Profafor

CONSULTANCY REPORT

Trip to Brazilian Greenchoice Forest Conservation Project

Quito, Ecuador
October 30, 2007

Consultancy Report to Brazilian Greenchoice Forest Conservation Project

I.- List of all participants:

- Michiel Rexwinkel, Financial Manager, Greenchoice, The Netherlands
- Jurjen Algra, Marketing Manager, Greenchoice, The Netherlands
- Luis Fernando Jara, General Manager, PROFAFOR S.A., Ecuador
- Franco Condoy, Technical Assistant, PORFAFOR, S.A., Ecuador
- Helena Dacosta, Manager Brazilian Greenchoice Project, Brazil
- Charly and Boesio, boat sailor and assistant, Manus, Brazil

II.- Itinerary

Oct. 18, 2007	Fligth from Quito – Bogotá –Manaus, Brazil
Oct. 19, 2007	Meeting at Taj Majal Hotel in Manaus with M. Rexwinkel, J. Algra and H. Dacosta. Afternoon: flight to Corai. Overnigth at Fernández Hotel in Corai.
Oct. 20, 2007	Trip by boat to Ithanua and Juma Rivers. No sufficient water. Change to Urucu River. Overnight at the boat.
Oct. 21, 2007	Trip to Urucu River in small boat. Forest sampling in San Gabriel, primary forest.
Oct. 22, 2007	Trip by boat to La Esperanza-Chapare. Forest sampling in primary forest.
Oct. 23, 2007	Sampling of San Gabriel secondary forest. Trip back to Lake Urucu. Overnight at boat.
Oct. 24, 2007	Trip back to Corai. Afternoon: flight to Manaus.
Oct. 25, 2007	Visit to INPA: Herbarium, Dr. M. Hopkins; SIG Division, Mr. R. Trancoso and Ecology Division, Dr. E. Keizer and Mr. E. Noguiera. Flight back from Manaus to Quito.

III.- Background

Greenchoice is a Dutch electricity company based in Rotterdam. Its main objective is the production and distribution of green energy to customers in the Netherlands. Currently, it has around 200.000 customers that belief in green energy and concern on global warming and climate change. The company is very much interested in contributing to protect and conserve tropical primary forest in order to avoid green house gases emissions from deforestation. They have already started programs on this line, in the Netherlands, and in tropical countries as Tanzania, Ecuador and Brazil.

PROFAFOR (Programa Face de Forestación del Ecuador) is a Ecuadorian private company which provides forest services and consultancy. It was created in 1993 by Face Foundation from the Netherlands in order to run Face´s forestation programme in Ecuador. Its main objective is to support the establishment of forest plantations to

sequester carbon dioxide from the atmosphere and contribute to decontamination and avoid global warming. So far, it has established around 20.000 ha of forest plantations with fast growing species in the Ecuadorian Sierra.

At the same time, PROFAFOR is running a conservation programme in Ecuador jointly with the Fundación Bosques para la Conservación. The programme has the objective to protect and conserve tropical natural forests to avoid their degradation and destruction. In this way, green house gases emissions will be avoided from deforestation and land use change. The programme is funded by Greenchoice through Face Foundation in the Netherlands and was initiated in 2005. Currently, four conservation contracts have been signed with private land owners and the Ministry of Environment. Altogether, cover a forest surface of around 5.500 ha located in two areas: Nono-Tandayapa, in Pichincha Province in the Ecuadorian highlands and in Tena, Napo Province, on the foothills of the Amazon region.

Greenchoice asked PROFAFOR for a short consultancy since it is starting a similar programme in Brazil. It is interested in having an estimation of the amount of carbon stored in primary and secondary forests located beside the Urucu River, on the Corai Municipaly, in the Amazonas Department, Brazil. Also, in the implementation of conservation program in Western Brazil to avoid deforestation and carbon dioxide emissions to the atmosphere.

IV.- Objectives of the consultancy:

- To estimate the amount of carbon stored by primary and secondary natural forests on the Urucu River area, Corai Municipality, Amazonas Department, based on a quick and non statistical sampling of forest biomass.

- To locate Greenchoice forests properties beside the Urucu River using accurate and precise GPS (Geographic Position System) equipment and elaborate a preliminary digital map.

- To support the design and implementation of the conservation programme that Greenchoice is seeking to run in the Brazilian tropical forest.

V.- Activities carried out

5.1.- Sampling of primary and secondary forests on the Urucu River area

5.1.1.- Sites sampled: due to the circumstances, it was only possible to do sampling in two sites:

- San Gabriel (primary and secondary forests), property of Mrs. Helena Dacosta
- La Esperanza-Chapare (primary forest) that belongs to Greenchoice.

5.1.2.- Geographic location (coordinates):

San Gabriel (primary forest): 63º 55’ 40’’W, 4º 21’36’’ S

San Gabriel (secondary forest): 63º 55’ 53’’ W, 4º 21’ 28’’ S
La Esperanza-Chapare (primary forest): 63º 51’ 23’’ W, 4º 17’ 22’’ S

5.1.3.- Sampling methodology:

It has to be noticed, that no statistical sampling method was applied since there was no information on the total area to be sampled, neither surface per type of forests (primary and secondary) and no geographic information on the location of the properties where the forest exists. Therefore, a quick sampling of primary forest on San Gabriel and La Esperanza, and on secondary forest just in San Gabriel, was carried out. Seven persons participated in the sampling, divided in two teams: one team composed by one forester and two workers established transects and delimitated the sampling units and small plots. While the second team, composed by four persons leaded by a forester did the inventory: one species recognizer, one for DBH measurement, one for height measurement and one for taking notes on pre-established formats.

Based on PROFAFOR experience, on the short time to make the sampling and in order to have a raft estimation on the amount of carbon stored on the natural forests of the Urucu River, the method used for sampling was transects on pre-selected kind of forests (primary an secondary). Four transects were established along a main axes. Using a Sunto compass, these axes were oriented N-S and E-W. Along the transect axes, perpendicular lines of 10 m each side were measured with a fibre metric tape (0,1 m) and marked with 2.0 m sticks and red ribbon. In this way, small plots of 10x10 m (100 m^2) were designed on each side of the transect axes; 5 small consecutive plots compose a large plot of 500 m^2, which constitute the sampling unit. The total area inventoried at 100% was 1,0 ha or 10.000 m^2 Table 1 shows transect location, number of small plots and sampling units established on four sites:

Table 1: Description of transect location and sampling plots in three forests in Corai, Amazonas, Brazil.

No. Line	**Location**	**Type of forest**	**Orientation**	**Length (m)**	**Number small plots (100 m^2)**	**Number sampling units (500 m^2)**
1	San Gabriel	Primary forest	E - W	150	30	6
2	La Esperanza	Primary forest	E - W	200	40	8
3	La Esperanza	Primary forest	E - W	50	10	2
4	San Gabriel	Secondary forest	N - S	100	20	4
			TOTAL	500	100	20

Within each small plot, the following information was taken from each tree with more than 10 cm of diameter at breath height (DBH):

- DBH, taken with a 65 cm Hoglof aluminium calliper (0,1 cm); for those trees bigger than 80 cm of DBH, a 2,0 m diameter fibre tape was use (0,1 cm).

- Total height was taken with Sunto hypsometer at a distance of 15 m and estimation of 1,0 m.
- Species common name, given by a local worker

Trees below 10 cm of DBH, were measured in two small plots (100 m^2) for each transect line. The same information was taken (DBH, total height and species common name). Palms, lianas and dead tress were not taken in the inventory. Special formats were designed and used to capture field information. These are presented in Annex 1.

5.1.4 Data processing

Once the inventory was finished in the field, data collected was immediately digitized on Excel sheets. On these sheets, the data was stored on the same way as it was collected, meaning four transects in four sites. Since Greenchoice is interested mostly in the amount of carbon stored by each forest type and on the other hand, common names were not perfectly recorded in Portuguese, common names of trees were not digitized. A copy of more than 100 different forest species recorded in the field was given to Dr. Mike Hopkins at the INPAs Herbarium (Instituto Nacional do Pesquisas para Amazonas) in Manaus for its recognition. He mentioned that he will try to at least return us the list with the Genus of the common names. The list of common names and possible scientific names are presented in Annex 2.

The following steps were done to calculate the amount of carbon for each tree and sampling plot:

- Basal area: circular area of each tree assuming complete circularity, by applying an universal formula based on DBH:

  $BAt = 0{,}785 * DBH_t^2$

  Where:
  BAt: basal area of each tree given in m^2
  DBH_t: diameter at breath height, given in m
  0,785 = obtained by dividing pi by 4

- Stem volume: total volume from main stem, assuming complete cylinder shape and using an universal formula: m^3:

  $V_t = BA_t * TH_t$

  Where:
  V_t: volume per tree given in m^3
  BA^t: Basal area per tree given in m^2
  TH_t: total height of each tree given in m

- Stem shape factor: since all tree stems are not complete cylinders, a form factor (FF) is applied to total volume to obtain stem volume. The FF was obtained from Nogueira et al. 2007, for forest species from the Central Amazons region.

$V_{ts} = V_t * FF$

Where:
V_{ts} = Volume of each tree stem given in m^3
V_t = Volume of each tree given in m^3
FF = 0,70

- Non-circular form correction factor: since not all the trees have its cross section completely circular, Nogueira et al., 2006, suggests a correction factor for this overestimation on the volume for all trees over 5 cm DBH for the Central Amazons region (11%):

  $CV_{ts} = V_{ts} * CFF$

  Where:
  CV_{ts} = Corrected total volume for each tree stem given in m^3
  V_{ts} = Volume of each tree stem given in m^3
  CFF = Non-circular correction factor = 0,89

- Biomass: dry biomass is obtained relating the total volume and wood density. An average for wood density for most of forest species from Central Amazonas region was obtained from Nogueira et al., 2007.

  $B_{ts} = CV_{ts} * WD$

  Where:
  B_{ts} = Total biomass for each tree stem given in tons
  CV_{ts} = Corrected total volume for each tree stem given in m^3
  WD = average wood density = 0,675 given in g cm^3

- Wood density correction factor: since wood density varies across its stem and across its length, Nogueira et al., 2007, suggests a correction factor for overestimating wood density of 9,6%:

  $CB_{ts} = B_{ts} * WDCF$

  Where:
  CB_{ts} = corrected total biomass of each tree stem given in tons
  B_{ts} = Total biomass for each tree stem given in tons
  WDCF = wood density corrected factor = 0,904

- Biomass expansion factor (BEF): the relation between the amount of biomass in the stem and the total amount of carbon in the crown (branches, small branches and foliage). Expands bole biomass to all above ground biomass, for all trees above 10 cm DBH. According to Houghton 2001, citing Brown and Lugo, 1992, BEF = 1,74 for the Amazonia, for stand biomass of boles higher than 10 cm DBH and 190 t/ha. On the other hand, Kruijt et al. 2006 assumed that 50% of above – plus below – ground carbon is above ground, hence above ground carbon is multiplied by a factor of 2,0.

For this raft estimation of carbon, it was decided to be conservative and a BEF of 1, 30 was used.

The total above ground biomass from forest stems is:

$TAGB_{ts} = CB_{ts} * BEF$

Where:

$TAGB_t$ = total above ground biomass for each tree given in tons
CB_{ts} = corrected total biomass of each tree stem given in tons
BEF = 1, 30

- Root/shoot factor: estimated the amount of biomass below ground based on the total above ground biomass. It was assumed the R/S factor to be 1, 20. So, the total amount of biomass above and below ground for each tree is:

  $TB_t = TAGB * R/S$

  Where:
  TB_t = total biomass for each tree in tons
  $TAGB_t$ = total above ground biomass for each tree given in tons
  R/S = 1, 20

- Carbon content: an universal factor of 0,5 was used to calculated the amount of carbon from total biomass.

  $C_t = CB_t * 0,5$

  Where:
  C_t = total amount of carbon of each tree given in tons
  CB_t = corrected total biomass of each tree given in tons
  0,5 = carbon factor

- Carbon dioxide content: the relation of one molecule of CO_2 to C is 22/6 = 3,666. This factor was used to estimate the amount of CO_2e stored in the forests.

  $CO_2e\ t = C_t * 3,67$

  CO_2e t = total amount of CO_2e of each tree given in tons
  C_t = total amount of carbon of each tree given in tons
  3,67 = relation CO_2 to C

- Amount of CO_2e in small plots (100 m^2): add the total amount of CO_2e estimated for each tree found within each plot of 100m2.

  $\Sigma\ CO_2e\ t_{P1} = \Sigma\ (CO_2e\ t_{1\ P1}$ ……..$tn_{P1})$

  Where:

Σ CO_2e t = sum of all CO_2e in each tree (t) in plot 1 (P1) given in t/100m^2
CO_2e $t_{1\ P1}$ = amount of CO_2e in tree one (t1) in plot 1 (P1) given in tons
CO_2e $t_{1\ P1}$ = amount of CO_2e in tree n (tn) in plot 1 (P1) given in tons

- Amount of CO_2e per sampling plot of 500 m^2: add the total amount of CO_2e for every consecutive 5 small plots in each side of each transect.

  Σ CO_2e SP = Σ (CO_2e P1 + ……. CO_2e P5)

  Where:
  Σ CO_2e SP = sum of all CO_2e in five small plots and given in t/500 m^2
  CO_2e P1 = total amount of CO_2e in small plot 1 and given in t/100 m^2

- The average amount of total CO_2e (above and below ground) per hectare was obtained from the arithmetic mean of all sampling plots multiplied by 20.

  CO_2e/ha = Σ CO_2e SP/number of sampling plots in each transect * 20

  Where:
  CO_2e/ha = average amount of total CO_2e/ha (above and below ground) given in t/ha
  Σ CO_2e SP = sum of all sampling plots in each transect
  20 = facto to convert one sampling plot to one hectare (20 * 500 m^2)

- Estimation of amount of CO_2e for each forest type (primary and secondary forest). The above calculations were processed separately for each forest type. The results will be given on site basis. It was not possible to estimate the amount of CO_2e for the entire properties owned by Greenchoise and Mrs. Helena Dacosta, because there were no surface data for each individual property. Not even a differentiation between primary forest and secondary forest.

5.2. - Location of Greenchoice forest properties.

The location of the forests on the Urucu River area was carried out by using a Trimble Recon GPS XC edition, which has accuracy of 3 to 5 m of the real coordinate. No differential correction was made. Dots or points were taken to the following properties beside the Urucu River:

- Mickey at the Urucu Lake (one dot)
- La Esperanza – Chapare (three dots)
- San Gabriel (three dots)

At La Esperanza and San Gabriel properties, one point was taken at the beginning of the property (water stream upwards), the second one in front of the main house and entrance, and the third at the end of the property. This information was based on Helena´s Dacosta knowledge of the region.

The points were located on Google satellite information since it was not possible to have digital maps from the Corai Municipality offered by INPA, Manaus. The points were located on Google information by using the coordinates read by the GPS.

At the same time, a desk exercise was carried out to estimate the total area of La Esperanza and San Gabriel properties based on land titles and Helena Dacosta information. For the first one, from the first and third point, five kilometres straight lines perpendicular to the river were located on the Google information. For San Gabriel the same exercise was done but using seven kilometres straight lines. It was not possible with Google satellite information to follow the Do Curupira water stream as the western natural border of La Esperanza – Chapare property, not even the Pingo de Ouro Lake at Southern part of San Gabriel property. The polygons obtained from this exercise were exported to ArcView software Version 3.2; by using this mean, an estimation of the surface was done. So, the results from this information should be taken as an approximation to the real area. Field work has to be done to take more dots on the border of each property and located them in digital maps at better scale, so the total area can be calculated more accurate and realistic.

5.3.- Design and implementation of Greenchoice conservation programme in Brazilian tropical forest.

In order to give technical support for the design and implementation of the programme in Brazil, it was necessary to look at land titles and information from internet from the following websites:

- Brazilian Ministry of Environment (www.mda.gov.br)
- Instituto Brasilero do Medio Ambiente (www.ibana.gov.br/siucweb/rppn):
-
    - National System of Conservation Units (Sistema Nacional do Unidades de Conservacion – SNUC)
    - Private Reserves of Natural Heritage (Reserva Privadas do Patrimonio Natural – RPPN)

- Instituto Nacional de Pesquisas para Amazonas – INPA (www.inpa.gov.br)

Also, regional information was given by Mrs. Helena Dacosta, Dr. Michiel Rexwinkel and interviews with the following INPA staff:

- Dr. Mike Hopkins, Herbarium Division (mikehopkins44@hotmail.com)
- Dr. Edwin Keiser, Ecology Division (keiser@inpa.gov.br)
- Euler M. Noguiera, Ecology Division (enoguiera@inpa.gov.br)
- Mr. Ralph Trancoso, SIG Division (ralph@inpa.gov.br)

A quick literature review from scientific papers was carried out, basically from INPA researchers, in order to support carbon estimations.

VI.- Results

6.1- Carbon estimations on primary and secondary forests

Table 2 presents a summary of the estimation of carbon dioxide above and below ground in three different forests on the Corai River region. As it was mentioned above, the sampling method was not based on a statistical approach, since we did not know precisely the total area to be considered, not the area for each forest. Although, it gives a raft estimate of the amount of carbon stored in each forest.

The primary forest has an average of 891,4 tCO_2e and varies between 866 and 916 tCO_2e/ha for the two forests sampled, including trees below 10 cm of diameter (DBH). The standard deviation for the samples is very large (548 and 354 tCO_2e/ha for the two forests, San Gabriel and La Esperanza, respectively (see Annex 3)). The reason of this is the presence of scattered Castaña huge trees found in some plots that affects variation. San Gabriel primary forest has slightly more volume and carbon content than La Esperanza primary forest. In relation to San Gabriel secondary forest, it was found a large difference in carbon content compared to primary forest. The average found was almost 470 tCO_2e/ha which represents almost half (47%) of the carbon content in primary forests. Annex 3, contains all the information from the sampling plots, a basic statistical description and a more descriptive summary of the results.

Table 2: Above and below ground estimation of CO_2e/ha found in three forests at the Urucu River.

Above and below ground CO_2e/ha for three types of forests						
San Gabriel Primary Forest			**La Esperanza Primary Forest**		**San Gabriel Secondary Forest**	
	Mean	%	Mean	%	Mean	%
CO2e/ha (DBH > 10 cm)	874,3	95,2	832,4	96,0	469,5	94,1
CO2e/ha (DBH < 10 cm)	42,3	4,8	33,7	4,0	27,9	5,9
Total	**916,6**	**100,0**	**866,1**	**100,0**	**497,4**	**100,0**

Small trees (< 10 cm DBH) contributed with a small portion of the carbon content (between 4,0 and 4,8 %) for two sampled primary forests. While for secondary forest contributed with 5,9 % of the carbon content.

These figures are very similar to those reported in the literature for the central Amazonian region, by Noguiera et al. 2005, Noguiera et al. 2007, Malhi, Y. et al. 2006, among others. These figures are also considered conservatives since there were made corrections on the measurements on diameter and on wood density. Also the biomass expansion factor (BEF) and root/shoot ratio were taken much lower than those reported by Houghton 2001, citing Brown and Lugo, 1992, BEF = 1,74 for the Amazonia, for stand biomass of boles higher than 10 cm DBH and 190 t/ha. And by Kruijt et al. 2006 that assumes that 50% of above – plus below – ground carbon is above ground, hence above ground carbon is multiplied by a factor of 2,0.

Concerning species diversity, it was found more than 100 different forest species on the sampled area (one hectare). The most frequent were louros (*Aniba spp., Xylopia spp*., *Licania spp*. and *Ocotea spp*.)), abiurana (*Pouteria spp., Microphilis spp*.), breu (*Protium spp.*) balata (*Chrysophyllum spp*.), matamata (*Eschweilera spp*.), seringuiera (*Hevea spp*.), inga (*Humiriastrum spp*.), ucuba (*Virola spp*.and *Iryanthera spp*.), itauba (*Mezilaurus spp*.), jarana (*Lecythus spp*.), among others. Castaña (*Lecythis spp*. or Corythophora spp. ?) was the biggest tree found, with 140 cm of DBH and almost 40 m tall. A tentative list of the species found is found in Annex 2.

6.2.- Time estimation for recovery of secondary forest

Primary forest is assumed to have a mean annual increment of 1,0 tC/ha/y (above and below ground), which is equivalent of 3,67 tCO_2e/ha/y. In a period of 50 years, it will fixed 50 tC/ha (see Table 3).

In order to have an idea of the time that needs a secondary to recover to a climax forest at San Gabriel site, it was assumed a mean annual increment (MAI) in total stem volume of 5 m^3/ha/y, which represents 1,68 tC/ha/y or 6,19 tCO_2e/ha/y (above and below ground). Table 3 shows the calculations for recovery time in terms of C and CO_2e.

Table 3.- Time recover for secondary forest to reach climax state and amount of carbon captured in this period.

Type of forest	Total C (t/ha)	Total CO_2e (t/ha)	C MAI (t/ha/y)	CO2e MAI (t/ha/y)	Recovery time (years)	Amount of C captured (t//ha/50 yeas)	Amount of CO_2e captured (t/years/ha)
Primary forest	249,7	916,6	1,00	3,67	-	50,0	183,5
Secondary forest	135,5	497,4	2,38	8,73	48	116,2	426,4

Time recovery for a secondary forest to reach the climax state is around 48 years. During this period of time, the forest will capture of 419, 1 t/ha of CO_2e above and below ground. After that period, it will grow at a MAI of 1.0 tC/ha/y or 3,67 tCO_2e/ha/y.

6.3.- Location of Greenchoice properties

The results of this exercise are presented in two basic maps. As mentioned above, the information promised by INPA staff did not come to our office. Map 1 shows dots where the properties are located on the Urucu Riverside: Mickey, La Esperanza – Chapare and San Gabriel. The distance from dot 1 to dot 3 through the Urucu River on San Gabriel property is 6.475 m (North limit). For La Esperanza – Chapare property, the distance between dot 1 and 3 is 3.338 m approximately (South limit). These distances were used for the surface calculation of the polygons.

The polygons constructed have no real boundaries and should not be considered for any purpose. The tentative surface obtained form the exercise is presented in Map 2, based on Arc View software. Only two properties were calculated their surfaces: San Gabriel with 4381 ha and La Esperanza – Chapare with 794 ha. Again, these figures are not based on real boundaries and they need to be worked much better on the ground.

6.3.- Design and implementation of Greenchoice conservation programme

Based on interviews with Helena Dacosta and Michiel Rexwinkel and the review of documents, maps and land titles, we have the following suggestions to complete the implementation of the conservation programme:

- The land titles that were available and reviewed are registered at the Official Local Register and look to be legally correct. Although, the description of boundaries or borders and surface, are not well described and not accurate. The surface is given en squared meters and is just estimated. We suggest working this issue, in the sense to be more precise and accurate on the description of the borders and surface; this can be done with support of local or regional digital maps, at a convenient scale, most likely with field checks with GPS and the support of local people who know the area. Once the borders are clear, the surface can be calculated by using ArcView software and will bring more accurate figures. This ground truthting has to be coordinated with local neighbours, so they will know as well their limits in agreement with Greenchoice. Landmarks should be installed also in agreement with neighbours and geographic coordinates should be taken. Later on, it will be convenient to make the correction (if is the case) at the Official Local Register.

- Since Greenchoice is very much interested on the avoiding deforestation and the recovery of secondary forests in its properties, it would be necessary to estimate the amount of secondary forest on each property. This can be done by using satellite images at a convenient scale and resolution, once the property polygons have been obtained by the above process.

- The above suggestion is based on the objectives of the conservation programme, keeping these areas as best protected as possible in the long term. On the other hand, if it is decided to include all natural forests bought by Greenchoice to the National System of Conservation Units (SNUC) as a Private Reserve of National Heritage (RPPN), the information obtained from the above point, will be useful to complete the entire information request by the Brazilian Institute of Environment and Renewable Natural Resources (IBANA) (see below).

- It is advisable for future purchase of forest land, to buy a large area in one or two specific places, rather than buying pieces all around the western part of the Corai Lake. This will avoid in the future, high costs on the surveillance, supervision, administration and control of the areas. The ideal situation would be to have a big spot of natural forest between two rives as natural borders, say between Ithanua and Juma Rivers. Apart from the mentioned costs arguments, another advantage is by having natural limits, there won't be any risks from neighbours

asking for their possession or pieces of land in the medium or long term. This is a very important issue to consider avoiding land ownership discussions with the neighbours, as it is happening in the Southern part of Brazil. For this specific situation, it would be necessary to review the legislation and regulations related to the assignment of forest land in Brazil, specifically for conservation and protection purposes.

- As it is shown in Map 1, the oil pipeline constructed by PETROBRAS crossed La Esperanza- Chapare property on the Southern part. It would be convenient to ask PETROBRAS, if they are considering any kind of compensation for the damage caused by the enlargement of the roads and new gas pipeline.

- In relation to the administration and management of the local programme, it would be advisable to consider the creation of a structure such an NGO (Non Governmental Organization), a Foundation or Corporation, that is non-profit organization, according to the Brazilian law. Forest land purchased should be on the name of such Foundation. Taxes on land purchase, hiring of personnel of staff, operative costs and other investments, have to be considered in this structure. In most countries, NGOs have advantages on this respect. This organization can hire specific tasks to third parties or by doing them directly.

Concerning the incorporation of the forest land purchased by Greenchoice to the SNUC, we have gone through the legislation and regulations and the following comments came up:

- The Law. 9.985 of July 18th, 2000, created the National System of Conservation Units (SNUC) (Annex 4). This system is composed by a group of federal, state and municipality conservation units and legally formed by the Public Power (Government), according to what is established in this Law.

- The main objective of SNUC is to contribute to the maintenance of the biological biodiversity and natural resources on the national territory; protect threat species at the regional and national level; contribute to the preservation and restoration of natural ecosystems diversity; to promote the sustainable development from natural resources, among others.

- The SNUC is managed by three instances: National Council of the Environment (Conama) as the deliberative and counselling instance; Ministry of Environment as Central instance and coordinator; and the Brazilian Institute of the Environment and Renewable Natural Resources (Ibama) as executive instance through its regional offices.

- The conservation units are divided into two groups: Integral Protection Units (IPU) and Sustainable Use Units (SUU). The IPU is composed by the following categories of conservation units: Ecological Station, Biological Reserve, National Park, Natural Monument and Wildlife Refugee. The first three ones are public land tenure and belongs to the state. Natural Monuments and Wildlife Reserves are private land tenure, if they comply with all the conservation unit objectives, such as land and local natural resources use by the land owners. If

such condition is not complied completely, the forest land can be expropriated according to the Law.

- The second group SUU, is composed by seven conservation unit categories: Environmental Protection Area, Ecological Relevant Area, National Forest, Extractive Reserve, Fauna Reserve, Sustainable Development Reserve and Private Reserve of Natural Heritage (RPPN). The National Forest, Extractive Reserve, Fauna Reserve and Sustainable Development Reserve are public land tenure and belong to the state. The Environmental Protection Area and Ecological Relevant Area can be either public or private lands. These categories are basically small areas with low amount of population but high interest from the environmental point of view.

- The RPPN are private land areas, legally recorded on perpetuity for the conservation of biological diversity. A commitment document (format) has to be signed by the owner and registered in the Real State Public Register. It is allowed within the RPPN: scientific research and visiting for tourist, ecological and educational purposes. The RPPN guarantees the ownership to the private right. Ibana will assist on technical and scientific orientation to the RPPN owner, for the elaboration of the Management Plan and/or the protection or management of the unit. The RPPN is not required to have a buffer zone. All the conservation units (CU), including RPPNs have to elaborate a Management Plan within fives year after its creation and can be managed by civil society organizations with public interests and with objectives similar to the CU.

- The Ibana's regulation No. 62 of March 2005 (Annex 5), established the criteria and administrative procedures for the creation of a RPPN. The official request has to be sent to the Ibana Executive Manager, with the support of the following documents:
    - request format signed by the owner,
    - copy of a notarized owner's identification card,
    - Rural Territorial Tax receipts given by the corresponded entity from the last five years, cadastre certificate from rural real state (CCIR),
    - commitment format signed by the owner, land title showing the inclusion on the Real Sate Register (land title should have the description of limits and if possible the geographical coordinates of main vertexes of the property),
    - map of the property including total area and description of the limits of the RPPN within the whole property,
    - location of the property within the Municipality and the geographic coordinates from main vertexes of the RPPN according to the Brazilian Geodesic System and mentioning the map used and name of the technical person who assist the elaboration of the map.

- Some benefits from the RPPN:
    - exception from the Rural Territorial Tax (ITR),
    - the right to keep private ownership,
    - the National Environmental Fund (FNMA) will give priority to the assessment of projects to be executed within the RPPN,

    - priority in the assignment of credit lines for activities to be carried outside the RPMM but within the same property and,
    - strategic alliances with other projects at national or international level on protection, conservation and management activities.

- Advantages and importance of the creation of a PRPPN:
    - to contribute to enlarge the conservation areas in the country;
    - have shown high cost/benefits indexes;
    - easy to create;
    - to encourage private initiatives to contribute to the national conservation effort;
    - to contribute to the protection of Brazilian diversity ecosystems.

- As it is noticed, it is a very burocratic procedure but not difficult to carry it out. We think that the RPPN is the most suitable for Greenchoice purpose, since it keeps the conservation compromise at perpetuity and gives the opportunity to work on scientific research and do educational and tourist activities and keeps private ownership rights.

VII.- Conclusions

- The amount of carbon stored by primary and secondary natural forests on Greenchoice properties in the Urucu River area are relative high, but comparable to data found in the literature from Central Brazilian Amazonia.

- The data obtained from this quick sampling should be taken with reserve, since it was not based on a statistical approach. Once it has been defined the limits and surfaces of Greenchoice properties, a more detailed and statistical based work could be implemented in order to obtain a more accurate and precise figures.

- Intensive work should be carry out on properties already purchased by Greenchoice in order to have a clear panorama of limits and surface of primary and secondary forests. This can be done by using appropriate digital maps and ground thuthing work, jointly with intensive socialization activities with neighbours.

- It was not possible to have an estimate of total surface from two Greenchoice properties, since the information and the quality of the maps available were poor and insufficient.

- The RPPM is a conservation unit within the SNUC that would guarantee at perpetuity the conservation of Greenchoice natural forests, keeping private ownership and allowing research and tourist and educational activities.

- It is suggested the creation of a administrative figure to carry out the Greenchoice conservation programme in Brazil, so once the RPPNs are created, it can benefit from may incentives such as land tax exemption, among others.

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