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Original Research Article

Possibilities of Using Essences Alstonia Congensis Engler, Cynometra Hankei Harms, Cynometra Sessiliflora Harms (De Wild) Lebrun and Milicia Excelsa (Welw.) CC Berg Based on the Analysis of Vulnerability: Case of the Biaro Forest (Ubundu, DR Congo)

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Abstract

A study was carried out in the Biaro forest to determine the vulnerability index of the species Alstonia congenis, Cynometra hankei, Cynometra sessiliflora and Milicia excelsa. Over an area of 50 hectares; 526 trunks of Alstonia congensis, 87 trunks of Cynometra hankei, 482 trunks of Cynometra sessiliflora and 482 trunks of Milicia excelsa were identified by the method of mesuring the diameters of these trees. At the end of the results, all these four species are declared vulnerable in this Biaro forest.

Keywords: Study, Vulnerability, Plant species, Biaro forest.

I. INTRODUCTION

Tropical rain forests are plant formations where the crowns of trees and shrubs touch each other. These dense evergreen forests hold an important place at the local, national and international level. They render ecosystem services among which the services of supply to the populations by the various vital products, namely; food, medicines, fibres, fresh water, ornamental resources, energy (Golley, 1983; Fao, 1985; Pelissier *et al.,* 2001). They offer cultural services which are leisure, aesthetic and spiritual values, tourism and fulfill artisanal functions in the daily life of populations (FAVQP) (Buttoud, 1991a; Goodland, 1991; Ake, 1992; Fairhead; Leach, 1994; Doucet *et al.*, 1996).

In the majority of tropical countries, forests constitute a financial resource obtained from the tropical timber trade, representing about 10% of world trade, i.e. more than six billion US dollars per year (Fao, 1987; Sodefor, 1988; Buttoud, 1991b; Garba-Lawal, 1993). The World Bank quoted by Greenpeace (2007) suggests that the Congolese forestry sector can reach production levels of five million m^3 to bring in one hundred million dollars per year to the State.

In Democratic Republic of Congo (DRC), these forests are threatened by illegal logging that does not comply with reduced impact logging standards (NEIR) on the forest environment or with minimum logging diameters (DME) set by the forest administration, by industrial agriculture due to the installation of vast plantations such as in Brazil with rapeseed or in Indonesia with oil palm, by various quarries of precious materials, by shifting agriculture on burns ensured by a galloping and idle demography in the rural areas as well as by the wars in the East of the country which cause an influx of refugees.

It is really imperative to understand how tropical forests work in order to better manage and preserve them. Timber production is linked to the diametric population structure (DPS) which is favored by ecological conditions.

This study is based on the diameter structure of species intended for the manufacture of boxes, coffins, tamtam (case of Alstonia congensis); the production of embers and their use in carpentry (making chairs, tables and cupboards), in carpentry, in the construction of bridges (case of Cynometra hankei and Cynometra sessiliflora); in cabinetmaking, carpentry (manufacture of chairs, cupboards, showcases, doors and windows) and for the manufacture of parquet floors (case of Milicia excelsa) by the populations living near the Biaro forest.

The species having a high annual growth present before the second rotation a good number of individuals likely to be exploited for the uses mentioned above. Thus, species with low annual increment will have fewer individuals and may become vulnerable if not managed rationally. SODEFOR (1988) requires studies of the vulnerability of species in habitats declared disturbed.

II. METHODOLOGY

An inventory of the individuals of these species was carried out in the 50 ha device in the forest of Biaro where the anthropic action is obvious. The diameter measurements of all these individuals were also taken at 1.3 m from the ground. The vulnerability of these species was analyzed using the following formula (SODEFOR, 1994).

- $\text{Iv} = \frac{(\text{N0}\ (1-\Delta)(1-\alpha)\text{T}}{\text{NP}} \times 100$

VI= Gasoline Vulnerability Index (in percentage)
VI>50 = Essence not vulnerable
VI<50 = Vulnerable Essence
No = Cumulative number of individuals between the Minimum Diameter of Exploitation and that obtained from AAM x T
Δ= Mortality rate (fixed at 0.1)
α= Gasoline damage rate (fixed at 0.01)
T= Rotation or Transition time between two farms (25 years)
Np= Cumulative number of gasoline individuals with DME available

III. RESULT AND DISCUSSION

The numbers of individuals of these four species are listed according to their diameter classes presented in Table 1.

Table 1: Number of individuals by diameter classes

Species diameter classes	Alstonia congensis	Cynometra hankei	Cynometra sessiliflora	Milicia excelsa
10 – 19.9	38	8	140	137
20 – 29.9	57	23	88	98
30 – 39.9	69	19	69	66
40 – 49.9	58	8	43	32
50 – 59.9	100	5	41	36
60 – 69.9	56	9	28	18
70 – 79.9	44	4	23	22
80 – 89.9	27	2	14	21
90 – 99.9	32	1	23	22
100 – 109.9	30	2	3	11
110 – 119.9	4	6	0	7
120 – 129.9	4	0	5	8
130 – 139.9	5	0	4	1
140 – 149.9	1	0	1	0
150 – 159.9	1	0	0	3
TOTAL	526	87	482	482

Table 2 presents the vulnerability values of these four forest species in Biaro.

Table 2: Vulnerability values of the species studied

Species	AMA	EMD	AAM × T	EMD – (AAM×T)	N_0	Np	VI (%)
A. congensis	0.5	60	12.5*	47.5	284	526	40
C. hankei	0.7	60	17.5*	42.5	55	87	47
C. sessiliflora	0.5	60	12.5*	47.5	241	482	37
Mr excelsa	0.5	80	12.5*	67.5	272	482	42

Legend: * The number of individuals N_o is considered from the upper class (class 2 Up to pre EMD class) for all four species. AAM= Average annual growth of gasoline (in cm). AMA=Average minimum rate. EMD= Diameter Minimum of Exploitation.

From this table, it should be interpreted that all four species are declared vulnerable. This is explained by the low vulnerability index obtained for Alstonia congensis (40%), Cynometra hankei (47%), Cynometra sessiliflora (37%) and Milicia excelsa (42%).

When the importance of different uses related to these species is taken into account, they are less representative in the delimited area (50 ha) to carry out this work. This implies that local populations irrationally exploit these four forest species. PINTO and GEGOUT (2005) confirm that the more useful a forest species is, the more vulnerable it becomes in its environment.

Biaro forestis a replacement forest succeeding the forest regrowth which is destroyed by the populations carrying out pastoral activities.

Maitre *et al.*, (1985), Locatelli (1996) affirm that forest environments undergoing clearing are depopulated of their original vegetation, in particular woody plants and other useful species.

IV. CONCLUSION

The study of the vulnerability of Alstonia congensis, Cynometra hankei, Cynometra sessiliflora and Milicia excelsa species of the Biaro forest in relation to their uses by local communities obliges us to:

- Preserve the individuals of these four species in this Biaro forest;
- Apply the sustainable exploitation policy by respecting the exploitation standards set by the forest administration in the Democratic Republic of Congo in order to safeguard these threatened species.

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