of 10% at a 90% confidence interval, and the uncertainty (error as percentage of the mean) of the emissions factors in each stratum is always less than 20%[4]. At the end of each field campaign and quality control cycle, there is a re-evaluation of the sample intensity to achieve a target precision for the total and per *strata* estimates in future field campaigns.

[4] According to the CDM A/R Methodological Tool "Calculation of the number of sample plots for the measurements within a A/R CDM project activities"

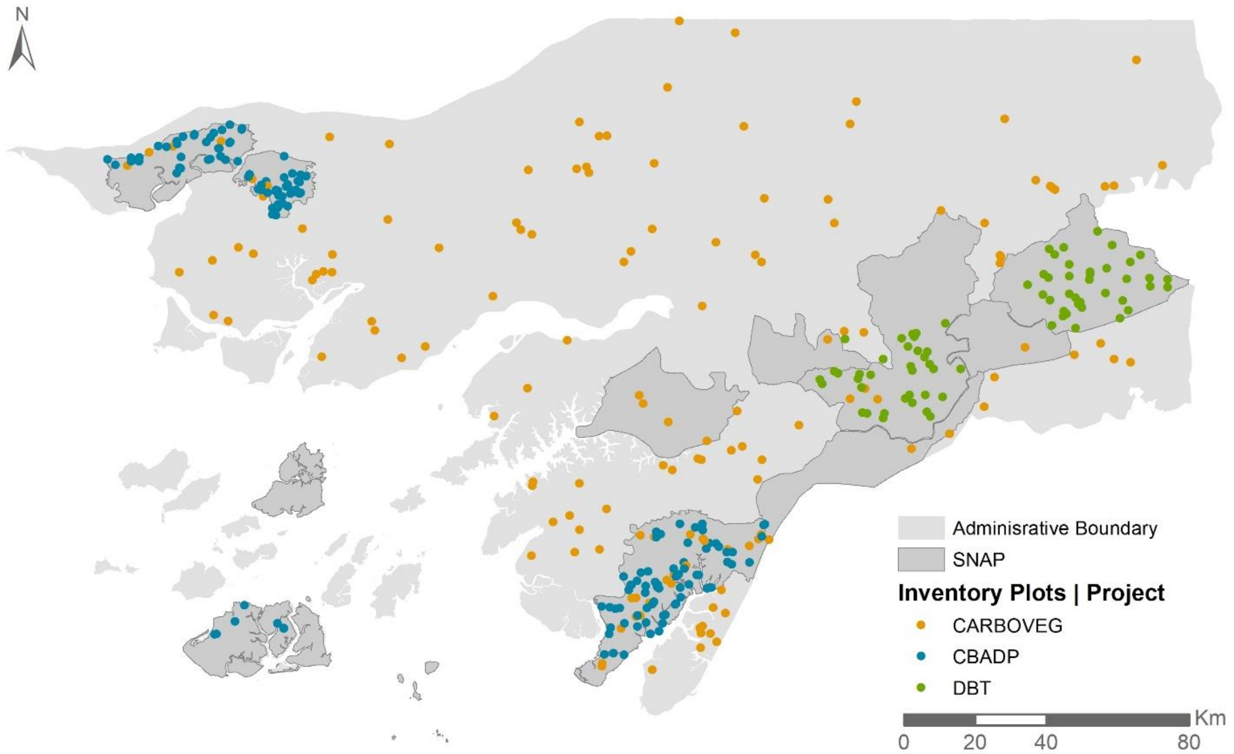
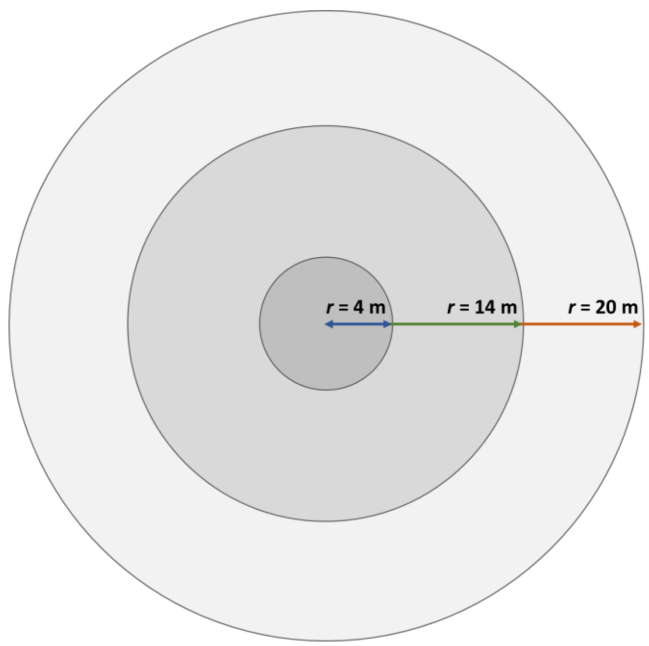


Figure 6 - Location of the 364 plots included in the construction of the proposed FREL according to the performed forest inventories.

Table 6 - Form and dimension of the circular nested plots and respective measurement criteria.

Scheme of circular nested plots	Trees measurement criterion
	Trees with DBH ≥ 5 cm
	Trees with DBH ≥ 20 cm
	Trees with DBH ≥ 50 cm
	Note: For the plots assessed in 2010 and 2012 in M *stratum*, the tree measurement criterion was: *r* = 4 m, DBH ≥ 5 cm; *r* = 14 m, DBH ≥ 10 cm, *r* = 20 m, DBH ≥ 15 cm; and: *r* = 4 m, DBH ≥ 5 cm; *r* = 14 m, DBH ≥ 10 cm, *r* = 20 m, DBH ≥ 20 cm, respectively.

3.3.2.2 Methods used for estimating carbon stocks

A detailed description of the methods and equations used to reach the carbon stock estimates can be found in Table 7. In the case of the proposed FREL, the emission factors for each specific *stratum* are considered constant in space and time.

Table 7 - Allometric equations and factors used to estimate carbon stocks for AGB and BGB.

Application	Equation or Factor	Reference	Notes
AGB			
CF	$0.112 \times (\rho \times DBH^2 \times H)^{0.916}$	Chave *et al.* (2005)	After testing different models using national data, it was concluded that the best fit for estimating AGB of trees in Guinea-Bissau was the pantropical allometric equation formulated by Chave *et al*. (2005). This equation was validated using a limited measurements method (following the methodology approved by the VCS in the module CP-AB[5]): about 43 trees with DBH between 20 and 140 cm corresponding to the most common species present in the inventory were measured. For each tree, the diameter of the stem was measured at different heights and estimated at the top of the stem, i.e. up to the first branch. The height at the top of the stem was also measured with a hypsometer. At the office, the stem volume of each tree was calculated from measurements as the volume of a truncated cone and multiplied by a species-specific density to establish the biomass of the stem. Species-specific wood densities were collected for the most representative species in Guinea-Bissau during the CARBOVEG programme. The estimated biomass of all the measured trees was plotted against the Chave's estimate. This analysis revealed that Chave *et al.* (2005) presents conservative estimates of AGB as most of the estimated AGB of the measured trees are distributed above the line of perfect agreement (1:1). However, there is no guarantee that it remains conservative beyond 140 cm. In cases where the DBH is greater than 140 cm (about 12 individuals), it is assumed that the DBH of these trees is equal to 140 cm. The equations for the mangrove and palm trees were also validated following the same approach. About 38 mangrove trees and 30 palm trees were sampled.
OF	$0.112 \times (\rho \times DBH^2 \times H)^{0.916}$	Chave *et al.* (2005)	
SA	$0.112 \times (\rho \times DBH^2 \times H)^{0.916}$	Chave *et al.* (2005)	
M	$0.168 \times \rho \times DBH^{2.47}$	Chave *et al.* (2005)	
Palms	$6.666 + 12.826 \times A^{0.5} \times \ln(H)$	Delaney *et al.* (1999)	

[5] verra.org/wp-content/uploads/2017/11/VMD0001v1.1.pdf

Application	Equation or Factor	Reference	Notes
BGB			
CF	if AGB < 20 $tCha^{-1}$, BGB = 0.56 x AGB if AGB > 20 $tCha^{-1}$, BGB = 0.28 x AGB	Mokany *et al.* (2006)	Relevant data of AGB and BGB reported by Komiyama et al. (2008) was compiled and the half-width of the 95% confidence interval was used. Conservatively, BGB of palm trees was excluded.
OF			
SA			
M	BGB = 0,46*DBH	Komiyama *et al*. (2008)	
Correction of measured heights			
CF	10.094 × ln(DBH) – 13.823	CARBOVEG, CBADP and DBT	Develops a relationship between DBH and Height for each *stratum* based on data collected in the inventories. The hypsometric equation developed in each case was used for quality control, identifying trees with improbable height measures. In cases where the difference between the measured height and the estimated height (from the hypsometric equation) is greater than 20 m, the estimated height to calculate the biomass was used.
OF	6.3955 × ln(DBH) – 6.1713		
SA	5.1534 × ln(DBH) – 4.6192		
Extrapolation of biomass to 1 hectare			
CF	if DBH≥5 cm and <20 cm, e = 198.94 if DBH≥20 cm and <50 cm, e = 16.24 if DBH≥50 cm, e = 7.96		The biomass at plot level was extrapolated to an area of 1 ha (10 000 m^2) by calculating the proportion that is occupied by a given plot using a dimensional scale factor (e), defined by the equation e = (10000 / π × r^2), where *r* is the radius of the plot in meters.
OF			
SA			
M	if CARBOVEG and if DBH≥5 cm and <20 cm, e = 198.94 if CARBOVEG and if DBH ≥20 cm and <50 cm, e = 16.24 if CARBOVEG and if DBH≥50 cm, e = 7.96 if CBADP1 and if DBH≥5 cm and <10 cm, e = 198.94 if CBADP1 and if DBH≥10 cm and <15 cm, e = 16.24 if CBADP1 and if DBH≥15 cm, e = 7.96 if CBADP2 and if DBH≥5 cm and <10 cm, e = 198.94 if CBADP2 and if DBH≥10 cm and <20 cm, e = 16.24 if CBADP2 and if DBH≥20 cm, e = 7.96		
Palms	e = 7.96		

Application	Equation or Factor	Reference	Notes
Average wood density			
CF	0.731	CARBOVEG	When known, the specific wood density of the species was applied. In cases where it was not possible to identify the species or values of wood density are not published/available, an average wood density was calculated from data collected in CARBOVEG.
OF			
SA			
Default values for the conversion of biomass in carbon and carbon dioxide equivalent			
Global	0.47	2006, IPCC Guidelines	Default carbon fraction
	44/12		Stoichiometric ratio for the conversion of tons of carbon to tons of carbon dioxide equivalent.

Where: ρ = wood density; DBH = diameter-at-breast-height e H = tree height.

4 CONSTRUCTION OF THE PROPOSED FREL

4.1 Proposed FREL

The equation used to construct the proposed FREL (Table 8), which will be used to measure, report and verify future GHG emissions from deforestation in the context of results-based payments, is the following:

$$E_t = \sum_{i}^{l} (A_{i,t} \times FE_{i,t})$$

Where:

E_t	Emissions from deforestation in year *t* (tCO_2-e yr^{-1})
$A_{i,t}$	Deforested area in *stratum i* in year *t* (ha yr^{-1})
$EF_{i,t}$	Emission factor applicable to the *stratum i* in year *t* (tCO_2-e yr^{-1})
i	*Stratum i* (dimensionless)
l	Total number of *strata* (dimensionless)
t	A year (dimensionless)

Table 8 - Carbon emissions for each FCC category (in tCO_2-e per year).

FCC Category	Emissions (tCO_2-e *per* year)
CF to NF	11 334.5
OF to NF	38 429.1
SA to NF	10 644.4
M to NF	7 397.5
Total	**67 805.5**

4.2 Uncertainty of the FREL

The uncertainty of the adjusted areas was calculated through the formulas 10 and 11 provided in Olofsson et al. (2014), while the standard deviation and the error at 95% confidence interval of the carbon stocks estimates were calculated to take into consideration the sampling design used for collecting the data. No systematic errors are expected from the forest inventory as it was reviewed several times and included quality control procedures. However, the uncertainty due to the models applied (biomass equations) was not included in the study. A more complete uncertainty analysis is under implementation.

The combination of uncertainties followed the propagation of errors approach described in equations 3.1 and 3.2 of the 2006 IPCC Guidelines. Total uncertainty for the proposed FREL is 20.3% (uncertainty as a percentage of the mean) (Table 9).

Table 9 - Uncertainties percentages of carbon emissions for each FCC category and total uncertainty of the proposed FREL.

FCC Category	Uncertainty (%)
CF to NF	29.8
OF to NF	31.5
SA to NF	46.6
M to NF	34.0
Total	**20.3**

5 AREAS OF FUTURE IMPROVEMENT

This FREL was constructed based on the currently available data and knowledge under national circumstances, capacity and capability. Guinea-Bissau has chosen to develop the FREL using a step-wise approach which allows for iterative updates and improvements to the FREL as and when new data and or updated methods become available. As such, the present FREL, while comprehensive, will see updates and improvements in the future that enhance the ability to capture the emissions in Guinea-Bissau. These areas of future improvement will be covered under the step-wise approach when new, adequate data and better information become available, and can include:

- Expanding the scope of the submission to cover the entire national territory and possibly expand the reference period for better consistency with National Communications. Guinea-Bissau plans to include land cover maps from the CARBOVEG national programme and have both national scope and a reference start period in 1990 to keep consistency with the Third NC. However, further resources are necessary to correct the national maps taking full advantage of better pre-processed and georeferenced data currently available.

- Expanding the scope of the submission in terms of activities covered and include emissions and removals from forest degradation and enhancement of carbon stocks. At this moment these two activities although significant were omitted from the FREL due to lack of accurate and consistent data. However, measures to reduce emissions from forest degradation (e.g. controlled production of vegetable coal, promotion of energy-efficient stoves, law enforcement to reduce illegal logging) as well as a number of afforestation, reforestation, and managed regrowth initiatives are already being coordinated and implemented by the Government and by IBAP in the SNAP. Several strategies, plans, inventories, and reports highlight the potential of carbon sequestration in the forest sector, including IBAP's Strategic Plan 2014-2020 (Republic of Guinea-Bissau, 2015c), the Third NC, and the iNDC, with the latter listing afforestation and reforestation as both a mitigation and adaptation contribution.

- Testing methods for estimating emissions and removals for the inclusion of other activities, such as forest degradation and enhancement of carbon stocks. Possibilities to quantify degradation can include mapping burnt areas in forests remaining forests and fuelwood collection using PRA methods, while for enhancement of carbon stocks a combination of FFC maps and tabular cadastral records of afforestation and restoration areas from IBAP can be used. For both degradation and enhancement of stocks, new technologies such as lidar data (GEDI) or Radar data (future Biomass or already existing ALOS PALSAR data) to construct carbon change maps can also be tested.

- The definition of forest adopted by Guinea-Bissau does not include land predominantly for agricultural use. However, planted tree species cannot be easily separated from natural forests using classification of Landsat imagery. Nevertheless, future work is being planned to undertake a new forest inventory which will include quantifying and mapping areas of conversion to plantations (from forests and non-forests). This information will improve the accuracy of estimates of emissions from "forests converted to other land uses" and "removals by biomass stocks".

- Testing improved methods for estimating AD such as direct FCC detection to obtain estimates with fewer correction steps and higher accuracies. A direct classification of FCC can be produced based on the collection of training data with direct information of the change that occurred in a given location and period of time, rather than the post-classification that is based on the subtraction of two forest cover maps corresponding to two points in time. The direct classification of FCC has the advantage of minimizing the propagation of the error that occurs in the post-classification process. Due to this advantage, the direct classification of FCC was tested. However, there were constraints on the collection of training data due to lack of images in Google Earth for the reference period under analysis, and better results were obtained with the post-classification process. The scarcity of images present in Google Earth, both spatially and temporally, also affected the validation process of the FCC map used in this FREL. However, as more images become available, direct classification has the potential to produce better results in the future.

- Also on the improvement of methods to estimate AD, Guinea-Bissau will: include in future submissions a sensitivity analysis of the AD estimates using a dataset of sampling units with different sizes (pixel, or block of pixels), and following IPCC guidance, the minimum mapping area of deforestation events will be adjusted to match the minimum area of forest definition.

- Implementation of Tier 3 robust methodologies to assess the uncertainty of the FREL. Guinea-Bissau considers the accuracy of the FREL as an area to be continuously improved. This includes quantifying the uncertainty of the FREL considering all sources of error not yet included in this submission, namely measurement errors (DBH, Height) and allometric model errors.

- Inclusion of emissions from omitted carbon pools depending on the availability of resources to collect accurate data. In the preparation of this FREL the AGB and BGB pools were prioritized as emissions from these pools were more accurate considering the available data.

- Inclusion of emissions from omitted GHG associated with forest fires. Although the MODIS sensor offers easy to use fire products, more accurate, higher-resolution alternative activity data sources will be researched for long term use, which entails additional technical capacities.

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ANNEXES

Annex I. Forest Cover Change mapped and adjusted areas between 2007 and 2015

FCC Category	Mapped area (ha)	Adjusted area (ha)
F to F	63 8506.3	537 096
CF to NF	295.9	238
OF to NF	2 384.3	861
SA to NF	2 655.2	512
M to NF	1 456.9	517
NF to F	716.8	496
NF to NF	35 170.1	141 465

Annex II. Validation plots with mapped and reference Forest Cover Change category

ID	Center Coordinates		FCC Category		ID	Center Coordinates		FCC Category	
	X	Y	MAP	REFERENCE		X	Y	MAP	REFERENCE
1	346997.5	1352852.5	NF to F	NF to F	58	501222.5	1257377.5	F to F	F to F
2	481997.5	1233152.5	OF to NF	F to F	59	369772.5	1365227.5	M to NF	M to NF
3	521697.5	1302577.5	SA to NF	SA to NF	61	355172.5	1361852.5	NF to F	NF to NF
4	494372.5	1251402.5	CF to NF	CF to NF	62	391672.5	1349227.5	OF to NF	F to F
5	485022.5	1227502.5	F to F	F to F	63	539147.5	1297202.5	SA to NF	NF to NF
6	350622.5	1355652.5	NF to F	NF to F	64	507797.5	1257627.5	CF to NF	CF to NF
7	507947.5	1258252.5	CF to NF	CF to NF	65	489247.5	1252152.5	CF to NF	CF to NF
8	572772.5	1328352.5	F to F	F to F	66	377572.5	1237002.5	M to NF	NF to NF
9	361847.5	1366652.5	NF to NF	NF to NF	67	490797.5	1249177.5	CF to NF	NF to NF
10	496122.5	1251902.5	SA to NF	NF to NF	68	489747.5	1238752.5	OF to NF	NF to NF
11	349222.5	1349777.5	F to F	F to F	69	630197.5	1323827.5	F to F	F to F
12	487372.5	1243402.5	OF to NF	NF to NF	70	495697.5	1242827.5	CF to NF	OF to NF
13	349747.5	1353402.5	NF to F	NF to F	71	482422.5	1233377.5	CF to NF	NF to NF
14	585972.5	1316952.5	F to F	F to F	72	351422.5	1353252.5	NF to F	NF to F
15	348922.5	1351752.5	NF to F	F to F	73	486022.5	1232927.5	CF to NF	CF to NF
16	559397.5	1314402.5	SA to NF	SA to NF	74	372697.5	1229352.5	OF to NF	NF to NF
17	372847.5	1225452.5	NF to NF	NF to NF	75	363722.5	1368627.5	NF to NF	NF to NF
19	351847.5	1354002.5	NF to F	NF to F	76	397522.5	1234752.5	OF to NF	F to F
20	486272.5	1228802.5	M to NF	M to NF	77	484472.5	1245727.5	M to NF	M to NF
21	501422.5	1248677.5	CF to NF	CF to NF	78	562197.5	1337327.5	F to F	F to F
23	396697.5	1355052.5	OF to NF	OF to NF	79	489322.5	1246302.5	M to NF	M to NF
24	373672.5	1368327.5	NF to NF	NF to NF	80	562147.5	1281252.5	F to F	NF to NF
25	391547.5	1231952.5	F to F	F to F	81	373147.5	1364677.5	F to F	F to F
26	385597.5	1224927.5	M to NF	F to F	82	602222.5	1328852.5	NF to NF	F to F
27	566347.5	1314402.5	F to F	F to F	83	391747.5	1356977.5	F to F	F to F
28	495097.5	1281052.5	F to F	F to F	84	507772.5	1258202.5	CF to NF	CF to NF
29	378972.5	1366652.5	M to NF	NF to NF	86	568447.5	1344002.5	SA to NF	SA to NF
30	509947.5	1249177.5	F to F	F to F	87	354247.5	1351402.5	M to NF	M to NF
31	378647.5	1368852.5	NF to NF	NF to NF	88	485397.5	1248552.5	M to NF	NF to NF
32	535397.5	1276677.5	F to F	NF to NF	89	485597.5	1228477.5	M to NF	NF to NF
33	351847.5	1355177.5	NF to F	NF to F	90	357672.5	1359677.5	NF to F	F to F
34	502072.5	1242702.5	CF to NF	CF to NF	91	596072.5	1322827.5	F to F	F to F
35	554397.5	1293852.5	F to F	F to F	92	396297.5	1355452.5	OF to NF	OF to NF
36	578672.5	1344552.5	SA to NF	NF to NF	93	553172.5	1331652.5	SA to NF	F to F
37	617672.5	1328777.5	NF to NF	NF to NF	94	484797.5	1250827.5	NF to NF	NF to NF
38	598072.5	1314302.5	F to F	F to F	95	609272.5	1333027.5	CF to NF	NF to NF
39	482622.5	1229252.5	M to NF	M to NF	96	489822.5	1244352.5	M to NF	NF to NF
41	519947.5	1312527.5	SA to NF	NF to NF	97	501447.5	1248677.5	CF to NF	CF to NF
42	613197.5	1334952.5	F to F	F to F	98	387947.5	1347477.5	OF to NF	NF to NF
43	495522.5	1242502.5	SA to NF	NF to NF	99	560197.5	1328252.5	F to F	F to F
44	395022.5	1226777.5	M to NF	F to F	100	426697.5	1215202.5	M to NF	NF to NF
45	389172.5	1230002.5	M to NF	NF to NF	101	494472.5	1280377.5	F to F	F to F
46	356847.5	1356927.5	NF to F	F to F	102	393797.5	1268052.5	CF to NF	CF to NF
47	504247.5	1263452.5	F to F	NF to NF	103	351072.5	1349877.5	NF to F	NF to F
48	351597.5	1354577.5	NF to F	NF to F	104	386847.5	1270152.5	F to F	F to F
49	568472.5	1339877.5	F to F	F to F	105	576847.5	1309527.5	M to NF	NF to NF
50	356897.5	1357477.5	NF to F	NF to F	106	493797.5	1251627.5	CF to NF	CF to NF
51	549997.5	1331402.5	F to F	NF to NF	107	577572.5	1320602.5	F to F	F to F
52	390372.5	1359677.5	F to F	F to F	108	489022.5	1250352.5	M to NF	M to NF
53	567647.5	1305877.5	F to F	NF to NF	109	485922.5	1240202.5	M to NF	M to NF
54	387197.5	1362252.5	F to F	F to F	110	398297.5	1223102.5	F to F	F to F
55	551572.5	1329077.5	SA to NF	F to F	111	500072.5	1256902.5	SA to NF	SA to NF
56	542222.5	1297752.5	F to F	F to F	112	611847.5	1345477.5	F to F	F to F

113	489022.5	1250402.5	M to NF	M to NF	174	365147.5	1365827.5	NF to NF	NF to NF
114	491922.5	1248627.5	CF to NF	CF to NF	175	365147.5	1365827.5	NF to NF	NF to NF
115	380847.5	1371102.5	M to NF	F to F	176	495922.5	1244102.5	OF to NF	NF to NF
116	500522.5	1248752.5	CF to NF	CF to NF	177	488022.5	1245177.5	NF to NF	NF to NF
117	398547.5	1276827.5	OF to NF	NF to NF	178	505097.5	1258952.5	CF to NF	CF to NF
118	559847.5	1299652.5	F to F	F to F	179	598522.5	1308377.5	F to F	NF to NF
119	357072.5	1356602.5	NF to F	F to F	180	501622.5	1255527.5	OF to NF	NF to NF
120	480672.5	1231477.5	M to NF	F to F	181	489172.5	1251827.5	CF to NF	CF to NF
121	522847.5	1257627.5	F to F	NF to NF	182	378972.5	1366177.5	NF to NF	NF to NF
122	387872.5	1351077.5	F to F	NF to NF	183	577922.5	1302477.5	F to F	F to F
123	571897.5	1314402.5	F to F	F to F	184	569247.5	1321227.5	F to F	F to F
124	502097.5	1255252.5	CF to NF	CF to NF	185	513097.5	1252152.5	CF to NF	CF to NF
126	397547.5	1229152.5	OF to NF	F to F	186	496872.5	1260102.5	NF to NF	NF to NF
127	391697.5	1353652.5	F to F	F to F	187	361622.5	1368302.5	F to F	NF to NF
128	550047.5	1327177.5	SA to NF	F to F	188	371747.5	1370602.5	F to F	NF to NF
129	389322.5	1234627.5	OF to NF	F to F	189	501922.5	1242652.5	CF to NF	CF to NF
130	505122.5	1258877.5	CF to NF	CF to NF	191	348672.5	1353402.5	NF to F	F to F
131	379297.5	1356227.5	NF to NF	NF to NF	192	618722.5	1337152.5	NF to NF	NF to NF
132	350922.5	1351977.5	NF to F	F to F	193	499872.5	1255277.5	OF to NF	F to F
133	521072.5	1310052.5	OF to NF	OF to NF	194	509522.5	1261052.5	NF to NF	NF to NF
134	502547.5	1259927.5	NF to NF	NF to NF	195	535597.5	1276527.5	SA to NF	NF to NF
135	351372.5	1355627.5	NF to F	NF to F	196	351747.5	1353802.5	NF to F	NF to F
136	596672.5	1327527.5	F to F	F to F	197	603947.5	1336852.5	F to F	F to F
137	496997.5	1253452.5	OF to NF	OF to NF	198	488672.5	1249477.5	NF to NF	NF to NF
138	488697.5	1302277.5	F to F	F to F	199	484672.5	1233752.5	SA to NF	NF to NF
139	542997.5	1305627.5	F to F	F to F	200	355822.5	1356927.5	NF to F	NF to F
140	569472.5	1344927.5	F to F	NF to NF	201	399747.5	1265527.5	M to NF	F to F
141	571697.5	1321827.5	F to F	F to F	202	527322.5	1263177.5	F to F	F to F
142	496122.5	1302277.5	NF to NF	NF to NF	203	384197.5	1358502.5	OF to NF	OF to NF
143	352147.5	1354202.5	NF to F	NF to F	204	346547.5	1352352.5	NF to F	NF to F
144	477722.5	1235577.5	NF to F	F to F	205	387572.5	1348677.5	OF to NF	OF to NF
146	607097.5	1323152.5	F to F	F to F	206	429947.5	1219952.5	F to F	F to F
147	496847.5	1249277.5	OF to NF	OF to NF	207	569747.5	1304502.5	SA to NF	NF to NF
148	560097.5	1291277.5	F to F	NF to NF	208	350572.5	1355252.5	NF to F	NF to F
149	389247.5	1234677.5	OF to NF	F to F	209	499422.5	1247752.5	CF to NF	OF to NF
150	564122.5	1337077.5	F to F	F to F	210	540372.5	1281927.5	F to F	NF to NF
152	537072.5	1308102.5	F to F	F to F	211	386897.5	1352577.5	OF to NF	F to F
154	564997.5	1312777.5	F to F	F to F	212	502372.5	1244302.5	CF to NF	F to F
155	571022.5	1332627.5	SA to NF	F to F	213	579797.5	1343777.5	SA to NF	F to F
156	351647.5	1354352.5	NF to F	NF to F	214	385897.5	1353927.5	OF to NF	F to F
157	571322.5	1339277.5	F to F	F to F	215	396647.5	1354952.5	OF to NF	OF to NF
158	489822.5	1252777.5	OF to NF	NF to NF	216	589972.5	1315377.5	F to F	F to F
159	512697.5	1296177.5	F to F	F to F	217	595747.5	1310927.5	F to F	F to F
160	518522.5	1307527.5	SA to NF	NF to NF	218	389197.5	1351752.5	SA to NF	NF to NF
161	539197.5	1301502.5	F to F	F to F	219	575097.5	1317877.5	F to F	F to F
162	501597.5	1282227.5	OF to NF	NF to NF	220	388847.5	1352202.5	SA to NF	NF to NF
163	350647.5	1355427.5	NF to F	NF to F	221	502222.5	1260452.5	M to NF	NF to NF
164	507922.5	1261677.5	NF to NF	NF to NF	222	487122.5	1253927.5	M to NF	NF to NF
165	498497.5	1253902.5	CF to NF	CF to NF	223	607697.5	1316302.5	NF to NF	NF to NF
166	388197.5	1351602.5	NF to NF	NF to NF	224	496097.5	1256427.5	F to F	NF to NF
167	353847.5	1354802.5	NF to F	NF to NF	225	494672.5	1251052.5	SA to NF	SA to NF
168	373297.5	1365727.5	M to NF	NF to NF	226	355547.5	1356602.5	NF to F	F to F
168	373297.5	1365727.5	M to NF	NF to NF	227	391972.5	1277852.5	OF to NF	F to F
169	493972.5	1251477.5	CF to NF	CF to NF	228	496872.5	1236277.5	CF to NF	NF to NF
170	383297.5	1229752.5	F to F	F to F	229	487022.5	1254452.5	M to NF	M to NF
171	494772.5	1261852.5	M to NF	F to F	230	563997.5	1310852.5	SA to NF	NF to NF
172	493597.5	1247727.5	M to NF	NF to NF	231	376297.5	1371702.5	M to NF	F to F
173	399372.5	1268427.5	F to F	F to F	232	356747.5	1356252.5	M to NF	F to F

233	581522.5	1298752.5	NF to NF	F to F	296	527722.5	1271002.5	F to F	F to F
234	566147.5	1284027.5	F to F	F to F	297	396472.5	1281527.5	OF to NF	OF to NF
235	486547.5	1240927.5	NF to NF	NF to NF	298	477297.5	1217252.5	NF to NF	NF to NF
236	387497.5	1228327.5	M to NF	F to F	300	367272.5	1227252.5	F to F	F to F
237	497597.5	1298377.5	NF to NF	NF to NF	301	478522.5	1216802.5	OF to NF	F to F
238	480197.5	1233727.5	F to F	F to F	302	350847.5	1350152.5	NF to F	NF to F
239	355622.5	1359552.5	NF to F	NF to F	303	562822.5	1328102.5	F to F	F to F
240	391322.5	1237727.5	F to F	F to F	304	390397.5	1358752.5	F to F	F to F
241	598097.5	1308952.5	F to F	F to F	305	489597.5	1256652.5	F to F	F to F
242	513197.5	1252127.5	CF to NF	CF to NF	306	390597.5	1269977.5	CF to NF	NF to NF
243	489997.5	1240327.5	OF to NF	OF to NF	307	557922.5	1323252.5	SA to NF	NF to NF
244	598522.5	1325427.5	NF to NF	NF to NF	308	625872.5	1337752.5	NF to NF	NF to NF
246	350772.5	1354877.5	NF to F	NF to F	309	387847.5	1349027.5	SA to NF	NF to NF
247	512097.5	1260452.5	M to NF	NF to NF	310	502072.5	1242677.5	CF to NF	CF to NF
249	357472.5	1358177.5	NF to F	NF to F	311	359122.5	1355552.5	F to F	F to F
250	397847.5	1353852.5	NF to NF	NF to NF	312	370022.5	1362702.5	F to F	F to F
251	489097.5	1245727.5	M to NF	M to NF	313	385472.5	1363052.5	SA to NF	NF to NF
252	599372.5	1326352.5	NF to NF	NF to NF	314	529172.5	1268252.5	F to F	NF to NF
253	503397.5	1260602.5	F to F	F to F	315	492422.5	1244302.5	F to F	F to F
254	486147.5	1234277.5	CF to NF	OF to NF	316	350922.5	1355027.5	NF to F	NF to F
256	501347.5	1243577.5	M to NF	NF to NF	317	595522.5	1312002.5	F to F	NF to NF
257	351397.5	1354352.5	NF to F	NF to F	318	387697.5	1350352.5	SA to NF	NF to NF
258	477247.5	1216777.5	M to NF	F to F	319	544172.5	1302902.5	F to F	F to F
259	558772.5	1317027.5	SA to NF	NF to NF	320	580847.5	1312302.5	NF to NF	NF to NF
260	347022.5	1352802.5	NF to F	NF to F	321	352247.5	1354202.5	NF to F	NF to F
263	550097.5	1300902.5	F to F	F to F	322	619622.5	1321627.5	NF to NF	F to F
264	490672.5	1247802.5	CF to NF	CF to NF	323	381372.5	1367927.5	NF to NF	NF to NF
265	377197.5	1368277.5	NF to NF	NF to NF	324	486972.5	1243177.5	M to NF	NF to NF
266	520047.5	1305752.5	SA to NF	NF to NF	326	355447.5	1359227.5	NF to F	NF to F
267	359422.5	1351752.5	F to F	F to F	327	382447.5	1357602.5	OF to NF	OF to NF
268	522347.5	1303177.5	SA to NF	NF to NF	328	489872.5	1249777.5	SA to NF	NF to NF
269	391897.5	1352052.5	SA to NF	F to F	329	347347.5	1351927.5	NF to F	NF to F
270	350372.5	1350352.5	NF to F	F to F	331	396672.5	1354202.5	OF to NF	OF to NF
271	509447.5	1261077.5	NF to NF	NF to NF	332	387597.5	1357327.5	OF to NF	NF to NF
272	355272.5	1355327.5	M to NF	M to NF	333	506372.5	1257702.5	CF to NF	CF to NF
273	497022.5	1242552.5	F to F	F to F	334	376247.5	1371177.5	M to NF	F to F
274	553722.5	1319277.5	OF to NF	NF to NF	335	507697.5	1247852.5	F to F	F to F
275	600072.5	1339352.5	F to F	F to F	337	352997.5	1355502.5	NF to F	NF to F
276	354747.5	1355427.5	NF to F	F to F	338	347672.5	1357352.5	M to NF	M to NF
277	503322.5	1253527.5	OF to NF	NF to NF	341	494472.5	1250952.5	SA to NF	SA to NF
278	500422.5	1281577.5	SA to NF	NF to NF	342	492947.5	1246852.5	M to NF	NF to NF
279	486972.5	1246277.5	M to NF	M to NF	343	524422.5	1314877.5	CF to NF	OF to NF
280	603322.5	1317252.5	F to F	F to F	344	395747.5	1263427.5	F to F	NF to NF
281	385347.5	1225402.5	F to F	F to F	345	566022.5	1339202.5	SA to NF	F to F
282	551122.5	1328627.5	SA to NF	F to F	347	513522.5	1256327.5	CF to NF	CF to NF
283	396097.5	1268352.5	CF to NF	CF to NF	348	602197.5	1336102.5	F to F	F to F
284	351497.5	1353677.5	NF to F	NF to F	349	564322.5	1291377.5	F to F	F to F
285	363947.5	1362752.5	F to F	F to F	350	523047.5	1314977.5	SA to NF	SA to NF
286	479847.5	1240227.5	M to NF	M to NF	351	389372.5	1234477.5	CF to NF	F to F
287	572022.5	1298027.5	F to F	NF to NF	352	561372.5	1315127.5	F to F	F to F
288	500997.5	1263502.5	NF to NF	NF to NF	353	552922.5	1331827.5	SA to NF	SA to NF
289	622222.5	1324477.5	CF to NF	NF to NF	355	606347.5	1332377.5	F to F	F to F
290	620222.5	1334852.5	NF to NF	NF to NF	356	351472.5	1355702.5	NF to F	NF to F
291	393772.5	1268527.5	CF to NF	CF to NF	357	498797.5	1253902.5	CF to NF	F to F
292	500672.5	1261902.5	NF to NF	NF to NF	358	578697.5	1344727.5	SA to NF	OF to NF
293	401322.5	1275527.5	F to F	F to F	359	554022.5	1316877.5	F to F	F to F
294	554022.5	1334752.5	SA to NF	F to F	360	495447.5	1302352.5	NF to NF	NF to NF
295	378897.5	1366477.5	NF to NF	NF to NF	361	621647.5	1341052.5	NF to NF	NF to NF

362	492172.5	1237302.5	OF to NF	F to F	423	493222.5	1251277.5	CF to NF	CF to NF
363	560922.5	1317477.5	SA to NF	NF to NF	424	382447.5	1358027.5	OF to NF	NF to NF
364	369747.5	1368152.5	M to NF	M to NF	425	581297.5	1315877.5	NF to NF	NF to NF
365	489872.5	1258627.5	F to F	NF to NF	427	571997.5	1291627.5	F to F	F to F
366	497072.5	1252852.5	CF to NF	CF to NF	428	356872.5	1357502.5	NF to F	NF to F
367	541897.5	1277452.5	F to F	F to F	429	521197.5	1303177.5	F to F	F to F
368	400372.5	1228077.5	M to NF	NF to NF	430	552722.5	1322377.5	OF to NF	F to F
369	562072.5	1328552.5	SA to NF	F to F	431	508522.5	1293627.5	F to F	F to F
370	634647.5	1325527.5	F to F	NF to NF	432	488072.5	1228802.5	F to F	F to F
371	399822.5	1267252.5	OF to NF	NF to NF	433	348422.5	1361602.5	M to NF	F to F
372	611072.5	1316952.5	NF to NF	F to F	434	488747.5	1229002.5	F to F	F to F
373	427597.5	1212277.5	OF to NF	F to F	435	494672.5	1250877.5	SA to NF	NF to NF
374	573397.5	1337127.5	F to F	F to F	436	487947.5	1245177.5	M to NF	NF to NF
375	380922.5	1232477.5	OF to NF	NF to NF	437	583997.5	1321652.5	F to F	F to F
376	570047.5	1293402.5	F to F	F to F	438	527922.5	1263177.5	NF to NF	NF to NF
377	387322.5	1357802.5	OF to NF	F to F	439	599672.5	1317777.5	F to F	F to F
378	535222.5	1275252.5	SA to NF	NF to NF	440	355197.5	1349127.5	NF to F	F to F
379	622547.5	1322352.5	F to F	NF to NF	441	534997.5	1298727.5	OF to NF	SA to NF
380	394947.5	1267152.5	F to F	F to F	442	558447.5	1327827.5	F to F	F to F
381	498922.5	1286152.5	F to F	NF to NF	443	494447.5	1251327.5	CF to NF	CF to NF
382	488147.5	1250402.5	NF to NF	NF to NF	444	518497.5	1308827.5	SA to NF	F to F
383	354197.5	1351377.5	M to NF	M to NF	446	352522.5	1354377.5	NF to F	NF to F
384	494647.5	1255577.5	NF to NF	NF to NF	447	571647.5	1347302.5	SA to NF	NF to NF
385	490947.5	1239227.5	M to NF	M to NF	450	348422.5	1351377.5	NF to F	NF to NF
386	377547.5	1236977.5	M to NF	NF to NF	451	613522.5	1325152.5	F to F	F to F
387	516247.5	1255402.5	CF to NF	NF to NF	452	381397.5	1363627.5	F to F	F to F
388	357297.5	1356477.5	NF to F	F to F	453	502022.5	1242827.5	CF to NF	F to F
389	373372.5	1368902.5	NF to NF	NF to NF	454	368222.5	1366327.5	M to NF	F to F
390	602247.5	1319477.5	F to F	F to F	455	520847.5	1267852.5	F to F	F to F
392	551422.5	1330852.5	SA to NF	F to F	456	483997.5	1234902.5	CF to NF	OF to NF
393	601372.5	1318227.5	F to F	NF to NF	457	352697.5	1350602.5	NF to F	NF to NF
394	528547.5	1274527.5	SA to NF	NF to NF	458	478872.5	1238452.5	NF to NF	NF to NF
395	550897.5	1272752.5	OF to NF	NF to NF	459	505197.5	1259052.5	CF to NF	CF to NF
396	397172.5	1353477.5	OF to NF	OF to NF	460	499397.5	1247802.5	CF to NF	OF to NF
397	568197.5	1326877.5	F to F	F to F	461	356947.5	1356577.5	NF to F	F to F
398	501697.5	1288052.5	F to F	F to F	462	490522.5	1256727.5	CF to NF	CF to NF
399	578697.5	1328827.5	F to F	F to F	463	519197.5	1305277.5	OF to NF	SA to NF
400	540372.5	1314902.5	SA to NF	NF to NF	464	572672.5	1317052.5	F to F	F to F
401	507122.5	1253977.5	CF to NF	CF to NF	465	545922.5	1305677.5	SA to NF	NF to NF
402	569122.5	1319927.5	F to F	F to F	466	612622.5	1331077.5	F to F	F to F
403	356697.5	1357202.5	NF to F	NF to F	467	498872.5	1295127.5	F to F	NF to NF
404	481847.5	1232402.5	M to NF	M to NF	468	389947.5	1351152.5	SA to NF	SA to NF
406	555497.5	1314527.5	SA to NF	SA to NF	469	480197.5	1227927.5	NF to NF	NF to NF
408	611172.5	1332952.5	F to F	F to F	470	387522.5	1357452.5	OF to NF	NF to NF
409	354672.5	1350852.5	NF to F	F to F	472	352022.5	1353827.5	NF to F	NF to F
410	357772.5	1364727.5	NF to NF	NF to NF	473	383297.5	1353777.5	NF to NF	NF to NF
411	605447.5	1323027.5	F to F	F to F	474	350522.5	1354727.5	NF to F	NF to F
412	550497.5	1326227.5	SA to NF	F to F	475	538722.5	1279602.5	F to F	NF to NF
413	389647.5	1234602.5	CF to NF	F to F	476	355472.5	1357852.5	NF to F	NF to NF
414	520397.5	1307277.5	OF to NF	NF to NF	477	524447.5	1314902.5	CF to NF	OF to NF
415	498472.5	1253977.5	CF to NF	CF to NF	478	589897.5	1308477.5	F to F	F to F
416	577047.5	1313052.5	SA to NF	NF to NF	480	384397.5	1361702.5	F to F	F to F
417	383547.5	1354677.5	M to NF	F to F	481	513347.5	1254752.5	CF to NF	CF to NF
418	351272.5	1355102.5	NF to F	NF to F	482	353747.5	1354877.5	NF to F	F to F
419	352547.5	1352552.5	NF to F	NF to NF	483	626797.5	1336177.5	F to F	F to F
420	492322.5	1238027.5	OF to NF	NF to NF	484	502397.5	1244302.5	CF to NF	F to F
421	510697.5	1251277.5	OF to NF	F to F	485	397247.5	1267702.5	CF to NF	CF to NF
422	387897.5	1347252.5	OF to NF	NF to NF	486	369772.5	1368277.5	M to NF	F to F

487	347072.5	1356827.5	M to NF	NF to F	548	604197.5	1320627.5	F to F	F to F
488	555297.5	1302277.5	SA to NF	NF to NF	549	396447.5	1355452.5	OF to NF	OF to NF
489	377522.5	1228727.5	F to F	F to F	550	490597.5	1251527.5	M to NF	NF to NF
490	568972.5	1325402.5	SA to NF	NF to NF	551	574572.5	1323752.5	F to F	F to F
491	521072.5	1306302.5	SA to NF	F to F	552	524272.5	1270502.5	F to F	NF to NF
492	488147.5	1242302.5	OF to NF	NF to NF	553	486222.5	1234352.5	OF to NF	OF to NF
493	346622.5	1352252.5	NF to F	F to F	554	596197.5	1319827.5	F to F	F to F
494	581172.5	1342577.5	F to F	NF to NF	555	346447.5	1360902.5	M to NF	F to F
495	355697.5	1359177.5	NF to F	NF to F	556	576397.5	1323927.5	F to F	F to F
496	387972.5	1225952.5	M to NF	NF to NF	557	479447.5	1237877.5	M to NF	M to NF
497	376997.5	1223702.5	M to NF	NF to NF	558	562422.5	1323377.5	F to F	F to F
498	569147.5	1307352.5	F to F	F to F	559	494047.5	1247977.5	NF to NF	NF to NF
499	498072.5	1298452.5	F to F	NF to NF	560	387222.5	1267702.5	OF to NF	F to F
500	352122.5	1353177.5	NF to F	NF to F	561	567672.5	1313977.5	SA to NF	F to F
501	384647.5	1354027.5	SA to NF	NF to NF	562	487272.5	1243502.5	OF to NF	F to F
502	502522.5	1241752.5	CF to NF	CF to NF	563	594122.5	1325652.5	NF to NF	NF to NF
503	522972.5	1315102.5	SA to NF	SA to NF	564	356972.5	1356827.5	NF to F	NF to F
504	472922.5	1286102.5	F to F	F to F	565	501897.5	1242977.5	OF to NF	OF to NF
505	487972.5	1250502.5	M to NF	F to F	566	557422.5	1315352.5	F to F	F to F
506	347022.5	1351152.5	NF to F	NF to NF	567	493722.5	1240652.5	F to F	NF to NF
507	505197.5	1258952.5	CF to NF	CF to NF	568	500372.5	1280877.5	SA to NF	NF to NF
508	351747.5	1356177.5	NF to F	NF to F	569	478847.5	1233852.5	M to NF	M to NF
509	561222.5	1306827.5	F to F	NF to NF	570	551497.5	1328877.5	SA to NF	F to F
510	594772.5	1333027.5	NF to NF	F to F	571	487672.5	1243627.5	CF to NF	OF to NF
512	624547.5	1327952.5	NF to NF	NF to NF	572	581897.5	1301252.5	F to F	F to F
513	525997.5	1309202.5	OF to NF	OF to NF	573	500797.5	1282027.5	SA to NF	SA to NF
514	553722.5	1325652.5	F to F	F to F	574	546597.5	1296727.5	F to F	F to F
515	350772.5	1354127.5	NF to F	NF to F	575	575022.5	1322102.5	F to F	F to F
516	480447.5	1231102.5	M to NF	F to F	576	371072.5	1219827.5	F to F	F to F
517	484522.5	1248002.5	M to NF	M to NF	577	351972.5	1353352.5	NF to F	NF to F
518	390047.5	1348127.5	OF to NF	OF to NF	578	606672.5	1310802.5	F to F	F to F
519	354722.5	1350677.5	NF to F	F to F	579	505947.5	1291427.5	F to F	F to F
520	555297.5	1302177.5	F to F	F to F	581	482647.5	1236927.5	OF to NF	F to F
521	599122.5	1335477.5	F to F	F to F	582	617897.5	1330452.5	NF to NF	NF to NF
522	346647.5	1352802.5	NF to F	NF to F	583	501247.5	1243227.5	OF to NF	NF to NF
523	355947.5	1358852.5	NF to F	NF to F	584	510747.5	1299352.5	NF to NF	NF to NF
524	595422.5	1309077.5	F to F	F to F	585	562647.5	1329727.5	SA to NF	F to F
526	505147.5	1258827.5	CF to NF	CF to NF	586	528422.5	1271752.5	OF to NF	OF to NF
527	396297.5	1353827.5	OF to NF	OF to NF	587	355797.5	1359127.5	NF to F	NF to F
528	389522.5	1234402.5	OF to NF	F to F	588	506922.5	1253802.5	CF to NF	CF to NF
529	397247.5	1264477.5	OF to NF	NF to NF	590	388947.5	1352527.5	SA to NF	NF to NF
530	367772.5	1368577.5	NF to NF	NF to NF	591	487947.5	1256952.5	NF to NF	NF to NF
531	564222.5	1306377.5	SA to NF	NF to NF	592	522922.5	1311902.5	OF to NF	SA to NF
532	391897.5	1238052.5	F to F	F to F	593	392047.5	1230277.5	F to F	F to F
533	501797.5	1242477.5	CF to NF	CF to NF	594	492597.5	1255602.5	NF to NF	NF to NF
534	400172.5	1232102.5	NF to NF	F to F	595	351722.5	1355627.5	NF to F	NF to F
535	598772.5	1311002.5	F to F	F to F	596	578922.5	1344477.5	F to F	F to F
536	513522.5	1255877.5	CF to NF	CF to NF	598	504047.5	1249452.5	F to F	F to F
537	558547.5	1328852.5	F to F	F to F	599	490922.5	1238652.5	OF to NF	OF to NF
538	550697.5	1273602.5	F to F	F to F	600	567822.5	1331802.5	SA to NF	F to F
539	479672.5	1229427.5	NF to NF	NF to NF	601	383422.5	1230777.5	NF to NF	F to F
541	371797.5	1360102.5	M to NF	NF to NF	602	350647.5	1355302.5	NF to F	NF to F
542	378297.5	1236577.5	M to NF	F to F	603	569472.5	1322777.5	SA to NF	NF to NF
543	610322.5	1317127.5	NF to NF	F to F	604	558722.5	1311602.5	SA to NF	NF to NF
544	347022.5	1352027.5	NF to F	F to F	605	398447.5	1361502.5	NF to NF	NF to NF
545	360047.5	1355527.5	F to F	F to F	606	391222.5	1274552.5	CF to NF	CF to NF
546	635197.5	1328527.5	NF to NF	NF to NF	607	487347.5	1228102.5	M to NF	F to F
547	400247.5	1232527.5	OF to NF	F to F	608	557897.5	1319527.5	F to F	F to F

609	502822.5	1242052.5	CF to NF	CF to NF	675	489897.5	1249752.5	SA to NF	NF to NF
610	586822.5	1330627.5	F to F	F to F	676	393822.5	1351402.5	M to NF	F to F
611	609247.5	1325802.5	F to F	F to F	677	390022.5	1275352.5	M to NF	NF to NF
612	397047.5	1358877.5	F to F	F to F	678	349347.5	1354427.5	NF to F	NF to F
613	539122.5	1295852.5	F to F	F to F	679	566222.5	1339302.5	SA to NF	F to F
614	358247.5	1363027.5	NF to F	NF to NF	680	551097.5	1272052.5	SA to NF	NF to NF
615	485122.5	1243227.5	NF to NF	NF to NF	682	575622.5	1340977.5	OF to NF	NF to NF
617	611297.5	1347752.5	F to F	F to F	683	390897.5	1274427.5	OF to NF	OF to NF
618	392047.5	1229552.5	F to F	F to F	684	354597.5	1356877.5	NF to F	F to F
619	478997.5	1234152.5	NF to NF	NF to NF	685	595322.5	1318927.5	F to F	NF to NF
620	597722.5	1331027.5	F to F	F to F	687	543872.5	1306202.5	F to F	F to F
621	372672.5	1220427.5	OF to NF	F to F	688	397647.5	1229277.5	OF to NF	F to F
622	364122.5	1360877.5	F to F	F to F	689	520447.5	1305552.5	SA to NF	NF to NF
623	561872.5	1293752.5	F to F	F to F	690	396547.5	1279952.5	OF to NF	F to F
624	570772.5	1290677.5	F to F	F to F	691	570772.5	1289452.5	F to F	F to F
625	489572.5	1236702.5	M to NF	NF to NF	692	498797.5	1253952.5	CF to NF	F to F
626	573772.5	1290027.5	F to F	F to F	693	387597.5	1348677.5	OF to NF	OF to NF
627	357722.5	1356252.5	NF to F	F to F	694	477872.5	1237952.5	F to F	F to F
628	377397.5	1222527.5	F to F	F to F	695	386272.5	1234152.5	F to F	F to F
629	590547.5	1320277.5	NF to NF	NF to NF	696	347097.5	1362602.5	NF to NF	NF to NF
630	350772.5	1354627.5	NF to F	NF to F	698	513947.5	1256602.5	CF to NF	CF to NF
631	351147.5	1355102.5	NF to F	NF to F	699	490472.5	1237152.5	OF to NF	NF to NF
632	497397.5	1253452.5	CF to NF	CF to NF	700	381372.5	1235677.5	F to F	F to F
633	501497.5	1282102.5	NF to NF	NF to NF	701	373797.5	1232377.5	F to F	F to F
634	480547.5	1300177.5	F to F	F to F	703	380672.5	1235427.5	OF to NF	F to F
636	488147.5	1245902.5	M to NF	M to NF	705	584997.5	1309202.5	F to F	NF to NF
638	600047.5	1316152.5	F to F	F to F	706	507797.5	1257677.5	CF to NF	CF to NF
639	485172.5	1244052.5	M to NF	M to NF	707	390972.5	1274377.5	OF to NF	F to F
640	362447.5	1365677.5	F to F	NF to NF	708	387947.5	1348202.5	SA to NF	F to F
642	397172.5	1237452.5	M to NF	F to F	711	528122.5	1272877.5	F to F	F to F
643	352897.5	1351677.5	NF to F	F to F	712	554072.5	1324602.5	F to F	F to F
645	571097.5	1293352.5	F to F	F to F	713	491947.5	1249302.5	SA to NF	NF to NF
646	579547.5	1300102.5	F to F	F to F	714	489872.5	1245452.5	F to F	F to F
647	498622.5	1259877.5	F to F	NF to NF	715	494697.5	1261852.5	M to NF	F to F
648	508772.5	1249302.5	F to F	F to F	716	525597.5	1258702.5	F to F	NF to NF
649	548397.5	1305652.5	F to F	F to F	717	608772.5	1317052.5	F to F	F to F
650	344522.5	1360827.5	SA to NF	F to F	718	576997.5	1323902.5	NF to NF	NF to NF
651	381397.5	1365852.5	NF to NF	NF to NF	719	381747.5	1370302.5	F to F	F to F
652	478047.5	1215902.5	NF to NF	NF to NF	720	398747.5	1279202.5	OF to NF	OF to NF
653	521147.5	1314027.5	SA to NF	NF to NF	721	396822.5	1267677.5	CF to NF	CF to NF
654	615872.5	1339327.5	F to F	F to F	722	364347.5	1367502.5	F to F	NF to NF
656	484547.5	1255927.5	NF to NF	NF to NF	723	388147.5	1225302.5	M to NF	NF to NF
657	392272.5	1268752.5	CF to NF	CF to NF	724	396872.5	1267602.5	CF to NF	CF to NF
658	578747.5	1313027.5	F to F	F to F	725	588747.5	1332402.5	F to F	NF to NF
659	518847.5	1307927.5	SA to NF	SA to NF	726	349472.5	1354602.5	NF to F	NF to F
660	378347.5	1237077.5	F to F	F to F	727	362722.5	1366527.5	F to F	F to F
661	613447.5	1341052.5	F to F	F to F	730	400347.5	1268602.5	F to F	F to F
662	624072.5	1335427.5	F to F	NF to NF	731	352422.5	1354402.5	NF to F	NF to F
663	377522.5	1237002.5	M to NF	F to F	732	556797.5	1287452.5	F to F	F to F
664	597997.5	1336202.5	F to F	F to F	733	373497.5	1232102.5	F to F	F to F
665	574072.5	1300027.5	F to F	F to F	734	497472.5	1253127.5	CF to NF	CF to NF
667	358722.5	1357802.5	NF to F	NF to F	735	380497.5	1236277.5	CF to NF	F to F
668	575047.5	1305827.5	F to F	F to F	736	486397.5	1246102.5	M to NF	M to NF
669	497497.5	1253152.5	CF to NF	CF to NF	738	385047.5	1231752.5	F to F	F to F
670	485372.5	1251827.5	M to NF	NF to NF	739	351072.5	1361077.5	M to NF	NF to NF
672	494272.5	1251602.5	CF to NF	CF to NF	740	372797.5	1222627.5	F to F	F to F
673	345522.5	1351077.5	NF to F	F to F	741	493947.5	1251502.5	CF to NF	CF to NF
674	551322.5	1272002.5	SA to NF	NF to NF	742	426547.5	1215727.5	M to NF	F to F

743	536772.5	1278877.5	OF to NF	NF to NF	808	492372.5	1306952.5	F to F	F to F
744	505547.5	1286627.5	F to F	F to F	809	604572.5	1336477.5	F to F	F to F
745	541847.5	1312527.5	F to F	F to F	810	512072.5	1295352.5	F to F	F to F
746	485272.5	1232102.5	F to F	NF to NF	811	625922.5	1334902.5	F to F	F to F
747	519822.5	1307677.5	SA to NF	F to F	812	346572.5	1352752.5	NF to F	NF to F
748	358797.5	1366902.5	F to F	NF to NF	813	552572.5	1300177.5	F to F	F to F
749	493647.5	1251602.5	CF to NF	CF to NF	814	383147.5	1359652.5	SA to NF	F to F
750	396322.5	1271677.5	F to F	F to F	815	621597.5	1339527.5	NF to NF	F to F
751	352822.5	1356152.5	NF to F	NF to F	817	390447.5	1266702.5	F to F	F to F
754	385272.5	1361227.5	M to NF	F to F	818	609847.5	1321502.5	F to F	F to F
755	396447.5	1353577.5	OF to NF	OF to NF	819	502147.5	1242652.5	CF to NF	CF to NF
756	509922.5	1246552.5	OF to NF	OF to NF	820	371897.5	1366902.5	M to NF	M to NF
757	604372.5	1338252.5	F to F	F to F	821	554047.5	1292802.5	F to F	F to F
758	509622.5	1259202.5	F to F	F to F	822	398997.5	1223702.5	F to F	NF to NF
759	355822.5	1358802.5	NF to F	NF to F	823	483497.5	1247777.5	NF to NF	NF to NF
761	351997.5	1353327.5	NF to F	NF to F	824	523272.5	1258877.5	F to F	NF to NF
762	482372.5	1228377.5	M to NF	M to NF	825	548822.5	1288302.5	F to F	F to F
763	483372.5	1227102.5	CF to NF	F to F	826	507597.5	1257752.5	CF to NF	CF to NF
764	510047.5	1257327.5	NF to NF	NF to NF	827	505472.5	1254602.5	F to F	NF to NF
765	477147.5	1217102.5	NF to NF	NF to NF	828	345347.5	1359352.5	NF to NF	NF to NF
766	352172.5	1353277.5	NF to F	NF to F	829	391722.5	1346977.5	OF to NF	F to F
767	342797.5	1361202.5	F to F	F to F	830	487222.5	1245652.5	M to NF	M to NF
768	479247.5	1235977.5	OF to NF	NF to NF	831	350147.5	1353852.5	NF to F	NF to F
769	494972.5	1238302.5	F to F	F to F	832	345347.5	1354577.5	M to NF	NF to NF
770	502472.5	1242102.5	CF to NF	CF to NF	833	390647.5	1275502.5	OF to NF	F to F
771	493147.5	1308852.5	SA to NF	NF to NF	834	620422.5	1329452.5	NF to NF	NF to NF
772	528272.5	1265877.5	F to F	F to F	835	591972.5	1329277.5	F to F	F to F
773	569297.5	1306002.5	SA to NF	NF to NF	836	482522.5	1240002.5	NF to F	NF to NF
774	504147.5	1262902.5	SA to NF	SA to NF	837	381647.5	1357677.5	OF to NF	F to F
775	502497.5	1253552.5	SA to NF	NF to NF	838	502097.5	1242852.5	CF to NF	F to F
776	523772.5	1310902.5	F to F	F to F	839	507847.5	1258377.5	CF to NF	CF to NF
777	491072.5	1290452.5	OF to NF	OF to NF	840	492297.5	1249552.5	CF to NF	CF to NF
778	393347.5	1277952.5	OF to NF	CF to NF	841	535022.5	1308377.5	SA to NF	NF to NF
779	351022.5	1353552.5	NF to NF	NF to NF	842	494322.5	1250702.5	SA to NF	F to F
780	350622.5	1355977.5	NF to F	NF to F	843	507797.5	1258402.5	CF to NF	CF to NF
781	490422.5	1243602.5	M to NF	M to NF	844	498472.5	1254102.5	CF to NF	CF to NF
782	369472.5	1368552.5	M to NF	F to F	845	372447.5	1369427.5	F to F	F to F
783	486347.5	1242902.5	M to NF	NF to NF	846	556647.5	1273402.5	NF to NF	NF to NF
784	487972.5	1245977.5	M to NF	M to NF	847	485672.5	1244402.5	NF to NF	NF to NF
785	580222.5	1329577.5	NF to NF	F to F	848	505197.5	1258877.5	CF to NF	CF to NF
787	565572.5	1310452.5	F to F	F to F	849	391347.5	1270327.5	CF to NF	CF to NF
788	572347.5	1323952.5	F to F	F to F	850	501697.5	1242777.5	CF to NF	CF to NF
789	387872.5	1351152.5	NF to NF	NF to NF	851	344322.5	1362727.5	NF to NF	NF to NF
790	560122.5	1286002.5	F to F	F to F	852	586072.5	1309427.5	NF to NF	NF to NF
791	542722.5	1282502.5	F to F	F to F	853	390122.5	1275677.5	OF to NF	F to F
792	351222.5	1354427.5	NF to F	NF to F	854	389797.5	1362877.5	F to F	F to F
793	588672.5	1326702.5	F to F	F to F	855	355497.5	1355402.5	M to NF	M to NF
794	529097.5	1312227.5	F to F	F to F	856	483597.5	1228802.5	NF to NF	NF to NF
795	608297.5	1331677.5	F to F	F to F	857	504247.5	1262852.5	F to F	NF to NF
796	377422.5	1236877.5	M to NF	F to F	858	551147.5	1272352.5	SA to NF	NF to NF
797	367347.5	1368102.5	NF to NF	NF to NF	859	484722.5	1241027.5	NF to NF	NF to NF
798	581997.5	1313202.5	NF to NF	NF to NF	860	549047.5	1327602.5	OF to NF	SA to NF
799	534097.5	1273477.5	SA to NF	NF to NF	861	565922.5	1333252.5	F to F	F to F
801	630397.5	1322052.5	NF to NF	NF to NF	862	525547.5	1307777.5	SA to NF	NF to NF
802	491572.5	1238952.5	NF to F	NF to F	863	356672.5	1357402.5	NF to F	NF to F
804	508447.5	1293752.5	F to F	F to F	864	513872.5	1256902.5	CF to NF	CF to NF
806	531272.5	1315477.5	F to F	F to F	865	389697.5	1350827.5	OF to NF	OF to NF
807	381297.5	1357152.5	SA to NF	NF to NF	866	502747.5	1242052.5	CF to NF	CF to NF

867	629422.5	1322027.5	F to F	F to F	890	496622.5	1251102.5	CF to NF	OF to NF
868	577197.5	1335902.5	F to F	F to F	891	496622.5	1243927.5	OF to NF	NF to NF
869	523097.5	1314977.5	SA to NF	NF to NF	892	494772.5	1240927.5	OF to NF	NF to NF
870	582597.5	1319377.5	F to F	F to F	893	353297.5	1350852.5	M to NF	M to NF
871	521822.5	1304927.5	SA to NF	F to F	895	390072.5	1270202.5	CF to NF	CF to NF
872	519397.5	1304352.5	SA to NF	F to F	896	354147.5	1354702.5	NF to F	F to F
873	353747.5	1356602.5	NF to F	NF to F	897	486922.5	1248252.5	NF to NF	NF to NF
874	352322.5	1354102.5	NF to F	F to F	898	568397.5	1344327.5	SA to NF	SA to NF
875	347072.5	1358102.5	M to NF	NF to NF	899	503297.5	1255827.5	OF to NF	NF to NF
876	492247.5	1250452.5	CF to NF	NF to NF	900	518822.5	1308277.5	SA to NF	F to F
877	395497.5	1356802.5	OF to NF	OF to NF	901	351497.5	1355827.5	NF to F	NF to F
878	519097.5	1256252.5	F to F	F to F	902	386697.5	1356527.5	OF to NF	OF to NF
879	503072.5	1259627.5	NF to NF	NF to NF	903	388297.5	1347202.5	SA to NF	OF to NF
881	485122.5	1228302.5	M to NF	M to NF	904	354872.5	1356577.5	NF to F	NF to F
882	502972.5	1256302.5	OF to NF	NF to NF	905	502522.5	1242077.5	CF to NF	CF to NF
883	377747.5	1225302.5	F to F	F to F	906	536822.5	1276702.5	F to F	F to F
884	558897.5	1309552.5	F to F	F to F	907	627097.5	1323852.5	F to F	F to F
885	574947.5	1324902.5	F to F	F to F	908	401147.5	1279827.5	OF to NF	OF to NF
886	493097.5	1251177.5	OF to NF	OF to NF	909	351972.5	1353527.5	NF to F	NF to F
887	603997.5	1338427.5	F to F	F to F	910	618972.5	1322052.5	F to F	F to F
888	489372.5	1257852.5	NF to NF	NF to NF					