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Improved Beef and Nature Tourism Feasibility Study in the Flooded Savannah

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Introduction **-** The development of the flooded savannahs depends crucially on the hydrology of the region and the impact of development on water management. Though hydrological research in the area is lacking, opinions vary widely as to the best way to develop the flooded savannahs.

Some, especially in the agribusiness sector, advocate setting aside a few natural areas for preservation of biodiversity and engineering the drainage of the rest to allow intensive crop production. Others with a focus on environmental preservation, advocate setting aside the whole area as a nature preserve. In the middle are those who are concerned with diversification of economic opportunities for Casanare and Arauca citizens away from petroleum, while at the same time preserving the natural beauty and resources characteristic of the area. There is a hypothesis that a combination of improved beef production and nature tourism would provide economic returns that rival those of the engineered drainage alternative, while at the same time preserving wildlife. Experience suggests that cattle and wildlife co-exist very comfortably in the flooded savannahs. Existing bird watching tourism could be expanded to include other agro and ecotourism activities. This feasibility study considers the economic potential for improved beef production and nature tourism to compete with more intensive agriculture.

Improved Cattle Production Activities in the Model **-** Most of the discussion of improved beef production in the flooded savannahs centers on reseeding the native savannah with improved forage grasses. However, farmers in the flooded savannahs often say that if properly managed rate of gain on native savannahs is higher than that on improved pastures. They say that while the improved forage grasses produce a greater volume of grass, the nutritional content of the native savannah grass is higher. One of the key practices for managing the native savannah is rotational grazing. If the

native savannah is grazed continuously it does not have time to recover and regrow. This preliminary analysis will specify an improved grazing cow-calf activity because that is the set of practices that have received the most attention, but one of the research needs is to understand if appropriately managed native savannah can be economically competitive as well as environmentally desirable.

The parameters for this preliminary analysis were gathered by the Purdue Team, especially Kevin Jerez, State University of South Dakota, from interviews with farmers in Casanare and Arauca. Unfortunately, because data collection in the Flooded Savannah was not foreseen in the original Purdue proposal, it was started late and resources were inadequate. There has been substantial research on grazing management in the flooded savannahs (see for example Alfanador, 2017; Mora et al., 2013; Munoz, 2016; Peñuela et al. 2014, 2011 and 2012), but not all of it has been absorbed in this analysis. Consequently, this analysis must be considered very preliminary.

Table 1. Estimated Direct Cost for Traditional Cow-Calf Production in the Flooded Savannahs, pesos/month

	Jan	Feb	Mar	Apr	May	Jun
Pasture Implementation	0	0	0	0	0	0
Fences	0	0	0	0	4000	4000
Fertilizer	0	0	75000	75000	0	0
Supplementary salts	4050	4050	4050	4050	4050	4050
Vaccines	0	0	0	0	843.75	843.75
Technical assistance	0	0	37.5	0	37.5	37.5
Vet Supplies		200			200	
Total Cost	4050	4250	79088	79050	9131	8931
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Pasture Implementation	0	0	0	0	0	0
Fences	0	0	0	0	0	0
Fertilizer	0	0	0	0	0	0
Supplementary salts	4050	4050	4050	4050	4050	4050
Vaccines	0	0	0	0	843.75	843.75
Technical assistance	0	0	37.5	0	37.5	37.5
Vet Supplies					200	
Total Cost	4050	4050	4088	4050	5131	4931

The DYNMOD simulation (Lesnoff, 2009-2013) was used for estimating the steady state herd dynamics and offtake. The estimated direct costs for cow-calf production on native grass is in Table 1. The stocking rate in Table 1 is 1.2 animals per hectare. Note that the cow-calf activity on native grass uses some fertilizer and has a relatively high stocking rate, so it does not represent the truly traditional cattle raising practices. Paddock size for grazing on native grass is assumed to be 100

hectares. On native pastures cattle are assumed to drink water from natural sources. For both native grass and improved pastures, fence costs are based on roughly square fields. The estimated costs for cow-calf production on improved grass is in Table 2. The stocking rate is 1.4 animals per hectare. On improved pasture cattle are assumed to have water provided. Paddock size for grazing improved pastures is assumed to be 25 hectares. The parameters used in the Orinoquia linear programming model are in Table 3.

The base line analysis assumes a farm of 639 hectares. This is the average of the UAFs in the flooded savannahs. The farm family is assumed to have 2 working adults. It is assumed to be in an isolated area with limited labor available, so labor is limited to 2 permanent year round workers and 10 days of temporary labor that can be hired each month. The wage for the permanent labor is assumed to be 8,853,000 pesos which is the legal minimum in Colombia. The wage for the day labor is assumed to be 50,000 pesos per day. Prices are: 5000 pesos/kg for cattle live weight, oil palm fresh fruit bunches 284,000 pesos per ton, and renting out land for rice production at 450,000 pesos/ha.

Table 2. Estimated costs of cow-calf production on improved pastures in the flooded savannah, pesos per month

	Jan	Feb	Mar	Apr	May	Jun
Pasture implementation	0	0	100000	100000	0	0
Fences	0	0	0	0	6095	6095
Water tanks	0	0	0	0	0	0
Waterpump (1100 l/min) 3"	0	0	0	0	0	0
Water system (pipelines, tanks and towers)	0	0	0	0	0	0
Annual maintenance cost of equipment	311	311	311	311	311	311
Lime input	0	0	19048	19048	0	0
Fertilizer	0	0	35714	35714	0	0
Supplementary salts ($/month)	4457	4457	4457	4457	4457	4457
Vaccines	0	0	0	0	929	929
Technical assistance	0	0	38	0	38	38
Vet Supplies		200			200	
Total Cost	4768	4968	159568	159530	12030	11830
	Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Pasture implementation	0	0	0	0	0	0
Fences	0	0	0	0	0	0
Water tanks	0	0	0	0	660	660
Waterpump (1100 l/min) 3"	0	0	0	0	262	262
Water system (pipelines, tanks and towers)	0	0	0	0	690	690
Annual maintenance cost of equipment	311	311	311	311	311	311
Lime input	0	0	0	0	0	0
Fertilizer	0	0	0	0	0	0
Supplementary salts ($/month)	4457	4457	4457	4457	4457	4457
Vaccines	0	0	0	0	929	929
Technical assistance	0	0	38	0	38	38
Vet Supplies					200	
Total Cost	4768	4768	4806	4768	7547	7347

If only the cow-calf activities are in the model and labor is limited, the solution is to use all 639 ha for the cow-calf activity on native savannahs. This solution has a net return of 719,940,000 pesos. In this solution 0.775 years of permanent labor is hired and temporary labor is binding in April and June when cattle are being branded, vaccinated and treated for parasites. The difference in

productivity between the traditional cattle production and the improved pasture system is small in this estimate and so the model choses the more traditional approach. More data is need on the relative productivity and cost differences among different cattle management options.

The net return on the UAF sized farm with cow-calf production is 719,940,000 pesos annually, which may seem like a high income to a campesino (farmer), but probably does not even cover the opportunity cost of land ownership. For example, if the land is worth 10 million pesos/hectare, then at a 20% opportunity cost of capital the opportunity cost of ownership is 1,278,650,000 pesos. At a land value of 7 million pesos per hectare the opportunity cost is 895 million pesos. The 20% opportunity cost of capital is a common target rate for medium scale agricultural investment in the Orinoquia region. For owner operated farms, if the farm business does not at least cover the opportunity cost of landownership, then there is motivation to sell to someone who will convert it to a higher return use. This motivation to sell becomes particularly strong when a new generation takes over. The older generation may have been comfortable and satisfied in a low profit farm setting, but the younger generation often has other aspirations.

If oil palm and rice rental are introduced into that limited labor model, the solution is unchanged. There is not enough labor to do anything else. If labor is increased rainfed oil palm enters the solution. With 1000 days of temporary labor per month and 100 permanent workers available, the net return with rainfed oil palm is 746,441,065 pesos annually. If both labor and 100 ha of irrigated land are available, irrigated oil palm enters the solution and the net return rises to 964,768,328 pesos.

Renting land for rice production enters the solution only when labor availability is very low. For instance, if only family labor is available, 255 ha are rented for rice production. In that case the net return is 552,370,000 pesos per year. Renting land out may also occur with older farmers who are no longer able to effectively work their land.

Table 3. Preliminary estimates of LP parameters for traditional cow-calf and cow-calf on improved pastures in the flooded savannah.

Months	Cow-calf on native grass			Cow-calf on improved pasture		
	Labor, person days per ha	Direct costs, 000 pesos per ha	Yield, kg of live weight per ha	Labor, person days per ha	Direct costs, 000 pesos per ha	Yield, kg of live weight per ha
Jan	0.05	4.05	40.5	0.05	4.77	45.6
Feb	0.05	4.25	27	0.05	4.97	30.4
Mar	0.05	79.09	13.5	0.05	159.57	15.2
Apr	0.09	79.05	13.5	0.09	159.53	15.2
May	0.09	9.13	13.5	0.09	12.03	15.2
Jun	0.09	8.93	13.5	0.09	11.83	15.2
Jul	0.05	4.05	27	0.05	4.77	30.4
Aug	0.05	4.05	27	0.05	4.77	30.4
Sep	0.05	4.09	13.5	0.05	4.81	15.2
Oct	0.05	4.05	13.5	0.05	4.77	15.2
Nov	0.09	5.13	27	0.09	7.55	30.4
Dec	0.09	4.93	40.5	0.09	7.35	45.6
Total	0.82	210.8	270	0.82	386.7	304.24

Introducing a Nature Tourism Activity – A nature tourism activity was specified based on communications with entrepreneurs operating nature tourism businesses in the Orinoquia and observations from visits to farms with nature tourism activities. This is a preliminary specification meant only to provide an initial test of how nature tourism and other agricultural activity might interact in the Flooded Savannahs.

Estimated labor, direct cost and visitor flow per month are in Table 4. It is assumed that the primary source of visitors is bird watching which occurs during the drier months when birds are attracted to the water sources in the caños and esteros. Consequently, the labor and direct cost is higher in the November to March period. This estimate is for about 75 visitors/month during the peak periods and 20 per month during the off season. This amount to an average of two or three visitors per day.

Table 4. Estimates from nature tourism entrepreneurs

Months	Labor, person days	Direct costs, 000 pesos/ha	Number visitors per month
Jan	2	5000	75
Feb	2	5000	75
Mar	2	5000	75
Apr	1	3000	20
May	1	3000	20
Jun	1	3000	20
Jul	1	3000	20
Aug	1	3000	20
Sep	1	3000	20
Oct	1	3000	20
Nov	2	5000	75
Dec.	2	5000	75

Table 5. Estimated LP parameters for nature tourism.

Months	Labor, person days per visitor	Direct costs, 000 pesos per visitor	Visitors per 0.25 hectare per month
Jan	0.027	66.7	1
Feb	0.027	66.7	1
Mar	0.027	66.7	1
Apr	0.05	150	0.267
May	0.05	150	0.267
Jun	0.05	150	0.267
Jul	0.05	150	0.267
Aug	0.05	150	0.267
Sep	0.05	150	0.267
Oct	0.05	150	0.267
Nov	0.027	66.7	1
Dec.	0.027	66.7	1

The Orinoquia model is focused on farming and allocation of land to crop and livestock production. Consequently, the nature tourism activity must also specified in terms of land use. Bird watching in the Flooded Savannahs does not use much land because in grazing systems the birds, cattle and other wildlife seem to co-exist, but some land is needed for the visitor housing and some areas around caños and esteros will probably need to be protected from cattle. A rough estimate is made that this would be about 0.25 ha per visitor per year.

The LP activity is specified in terms of labor and direct costs per visitor (Table 5). The labor and direct cost per visitor is greater in the off season because the time require for some tasks is similar regardless of the number of visitors. For example, cooking a meal for one visitor requires almost as much time as cooking for two or three.

Revenue per visitor is estimated at about US$100 per visitor or about 268,000 pesos. Some nature tourism entrepreneurs have lower rates for Colombian nationals, but it is assumed that in this case most of the visitors are international.

When the nature tourism activity is introduced into the model the oil palm and rice activities are suppressed in the model. It is assumed that bird watchers will choose places with a maximum bird population diversity and that they would prefer not to be close to industrial agriculture. The solution in this case is 432 hectares of land in the traditional cow-calf activity and 207 hectares set aside for the nature tourism activity serving 830 clients per year. The net return with the nature tourism option is 852,316,361 pesos per year. In this solution two permanent workers are hired, which is the maximum, and temporary labor is a binding constraint in April and June when cattle are being branded, vaccinated and treated for parasites.

If the nature tourism schedule is adapted to the farm schedule, returns can be increased substantially. For example, in the scenario above the binding constraint for labor is April and June during the cattle roundup. That is off season for the birdwatchers and relatively low profit for the nature tourism activity. If the nature tourism activity is suspended for April, May, June to allow the farm labor to focus on the roundup, the number of visitors per year rises to 1547 and net return rises to 1,340,637,019 pesos per year with the same limited labor supply. To achieve that return with oil palm would require availability of substantial additional labor.

Conclusions – This analysis considered the potential for improved beef production and nature tourism as a competitive alternative to more intensive crop agriculture on the flooded savannahs. In this analysis more intensive crop agriculture was represented by rice and oil palm. Unfortunately, because data collection in the Flooded Savannah was not foreseen in the original Purdue proposal, it was started late and resources were inadequate. Consequently, it must be considered a very preliminary analysis. When labor is very limited, the model shows that land is rented to rice production. If more labor is available the choice is the cow-calf production on native savannah. If labor is easily available oil palm enters the solutions. That oil palm is produced with irrigation if possible. When a nature tourism activity is available farm income can be increased while maintaining the flora and fauna. If the schedule of the nature tourism can be adapted to the beef production

schedule competitive incomes can result. Short comings of the analysis is that labor, cost and productivity data was not available to represent the full range of cattle production technologies and the data on nature tourism enterprises was rudimentary.

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