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Restoring degraded land

For farm modelling in the Animal Change project, Component 3
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Areas of natural vegetation and anthropogenic land in the Cerrado biome (Figure 1 and Table 1) , have incorporated over 54 million hectares of planted pasture, large parts of which are in some stage of degradation (Figure 2; Barcellos *et al.*, 2001;Sano *et al.*,2008).

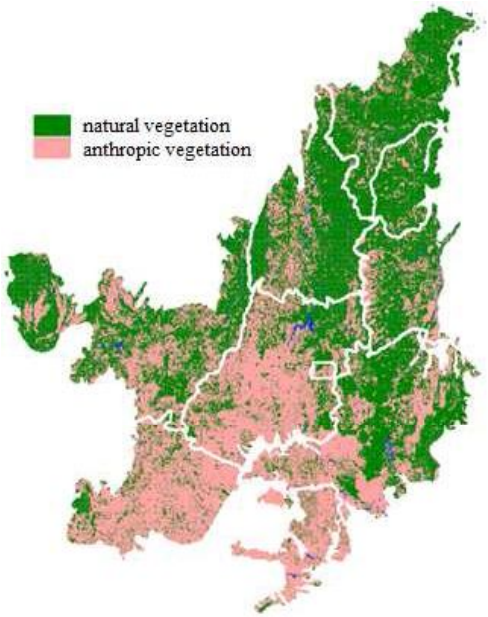

Figure 1 – Areas of natural and anthropic vegetation in the Cerrado biome in 2002. (Source: http://mapas.mma.gov.br/geodados/brasil/vegetacao/vegetacao2002/cerrado/documentos/relatorio_final.pdf

DISCRIMINAÇÃO DE ÁREAS OCUPADAS POR DIFERENTES CLASSES DE COBERTURA VEGETAL EM DIFERENTES REGIÕES HIDROGRÁFICAS DO CERRADO

Região Hidrográfica	Área Total (ha)	Cobertura Natural (Fisionomia)			Cobertura Antrópica		
		Florestal	Savânica	Campestre	Pastagem Cultivada	Cultura Agrícola	Reflorestamento
Atlântico Nordeste Oriental	12.608	12.229	0	0	0	0	0
Atlântico Sudeste	164.823	39.337	12.898	39.661	71.637	0	765
Atlântico Leste	3.324.836	258.122	1.412.885	754.958	343.246	58.354	488.169
Atlântico Nordeste Ocidental	12.477.471	9.382.857	1.762.400	59.606	1.190.119	57.629	24.947
Parnaíba	15.573.672	3.990.222	9.628.843	197.330	820.281	531.373	3.603
Amazônica	15.679.538	4.613.834	6.529.726	45.176	1.747.723	3.216.557	587
Paraguai	18.025.034	2.982.228	5.998.838	290.150	6.721.159	1.961.617	73.197
São Francisco	36.513.093	5.372.339	16.816.462	2.122.813	8.796.498	2.367.198	802.921
Paraná	43.013.213	4.361.310	4.626.543	1.687.526	19.739.907	10.022.347	1.743.860
Tocantins	59.865.603	9.308.907	28.553.023	2.822.305	14.636.989	3.277.530	27.606
TOTAL	**204.649.891**	**40.321.386**	**75.341.619**	**8.019.525**	**54.067.559**	**21.492.604**	**3.165.656**

Table 1
(Source: http://mapas.mma.gov.br/geodados/brasil/vegetacao/vegetacao2002/cerrado/documentos/relatorio_final.pdf)

Reviews on animal production systems that have incorporated pasture (planted and natural) areas have shown that traditional beef cattle production systems persist in Brazil in some regions because even with low (about 50 kg of meat/ha·year) productivity, their low cost makes them still competitive in economic terms as long as the price of land is low .

The production base is crucial for improving the technical and financial efficiency of such systems. This involves aspects such as: soil type, relief, climate, infrastructure (machinery, equipment, buildings, facilities), subdivisions of paddocks, types and conditions of fences, geographic location and logistics (road network access, proximity to consumer centers and suppliers of raw materials, and availability of service providers), and availability and quality of skilled labour. Stocking rate or grazing method and management practices are basic elements for better animal performance (Mendes Peixoto *et al.*, 2003;Silveira Pedreira, 2005;Carneiro da Silva *et al.*, 2009).

According to the agricultural subsidies analysis carried out by Nassar *et al.* (2009), in 2009 Brazil invested around 4% (US$ 56 billion) of the agricultural Gross Domestic Product as green box expenditure. At the same time the total amount available for the EU-15 was 12% (US$ 205 billion). Since then the Brazilian government has undertaken specific domestic initiatives to foster sustainable economic development while reducing GHG emissions.

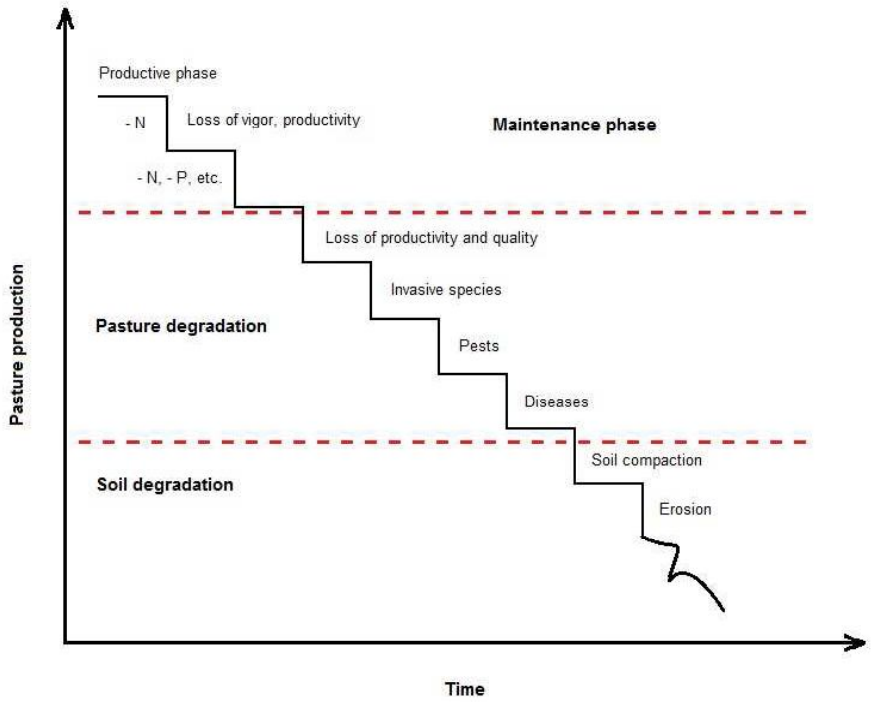

Figure 2: Dynamics of degradation of planted pasture. Adapted from Barcellos *et al.* (2001).

In 2011, the Brazilian Government established the ABC Low Carbon Agriculture Program aiming to promote technological changes in traditional beef cattle production systems and especially for restoration of degraded pastures by the incorporation of new grain crops (soybean and Phaseoulus beans) , cereals (such as: maize and sorghum) and trees (eucalyptus) into crop-pasture rotations. Basically, following environmental criteria, government-subsidized credit (R$ 4.5 billion) has been made available for investments and crop maintenance. Interest rates are very low (5% per year) when compared to the Brazilian capital market. In practice, however, the implementation of the ABC program has been limited due to complex environmental legislation and the bureaucracies that rural producers must face to obtain any agricultural credit in the local public banks.

Restoration of degraded pastures may be carried out directly (*i.e.*, removal of existing vegetation, incorporation of fertilizer and soil amendments and reseeding new pasture species) or indirectly (*i.e.*, through integration of crops and livestock, by cropping degraded lands for 1-3 years (with, *e.g.*, maize and/or soybeans) and then interseeding a new pasture with the last crop). In general, restoration of degraded pastures is best accomplished by the second method, as the direct restoration generally is not economically feasible because its high cost cannot be recovered through livestock production alone. Indirect pasture restoration, on the other hand, can be economically advantageous because income from the grain crop subsidizes the new pasture establishment. Cost-benefit analyses are complicated due to the almost infinite variations of crops, sequences and time periods that may be used. For simplicity, the values below would apply for direct restoration of degraded pasture, without the cropping component.

The restoration of degraded pastures in a traditional beef cattle production system located in the “Cerrado (savannah) biome, would require at least the following inputs to start a technically sustainable and ecologically sound beef production cycle:

Inputs

- Removal of weed species (including shrub regrowth); variable costs depending on state of pasture and technology used (*e.g.*, mechanical, chemical, fire).
- Lime (2 tons/ha, US$150/ha) – applied every 5 years.
- Phosphogypsum (CaSO4 - 500 kg /ha) – applied each 5 years.
- Fertilizer (300 kg 10-10-10/ha.year-1,+ FTE (80/1080),US$200/ha) applied in the first and the second years.However,the fertilization rate after the second year does not requireadditional FTE (Zn, Cu, B, Mn and Mo micronutrients). In the case of additional N application the urea fertilizer costs US$ 650/ton.
- Tilling ($90/ha) –every 5 years.
- Reseeding pasture species (20 kg/ha, US$120/ha + US$ 30/ha for sowing seeds) – applied every 5 years.

Outputs

- Increased stocking rate (1 AU*/ha to 3 AU/ha) (1 AU = 450 kg live weight)
- Increased individual performance (50 kg carcass eq/animal/year to 150 kg carcass eq/animal/year at US$3/kg carcass eq)

For small properties, after the first year, the reseeding and fertilization practices could be carried out by using the equipment shown in Figure 3 which requires less fuel than any tractor.

Figure 3: Low cost application equipment. Further information available at http://www.youtube.com/watch?v=I1IleF2-RPY

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