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## **Production of animal protein in the Congo Basin, a challenge for the future of people and wildlife**

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### **Summary**

Protein needs are considerable in the Congo Basin, a vast territory dominated by forest and inhabited by tens of millions of people. Whereas over 85% of the DRC's population of the Basin live in the forest, the situation is different in other countries where the majority is urban (Cameroon, Central African Republic, Congo and Gabon). This paper presents several achievements of the Centre for Tropical Agriculture and Veterinary Medicine in Kinshasa (CAVTK), which aims since 2001 to conduct pilot projects in animal husbandry and agriculture, highlighting the skills of the Belgian universities, breeders and entrepreneurs. Different production runs are presented, going from the cattle ranching operations in Katanga, poultry breeding in Bas-Congo, through rabbits in Butembo, mini-livestock and insects.

### **Introduction**

The Congo Basin is a vast territory covering Angola, Cameroon, Central African Republic (CAR), Democratic Republic of the Congo (DRC), Republic of the Congo, Burundi, Rwanda, Tanzania and Zambia, dominated by forest and inhabited by tens of millions of people.

Whereas over 85% of DRC's population of the Basin lives in the forest, the situation is different in other countries where the majority is urban (Cameroon, Central African Republic, Congo and Gabon).

Depending on the vegetation and the climate, forests or commercial plantations where rain fall can go up to 4,000 mm/year and livestock and subsistence farming with rain fall below 750 mm/year are observed.

According to Tollens (2010), except in CAR and Equatorial Guinea, the agricultural sector in the Congo Basin countries has a dualistic character: large

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group of smallholder family farms vs. larger commercial plantations (Cameroon, Gabon and the DRC).

Protein needs are considerable in the Congo Basin. According to Fa et al. (2003), non-bushmeat protein (mainly crops or animal-derived products that include meat, seafood and fish) derives from domestic agriculture and from imports that vary from 6% of total supply in the DRC to 55% in the Congo.

The consumption of wildlife meat constitutes an important source of animal proteins for rural and urban population in Congo and, in some regions, becomes a component of the subsistence diet. In his remarkable book on edible wild products in the Democratic Republic of Congo, Malaisse (1997) describes the animal species concerned in the context of animal protein: large mammals, rodents, birds, fish, reptiles, caterpillars, termites and other insects.

For a better understanding of this protein contribution, a quantitative survey on the consumption of bushmeat was undertaken by Mbete et al. in Brazzaville during 2006, on about 1,050 urban households (Mbete et al., 2011b).

The survey's objective was to draw the profile of the bushmeat consumers and their motivations, to evaluate their consumption, to identify the most consumed mammals and to collect their perception of the microbiological quality of bushmeat as well as their perception of game-breeding.

The results of Mbete et al. (2011b) showed that the consumption of bushmeat concerned 88.3% of the households surveyed. The urban consumer is generally an educated adult whose average age is  $44.4 \pm 12.3$ . He has a permanent employment and has an average income of  $98,334 \pm 84,306$  CFA ( $150.1 \pm 128.7$  €). The average number of persons per household is  $5.7 \pm 3.2$ . More than 80.6% of the surveyed persons expressed a concern regarding food safety, more particularly targeting the threat of Ebola, and wished this concern to be handled by public health services.

Bushmeat is an attractive food for its good organoleptic qualities, but this appreciation has equally been influenced by social habits. The games are mostly mammals, belonging to three main genders: the Artiodactyls (49.3%), the Rodents (31.5%) and the Primates (14.0%). The increasing price of bushmeat, in an increasing impoverished population context, along with zoonotic diseases, such as Ebola hemorrhagic fever (mostly for primate consumers), have appeared as two main factors limiting the consumption.

With a daily bushmeat consumption per person about 180 g in Gabon, 50 g in Congo, 30 g in CAR and 20 g in DRC and Cameroon, whatever the location of the populations, biodiversity will be inevitably put in danger given the demographic growth in these countries. If agricultural alternatives fail to be developed, this loss of natural resource will be a threat to local populations themselves. The central part of the Basin would be more affected by this phenomenon.

A similar survey undertaken by Delvingt et al. (2002) in villages around the Dja reserve in Cameroon, the Odzala National Park in the Congo and Ngotto forest in the Central African Republic, revealed that the average bushmeat consumption varies between 80 and 160 g/person/day.

The fauna's overexploitation in the Congo basin appears as a crucial problem (Vermeulen and Doucet, 2006). Therefore, as suggested by Mbeté (2012), strategies aiming at guiding consumers towards other protein sources, or else, undertaking game farming or game ranching activities, must be promoted. It is also necessary to carry out awareness-raising campaigns among the bushmeat network actors, through participatory approaches in natural resources management.

Several solutions intended to maintain the supply of bushmeat: game farming, hunting control, market control, actions on prices, consumer education and livestock development.

### **Cattle, Sheep and Goat**

Cattle in the Congo Basin is essentially in the hands of large companies engaged in ranching operations over large surfaces. According to Mammerickx (1986), it is in 1886 that imported cattle from Angola and the island of Madeira, arrives on the island of Mateba (estuary of the Congo river). This is actually the start of the first cattle breeding operation in DRC leading to several thousands of heads of cattle in 1900 known as Mateba island cattle.

Later, given the presence of the tsetse fly, responsible for the transmission of trypanosomosis, imports of West African cattle led to the multiplication of N'Dama breed in Bas-Congo especially by the JVL, a company that is currently part of Orgaman group which also has operations in Bandudundu.

Cattle breeding was practiced later in several regions of DRC, particularly in Katanga (Grelco, Pastorale, Marungu, Kundelungu). Currently, the largest livestock company: Grelka (Grands Elevages de Katongola) of the Forrest Group (GFI) has 35,000 cattle of the Grelka breed of Afrikander origin and improved recently (2008) by Bonsmara cattle imported from South Africa. An experimental cross with Belgian Blue cattle was launched in 2008. Grelka operates in altitude on the Bianco plateau and produces castrated bulls, sold at 4 years old.

Cattle breeding is also observed in Gabon where the company SIAT continues the cattle ranching of the N'dama, Senepol crosses and Zebu Goudali imported from Cameroon.

In Cameroon, cattle is mainly located in the North (> 75%) and in the high altitude pastures of the Adamaoua plateau (15%).

For Tollens (2010), the only livestock encountered in the humid rainforest are sheep and goats. The author discusses the resilience and the adaptation of sheep and goat, the preferred livestock in the rainforest.

**Production of meat, milk and eggs, 1995-2007, Congo Basin, thousand tons**

	Meat		Milk		Eggs	
	1995	2007	1995	2007	1995	2007
Cameroon	180	221	183	189	13	13
CAR	89	118	50	65	1	1.2
DRC	212	157	7	5	9	6
Eq. Guinea	-	-	-	-	-	-
Gabon	28	32	1	2	2	2
Rep. of Congo	22	31	1	1	1	1

Source: The State of Food and Agriculture 2009, FAO, Rome, table A1, pp. 128-129.

From Tollens (2010)

**Production of pigs, poultry, cattle and sheep, 1995-2007, Congo Basin, thousand tons**

	Pigs		Poultry		Cattle		Sheep	
	1995	2007	1995	2007	1995	2007	1995	2007
Cameroon	12	16	21	30	73	92	28	32
CAR	10	13	3	4	48	74	8	13
DRC	28	24	13	11	16	13	23	21
Eq. Guinea	-	-	-	-	-	-	-	-
Gabon	2	3	3	4	1	1	1	1
Rep. of Congo	2	2	6	5	1	2	1	1

Source: The State of Food and Agriculture 2009, FAO, Rome, table A2, pp. 133-134.

From Tollens (2010)



Bonsmara Cattle – Grelka (Forrest Group) Bianco, Katanga, DRC, Picture P. Leroy 2008



N'Dama Cattle – Compagnie JVL- Kollo- Bas Congo, DRC,  
Picture P. Leroy 2010

## **Alternatives to poaching**

### **Mini-livestock**

As indicated by Hardouin (2005), the concept of mini-livestock is accepted as a normal tool and component for rural development in the tropics. Knowledge in the mini-livestock sector is organized by BEDIM, an international nonprofit organization located in Gembloux and dedicated to the collection, processing and dissemination of information on animal species under the mini-farming and the use of their products.

In the context of mini-livestock, the Grass cutter (*Thryonomys swinderianus*), the African brush-tailed porcupine (*Atherurus africanus*) and the Cricetomys were studied in several countries of the Congo Basin.

The African brush-tailed porcupine (*Atherurus africanus*) is the wild rodent preferred by bushmeat consumers of the Congo Basin and especially in Gabon (Edderaï and Houben, 2002). It thus constitutes a source of proteins for urban dwellers and a source of considerable income for actors involved in this value chain. Indeed, the insatiable demand of the urban centers encourages the inhabitants of forest to engage in the poaching and marketing of this species. After having shown the general characteristics of the species, Mondï Ikobo et al. (2013) review the current data on its reproduction, nutrition and diseases. The aspects relating to the consumption and the marketing are also discussed.

Several characteristics of the different species were given by Jori (2001)

	Grass cutter	Atherus	Cricetomys
Adult weight	3	2.8	1.3
Gestation length (d)	150	120	30
Birth weight (g)	120	135	20
Litter size	4	1	3.5
Litters / year	1.8	2.3	6
Slaughter weight (Kg)	3.5	3	1.5
Killing out %	65	6.7	52
Sexual maturity (Kg)	1.5	2	0.6

### Small scale farming

The interest of mini-livestock and small scale farming is not only to meet the needs for animal protein but it shows also advantages in the socio-economic characteristics of its production. Thus, it has a particular role to play in poverty alleviation. Indeed, they constitute a sustainable alternative for meat production, for several reasons. First, they require little investment and are, for this reason, low-risk activities while generating steady income. This steady income they provide is especially valuable in contexts where financial services are lacking and where social and own economic pressure to spend the money available are high. Most of these species require less space than larger species and are thus accessible to poor households, including those that do not own any land. For the same reason, it constitutes a viable urban or periurban activity. In addition, technical management and monitoring of these types of livestock are accessible to most stakeholders. As a result, a traditional gender-bias is observed in most cultures, explaining the major involvement of women in such activities. This is an opportunity to use the promotion of such mini-livestock in the empowerment of women inside communities. Lastly, backyard poultry, sheep, goats, pigs, rodents (grasscutter), lagomorphs (rabbits), insects, snails and aquaculture are generally prone to enter short supply chains that ensure a maximal part of the value-added to be kept at the level of the farmer.

In the survey by Moula et al. (2012c) among poultry-keeping households in Bas-Congo (DRC), besides poultry, the other species raised were goat, guinea pig, sheep, duck, rabbit and pigeon (see table here below). Those households also cultivated the following crops [Cassava (pondu, saka-saka) (100%), Vegetables (tomatoes, onion, peppers and eggplant: 100%), Corn (84.4%), Peanuts (81.8%), Beans (57.1%), Soybeans (54.5%), Sweet potato (37.7%), Yams (31.2%), Sesame (26.0% ), Millet (13.0%), Okra (10.4%) and Coffee (5.2%)].



Species	Farm (%)	Number of animals			
		Mean	Median	Maximum	Minimum
Goat	44.2	3.47±3.19	3	16	1
Guinea pig	20.8	8.37±6.36	7	23	2
Pig	13.0	4.50±2.69	2	12	1
Sheep	7.79	3.83±2.14	3	8	3
Duck	7.79	8.67±3.82	9	11	5
Rabbit	7.79	3.83±2.14	3	8	3
Pigeon	2.60	8.00±1.41	8	9	7

## Backyard poultry

Indigenous chicken breeds contribute significantly to the world production of meat and eggs (Moula, 2012a, 2012b). They are mainly raised as backyard poultry, and represent 80% of the world poultry population. However, the majority of these breeds has not been recorded and studied (Besbes, 2009). About 40% of poultry breeds have an unknown risk status. Hence, considerable efforts are necessary to evaluate them (FAO, 2008).

Backyard poultry refers to low-input production systems, with a financial or social role rather than being a true income-generating activity. Poultry is then often part of a diversified livestock portfolio, as highlighted here above. Women or children are often in charge of the management of the flock, as highlighted by Moula et al. (2012c) in their survey in Bas-Congo, where women were in charge of poultry breeding 42.9% of interviewed households. In the same survey, interviewed farmers stated various rationales for keeping poultry. The main reasons are meat (45.5%) and tradition (59.7%). The reasons to prefer the indigenous breed were the organoleptic quality of chicken meat and eggs (15.6%), the toughness and resilience (53.3%) and the ease of breeding (75.3%).

Still according to Moula et al. (2012c), concerning feed and feeding systems for chickens in Bas-Congo, 77% of the farmers provided supplementary feeding to their chickens, as e.g. kitchen leftovers (65.5%), or crops residues (94.2%). 10.4% of chicken breeders used a nutrition formula (50% of corn, 30% of soya and 20% of manioc (10% of leaves and 10% of spuds)), that had been suggested by a locally active NGO. 23% of the farmers do not feed them and the animals collect their feed in their environment (insects, worms, grasshoppers, larvae, grass, crops...). The majority of backyard chicken keepers provided water to the birds (79.2%). The mainly cited constraints on the productivity of family-based poultry are predators (93.5%), diseases (80.5%), expensive chicken feed (22.1%) and theft (26%).



Ardenaise poultry breed in Kinshasa, CAVTK project, Picture P. Leroy 2008

Households in the Congo Basin generally practice the farming of indigenous chicken as a secondary activity. It is part of a wider livelihood strategy, with a diversification aiming at risk management. Therefore, the contribution of this activity to food security is already effective and crucial. Basing further improvement of food security, in terms of quantity and quality of the diet, on that production could be achieved in two ways. One would fully accept the status of side activity of poultry keeping and maintain the improvement actions in the strict framework of low-input systems. Such actions could then apply to all chicken-keeping households. Vaccination is an example of such actions, as recently implemented by the Centre for Tropical Agriculture and Veterinary Medicine in Kinshasa (CAVTK) in Bas-Congo. Another way might be of interest to only part of the presently involved actors. Indeed, some actors might engage in some professionalization aiming at income generation through the sale of poultry products. Particularly women would then organize themselves to improve their production systems and gain access to information, inputs, financial services and outlet markets.

### **Rabbits**

Rabbit breeding has several advantages. First, there is an overall cultural acceptance of its consumption (apart from the Adventist religion). Then, the investment and labor in rabbit breeding are relatively inexpensive. Furthermore, it can be run on small surfaces, allowing for its practice in (sub-)urban settings. Finally, rabbits are good converter of crop residues, weeds, waste of fruits and vegetables.



In Butembo, in the East of DRC, rabbit breeding was chosen as part of a strategy for the development of urban agriculture to improve food security in a context of military conflict and presence of a large refugee population (Vumilia Kasuki, 2013).

Nevertheless, rabbit is known for its susceptibility to poor hygiene, heat and well-identified infectious diseases. Hence, the training of the new practitioners is an important step to ensure the sustainability of such actions. The monitoring by veterinarians and a close technical assistance to newcomers are also essential.

## Guinea pig

The Guinea pig (*Cavia porcellus*) is a small herbivorous rodent originating from the central highlands of the Andes where they were domesticated for their meat and their population estimated at 36 million (Ngou Ngoupayou et al., 1995).

As indicated by Hardouin et al. (1991) and Bindelle et al. (2007), low productivity of the Guinea pig in tropical Africa is essentially due to a lack of management.

According to Bindelle et al. (2007), in Africa, only limited research has been carried out in Cameroon to improve the traditional rearing and feeding systems.

In *Troupeaux et Cultures des Tropiques*, the thematic publication of the Centre for Tropical Agriculture and Veterinary Medicine in Kinshasa (CAVTK), Nkidiaka et al. (2004) studied the urban and periurban practices in Kinshasa where Guinea pigs are raised by 7% of the people keeping farm animals at home, representing around 30% of the families in the periurban area.

In the same thematic publication of the CAVTK, Bindelle and Picron (2012) described the main reproduction characteristics: puberty in male (3.5 month), female (1 month), estrus cycle (15 days), gestation length (2 month), reproduction interval (65-80 days), gestation length (2 month), weaning (21 days), litter size (3), age at adult weight (5 month), culling after 6 litters, life time (5 years).

The productivity is mainly influenced by the reproduction cycle length, partly influenced by the farmer, and by the management.

In Cameroun, the liveweight of Guinea pig reaches around 350 g with a dressing out percentage of 70% (Niba et al., 2004). Higher values were obtained in the Andes and also in Kivu (DRC).

Regarding nutrition of the Guinea pig, a combination of *Panicum maximum* with *Desmodium intortum*, *Euphorbia heterophylla* or *Amaranthus hybridus* was suggested to the farmers in a recent study conducted by Bindelle et al. (2007).

In a huge selection experiment involving 202 sires, 718 dams and 3,192 progeny Quijandria et al. (1983) found a value for heritability ( $h^2$ ) of 0.17 for the weight at 13 weeks. Higher values were found by Vaccaro et al. (1968) and Dillard et al. (1972) cited by Quijandria et al. (1983). The results illustrate the potential of selection for live weight and less possibility for litter size.

The live weight of the Guinea pig can reach values as high as 2 kg indicating a potential to be exploited by genetics and selection.

Kampemba and Hornick (2013) studied the effect of forage source on levels of copper and zinc in various samples from growing guinea pig in Lubumbashi (DRC). The preliminary results indicate that the concentrations observed in edible fractions appear to be safe for human intake. Nevertheless, caution should be taken when consuming the liver owing to its tendency to accumulate metallic trace elements.

## Insects

As indicated by Malaisse (1997) and relayed by Nsevolo (2012), insects are reliable and sustainable sources of high-quality animal protein. The availability of these valuable sources of protein fluctuates significantly and is totally dependent on seasonal variations (Mapunzu, 2002; cited by Nsevolo, 2012).

Malaisse (2005) considers some 104 families distributed in 14 orders in human consumption of insects. In his work on the consumption of Lepidoptera (mainly caterpillars), Isoptera (termites), Orthoptera (locusts, grasshoppers, crickets) and Formicidae (ants), relaying the survey of Gomez (1988) concerning insect consumption in Congo, the author indicates that it represents more than 40% of animal proteins in some parts of the country and that around Brazzaville, 40 g dry weight smoked caterpillars are consumed per day and in other parts of the continent values of 30–50 dry weight of insects per person per day, mainly caterpillars, are not at all rare for several months.

In Bas-Congo, according to Latham (2002), gathering caterpillars is a seasonal activity, taking place in the rainy season. The author indicates that dried caterpillars contain 52.9% of proteins, 15.4 % of fat, 16.9 % of carbohydrates and a significant amount is exported in Europe (France and Belgium).

Entomophagy could become a challenge with a balance between consumption and conservation in the context of a sustainable production of insects.

In the recent study of Nsevolo (2012), the 11 insect species consumed in the city of Kinshasa showed a great variability in protein, with highest value being found in Isoptera ( $74.76 \pm 0.78\%$ ), followed by Orthoptera ( $69.48 \pm 0.46\%$ ) and the nine species of Lepidoptera (Notodontidae and Attacidae) ( $60.29 \pm 4.7\%$ ).

## **Production of animal feed**

Feed production is a major limiting factor of the development of animal production. If many smallholders primarily rely on self-produced crops or residues, the access to quality feed becomes crucial when it comes about to developing commercially viable structures. Regarding the different productions presented in this paper, this aspect is all the more true in the case of poultry production.

In Cameroun, the poultry sector seems to be the most developed animal sector but lived difficult times since decolonization. The Douala-Banga, Mvog-Betsi, Nkounden state poultry stations were merged but stopped their activities due to the consequences of the Structural Adjustment Programme. As a result of this long history of a large-scale poultry production, the country has a feed mill tradition since many years. At present, 33 enterprises are involved in the agro-industrial sector, allowing for economic competition between them.

On the opposite, in DRC, the MIDEMA feed mill in Matadi is the only one producing animal feed. According to Tollens and Huart (2006), imports of wheat and wheat flour, rice, corn, sugar, beef, chicken, pork, fish such as "chinchard" (mackerel) and vegetable oil, continue to grow, but unfortunately the imported products are of lesser quality. The price of frozen "chinchard" (mackerel) imported of 1 USD/kg is to be compared with the local fish (5 USD/kg).

## **Conclusion**

The demand for animal protein is significant in the Congo Basin. Because of demographics, this demand is growing. Considering that the consumption of bushmeat is an important source of protein for the rural and urban populations, this growth puts wildlife under strong pressure. The various measures for alleviating that overexploitation, as breeding of wild animals, control of hunting and education, are not likely to restore the lost equilibrium.

In this context, we must mobilize and provide sustainable and innovative solutions for the shortfall in protein. To achieve the expected results, applied research, development and extension are made in pilot farms promoting appropriate technologies in the context of a comprehensive approach to animal productions incorporating animal nutrition, health, genetics and selection, environment and management.

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