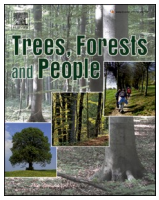
Trees, Forests and People 10 (2022) 100330

Contents lists available at ScienceDirect

Trees, Forests and People

journal homepage: www.sciencedirect.com/journal/trees-forests-and-people



Potential to use invasive plants in biomass energy production: A case study *Prosopis juliflora* in coastal wetlands of Sri Lanka

W.A.R.T.W. Bandara [a,*], Oshadhi Ranasinghe [a], Priyan Perera [b], Richard Vlosky [c], Anil Raj Kizha [d]

[a] *Department of Zoology & Environmental Management, University of Kelaniya, Dalugma, Sri Lanka*
[b] *Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[c] *Lousiana Forest Products Development Center, Louisiana State University Baton Rouge, LA, USA*
[d] *School of Forest Resources, University of Maine, Orono, ME, USA*

ARTICLE INFO

Keywords:
Prosopis juliflora
Leucaena leucocephala
Wetland
Invasive species
Fuelwood

ABSTRACT

Prosopis juliflora is an invasive plant species rapidly expanding in the Asian and African continents. The invasion of *P. juliflora* in Bundala Ramsar Wetland (BRW) in Sri Lanka has created several biodiversity conservation issues. This study was conducted to assess the possibility of utilizing invasive *P. juliflora* as an alternative energy source. *P. juliflora* performed better than L. *leucocephala* for most evaluated fuelwood properties. Ash content was comparatively higher in *P. juliflora* than L. *leucocephala*. However, biomass to ash ratio of *P. juliflora* was significantly lower (<0.05) and the Fuel Value Index (FVI) of *P. juliflora* (3,276) was slightly lower than that of L. *leucocephala* (3,336), a non-significant difference. *P. juliflora* and L. *leucocephala* reached Fiber Saturation Point within 24 and 27 days of drying, respectively. Results show that 1 kg of *P. juliflora* would produce an estimated energy equivalent to 0.5 L of diesel and furnace oil and 5 kWh of electricity. As such, we recommend further study on harvesting and commercialization of *P. juliflora* as a potential wood energy source.

1. Introduction

Biomass accounts for significant inputs to satisfy energy demand, especially in developing countries. With fossil fuels becoming scarce and growing global concerns over greenhouse gas emissions from their use, renewable energy sources such as biomass have been recognized as potential "green" energy sources (Kaygusuz, 2009; Plate et al., 2010). Wood, energy crops, agricultural and forestry wastes are the commonly available biomass energy resources (Kizha and Han, 2016; Perea-Moreno et al., 2019).

Biomass is a promising renewable energy resource for developing countries such as Sri Lanka (SLSEA, 2011). It can enhance energy security by diversifying the energy mix, optimizing the utilization of local resources, and increasing revenue from forestry and agricultural sectors (Himandi et al., 2021; Louis and Kizha, 2021). Sri Lanka, a tropical country with a high vegetation growth per unit area due to high incident solar energy, has an immense potential for biomass energy resource development. Currently utilized biomass includes agricultural residues (rice husk, waste from rubber and coconut plantations, woodlots, and home gardens) and rubberwood from plantations (Arachchige and Sakuna, 2019; ADB, 2019). However, Sri Lanka's biomass resources are underutilized and the biomass energy development sector is unorganized (Dissanayake et al., 2017; Himandi et al., 2021).

Although biomass is a significant energy source in Sri Lanka, primarily in the form of firewood for cooking, it has received scant attention in electricity generation. For instance, the use of biomass in the country's energy mix has declined from 65% in 1990 to 39% in 2015, while petroleum products have increased (ADB, 2017). As of 2017, there were ten biomass-based small power producers with a total installed capacity of 26.1 MW, which is only 1.1% of the country's estimated potential biomass-based generation capacity of 2400 MW (ADB, 2019). The use of biomass, especially for thermal energy in the industrial sector in Sri Lanka, has been recognized in the country's Energy Sector Development Plan for 2015–2025. Several plant species including *Gliricidia sepium, Acacia auriculiformis,* and *Calliandra calothyrsus* are the most common fuelwood species in Sri Lanka due to their high calorific values (4000–5000 kcal kg^{-1}) (UNEP, 2013). Additional fuelwood species in Sri Lanka are *Eucalyptus grandis, Eucalyptus camaldulensis,*

* Corresponding author.
E-mail addresses: rangika@kln.ac.lk (W.A.R.T.W. Bandara), priyan@sjp.ac.lk (P. Perera).

https://doi.org/10.1016/j.tfp.2022.100330

Available online 9 September 2022