Invading species are recognized as a serious problem threatening global biodiversity and human health worldwide and are one of the leading causes of native species becoming rare, threatened or endangered. Once established, it can be extremely difficult and costly to eradicate introduced species, control measures are usually very expensive and may be harmful to the environment. Developing effective weed management strategies require a thorough understanding of the biology and ecology of the invasive plant and the invaded community. Regrettably, there is hardly any simple or cost-effective way to control the infestation of these weeds in an environment-friendly manner. So an alternative solution to check the massive population of these weeds might be their utilization. The various weed utilization options include: as livestock feed, as source of paper pulp, as source of protein, as a bioagent in wastewater treatment and as a source of energy. In the present study, the problem of an invasive weed *Limnocharis flava*, which is present in vast stretches of Kuttanad wetland ecosystem is addressed.
Present Work

In the present work, the autecological studies of *L. flava*, distribution mapping in Kuttanad wetland ecosystem and various means of utilization of the weed in order to derive a viable weed management strategy have been carried out. The study has been undertaken to evaluate the ecology, distribution pattern and utilitarian aspects of a recent invasive plant *Limnocharis flava* (L.) Buchenau. *L. flava* is commonly known as yellow bur-head, is a monocot weed in the Limnocharitaceae family. It is an emergent aquatic plant that has invaded the flood plains of Kuttanad and other low-lying areas of Kerala. The plant is now the most dangerous wetland weed due to its deadly pace of regeneration and one third of the paddy fields in Alapuzha, Thrissur and Ernakulam districts are under the grip of this weed. The scope of this work was to investigate the feasibility of using *L. flava* as a phytoremediation agent, energy recovery via anaerobic digestion and to assess the potential of *L. flava* as livestock fodder.

Chapter - I

A general introduction to weeds, exotic weeds, invasive plant impacts and details about the plant, *Limnocharis flava* are presented. Studies on the growth rate, associated species, habitat analysis and distribution mapping were done. The findings of this study reveal that the relative growth rate of the plant is comparable with other fast growing aquatic weeds. The habitat analysis of the plant revealed that the soil nutrients, land use/land cover pattern, water depth and associated species are the important factors affecting the successful growth and establishment of the weed. The eco-distribution map of *L. flava* in Kuttanad wetland ecosystem was prepared.

Chapter - II

This chapter begins with a general introduction on water pollution by metals and a general review on phytoremediation. The study aims to evaluate the bioaccumulation property of *L. flava* from natural sites where it is growing gregariously. Green house study has been conducted to study the effect of lead accumulation on *L. flava* and changes in its
biochemical parameters like chlorophyll, phenol, protein, proline and carbohydrates. The analysis of plant parts, root zone soil and water from the natural sites showed that the plant is accumulating significant amounts of metals like iron and lead from soil and water. The result suggests that the plant may be used as phytoremediant and as an indicator of metal and nutrient accumulation in soil and water.

Chapter – III

In this chapter details on the recovery of energy as biogas from the weed through anaerobic digestion are described. The study was done to evaluate the suitability of L. flava as a feedstock in High Solid Anaerobic Digesters (HSADs) for the recovery of energy. The findings of this chapter indicate that: the chemical characteristics of the plant L. flava is comparable with that of other plants/weeds used as feed stocks in various anaerobic digesters reported in the literature. The daily biogas yield with respect to digester volume recorded in the present study was 200L per cubic meter of the digester. The performance of the reactors are comparable with the values reported in literature.

Chapter - IV

This section deals with attempts to explore the possibilities of the utilization of exotic weed L.flava as an unconventional feed resource to the livestock and also to evaluate the chemical composition and nutritional characteristics of the plant at its different growth stages such as pre-flowering, flowering and post flowering. The highest values of crude protein, fibre content, nitrogen free extract (NFE) and ether extract (EE) were observed at flowering stage. Therefore harvesting of the plant for feed at the flowering stage is recommended. This plant posses a number of characteristics of relevance which in turn makes it a nutritious feed suitable for domestic livestock. The analytical results of the study showed that the plant contained the nutrient and mineral contents that are comparable to the mineral requirements of lactating cattle. So it can be concluded that this plant seems to have several characteristics that make it a useful plant for cattle feed. Even though the findings of this study indicate L. flava as a promising plant for the production of animal...
feed, further tests on palatability, digestibility, feed trials etc. can only confirm the suitability of this plant for animal fodder.

Conclusions

The following significant conclusions are drawn from the findings of the study.

i) *L. flava* is a noxious weed having high growth rate compared to other common fast growing aquatic weeds in Kuttanad wetland ecosystem.

ii) The soil and water nutrients, land use/land cover pattern, water depth and associated species are the important factors affecting the successful growth and establishment of the plant.

iii) From the eco-distribution mapping of *L. flava* in Kuttanad wetland ecosystem it is clear that the plant is fast spreading there.

iv) The plant is accumulating significant amounts of metals like iron and lead from soil and water from the natural sites.

v) The results of the green house study indicate that, the plant can be used as a phytoremediant for lead at moderate concentrations.

vi) *L. flava* is found to be a suitable feed stock in anaerobic digesters. The performance of anaerobic digesters fed with *L. flava* was found to be comparable with the values reported in the literature.

vii) The plant possesses several of characteristics of relevance which in turn makes it as a nutritious unconventional feed suitable for domestic livestock. However necessary precautions are to be taken with regard to the heavy metal content of the plant.

viii) Based on the nutritive value of the plant analysed at different growth stages, it is recommended that harvesting of the plant for the purpose of animal feed need to be done during the flowering stage.