

Determination of Non-Renewable Biomass, Honduras

Calculating NRB (Non-Renewable Biomass):

Non-renewable woody biomass (*NRB*) is the quantity of woody biomass used in the absence of the project activity (**Bold**) minus the Demonstrably Renewable Biomass *DRB* component, as long as at least two of the following supporting indicators are shown to exist

A trend showing an increase in time spent or distance travelled for gathering fuel-wood by users or suppliers, or a trend showing an increase in the distance the fuel-wood is transported to the project area.

- *The FAO's State of the World's Forests reports an annual change rate of forest area in Honduras to be -2.1% (-120 ha/yr) from 2000 to 2010,¹ although there are more conservative estimates of the deforestation rates of Honduras which range from 54,000ha/year to 100,000ha/yr,² it is clear that there is an overall trend of large scale deforestation in the country. The depletion of fuelwood resources around localities and peri-urban areas directly affects the poor by extending even more, the time consuming task of fuelwood collection, as well as increasing fuelwood prices.³*
- *A study conducted by Caroline Howe, Sara Bushey, and Rob Bailis on an improved stove program in Honduras performed a qualitative survey of rural households. The surveys revealed that 58% of households surveyed report that local forest resources have become degraded over time. Also, half of the users of the improved stoves report that wood has become harder to find in the past five years. As wood becomes harder to find, families will spend an increased amount of time and travel longer distances to find fuelwood, indicating scarcity.⁴*

Increasing trends in fuel wood prices indicating a scarcity of fuel-wood

- *In the same survey, by Caroline Howe, Sara Bushney, and Rob Bailis, half of the surveyed families reported that wood had become more expensive over the last five years.⁵*

¹ United Nations Food & Agriculture Organization. State of the Worlds Forest Report 2009. Table 2: Forest Area and area change. Page 116 <
<http://www.fao.org/docrep/013/i2000e/i2000e05.pdf>>

² Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Hondura. Jul 2011. Page 27

³ Arnold M, Kohlin G, Persson R. Woodfuels, livelihoods, and policy interventions: changing perspectives. World Development 2006;
<http://www.sciencedirect.com/science/article/pii/S0305750X05002263%20%E5%A1%B9%EF%92%81%E1%B4%BB%E4%A1%BF%E2%B2%AF%E5%B6%82%E8%97%84%E6%8C%A7%20%20%EA%AE%A5>

⁴ Caroline Howe, Sara Bushey, and Rob Bailis, "Fuel Efficiency Improvements in Rural Honduras: Research Study for the Overlook International Foundation.", 2008. pg 20. <http://www.proyectomirador.org/sites/default/files/documents/fuel-efficiency-improvements-rural-honduras.pdf>

⁵ Caroline Howe, Sara Bushey, and Rob Bailis, "Fuel Efficiency Improvements in Rural Honduras: Research Study for the Overlook International Foundation.", pg 20. <http://www.proyectomirador.org/sites/default/files/documents/fuel-efficiency-improvements-rural-honduras.pdf>

- *The FRA Honduras Country Report 2010 reports that the unit value of fuel wood is increasing due to low availability of raw materials and the many requirements that must be met to collect it.*⁶

Carbon stocks are depleting in the project area

- *The FAO forest survey of 1962 serves as a baseline forest stock to determine the rate of deforestation,, although data from the 1980s is more commonly used to determine the rate of deforestation (80,000 ha/yr)⁷. More recent data estimates the deforestation rate to be 54,000 ha/yr, based on new estimates of the growing stock conducted by ICF using satellite imagery.⁸ The Global Forest Resources Assessment 2010 reports that the carbon stock in living forest biomass in Honduras decreased 36% between 1990 and 2010, and the annual change of carbon stocks between 2005 and 2010 was 8 million tons per year.⁹ Although the exact rate of deforestation is unclear all data demonstrates that there is a large amount of deforestation occurring and all recorded types of biomass in Honduras show a decline in volume, area, and carbon stored*

Given that three of the supporting indicators can be shown to exist in the project area, the biomass used in the absence of the project activity that cannot be shown as demonstrably renewable is considered non-renewable. Thus, the non-renewable woody biomass is equal to the quantity of woody biomass used in the absence of the project activity (Bold) minus the DRB component:

Calculating DRB (Demonstrably Renewable Biomass):

Woody biomass is renewable if the following conditions are satisfied:

a. The land area remains a forest

There is conflicting data as to the area of forest cover in Honduras ranging from 5,791,602 ha¹⁰ to 6,598,289ha¹¹. Even though this data is conflicting both sets of data demonstrate that Honduras has a large area of forested land. Although, Honduras also has a very high deforestation rate with sources citing anywhere from 54,000ha/year to

⁶ The Global Forest Resources Assessment 2010. Honduras FRA Country Report 2010. Table 11.5 Comentarios a la Tabla T11. p.37.
<http://www.fao.org/docrep/013/al527S/al527S.pdf>

⁷Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 27

⁸Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 13

⁹ Global Forest Resources Assessment 2010 (FRA 2010). Global Table 11 Trends in carbon stock in living forest biomass 1990-2010.
<http://www.fao.org/forestry/fra/fra2010/en/>

¹⁰ Evaluacion de los Recursos Forestales Mundiales 2010. Informe Nacional Honduras. FAO 2010 Table 4 Page 34

¹¹ Anuario Estadístico Forestal 2010. Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas, y Vida Silvestre. Vol 25. March 2010. Page 11-12

156,000ha/yr,¹² .. The country contains 3,999,235 ha of protected reserves, which include Forest and Ecological Reserves as well as cultural, anthropological, and marine reserves.¹³ According to the FOA Survey of Forests and Trees there exist 1,421,024 ha of forested land that lies within protected areas, along with 961,592 ha of unsurveyed forests within protected areas.¹⁴ The unsurveyed forest is classified as inaccessible.¹⁵ A Protected Area is defined as an area designated by the state under a certain management characteristic, to protect and conserve both cultural and natural resources.¹⁶ In reality, Protected Areas have been largely ineffective, as they are some of the areas where most deforestation occurs.¹⁷ This is demonstrated by Honduras' high deforestation which is conservatively cited at 54,000 ha/yr, even though 20% of the forests are classified as protected.¹⁸ Only 818,759 ha, 7% of the total area of the country is strictly protected, ensuring that the area remains a forest.¹⁹ This area is characterized as the “zona nucleo”, and the exploitation of forest resources is prohibited, thus we should consider this area inaccessible to woodfuel users, and it should be excluded the DRB.^{20,21} Even though, there is strong evidence that Protected Areas are being deforested, we will take a very conservative approach and classify the land that remains a forest as the 27% of the country that is classified as a protected area.

- b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting)*

Studies published by The Inventory of Forests and Trees, and FAO Forest Resource Report indicate that 1,026,000 ha of Honduran forests are under sustainable management^{22,23}. Sustainably managed is defined by having a management plan which is being applied to some protected areas^{24, 25}. The goal of the management plans is to provide technical and administrative rules to ensure the conservation and sustainable development of the forested area²⁶. Even though the presence of an effective management plan should be the figure used

¹²Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 27

¹³CATEGORIAS NACIONALES DE MANEJO DE ÁREAS PROTEGIDAS 2009

¹⁴Evaluación de los Recursos Forestales Mundiales 2010 Cuadro 21. Informe Nacional Honduras. FAO 2010, Page 76

¹⁵Evaluación de los Recursos Forestales Mundiales 2010 Cuadro 21. Informe Nacional Honduras. FAO 2010, Page 34 and 40

¹⁶Honduras Government. Ley Forestal Áreas Protegidas y Vida Silvestres Pg 8.

¹⁷Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 14

¹⁸Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 13

¹⁹Galdames Fuentes, Jose Antonio. Proyecto Evaluación de las Capacidades y Prioridades del País para Implementar el Plan de Acción de la Estrategia Nacional de Biodiversidad 0028170. Secretaría de Recursos Naturales y Ambiente Dirección General De Biodiversidad. Pg 24

²⁰Reglamento del Sistema Nacional de Áreas Protegidas de Honduras (SINAPH). Secretaría de Recursos Naturales y Ambiente Acuerdo Presidencial Número 921-97. 1997 Page 5

²¹Honduras Government. Ley Forestal Áreas Protegidas y Vida Silvestres Pg 66

²²Resultados del Inventario de Bosques y Árboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Árboles. Page 54

²³Evaluación de los Recursos Forestales Mundiales 2010. Informe Nacional Honduras. FAO 2010, Page 17

²⁴Evaluación de los Recursos Forestales Mundiales 2010. Informe Nacional Honduras. FAO 2010, Page 18

²⁵Honduras Government. Ley Forestal Áreas Protegidas y Vida Silvestre

²⁶Reglamento del Sistema Nacional de Áreas Protegidas de Honduras (SINAPH). Secretaría de Recursos Naturales y Ambiente Acuerdo Presidencial Número 921-97. 1997 Page 6

to determine if the forest is sustainably managed and demonstrably renewable, we will take an even more conservative approach and classify all protected areas as demonstrably renewable to arrive at an extremely conservative estimate, even though sources cite that large scale deforestation occurs within Protected Areas and 38% of fuelwood users collect firewood from restricted areas.^{27,28} Thus the area of sustainably managed forest we will classify as Demonstrably Renewable to calculate the DRB will be the 1,421,024 ha of forests within protected areas²⁹. There is also a “zona nucleo” included in protected areas (818,759 ha)³⁰ which prohibits the harvest of any materials^{31, 32}. We will deduct this inaccessible area from the area considered to be renewable, as it is inaccessible to woodfuel users for the collection of woodfuel.

c. Any national or regional forestry and nature conservation regulations are complied with

There are various laws pertaining to the management of forests including the Ley Forestal. These laws are often conflicting and lead to confusion and misinterpretation, which coupled with lack of resources to implement and enforce the laws leads to poor compliance and enforcement of laws³³. Data from the CEPAL study indicates that 38% of woodfuel users collect their firewood from areas where the collection of firewood is prohibited, implying that rules and regulations are not complied with in regards to the harvest of fuelwood³⁴. Once again we will take a conservative approach and ignore this data and assume all laws are complied with.

Woody biomass originating from land areas that are non-forests is “renewable” were all three conditions are satisfied:

a. The land area remains as non-forest or is reverted to forest

Protected Areas not only extend to forests, but also non-forested lands as well. Non-forested Protected Areas include Areas of Multiple Use, Forestry Reserves, National Monuments, Anthropological Sites, etc³⁵ The Inventory of Forests and Trees classifies non forest areas in Honduras into two types: other natural land with trees and other lands. Other lands include pastures, savannahs without trees, bare land, agroforestry systems,

²⁷ Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 14

²⁸ CEPAL UN, Consumo de Leña en Honduras. 2011. Page 23

²⁹ Resultados del Inventario de Bosques y Árboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Árboles. Table 21.

³⁰ Galdames Fuentes, Jose Antonio. Proyecto Evaluación de las Capacidades y Prioridades del País para Implementar el Plan de Acción de la Estrategia Nacional de Biodiversidad 0028170. Secretaría de Recursos Naturales y Ambiente Dirección General de Biodiversidad. Pg 24

³¹ Reglamento del Sistema Nacional de Áreas Protegidas de Honduras (SINAPH). Secretaría de Recursos Naturales y Ambiente Acuerdo Presidencial Número 921-97. 1997 Page 5

³² Honduras Government. Ley Forestal Áreas Protegidas y Vida Silvestre. Page 66

³³ Larios, Mario Vallejo. Evaluación Preliminar sobre Causas de Deforestación y Degradación de Bosques en Honduras. Jul 2011. Page 39-43

³⁴ CEPAL UN, Consumo de Leña en Honduras. 2011. Page 23

³⁵ CATEGORÍAS NACIONALES DE MANEJO DE ÁREAS PROTEGIDAS 2009

crops, cattle land and wetlands³⁶. We assume that the areas which are considered protected areas will remain as non-forest or revert to forest. We also assume that the non-protected areas will not be converted into forest, based on the rate of increase in population (1.8%) coupled with the rate of deforestation 54,000ha/yr, which will lead to the necessity of more cropland and urban development

- b. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting)*

Similar to our conservative assumptions addressing the sustainability of forest areas, we will assume that non forest protected areas are sustainably managed. This is even more conservative than our previous assumption regarding forested land as non forest areas classified as protected, are not necessarily sustainably managed in regard to the harvest of fuelwood. We will include areas which the Inventory of Forests and Trees study indicates have trees, as other land would be inaccessible to gather fuelwood, as they have no woody biomass. Thus we conservatively suggest that 186,029 ha (Non-forest areas with trees and agroforestry systems) of non-forested land is sustainably managed.³⁷

- c. Any national or regional forestry and nature conservation regulations are complied with*

Being considered a protected area there are laws and regulation protecting the area, and as mentioned above it is reported that 38% of fuelwood users collect fuelwood from areas where the collection of fuelwood is prohibited³⁸. Once again we will be conservative and assume that this does not affect the renewability of the non-forest area.

DRB Analysis

Per our aforementioned conservative assumptions regarding Protected Areas, we will continue to assume that Protected Areas are demonstrably renewable to calculate the DRB. We will then calculate an estimation of the amount of baseline firewood biomass, which comes from these demonstrably renewable areas.

We estimate that the chances that a woodfuel user will use wood from a demonstrably renewable area would be proportionate to the percentage of accessible biomass within Protected Areas compared to the total biomass of accessible woodfuel in the country³⁹. Thus we include protected areas that are classified as forests, as well non-forests with wood biomass (trees), and agroforestry systems as demonstrably renewable areas, as all other protected areas do not include trees, and thus are inaccessible for woodfuel collection. We also subtract the biomass of the

³⁶ Resultados del Inventario de Bosques y Arboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Arboles. Table 21

³⁷ Resultados del Inventario de Bosques y Arboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Arboles. Table 21 Page 76

³⁸ CEPAL UN, Consumo de Leña en Honduras. 2011. Page 23

³⁹ Resultados del Inventario de Bosques y Arboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Arboles. Table 17 Page 72.

“zona nucleo” from the forest biomass of Protected Areas, as fuelwood collection is prohibited in these areas, making them inaccessible to fuelwood users.

In order to calculate the biomass of protected areas we use the biomass densities for each type of land cover listed in table 17 of Inventory of Forests and Trees. We multiply the area (ha) in Table 21 by the density in Table 17 to estimate the biomass within the protected areas⁴⁰. Table 17 rounds the conversion factor (kg/ha) to the closest 1,000, so we will do the same, in order to be consistent with the numbers reported in Inventory of Forests and Trees. We did the same to calculate the biomass of the “zona nucleo” which we assumed had the same density as all other forests in Honduras. We will use biomass data from Table 17 for to calculate total biomass accessible to woodfuel users.

The biomass of the Forest Protected Areas and Non-forest protected areas with woody biomass, minus the biomass of the “zona nucleo” gives us the total biomass which is considered renewable in the country. We then divide this by the biomass of total all forested areas and all non forested areas which have woody biomass to create a proportion of renewable woodfuel resources to total woodfuel resources.

We decided to take the bottom up approach to calculate By, multiplying the household fuel consumption of woodfuel (tons/household-year) by the number of households cooking with woodfuel biomass in the country

We then multiplied By (Biomass of fuelwood consumed nationally) by the aforementioned proportion of the biomass(tons) of accessible protected areas to total accessible biomass(tons), in order to determine the DRB used in the absence of project activity.

Below are the calculations we used:

Description	Value	Unit	Source
Population of Honduras (2010)	8,203,000	number	http://ww2.unhabitat.org/habrdd/conditions/centamerica/honduras.htm
Avg # people per household (2010)	4.81	number	http://ww2.unhabitat.org/habrdd/conditions/centamerica/honduras.htm
# of households in country	1,705,405	number	Calculated
% HH cooking with woodfuel stoves	68.6%	%	Programa de aumento del aprovechamiento de fuentes renovables de energía (srep) plan de inversiones de honduras, April 2011 - table 13, total Fuente Lena

⁴⁰ Resultados del Inventario de Bosques y Arboles 2005-2006. Proyecto Apoyo al Inventario y Evaluación Nacional de Bosques y Arboles Table 17 Page 72

HH cooking w/ woodfuel stoves	1,169,908	number	
Household woodfuel consumption (2010)	3.1	tonnes/hh/yr	Energy Efficiency in Central America: Progress and Action towards the fulfilment of Goals of the Central American Sustainable Energy Strategy” by Victor Hugo Ventura and Ryan Carvalho, published by UN-CEPAL, 2014
Total (By)	3,626,715	tonnes/yr	Calculated

DRB	=	By	x	Forest Protected Areas (tons)	+	all other non- forest protected areas (tons)	-	"zona nucleo" (tons)
Total Biomass of Accessible Areas (Non-forest + forest)								

DRB	=	3,626,715	x	$\frac{164,838,784}{509,228,579}$	+	$\frac{12,541,590}{509,228,579}$	-	$\frac{94976044}{509,228,579}$
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DRB	=	586881.8899
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B_y (tons)		DRB (tons)		NRB (tons)
3,626,715	-	586881.8899	=	3,039,833

NRB	3,039,833	=	83.82% fNRB
NRB + DRB	3,626,715		

The Fractional Non-Renewable Biomass (fNRB) is found to be 83.82%