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CONSERVATION OF SANDAL GENETIC RESOURCES IN INDIA: I EXTRACTION PATTERNS AND THREATS TO SANDAL RESOURCES IN KARNATAKA

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ABSTRACT

Sandal is one of the most important commercial tree species in the deciduous forests of South India contributing substantially to the foreign exchange earned through the export of forest products. However, due to extensive changes in the land use patterns, deforestation and the indiscriminate exploitation of the sandal resources, the natural stock of the species has been rapidly dwindling in the country. This paper highlights on assessment of extraction patterns and threats to sandal resources in the state of Karnataka, that accounts for more than 60 to 70 per cent of the total area under sandal in the country. Our study confirms that over the years there has been a steady decrease in the availability of sandal. The decrease is mirrored in the reduction of sandal wood supplied to the factories over the years. The implications of the study with particular reference to the conservation of sandal genetic resources in the state as well as in the country has been discussed.

Introduction

Sandal (*santalum album* L.) is one of the most economically important forest trees harvested, for its heartwood oil, forms an important component of the total foreign exchange earned in the country (Rajan 1994). Owing to its wide use in religious ceremonies of Hindus and Buddhists, Ayurveda, and perfumery (Srinivasan *et al.,* 1992) and in the wake of increasing world demand for its oil, it has more prospects of trade than what is being realized at present in the country.

The heartwood of sandal is estimated to be fetching more than Rs. 4,00,000 to 5,00,000 per tonne (Kushalappa, 1999). More than 90 per cent of the sandal occurs in the deciduous forests of the Deccan Plateau, with more than 60-70 percent of this area in the state of Karnataka alone (Srinivasan *et al.* 1992). In recent years, be-

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cause of extensive logging both organised and illicit, the natural population of sandal is rapidly getting depleted probably resulting in the loss of genetic diversity. At our centre, we have initiated a program to map the spatial patterns of loss of sandal resources in the forests and to analyse the drivers of this erosion and associated economic consequences. In the process, we are also assessing the resultant loss in the genetic diversity of the sandal populations and develop possible measure to mitigate it (Uma Shanker *et. al.*, 1999, 2000).

In this paper, we briefly reviewd the status of sandal resources in Karnataka and discussed the potential threats and prospects to conserve the remaining sandal genetic resources. We analysed the patterns in the extractions of sandal in the state of Karnataka over the past 10 years. As an index of the threat to the sandal resources through poaching, attempt was made to obtain data on the estimates of illicit fellings of sandal trees and the estimated loss of revenue there of. We discuss the results in the light of the threat to the sandal genetic resources and suggest processes through which the conservation of sandal genetic resources could be attempted in Karnataka.

Materials and methods

Data on the extent of extraction of sandal from different parts of the state was collected from the Annual Administration Reports and other archival material from the Karnataka Forest Department. The total revenue obtained from such extraction was then estimated. Data on the extent of sandal poached and the consequent loss of revenue was compiled. We also compiled information on the supply of sandalwood to sandal based industries from institutions such as the Export Promotion Council & Karnataka State Handicraft Development Corporation. Based on these information, we have attempted to analyse the nature and magnitude of threat to sandal genetic resources in the state.

Results and discussion

Beginning as early as 1882, sandalwood was exported from the Indian subcontinent to several countries including the United Kingdom, Europe, USA, Japan and a few Arab countries (Chandrashekaraiah, 1971). The harvest of sandal was especially intense in the later half of this century, when it began to be exported in large scale. However, precise information on the amount of sandalwood extracted during this period is lacking. We collected the data on the extraction of sandal between 1952 and 1997 in Karnataka and found a substantial decline in the total quantity of sandalwood extracted **(Fig. 1).** Between 1952 and 1973, the average annual extraction of sandal was approximately 2276 tonnes while during 1975 to 1996, the quantity extracted decreased to 1080 tonnes. There was a monotonic decrease in the quantity of extractable sandalwood in the 44 years between 1952 and 1996. The decrease in extractable sandalwood may reflect the dwindling resource base of sandal in the state possibly driven by increased rates of exploitation along with

loss of populations due to land use changes and deforestation.

Perhaps, because of the increasing value of the product, the revenue released from sandal, has increased phenomenally in the last two decades. Thus between 1980 and 1995, there has been an increase in revenue from about 2 crores (in 1980-81) to nearly 14 crores during 1994-96 **(Fig 2).** The decline in the extraction is also mirrored in the reduction in the quantity of sandalwood supplied to the sandal based industries **(Fig 3).** Compared to 1980-81 wherein about 900 tonnes of sandal was supplied to factories, in 1987-88 barely about 300 tonnes was made available.

The decline in the resource base has had an adverse affect on the industries and the livelihoods of the traditional craftsmen. For instance, the sandal-oil factories at Shimoga and Mysore, which require at least 2000 tonnes of heartwood per annum, have been facing actuate shortage of the billets, in fact the factory at Shimoga closed down for lack of raw materials. Further, against an estimated requirement of nearly 200 tonnes of heartwood annually by the craftsmen, only half the quantity is met. This has led to serious underemployment of the artisans affecting their livelihoods (Chandrashekaraiah and Dabgar, 1998). Our study (data not shown) also indicated that because of lack of supply, the traditional craftsmen have been losing the skills of working with sandal and are constrained to seek alternative sources of livelihood.

The pressure on the sandal resources is further aggravated by the large scale poaching of the trees. Between 1980 and 1997, about 100 to 500 tonnes of sandal have been recovered annually from poaching (amounting to about 30 per cent of the gross sandal yield in the state; **Fig 4)** and fetching a revenue of Rs 0.50 crores (in 1982) to Rs 3 crores (in 1994), **(Fig 5.)** It is estimated that this recovery might represent just about 10-20 per cent of all sandal that is poached. Thus a substantial amount of sandal from the natural populations is lost each year through illicit felling. Effective measures to prevent these losses are necessary to safeguard the natural populations of sandal.

Conclusions and Implications

Our studies show that the sandal genetic resource of the state is seriously undermined by the indiscriminate extraction of the trees. These results have important implications for the conservation and management of sandal genetic resources in the country. Loss of the natural populations of sandal may have an adverse effect on genetic diversity of the species. Preliminary studies at our centre have revealed a decline in the genetic diversity of populations of sandal outside the protected areas compared to those within (Uma Shaanker *et al.*, 2000) the loss is presumably due to the intense extraction of the sandal from the unprotected areas. It is feared that unless these losses are checked it could lead to an irreparable loss of the genetic resources of sandal from the state (Nageswara Rao *et al.*, 1999). Further, the loss of natural

populations might also lead to a loss of the adaptive gene complexes or assemblages that might have evolved through the process of natural selection. The concern over the loss of genetic variability in sandal is especially critical considering that there is hardly any information on the relation between the heartwood oil content and the corresponding genetic diversity of the populations of sandal in the country.

The loss of sandal resources has also led to the impoverishment of the local artisans who are completely dependent upon the forest genetic resources for their livelihoods. For instance, the livelihoods of the artisans working under Karnataka State Handicraft Development Corporation (KSHDC) in seven production centers in Karnataka is critically at stake for want of sandal material; there is a strong possibility of these artisans to shift to nontraditional occupations (Chandrashekharaiah and Dabar, 1998). Infact because of the gradual decline in the quantity of sandal wood supplied to them from Karnataka, the KSHDC had to import wood from Tamilnadu (7.5 tonnes from Salem, Data unpublished), to meet the bare requirements of artisans.

Conservation of the natural populations of sandal requires strong management interventions especially to protect the species from being poached indiscriminately. In this context, we propose that there is a need to critically review and if necessary amend the regulatory status accorded to sandal. In India, sandal has been a nationally protected resource since the time of Tippu Sultan (1792), the former King of Mysore State. The monopoly on the cultivation and extraction of sandal by the monarchy has been followed by successive rulers and has been carried on even after the country's independence. However, ironically, and perhaps because of its extremely high export value, despite the protection status, the resource has been indiscriminately exploited. We suggest that deregulation of the protection status and initiating plantations of sandal may partially relieve the pressures faced by the natural populations of sandal.

Acknowledgements

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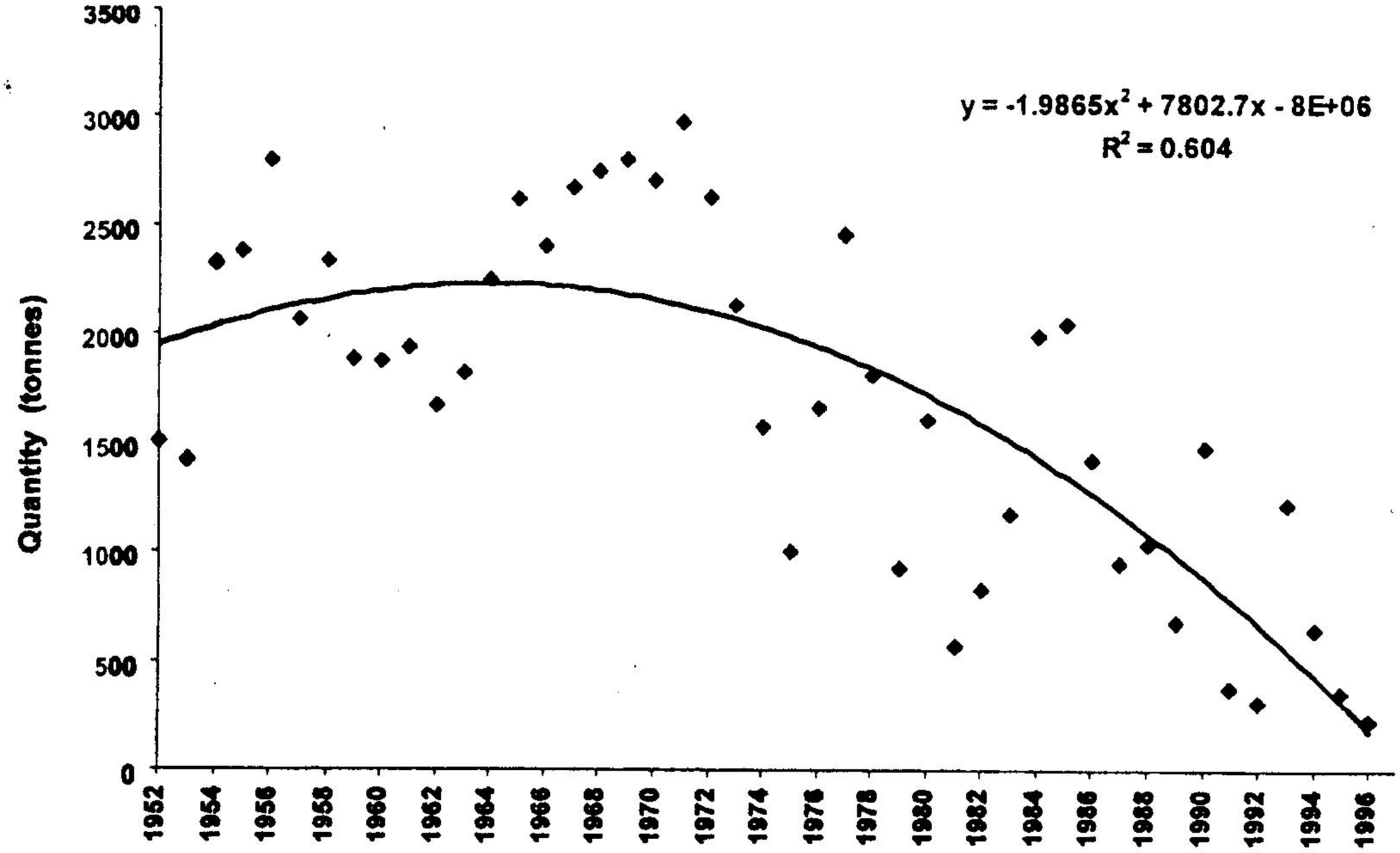

Fig. 1: Quantity of Sandalwood extracted in Karnataka between 1952-96.

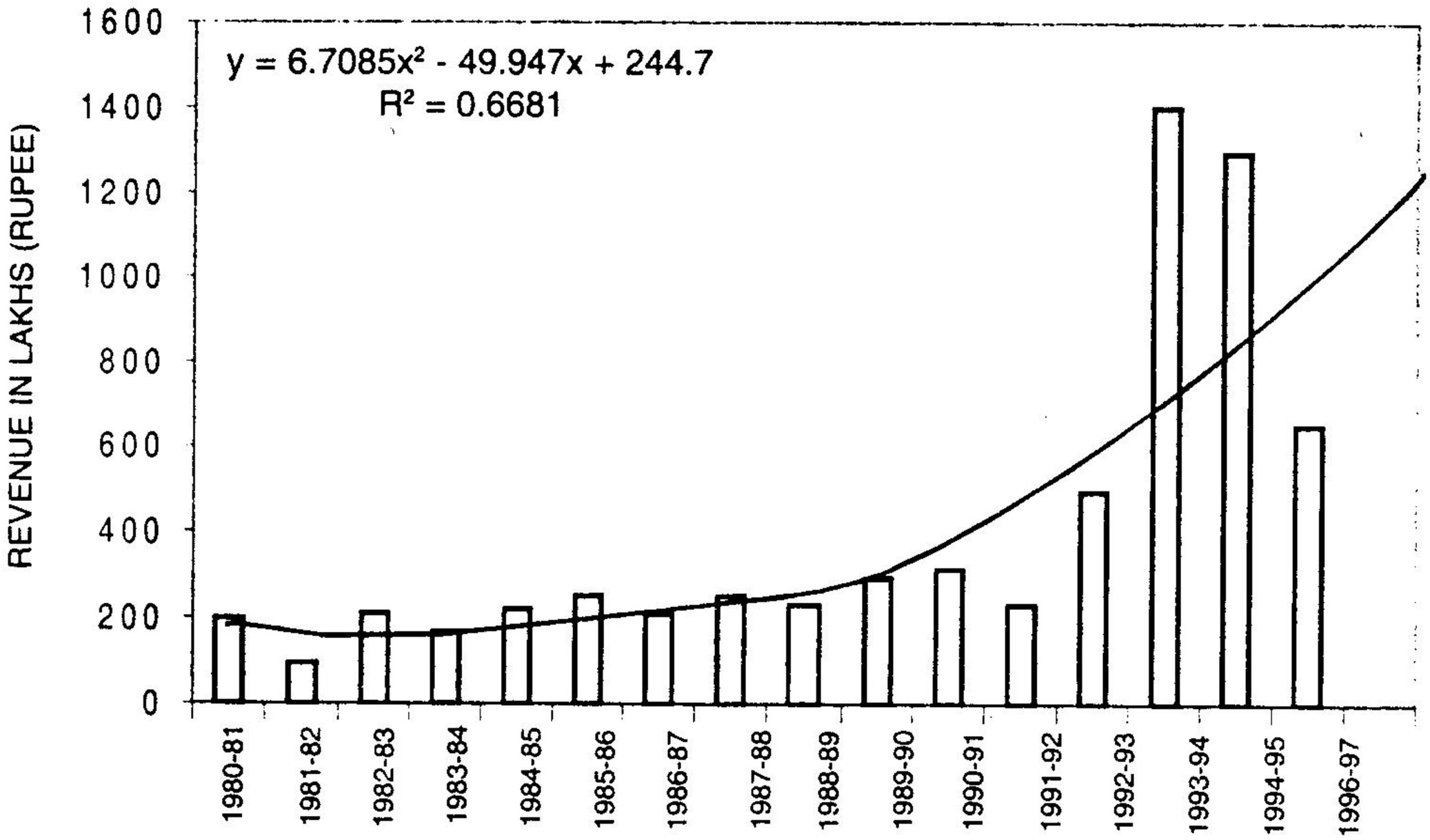

Fig. 2: Revenue obtained from Sandalwood in Karnataka between 1980-96. (data compiled from annual administrative reports and forest archival sources, Karnataka Forest Department).

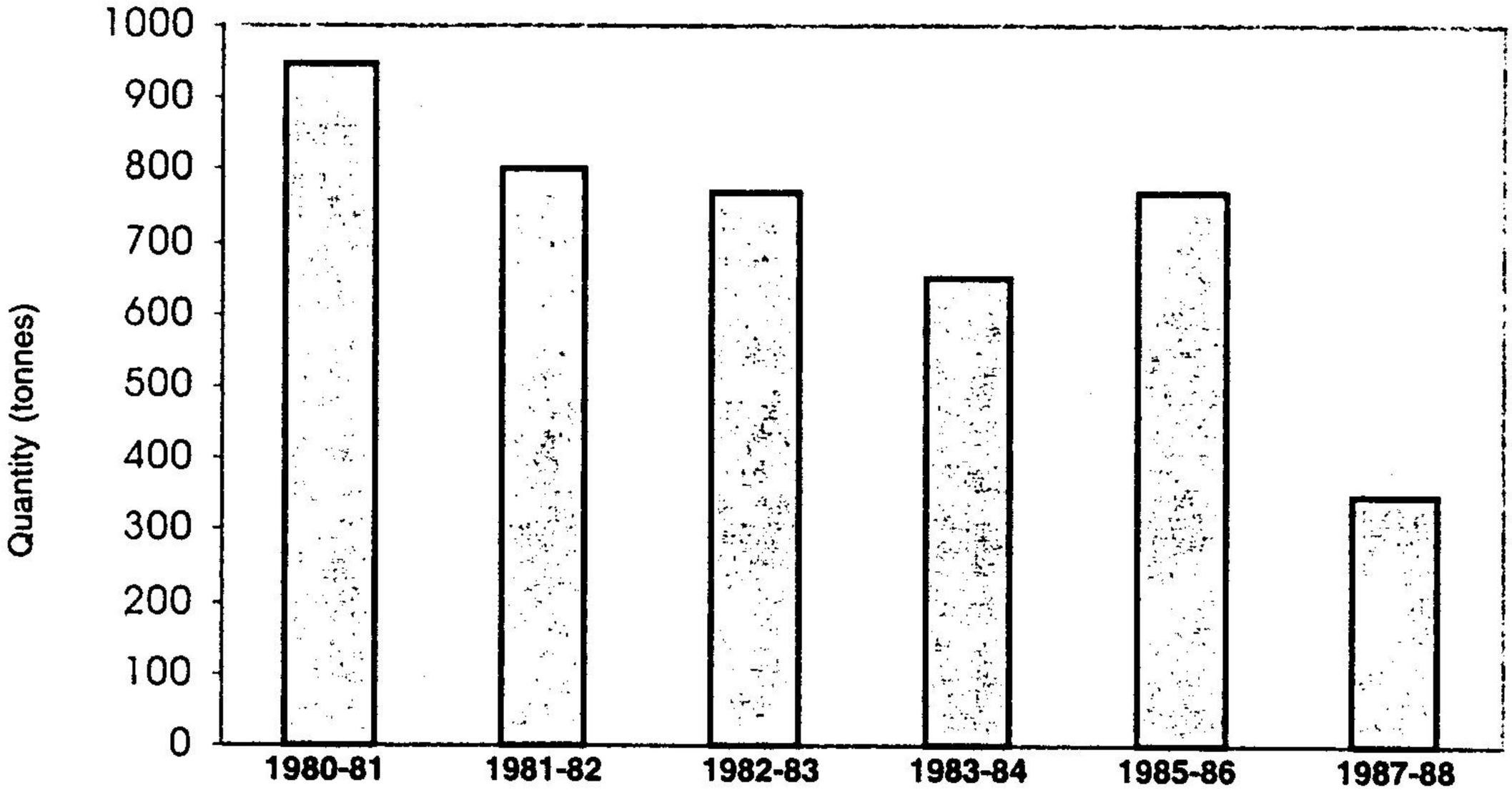

Fig 3: Quantity of Sandalwood supplied to factories between 1980-88

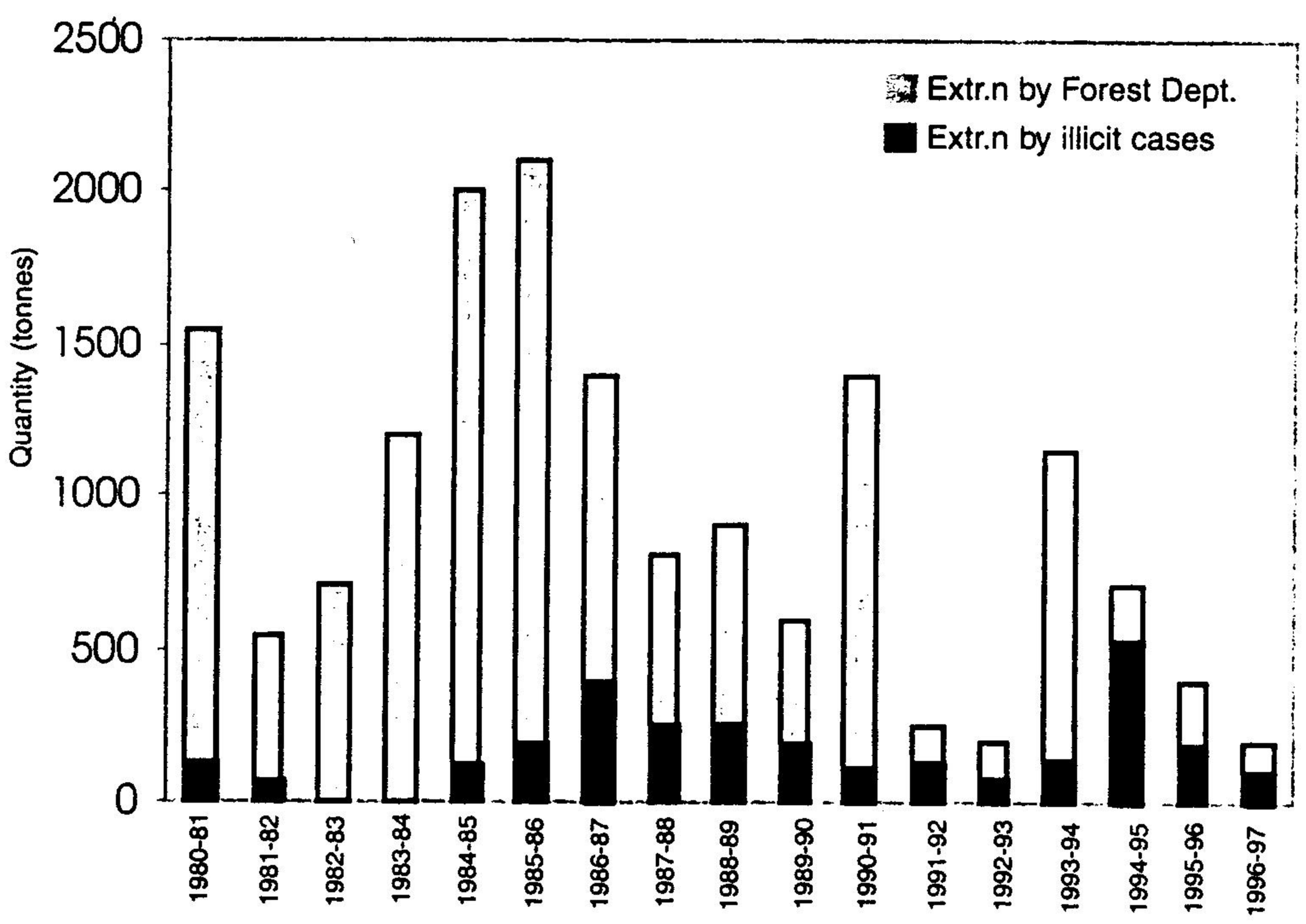

Fig. 4 : Quantity of Sandalwood extracted by Forest Department and that confiscated from illicit felling between 1980-97 in Karnataka

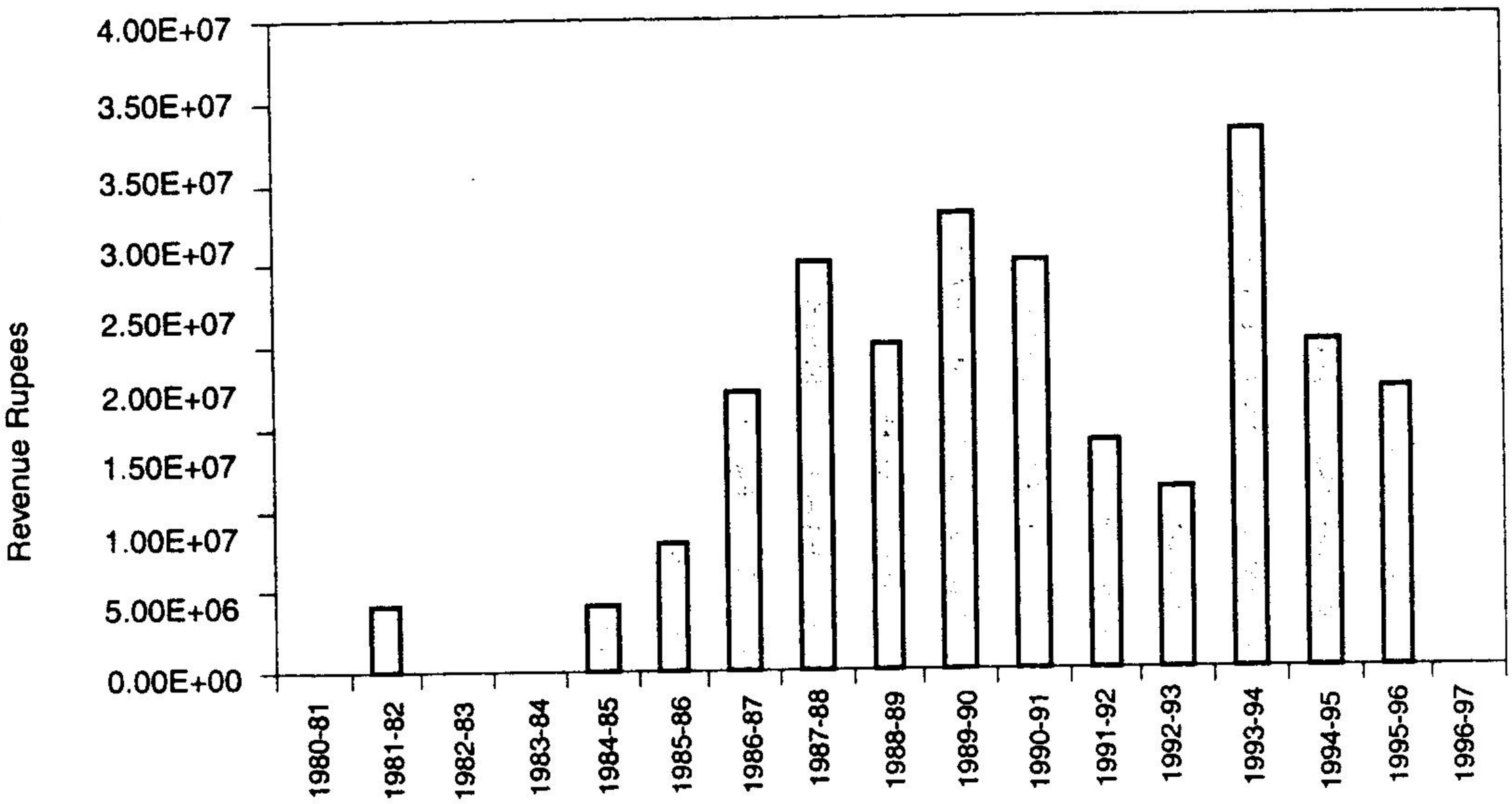

Fig. 5 Revenue realized from Sandalwood seized in Karnataka between 1980-97

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