What Fiscal Policy for a Sustainable Management of Forest Resource in Cote d'Ivoire?

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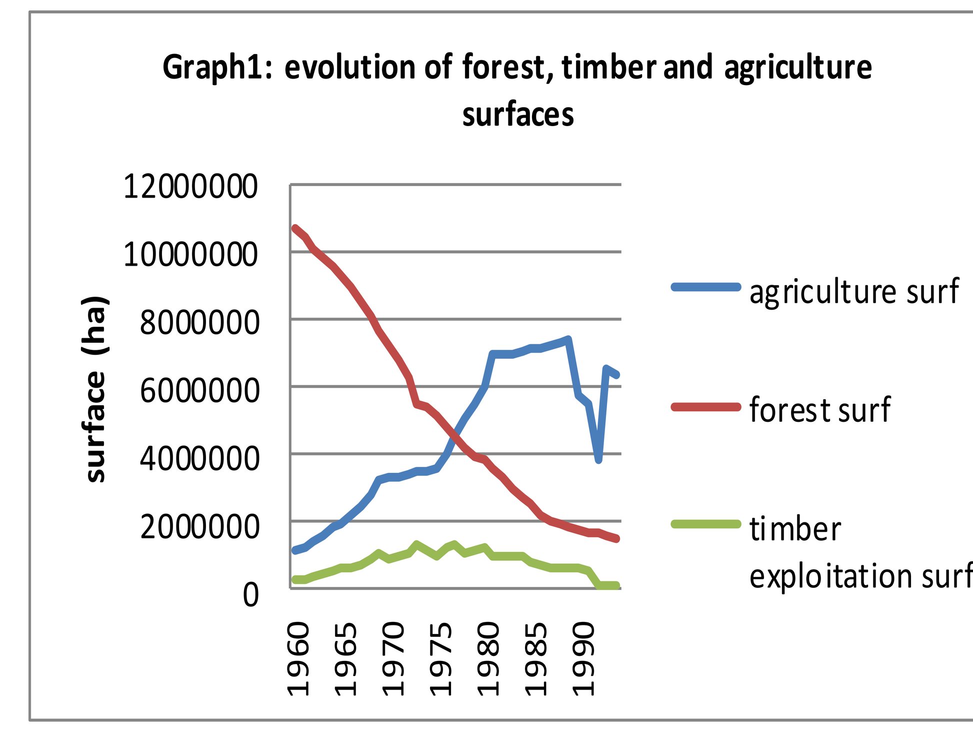
Introduction

The economic development of Côte d'Ivoire is linked to the exploitation of its forest which, in addition to the quality of its woods, provided fertile land and climatic conditions for agricultural development. However, the forest sector is extremely alarming today. Indeed, the Ivorian rainforest was covering a surface of 16 million hectares at the beginning of last century but it represents less than 2 million today. In general, the decrease in the forest cover is the result of an exploitation condition that is not sustainable. Indeed, the rate of forest exploitation (250000ha/year) largely exceeds its natural growth rate and even the rate of reforestation (5000ha/year). However, various political reforms (tax reform in 1990, forest plan formulated in 1988 over the period 1988-2015,...) that have been implemented so far did not mitigate the forest depletion tendency. Moreover, the forest tax reform of 1990 did not lead to the expected results concerning the sustainable management of the forest. Indeed, instead of giving incentives to forest harvesters to behave in the sustainable way, the tax reform resulted in government revenue rising. Consequently, the forest cover continues to be degraded (graph 1). Therefore, this paper researches strategies that insure the sustainable management of Ivorian rainforest. To achieve this objective, we set up an intertemporal model for optimal allocation of forest land to competitive uses (agriculture, timber, wood energy, conservation) through the optimal control techniques.



Results and discussion

We distinguish two cases according to whether ecological balance is threatened or not.

Case 1: normal situation

. Farmers $$\frac{R_1'(x_{1t}^*)}{(1+r_0)^{t-1}} = \lambda_{1,t}^* + (1-\alpha_1)\lambda_{2,t}^*$$

This equation establishes the optimal allocation rule of forest land conversion to agriculture. Indeed, the optimal rate at which the forest land should be converted to agriculture corresponds to the maximum benefice deriving from this activity after accounting for social opportunity cost. This cost comprises: the private cost (set to zero in this study), the user cost and the cost of damage (externality)

. Forest harvesters $$\frac{R_2'(x_{2t}^*)}{(1+r_0)^{t-1}} + \alpha_2\lambda_{2t}^* = \lambda_{1t}^* + (1-\beta)\lambda_{3,t}^*$$

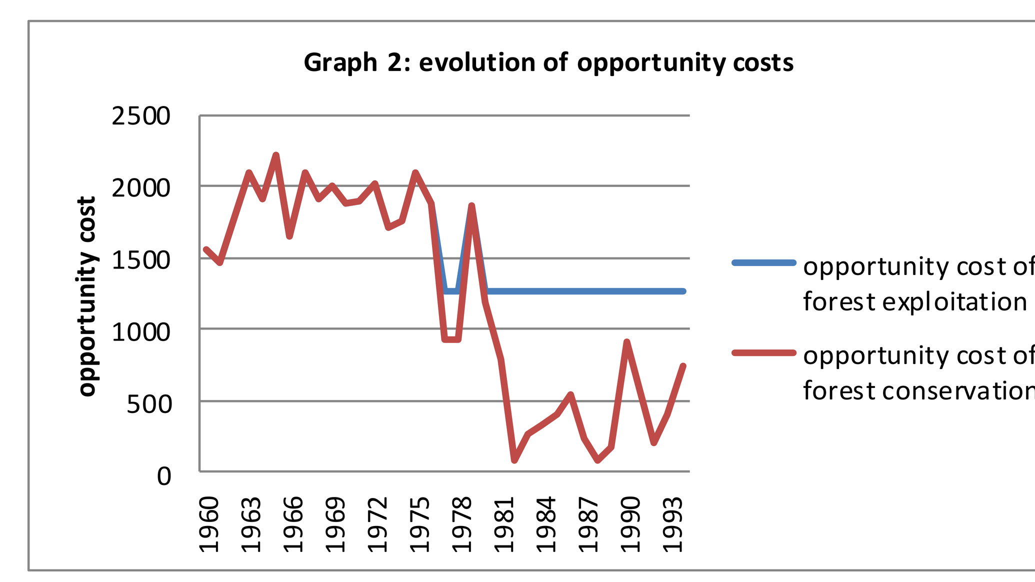
This equation establishes the optimal allocation rule of forest land conversion to forest exploitation (timber and wood energy). Indeed, for an efficient intertemporal allocation programme, forest land is exploited for wood energy or timber production up to the point where the discounted marginal benefits of wood energy (or timber) are equal to its social marginal opportunity cost.

Case 2: ecological break situation where $\lambda_{1,t+1}^* > \lambda_{1,t}^*$

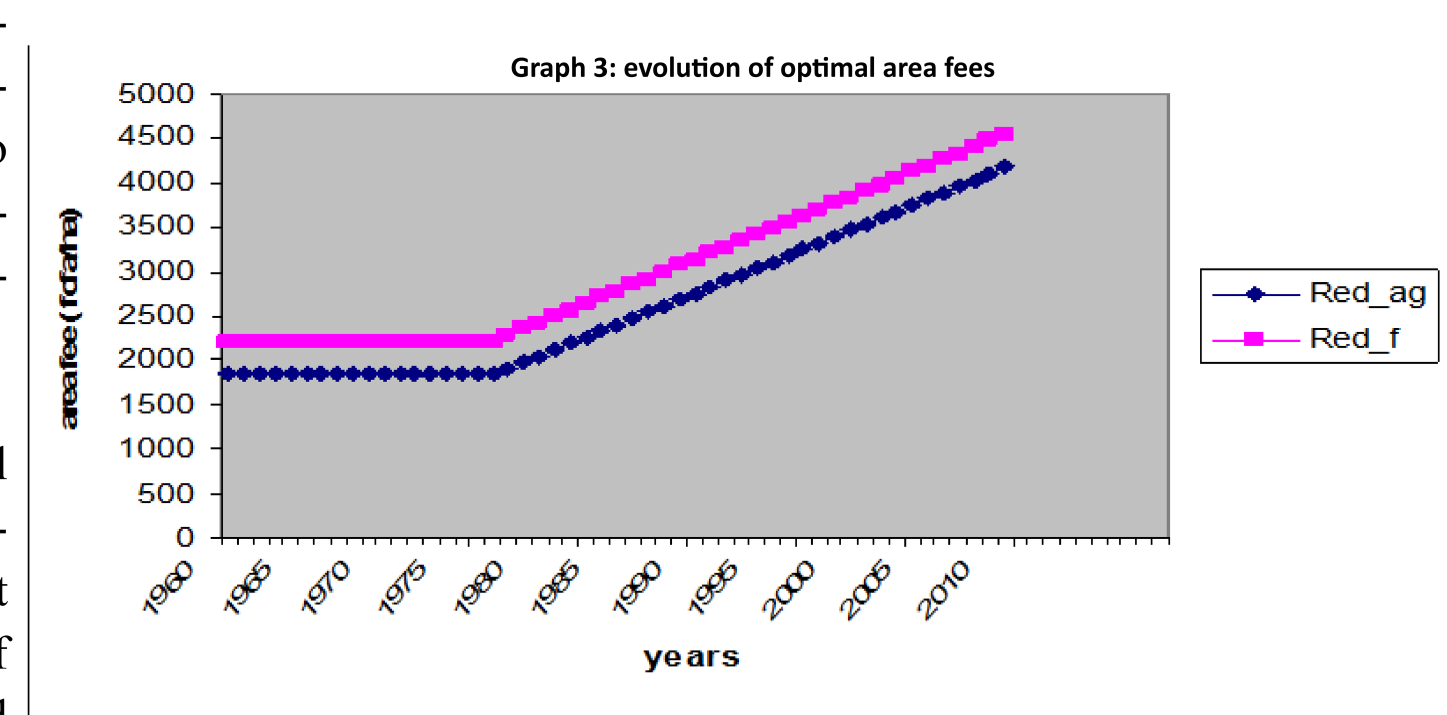
The major changes that the modification of the ecological constraint involves are the continuous decrease in optimal agricultural surfaces, optimal timber production surfaces and optimal energy production surfaces from period to period. On the contrary, the optimal stock of forest has to grow from over the time with the intensification of reforestation activity since the preservation of an additional unit of forest positively affects the social welfare.

Policy implications

Any resource whose extraction or accessibility cost is lower than its social exploitation cost leads to overexploitation (Pearce, 1987). Indeed, if there is no incentive to account for future user costs and externalities, there will be a tragedy of commons. To overcome this and ensure a sustainable management of the resource, Pigou proposed to internalize the externalities deriving from various forest harvesters' activities through fiscal instrument (Pigou, 1920). The deviations between the optimal and actual forest surfaces partly confirm the forest taxation system inefficiency in Côte d'Ivoire (see graph 1 and 2). Indeed, taxes should lead in theory to a sustainable management of the resource if they set according to the efficiency criteria. As a result, a tax reform in the forest field should account for the negative externalities generated by forest users as well as ecological conditions. For this purpose we evaluate the optimal level of area fees to be applied to forest users (farmers and harvesters) following the opportunity cost concept. This principle ensures that the resource is rationally managed and constitutes a suitable guide in formulating sustainable environmental policies. The results show that since 1977, the decision making process concerning the allocation of forest land between competing uses is not optimal. Indeed, since this date, the opportunity costs of maintaining land under forest are lower than those of competing uses (graph 2). In an efficiency context, this situation should result in an increase in forest land conservation by reducing the agricultural and timber exploitation surfaces. Unfortunately, graph 1 shows the reverse. Therefore, the progressive taxation system (case 2 in table) should have been implemented since 1977 as illustrated by graph 3 in order to constrain forest users to behave in a sustainable way. But, in normal situation (case1 in table), the area fee should be constant although its level should be higher than the current one of 50 FCFA/ha/an in accordance with the World Bank recommendations. The area fee is a decreasing function of forest natural rate of regeneration (rate of agricultural land reconversion) and will give incentives to harvesters (farmers) to rationally exploit their concessions (farmlands). This action will globally increase the forest natural rate of regeneration and reduce the shifting agricultural practices.



Forest users / Parameters	Farmers	Harvesters
	Formula and figures	Formula and figures
$\bar{\lambda}_1^* = 1577.9$ $\bar{\lambda}_2^* = 1304.2$ $\bar{\lambda}_3^* = 1214.1$ $\alpha_1 = 0.8$ $\beta = 0.15$ $\alpha_0 = 20\%$ $\bar{\varpi} = 707.36$	**Case 1 : normal situation**	
	$R^{A*} = \lambda_{1t}^* + (1-\alpha_1)\lambda_{2,t}^*$ $\bar{R}^{A*} = 1838.7$ FCFA/ha/an	$R^{F*} = \lambda_{1,t}^* + (1-\beta)\lambda_{3,t}^*$ $\bar{R}^{F*} = 2209.9$ FCFA/ha/an
	Case 2 : ecological crisis	
	$R_{t+1}^{A*} = \frac{\alpha_0\bar{\varpi}}{2} + R_t^{A*}, \forall t$ $R_t^{A*} = 1838.7 + (t-1)70.7$	$R_{t+1}^{F*} = \frac{\alpha_0\bar{\varpi}}{2} + R_t^{F*}, \forall t$ $R_t^{F*} = 2209.9 + (t-1)70.7$



Conclusion

A sustainable management of tropical forest land is a major challenge for governments. Indeed, in Côte d'Ivoire, forest degradation at the current rate threatens the agricultural productivity on which depends its economy. To mitigate these potential harmful effects and support the economic growth, this study proposed an increase in area fees not only for its incentive effects but for its lowest management cost and it is easy to collect. Therefore, any forest land user (farmer, wood energy or timber producer) should pay an area fee depending both on the surface used and the amount of damages generated. These area fees are a decreasing function of forest natural rate of regeneration and the reconversion rate of agricultural land. At a given forest natural rate of regeneration and the reconversion rate of agricultural land, the area fees are progressive in the sense of arithmetic progression in the context of ecological equilibrium break while they are constant in normal situation. However, for an efficiency goal, this fiscal reform must be supported by a reinforcement of forest control and be integrated into the general framework of sustainable development.