

Draft Final Report

**Land Use Trends in the San Rafael
Resource Management Area**

**Addendum to Report
“Land Use Trends in Paraguay and the Northern Chaco”**

Prepared for World Land Trust and Guyra Paraguay

by

Peter M. Hansen

**with collaboration of
Edgar Rojas
(satellite imagery)**

**January 25, 2010
Asunción, Paraguay**

Table of Contents

Introduction	3
I - Overview of the San Rafael Resource Management Area	5
II - Land Use Trends in Settlement “La Amistad”	9
III - Likely Future Land Use Trends in La Amistad and Proposal for Joint Management of the Remaining Forest Resources	14
Bibliography and References	16

Annex 1 - Maps and Satellite Images (in PowerPoint)

1. Paraguay – Departments, project reference area, and annual rainfall
2. Location of San Rafael Resource Management Area – Department of Itapúa
3. San Rafael Watershed – River Tebicuary
4. San Rafael – Density of Forest Cover
5. Properties within San Rafael Reserve
6. San Rafael Reserve Land Use, 2002
7. San Rafael Reserve Land Use, 2009
8. San Rafael Reserve – Deforestation, 2002-2009
9. Neighboring community Lima – vegetation and land use, 1973
10. Neighboring community Lima – vegetation and land use, 1985
11. Neighboring community Lima – vegetation and land use, 1994
12. Neighboring community Lima – vegetation and land use, 2009
13. Location of Settlement “La Amistad”
14. La Amistad – vegetation and land use, 1997
15. La Amistad – vegetation and land use, 2003
16. La Amistad – vegetation and land use, early 2009
17. La Amistad – vegetation and land use, end-August 2009
18. Location of Amistad Survey Respondents’ Homes, August 2009

Introduction

This report is an addendum to a prior report, “Land Use Trends in Paraguay and the Northern Chaco,” prepared for the World Land Trust and Guyra Paraguay as background information and analysis for a possible carbon sequestration project.

The prior report analyzed the importance of agriculture and livestock production in Paraguay and described how these sectors are the leading drivers of growth, exports and deforestation. Given the steady expansion of these sectors, in particular, soybean and beef production, and the growing world demand for these products, the report concluded that the past trends of increased land utilization are likely to continue, leading to continued expansion of the agricultural frontier (already over 80% of Paraguayan territory is devoted to agropecuario production, i.e., agriculture and livestock) and intensification of existing production models.

The prior report also analyzed land use changes in the two main regions of Paraguay – the Eastern Region, where 98% of the population lives and the dry Western Region or Chaco, which comprises 60 percent of the national territory.

The Eastern Region contains the last remnants of the sub-tropical Atlantic Rainforest, which previously covered about one-half of the Eastern Region’s 16 million hectares. Conversion of the rainforest initially to pasture and subsequently to “mechanized” fields for agriculture was taken on as a development challenge during the second half of the twentieth century and promoted through an extensive program of state land distribution to both small and large farmers.

Pasture for cattle production still occupies about one-half of the agropecuario land in use in the Eastern Region, while cropland occupies about one-quarter, but the area of cropland has grown significantly over the past two decades, in particular, for soybean production that now occupies about 2.5 million hectares. Seventy percent of soybean cultivation is concentrated in three of the Eastern Region’s 14 Departments -- Alto Paraná (30%), Itapúa (20%) and Canindeyú (19%).

The above trends are discussed in detail in the prior report, including the rapid growth of cattle ranching in the Chaco. The table on the following page, extracted from the prior report, summarizes the main changes in agropecuario land use since 1990.

The rest of this addendum focuses on land use change in the San Rafael Resource Management Area in the Eastern Region, which contains a site for possible inclusion in the afore-mentioned carbon sequestration project.

Summary of 2008 National Census of Agropecuario Establishments

	1991	2008	Increment	Percent
Total area in use (hectares)	23,817,737	32,527,075	8,709,338	36.6%
Regi—n Oriental	11,428,750	13,782,464	2,353,714	20.6%
Chaco	12,388,987	18,744,612	6,355,625	51.3%
Farms 500 has. and larger	19,369,213	27,807,215	8,438,002	43.6%
Regi—n Oriental	7,544,169	9,763,716	2,219,547	29.4%
Chaco	11,825,045	18,043,500	6,218,455	52.6%
Use of the land (has.)				
Cropland	1,662,006	3,365,332	1,703,326	102.5%
Regi—n Oriental	1,616,288	3,342,080	1,725,792	106.8%
Chaco	45,818	23,252	-22,566	-49.3%
Pasture	12,571,895	17,685,620	5,113,725	40.7%
Regi—n Oriental	6,266,341	6,907,801	641,460	10.2%
Chaco	6,305,554	10,777,819	4,472,265	70.9%
Forest	7,818,423	9,107,867	1,289,444	16.5%
Regi—n Oriental	2,312,411	2,231,879	-80,532	-3.5%
Chaco	5,506,012	6,875,988	1,369,976	24.9%
Other uses and fallow	1,765,413	2,368,256	602,843	34.1%
Regi—n Oriental	1,233,710	1,300,704	66,994	5.4%
Chaco	531,603	1,067,553	535,950	100.8%
Head of cows	1991	2008	Increment	Percent
Total pa's	7,626,617	10,561,894	2,935,277	38.5%
Regi—n Oriental	5,237,892	6,690,002	1,452,110	27.7%
Chaco	2,388,725	3,871,892	1,483,167	62.1%
Herds of 1000 head and larger				
Total pa's	3,767,593	6,050,678	2,283,085	60.6%
Regi—n Oriental	2,158,574	3,358,035	1,199,461	55.6%
Chaco	1,609,019	2,692,643	1,083,624	67.3%
Cropland in soybeans				
Total pa's	552,657	2,463,510	1,910,853	345.8%

see Statistical Annex for details

I - Overview of the San Rafael Resource Management Area

The San Rafael Resource Management Area (the “Reserve,” as it is popularly referred to) is located in the southeastern corner of Paraguay, in the area of the country’s highest rainfall. See Map 1, Annex 1 -- Maps and Satellite Images.

The Reserve lies mainly in the Department of Itapúa, from which it is accessible from the south – see Map 2. The northern part of the Reserve nevertheless flows over into the Department of Caazapá – see Map 3. The Reserve lies entirely within the upper watershed of the Tebicuary River – also Map 3 – and as such, forms part of a natural water management / forest preservation zone. The Tebicuary River also forms the western boundary of the Reserve.

The Reserve (about 69,500 hectares) is the largest remaining remnant in Paraguay of the sub-tropical Atlantic Rainforest that once stretched from the Atlantic coast west to the Paraguay River.¹ About three-quarters of the Reserve are covered by medium density forest. Stands of similar density forest extend to the north, west and southwest of the Reserve, but they are not as continuous as the forest within San Rafael itself – see Map 4, Density of Forest Cover.

The Reserve consists of private properties, not state lands, with the exception of a large parcel in the northeast corner held by the National Institute for Indigenous Development (INDI) for the benefit of an indigenous group that lives on the property. The property boundaries, including two properties belonging to Guyra Paraguay, are shown in Map 5.

In the mid-1990s, the area was designated as a natural resource management area, which designation prohibits logging and further conversion of land within the Reserve to agropecuario use. Clandestine logging nevertheless continues to some extent, occasionally provoking violent encounters between the few Reserve guards who patrol the area and the illegal loggers.² Also, there appears to be some illegal conversion of land to agropecuario use in small areas on some private properties within the Reserve.

Nevertheless, the pattern of land use within the Reserve remained fairly stable between 2002 and 2009 – see table on following page and Maps 6 and 7.

During this period, forest cover declined by an estimated 278 hectares, or 0.4% (i.e., by less than 1%) of the Reserve’s total area. The deforested land was converted to both cropland and pasture.

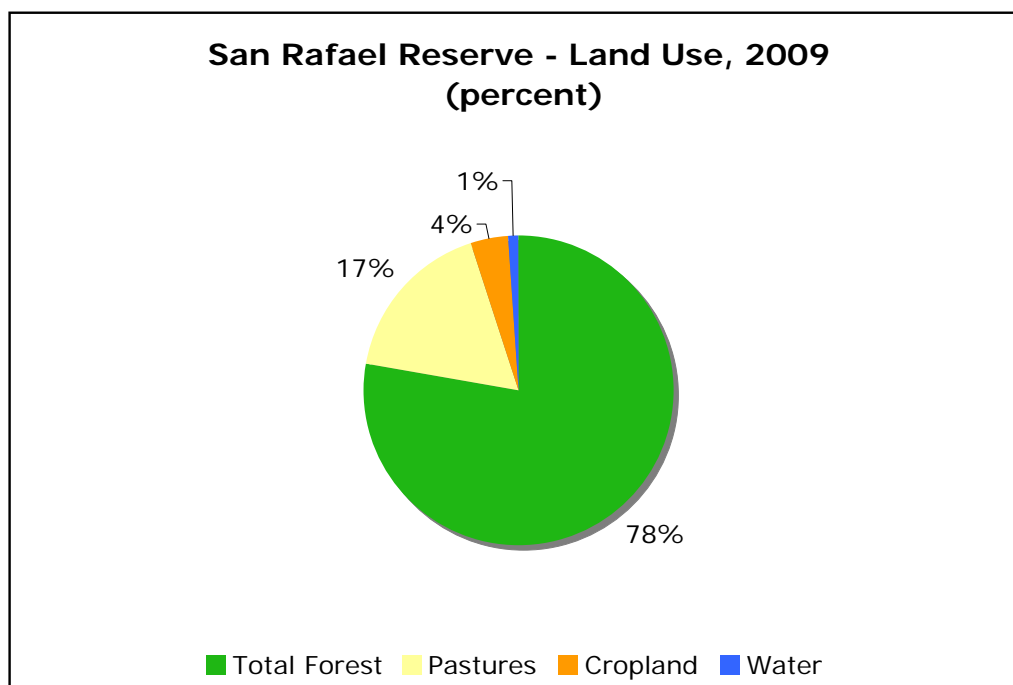
As of 2009, an estimated 78% of the Reserve remained forested, mostly with original-growth high canopy trees (“*bosque primario intervenido*”). Another 17% of the Reserve was pasture, mostly natural pastures (“*pastizales* or *cerrados*”) that are ideal for birdlife. Only 4% of the Reserve was in cropland, while water bodies (small lakes and ponds) account for the remaining 1% of the area.

¹ Other large remnants include the Moises Bertoni Reserve in Canindeyú (about 60,000 hectares) and some smaller private holdings in the 20,000 to 30,000 hectare range.

² For example, see Guyra Paraguay, Noticias de la Semana 16.01.10, “Illegal logging in Arroyo Tuna, San Rafael and attack against rangers.”

San Rafael Reserve - Land Use (hectares)

	2002	2009	2009 (% dist)	change 2009-02
Forest				
Original high	42,815	42,536	61%	-280
Original low	10,588	10,536	15%	-52
Secondary growth	429	482	1%	53
Reforested	451	451	1%	0
Total Forest	54,283	54,005	78%	-278
Pastures, natural + other	11,898	12,026	17%	127
Cropland	2,549	2,730	4%	181
Water	765	735	1%	-30
Total area	69,496	69,496	100%	0



The deforestation that occurred within the Reserve between 2002 and 2009 (a gross area of 332 hectares that was offset to some extent by the recovery of 53 hectares of secondary growth, for a net loss of 278 hectares of forest cover) was located mainly along the eastern and northern boundaries of the Reserve – see hot spots in Map 8.

The economic forces affecting the Reserve and the surrounding areas are mainly i) the rapid expansion of soybean production in the Department of Itapúa, and ii) the expansion of smallholder settlement in both Itapúa and Caazapá.

As mentioned in the Introduction, the expansion of soybean production has been one of the principle drivers of economic growth and exports for Paraguay over the past two

decades. The area under cultivation for soybean expanded from 550,000 hectares to 2.5 million hectares between 1991 and 2008 and currently occupies over 70% of total cropland in Paraguay.

A great part of this expansion occurred in the three easternmost Departments of Paraguay (Alto Paraná, Canindeyú and Itapúa) that border the Paraná River and that contain rich, deep, red loam soils that are particularly favorable to soybean production. These Departments were previously covered by the sub-tropical Atlantic Rainforest, which was largely cleared for timber and to make way for ranching and cropland.

In Itapúa, the expansion of cropland towards the San Rafael Reserve can be clearly observed in Map 5. Practically all the land on the eastern border of the Reserve has been converted into cropland, with the exception of the principal streams where thin margins of forest have remained.³

The parcels of cropland in this area appear to be mostly in the range of 5 to 20 hectares, but with some reaching 50 hectares or more. This would be characteristic of small independent farmers using mechanized methods of production. There may nevertheless be some settlements of poorer “*campesinos*” that exploit smaller parcels of 1 to 5 hectares using more labor-intensive methods -- see for example, the area along the eastern border of the INDI property in the northeast corner of the reserve (Map 5).

Both groups have brought their areas of cultivation right up against the border of the Reserve. As such, and with little forest reserve on their own lands, they are likely to use the Reserve as a secondary and/or occasional source of wood.

The conversion of forest to cropland has not been as extensive in the areas to the north and west of San Rafael Reserve, which lie in the Department of Caazapá. This is because the soils of Caazapá are not as rich and propitious for soybean production as are those of Itapúa. Also, the terrain is steeper and less suited for mechanized farming. The settlements to the north and west of the Reserve are thus more of the “*campesino*” type than that of the small-to-medium independent farmer that are more prevalent in Itapúa.

Where settlement has occurred, however, the clearing of forest has been nevertheless intense. An example is the community of Lima, which is located on the western border of San Rafael Reserve, just across the Tebicuary River.

While Lima is not specifically identified on Map 5, it is the area just west of the “Guyra Reta” property, and extends north about halfway up and opposite the “Santa Inés” property, and a bit south opposite the “von Streber Storm” property. The exact shape of the Lima community is shown on Maps 9 through 12 (slides 11 – 14), on which the following analysis is based.

The Lima area comprises about 2,500 hectares that were originally completely covered by forest. Clearing began around 1985 and advanced at an accelerated rate through 1994, by which year about 45% of the area had been cleared. Most of the clearing occurred on areas with “high” forest, while only about 10% of the clearing occurred on areas of “low” forest that are susceptible to occasional flooding.

³ Paraguayan law prohibits the clearing of trees within 100 meters of streams and lakes.

Land Use in Community of LIMA
(on western border of San Rafael Reserve)

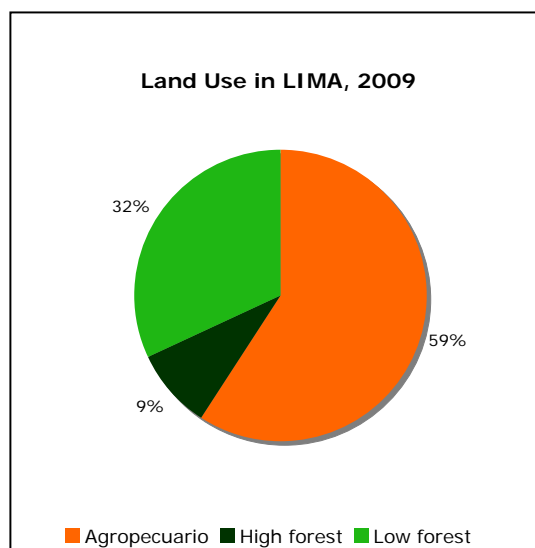
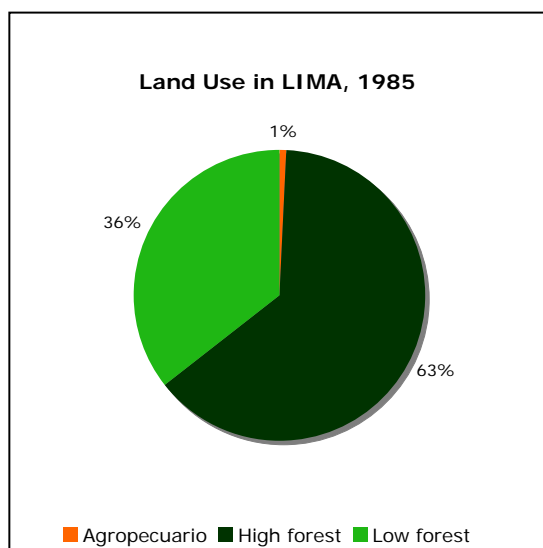
----- in hectares -----

	1973	1985	1994	2009
Agropecuario	0	20	1119	1482
High forest	1609	1592	605	222
Low forest	893	890	778	798
Total	2502	2502	2502	2502

----- in percent (%) -----

	1973	1985	1994	2009
Agropecuario	0.0	0.8	44.7	59.2
High forest	64.3	63.6	24.2	8.9
Low forest	35.7	35.6	31.1	31.9
Total	100.0	100.0	100.0	100.0

Source: See Annex 1, Maps 9 - 12



By 2009, nearly 60% of the area had been cleared and was in agropecuario use. Only 9% of the area remained with “high” forest, which remains susceptible to further deforestation. However, the “low” forest area, which mostly borders the Rio Tebicuary (see Map 12), has remained constant during the last 15 years, indicating that the “low” forest is not suitable for agriculture and is unlikely to be cleared in the future.

The progression of the above changes in land use can be seen by flipping through Maps 9 – 12 (slides 11 - 14) in Annex 1.

The inference from the above pattern of clearing is that once an area is opened for agropecuario use, all useful land will be cleared. (It should be noted that the deforestation in Lima complies with Paraguayan environmental legislation, which requires the maintenance of 25% of land area in forest. In the case of Lima, such compliance was probably more circumstantial than intentional, due to the considerable amount of unusable “low” forest (32% of total area) along the Tebicuary River.)

II - Land Use Trends in Settlement “La Amistad”

“La Amistad” (Friendship) is a settlement of about 80 previously landless *campesino* families who benefited from the Government’s program of land reform. It is the only settlement of its kind within San Rafael Reserve, although it is no longer technically part of the Reserve. It was purchased by the Government’s agency for land reform⁴ in the mid-1990s from a private landowner with land inside the Reserve and was settled in 1998.

La Amistad is situated on a 1,183-hectare finger of land that juts into the middle of the Reserve from the western border with the Tebicuary River, opposite to and contiguous with the afore-mentioned community of Lima. It is bordered on the north by the property “Guyra Reta” and on the south by a series of properties including Guyra Paraguay’s other property, “Canguery.” See Map 5 (slide 7).

The dimension of La Amistad is approximately 1 x 12 kms. In terms of suitability for land reform and in terms of environmental appropriateness, the choice of this property was unfortunate. Its shape is emblematic of the IBR’s previously ill-conceived policy of settling landless peasants in a linear pattern, stretched out along a road without proximity to basic social services such as schools and health clinics.⁵ The policy has since been changed to one of circular settlement with settlers living in a central community and their fields surrounding the center.

In terms of environmental impact, the choice was equally misguided. Until it was settled, the property was completely covered with natural forest and pastures (“*pastizales*”). It has since lost slightly more than one-half its forest cover, reduced from 61% to 28% of the area. In addition, the settlers are causing degradation of the Reserve’s forest on the neighboring properties. For these reasons, La Amistad is being considered for inclusion in the carbon sequestration project, to revert these tendencies.

The progression of land use change in La Amistad and the current socio-economic situation of the settlers are analyzed further in the following paragraphs.

⁴ The Institute for Rural Welfare (*Instituto de Bienestar Rural*, IBR), which was since transformed into the present Institute for Rural Development and Land (*Instituto de Desarrollo Rural y de la Tierra*, INDERT).

⁵ This policy supposedly originated during the Stroessner dictatorship, to limit the ability of the settlers to organize and possibly oppose the government.

When IBR established the settlement, it set aside about 540 hectares of *pastizales* and some high-ground forest in the western portion of the property as a common reserve and settled the families along a straight line going east deep into the forested area of San Rafael. Each of the 80 families was allocated approximately 8 hectares of land in parcels of approximately 80 x 1000 meters running north to south, each parcel with frontage on the dirt road that runs west to east along the northern boundary of the property.

The resulting pattern of settlement is best seen on Map 15 (slide 17), which shows land use in 2003, after the initial partial clearing of most lots. By this time, about one-third of the original forest had been cleared, and 22% of the entire area was in agropecuario use.

Forest clearing continued gradually during the subsequent six years, up through August 2009, at which time more than one-half of the original forest had been cleared (393 hectares of the original 726 hectares of high and low forest). As of August 2009, only 333 hectares of original forest remain, and 30% of the land was in agropecuario use.

Land Use in La Amistad
(settlement within San Rafael Reserve)

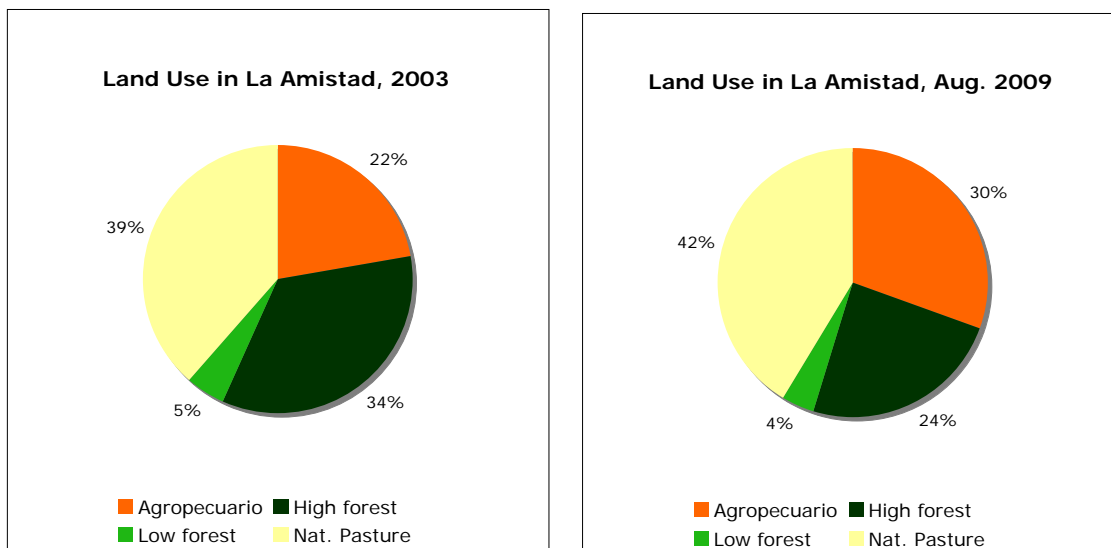
----- in hectares -----

	1997	2003	2008	Aug-09
Agropecuario	0	264	344	360
High forest	661	408	299	286
Low forest	65	54	50	47
Nat. Pasture	457	457	490	490
Total	1183	1183	1183	1183

----- in percent (%) -----

	1997	2003	2008	Aug-09
Agropecuario	0.0	22.3	29.1	30.4
High forest	55.9	34.5	25.3	24.2
Low forest	5.5	4.6	4.2	4.0
Nat. Pasture	38.6	38.6	41.4	41.4
Total	100.0	100.0	100.0	100.0

Source: See Annex 1, Maps 14 - 17



Of note, during the last six years, forest clearing occurred not only on the family lots, but also to some extent in the forested areas of the western common reserve – compare Maps 15 and 16 (slides 17 and 18). The clearing of forest in the western areas is believed to be due to a combination of illegal logging near the western entrance to La Amistad and informal settlement, i.e., additional families coming into the area that are not authorized by IBR / INDERT (discussed further below). The clearing of forest in the western common reserve also appears to account for the slight increase in the area of pastures during these years.

The progression of land use change in La Amistad can be seen on Maps 14 – 17 (slides 16 – 19).

Socio – Economic Conditions in La Amistad

As part of the background work for this project, a survey was made of the settlers in La Amistad.⁶ Of the 80 families on the original settlement plots, 62 responded to the survey, the others being absent or fearing a conflict of interest between Guyra Paraguay, which sponsored the survey, and other non-governmental organizations (e.g., CECTEC) that provide occasional technical assistance to the settlers.

The notable findings of the survey are:

- **Title to property.** Of the 62 respondents, only three families had paid IBR for their land, while three more had made partial payment. It is not clear whether the three

⁶ Informe Técnico de Encuestas “Colonia Amistad” (census of current settlers in Colonia La Amistad), prepared for Guyra Paraguay by Técnico Forestal Claudia Villasboa Giménez in August 2009.

families who had paid for their land had actually received title, but at least they were in conditions to do so. 57 families had paid nothing.⁷

- **Sale of lots.** 82% of the respondents (51 of 62) were original settlers from 1998. The others had “purchased” their sites by paying the original owners a mutually negotiated amount for their “rights” (“*derecheras*”) to the land, plus any improvements.⁸
- **Increase in number of settlers.** According to the neighborhood commission (“Comisión Vicinal, La Amistad”), the total number of families in the settlement increased to 107, with 27 new families occupying land in the western commons area. These squatters have no formal rights as do the original settlers, but are nevertheless accepted as part of the community.
- **Social services.** There are two primary schools (grades 1 to 6) in La Amistad. Electricity arrived two years ago, but some houses are not connected due to lack of funds to pay for the connection lines. About one-half of the settlers access drinking water via wells (40 meters deep), while the other half access water via springs and streams, sometimes entering the Reserve to do so. There is no health post in the settlement, something the settlers very much wish to have. The Comisión Vecinal is active and most settlers participate in occasional community projects.
- **Economic activity.** The settlers sustain themselves with activities for auto-consumption, including raising small animals (chickens, pigs, some cows) and rudimentary farming (maize, manioc, beans, sugarcane for molasses, etc.). Most settlers, nevertheless, have one to three hectares of commercial crops (cotton, sesame and/or soybean) that they sell for cash. The prices received for these cash crops are nevertheless below market due to the long distance and poor roads they must travel. Access to and exit from La Amistad is generally across the Tebicuary River via Lima to Caaguazú. Although not mentioned in the survey, a small sawmill is reported to operate within the settlement.
- **Use of San Rafael Reserve.** About one-third of respondents admitted to entering the Reserve from time to time. They do so to gain access to water, for both themselves and their animals, to wash clothes and to gather firewood.
- **Clearing of forest and remaining forest on family plots.** Paraguayan law permits settlers to clear up to 75% of their land.⁹ Most plots within La Amistad still appear to

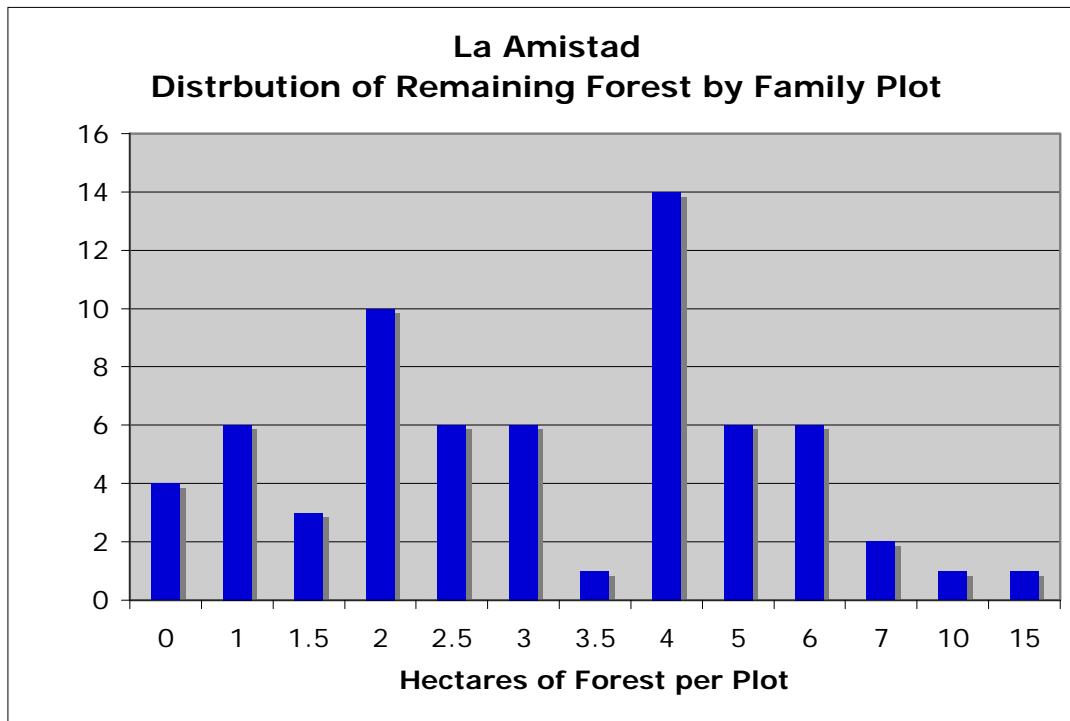
⁷ This result is typical of land reform in Paraguay. A 2001 census of IBR settlements (see Bibliography) found that only 5% of 38,600 previously settled families held title to their land. By law, land reform beneficiaries must pay for their land, in order to receive title. But as payment is rarely if ever demanded by the authorities, the vast majority of settlers occupy their land in an informal state unable to use it for collateral and without strong incentives for investment in their property. The price for the land is set at the fiscal value (the value for property tax purposes) at the time of settlement. But even at this artificially low price, estimated at only 2% of market value (World Bank, 2007), and even with the option to pay in installments, the common practice is to not pay.

⁸ Such transactions are illegal – the original beneficiary must occupy his plot for 10 years before the law permits sale – but the practice is commonplace in Paraguay.

⁹ The 2005 Law of Zero Deforestation does not apply to properties of 20 hectares or less.

have this required amount of forest – see Map 17 (slide 19). However, the settlers continue to have demand for wood for building homes, fences, tools and firewood. In view of the lack of control over this remote settlement, and the availability of forest resources just south of their plots in the San Rafael Reserve, there is no assurance and little incentive for them not to continue to clear the remaining forest on their land.

According to the responses to the survey, the average plot of land has 3.5 hectares of remaining forest. This result is somewhat distorted by the fact that there are two “larger” landowners who purchased additional lots from original settlers and declare to have 10 and 15 hectares of forest, respectively. Excluding these two, the average remaining area of forest is 3.2 hectares per plot. The distribution of remaining forest is shown in the following graph.



The total amount of remaining forest declared by the respondents to the survey, 228 hectares (see table on following page), is considerably less than the 333 hectares of high and low forest as measured by satellite imagery – see Map 17. This may be explained by the facts that i) the settlers who did not respond to the survey (18 of the 80 plot holders) are also likely to have remaining amounts of forest; ii) the respondents who did respond may have underestimated their actual forest holdings, and iii) the satellite imagery of the entire settlement area includes forest in the western commons, which would not be considered in the respondents’ answers.

The location of each of the survey’s respondents home is shown on Map 18 (slide 20), which also shows in graphic satellite imagery the incursion of La Amistad settlement into the heavily forested area of San Rafael Reserve.

La Amistad		
Distribution of Remaining Forest by Family Plot		
Remaining Forest (hectares)	Number of Families	Total Forest (hectares)
0	4	0
1	6	6
1.5	3	4.5
2	10	20
2.5	6	15
3	6	18
3.5	1	3.5
4	14	56
5	6	30
6	6	36
7	2	14
10	1	10
15	1	15
Total Remaining Forest		228

III – Likely Future Land Use Trends in La Amistad and Proposal for Joint Management of the Remaining Forest Resources

As alluded to in the preceding section, the expectation for future land use in La Amistad is for the settlers to use their existing forest resources to the full extent, given the absence of government control and the availability of high quality forest resources at their doorstep to the north and south of the settlement. This is similar to what happened to the “high” forest areas in the neighboring community of Lima, given the extensive amount of “low” forest that is not suitable for agriculture but which remains available as a wood source for the community.

Indeed, a few of La Amistad settlers have already cleared their land to the full extent possible down to the southern boundary – see Maps 17 and 18 (slides 19 and 20). At the rate of deforestation of the past six years (about 20 hectares of high forest per year), it could be expected that the majority of settlers would exhaust their own forest resources within the next 10 years and then put increased pressure on the San Rafael forest.

An alternative land use path would be to form an alliance with the La Amistad community to maintain their existing forest resources, and those of San Rafael Reserve as well, in return for payment for this environmental service.

Key elements for a balanced incentive scheme for sustainable forest management would include:

- i. Individual payments to settlers in proportion to the amount of forest they agree to maintain, since those with more forest would be sacrificing more than others who have already cleared their lands. These individual payments would need to reflect the opportunity cost of foregoing additional cash crop income, less the out-of-pocket cost of clearing the land (if any).
- ii. Individual payments to those who agree to reforest their land, in proportion to the area reforested and in relation to the amount of reforested biomass production vis-à-vis the biomass associated with maintenance of original forest (point i).
- iii. Payments to the community for maintaining pre-agreed targets concerning the density of forest cover and biomass. Community compensation would create a sense of community responsibility and moral pressure on all residents to participate in the program (e.g., by monitoring against illegal logging by others) and to avoid violating the norms (e.g., by not entering the San Rafael Reserve to prevent degradation). Community compensation could take several forms, e.g., i) payment to the Comisión Vecinal to finance community level projects, such as local road maintenance, installation or maintenance of a potable water scheme, or community based production projects, and ii) equal direct payments to all families in the community, so that all would gain some direct monetary benefit, even those without individual forest to be maintained or land to be reforested.
- iv. The provision of intensive technical assistance to improve agricultural productivity and raise farm incomes as an alternative to the expansion of existing low-productivity farming methods.
- v. The agreement on a sustainable level of wood off-take from both La Amistad and the San Rafael areas. The idea is not to prevent all use of the forest resource, rather to promote sustainable use consistent with the regeneration capacity of the forest.
- vi. Timely payment of compensation in a manner that will closely link payment with the successful completion of semi-annual or annual verification of project goals.

The amount and form of each type of compensation would need to be calibrated to the total amount of resources available to pay for these environmental services. They would also need to be discussed and agreed with the community.

>>> End

Bibliography and References

Dirección de Censos y Estadísticas Agropecuarias, Censo Agropecuario Nacional 2008, Resultados Preliminares

Instituto de Bienestar Rural (Institute of Rural Welfare), “Censo de Colonias 2001, Informe Final,” Asunción, Paraguay, Julio 2002.

Hansen, Peter M. and Edgar Rojas, “Land Use Trends in Paraguay and the Northern Chaco,” background paper prepared for World Land Trust and Guyra Paraguay, Asunción, Paraguay, August 2009.

Villasboa Giménez, Claudia, Informe Técnico de Encuestas “Colonia Amistad” (census of current settlers in Colonia La Amistad), prepared for Guyra Paraguay, Asunción, Paraguay, August 2009.

World Bank, “Paraguay – Real Property Tax, Key to Fiscal Decentralization and Better Land Use,” Report No. 37456-PA (in two volumes), May 16, 2007. Peter M. Hansen, principal author. Available on line at <http://www.worldbank.org.py>