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Land Use Systems in Degraded Areas in the Western Amazon Region of Brazil

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In the Brazilian part of the Amazon region, extensive areas of land have already been deforested, either for the establishment of pastures or monoculture plantations, or by shifting agriculturalists. A major part of these areas are now degraded and/or abandonned.

There is an urgent need for the development of alternative land use forms for these degraded areas, which have to fulfill the requirements of being economically viable, and ecologically and socially sustainable. If this can be achieved, there is a chance of reducing the pressure on the remaining forest areas.

The presented research project is part of the German-Brazilian SHIFT programme (Studies on Human Impacts on Forests and Floodplains in the Tropics). Its objective is to collect information about the stability of several land use systems in a degraded area in Amazonia through the study of the development of soil physical and chemical properties and of the fluxes of water and nutrients within and through the systems. These investigations will contribute not only to the understanding of the observed variability of crop yields in such areas, but also to the prediction of their future development.

The following land use systems are under investigation: conventional pupunha (*Bactris gasipaes*) plantation, conventional cupuacu (*Theobroma grandiflorum*) plantation, and a complex agroforestry association with pupunha, cupuacu, castanha do Brasil (*Bertholetia excelsa*) and urucum (*Bixa orellana*). The soil cover is *Pueraria phaseoloides* in all systems except the pupunha monoculture, which tolerates little ground vegetation. Adjacent areas of primary and secondary forest are investigated for comparison.

In the present phase of the project, the spatial variability of soil physical, chemical and hydrological characteristics within the systems are under study. The measured parameters include: soil hydraulic conductivity, bulk density of the soil, soil texture and porosity, soil moisture (TDR), soil water potential and chemical soil fertility. Simultaneously, the development of crop yields, nutrient leaching, distribution of root systems, nutrient accumulation in the biomass, microclimate in different positions in the systems and phytopathological aspects are investigated.

The project simultaneously develops a system of extension of obtained results on the tested land use systems from on-station research to local farmers. This is either done through the direct information transfer by researchers involved in the on-station research, which at the same time develop extension activities in the area; or through visits from extension workers, governmental authorities, researchers from other institutions, students and farmers.

Natural Grasslands in the Comanche Microregion

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In the agricultural seasons of 1992-93 and 1993-94, a study was made about the character of the vegetation in 50.000 has of the Comanche microregion (Pacajes province of the department of La Paz); located ecologically, according to Gastó (1992), in a dry invernal grassland province, very cold with inter Andean steppes, at an altitude of 3850 to 4320 m.o.l.s., with an average annual precipitation and temperature of 562 mm and 10 °C respectively, a relative humidity from 38 to 52% and 114 days of frost per year. The work was divided into three phases: the first one was the cartography of land occupation (aerial photos scale 1:20.000) in order to determine the kinds of natural grasslands (NG's); in the second one, methods for the measurement of vegetation were calibrated being "*transect to point*" for the vegetal layer, "*double sampling*" and "cut" for the biomass of bland herbaceous of high and low layers respectively, "*referential*" for hard herbaceous and bushes, "*dimensional analysis*" for succulent species; in the third phase all the NG's were evaluated with respect of the vegetation at the end of the subhumid season (March-period of the highest active growth). 29 kinds of NG's were identified whose vegetation consisted of: *Gramineas* (20%), *Compuestas* (28%), *Leguminosae* (7%), *Cruciferasae* (6%), *Chenopodiaceasae* (3.5%), *Amarantaceae* (3.5%), *Umbeliferasae* (2.3%) *and others* (29.7). In the biomass, it was observed that **48, 30, 11, 4** and **7%** of the NG's had the respective ranges of **21-566, 567-1112, 1113-1658, 1659-2204, 2205-2750 kgMS/ha/year**, being their respective vegetal layers of **6-79, 54-74, 43-91, 74-94 and 53-58%**. By studying the two more important NG's, it was observed that the stocking rates for the ovines (W = 20 kg) and bovines (W = 270 kg) in the NG of Festuca dolichophylla and Calamagrostis vicunarum were of **1.6 and 0.52 UA/ha/year** with the respective forage ingestions of **0.20 and 2.10 kgMS/$W^{0.75}$/day**; in the NG of Muhlembergia fastigiata and Distichlis humilis the stocking rates for the same animals were **0.43 and 0.18 UA/ha/year** with the respective forage ingestions of **0.25 and 2.34 kgMS/$W^{0.75}$/day**. The pasturing period and the degree of land use were of **180 days and 85%** respectively.