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# Agricultural Mining in Ethiopia and Congo-Kinshasa

Marc J.J. Janssens & Jürgen Pohlan

University of Bonn, Institut für Obst- & Gemüsebau, Abt. Tropischer Pflanzenbau
Auf dem Hügel 6, D-53121 Bonn (Germany)
Marc.janssens@uni-bonn.de, Drjpohlan@excite.com, Fax: 0049-228-735764

## Abstract

Agricultural mining is the extreme degradation of available natural resources for the sake of yielding agricultural produce. Within each country the major cropping systems were identified at either provincial or regional level and quantified in terms of rotation cycle and nutrient balance. Major factors leading to agricultural mining both in Congo-Kinshasa and in Ethiopia are identified and compared. In the Congo-Kinshasa shifting cultivation is highly destructive of the environment. In Ethiopia, the human carrying capacity of land is competing with high animal stocking rates.

*Keywords: Shifting cultivation, slash and burn*

## Introduction

Agricultural mining is the extreme dilapidation of available natural resources for the sake of yielding agricultural produce by all means. Shifting cultivation, which used to be sustainable under low demographic pressure, becomes uttermost destructive of the environment as soon as the human carrying capacity is overtaken as can be seen in Congo-Kinshasa. In Ethiopia, the human carrying capacity is competing with high animal stocking rates, leading periodically into a dramatic dead-end. It was attempted to pinpoint the major factors leading to agricultural mining both in Congo-Kinshasa and in Ethiopia as well as estimating the extent of the latter mining at provincial or regional level.

## Methodology

Within each country the major cropping systems were identified at either provincial or regional level and quantified in terms of rotation cycle and nutrient balance.

## Results

Deforestation in Congo between 1961 and 1994 reached a yearly level of 300000 ha whose total mineral loss could suffice to fertilise the present cultivated land (5 473 900 ha) at a rate of 38.3 kg of N, 13.5 $P_2O_5$, 39.4 $K_2O$ and 18.6 MgO per ha (Janssens (Ed) 1998). On average, cultivation of fields will last three years (it varies from one to eight years), whereas the subsequent fallow will take seven years (it varies from two to 17 years). Land use intensity is 1.3 crops/year on average and the Ruthenberg coefficient 30%. Out of 10 years, seven years are needed to restore the fertility of a field (Table 1).

Table 1. Average farming system parameters (Estimates)

| Province | DC | DJ | DT | DC/DJ | LUF | R % | Cropping Intensity |
|---|---|---|---|---|---|---|---|
| Bas-Congo | 2 | 4 | 6 | 2:4 | 3 | 33 | 1.5 |
| Bandundu | 2 | 7 | 9 | 2:7 | 4.5 | 22 | 1.25 |
| Kasaï-Occidental | 3 | 6 | 9 | 3:6 | 3 | 33 | 1.25 |
| Kasaï-Oriental | 3 | 9 | 12 | 3:9 | 4 | 25 | 1.2 |
| Katanga | 4 | 6 | 10 | 4:6 | 2.5 | 40 | 1.1 |
| Kivu | 3 | 7 | 10 | 3:7 | 3.3 | 30 | 1.3 |
| Province Orientale | 4 | 9 | 13 | 4:9 | 3.2 | 31 | 1.3 |
| Equateur | 4 | 7 | 11 | 4:7 | 2.7 | 36 | 1.4 |
| Kinshasa | ** | | | | | | ** |
| Congo | 3 | 7 | 10 | 3:7 | 3.3 | 30 | 1.3 |

- DC= Cropping duration (years); DJ=Fallowing duration (years);
- DT=Total rotation duration (years); LUF= Land Use Factor = DT/DC;
- R= Ruthenberg Factor = DC/DT (%); ** see Bas-Congo

The whole Congolese farming system encompasses 16.8 Mio ha out of which 11.3 Mio are fallow land, 0.6 Mio permanent crops and 4.8 Mio under cultivation with rotating crops Table 2). Each year, 1.7 Mio ha are

Table 2. Development Scenarios for Congo

| Scenarios | Scena. 0 Theoret. needs | Scena. 1 Sedentary agricult. | Scena. 2 Shifting agricult. | Scena. 3 IPNS * 1989-90 | Scena. 4 IPNS * 2010 |
|---|---|---|---|---|---|
| Balance | | | | | |
| N ('000 t) | -118 | -96 | -66 | -14 | -135 |
| $P_2O_5$ ('000 t) | -36 | -28 | -18 | +6 | -31 |
| $K_2O$ ('000 t) | -118 | -94 | -68 | -4 | -126 |
| MgO ('000 t) | -32 | -23 | -29 | +11 | -21 |
| Cropping cycle | | | | | |
| DC * | 3 | 3 | 3 | 4 | 4 |
| DJ * | 0 | 1.3 | 7 | 5 | 5 |
| Ruthenberg (%) | 100 | 70 | 30 | 44 | 44 |
| Fallow (mio ha) | 0 | 2.4 | 11.3 | 8.4 | 8.4 |
| CIC * | 1.3 | 1.2 | 1.3 | 1.5 | 1.5 |
| Deforestation ha | 0 | 0 | 150000 | 0 | 0 |
| TLU (mio) * | 2.1 | 2.1 | 2.1 | 2.1 | 4.3 |
| Ha/TLU | 7.1 | 7.1 | 7.1 | 4 | 4 |
| Population (mio) | 35 | 35 | 35 | 35 | 70 |

- IPNS = Integrated Plant Nutrition System
- DC = cropping duration in years; DJ = fallow duration in years
- CIC = cropping intensity coefficient; TLU = tropical livestock unit

converted into fallow and the same acreage is reverted to cultivation necessitating a horrendous investment (waste ?) of human energy. Average farm size is 5 ha out of which 0.2 ha permanent crops, 1.5 ha rotating crops and 3.4 under fallow requiring each year 0.5 ha to be broken up, mostly with the help of burning, for a new rotation cycle. Each

farm comprises, on average 0.5 cattle unit, 0.2 sheep, 1.1 goat, 0.3 pig and 5.2 chickens and other birds. Yearly available farm yard manure does not exceed 1 t per farm. Seven years of fallow land will restitute about 74 units of N, 25.6 of $P_2O_5$, 77.9 of $K_2O$ and 27.7 of MgO in so far no bush fire will run through this fallow land, which is seldom the case. Yearly requirements for fertilisers amount to 15 units of N, 5.4 of $P_2O_5$ and 19.2 of $K_2O$ according to Stoorvogel & Smaling (1990). Estimations by Janssens (1998) are higher by 30% for Nitrogen, by 18% for Phosphorus and by 5% for Potash. Yearly fertiliser requirements, under present farming practices and excluding any further deforestation, are estimated at 260000 t of urea, 79000 t of TSP and 236000 t of K2SO4 (Table 2 ).

In Ethiopia, the environmental conditions permitted the adoption of large flocks of animals, including cattle, donkeys and horses. Cereal growing expanded both for human consumption and animal feeding. In the mean time fallow land reduced dramatically (Table 3). Of cereal fields grown in

Table 3. Frequency and Effect of Fallowing in Cereal Growing Areas of Ethiopian Highlands

| Crop | Maize | Teff | Wheat | Barley |
|---|---|---|---|---|
| Number of sites | 86 | 585 | 248 | 90 |
| Sites preceded by fallow (%) | 1.2 | 3.6 | 6.9 | 17.8 |
| Average Yield (kg/ha) | 3053 | 707 | 1251 | 1011 |
| Yield after fallow | 3550 | 597 | 1317 | 1125 |
| Fallow effect (%) | +16.3 | -15.6 | +5.4 | +11.3 |

the central highlands only 5.5% are preceded by a fallow whereas 77.2% are preceded by other cereals. Except for the South-Western part of Ethiopia, dung is generally processed into dung cakes (350-500 g/unit) which are then sold, mainly during the rainy season, as house fuel in the urban areas at about 4-5 cakes/Birr (Janssens 1994). Moreover, all the cereal straw and legume straw is removed from the field for animal feeding (Table 4). With the present human population and the animal

Table 4. Fertility Management Classes at Farm Level in the Ethiopian Highlands

| Preparation & Removal | | Dung cakes | |
|---|---|---|---|
| | | - | + |
| Hay/ straw | - | Exports minimised | |
| | + | | e.g. Northern and Central Highlands |

overstocking the system has ruptured. Each year, cereal imports are nearing to 1 Mio of t coinciding with 16800 t of Nitrogen, 9400 t of $P_2O_5$, 5700 t of $K_2O$ and 2000 t of MgO. The farming system of Ethiopia is further characterised by a very small proportion of permanent crops and a very limited acreage of leguminous crops.

## Conclusions and Recommendations

1. By implementing integrated plant nutrition systems (IPNS), as advocated by FAO (Dudal & Roy, 1995), fertiliser quantities would reduce to only 30000 t of urea. However, in the year 2010, with a population estimated at 70 Mio inhabitants, fertiliser requirements will be 295000 t of urea, 64000 t of TSP and 250000 t of $K_2SO_4$ if further agricultural mining is to be avoided.
2. Balancing the system in Ethiopia could be achieved by (i) preventing the use of dung cakes which also means finding another source of revenue for the poor farmer; (ii) increasing the acreage under permanent crops; (iii) increasing the leguminous fraction in the rotation; (iv) increasing the irrigated surfaces (from 1960 up to present, they only increased from 150000 ha to 190000 ha (FAO,2000)), and (v) avoiding overstocking.

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