Conclusions
CHAPTER 7 CONCLUSIONS

All four bamboo species *Bambusa balcooa*, *B. bambos*, *Ochlandra travancorica* and *Thyrsostachys oliveri* in the present study can accumulate substantial biomass especially in culms. These bamboos can sequester considerable amount of carbon in the biomass. High biomass productivity and carbon sequestration of these bamboo species suggest their potential use in ecorestoration of marginal and degraded lands and those can contribute to carbon sequestration potential of terrestrial biomes. Biomass production of *B. balcooa* and *T. oliveri* was comparable to some of the fast growing tree species grown in Kerala. At the age of seven years, *B. balcooa* had produced highest biomass. It is a non-thorny species that can be recommended to farmers and planters for large scale cultivation. *T. oliveri*, the most preferred bamboo species of farmers in Kerala also is an efficient accumulator of biomass within a short span. *O. travancorica* is a species suitable for river bank stabilisation. On a financial point of view, bamboo can play a major role in carbon trading under Clean Development Mechanism and further global mechanisms, such as REDD and REDD+ (Reducing Emissions from Deforestation and Forest Degradation). Including bamboo in these mechanisms enables countries to generate income for related forestry projects which involve bamboo. Moreover, its inclusion provides access to global carbon funds and incentives to grow more bamboo. *Dendrocalamus strictus* has been certified in the Bhamragarh Forest Division of Maharashtra (effective 12 December 2012) by the Forest Stewardship Council as “Well Managed Forest” in accordance with the principles and criteria of the Forest Stewardship Council (www.thejakartaglobe.com). Hence, the possibility of inclusion of bamboo forests in Clean Development Mechanism and other initiatives had increased. Although some losses are associated with its culm harvest at maturity, their fast growth can compensate for the losses in the next growing season itself. Bamboo with more than 5000 uses must be considered as the best amongst other known biomass resources to sequester carbon. Bamboo, due to its fast growing nature, has a potential to sequester carbon at a faster rate. Moreover, bamboo also plays a very important role in the livelihood improvement of the rural population.
With the launching of two missions at national level in India (National Bamboo Mission and National Mission on Bamboo Applications) to extend the area under bamboos and popularise bamboo cultivation, more farmers are attracted to bamboo cultivation. Their major concern is about the growth and yield of bamboo and financial returns. However, biomass production and yield details of many bamboo species are lacking. Although many bamboo species are grown naturally and introduced to Kerala, biomass production of those are not recorded so far under Kerala conditions. The present investigation gives an insight to yield and carbon sequestration potential of four bamboo species.

From the decomposition studies it can be concluded that litter decay and release of nutrients varied among four bamboo species. The litterfall and its decomposition were in synchrony with growth of the new bamboo culms. Decomposition of litter by which organic matter and nutrients are returned to soil is a primary mechanism and has received considerable attention in sustainable soil fertility. The pattern of litter production, its decomposition and consequent nutrient release has important implications for exploring the possibility of bamboo as a crop for nutrient poor marginal or degraded lands as most of the bamboo plantations are grown in such areas. Litter quality and the time of litterfall determine the contribution of litter to soil fertility. In all bamboo species two phases of heavy litterfall occurred, first during November to December and second during the summer season. Decomposition studies indicated that litter decomposes to half of its original mass in the initial four months i.e. during the Southwest monsoon season. As the culm recruitment in bamboo species occur with the onset of monsoon in June or with the premonsoon showers in May, the litter decay synchronises with the growth of new culms. In all the bamboo species culms reached their maximum dimension during the first three to four months. The later slow release of nutrients can assist the growth of any new culms emerge during the Northeast monsoon. Perusal of literature indicates that intercropping can be practiced in bamboo in the initial stages of establishment. Thus the slow release of nutrients from litterfall in October-November may facilitate summer cropping in April, while the second peak in February makes nutrients available for monsoon cropping in July. The slow rate of
decomposition of bamboo litter on the soil surface indicates the potential of the litter to be used as an organic mulch to conserve moisture in agricultural soils. However, the allelopathic effect of bamboo litter, if any, has to be clearly understood before using it as a mulch material. It is recommended that the studies on ecological role of bamboos in the restoration of degraded sites should address litter decomposition as a key unit of investigation as this would throw light on decomposition patterns and nutrient release. Further studies on carbon sequestration and litter dynamics of other bamboo species suitable for cultivation in Kerala has to be initiated as bamboo becomes more popular today.

From the findings of the study *B. balcooa* and *T. oliveri* with higher biomass accumulation can be recommended for large scale cultivation and domestication in Kerala conditions. The decomposition and nutrient release pattern of these species which facilitate intercropping are an added advantage.