

Background

Aren (*Arenga pinnata*) and candlenut (*Aleurites moluccana*) are commonly found in agroforestry system in Indonesia. Aren juice can be processed into ethanol; while methyl-ester of candlenut oil has similar properties with biodiesel. However, its potentials are under development.

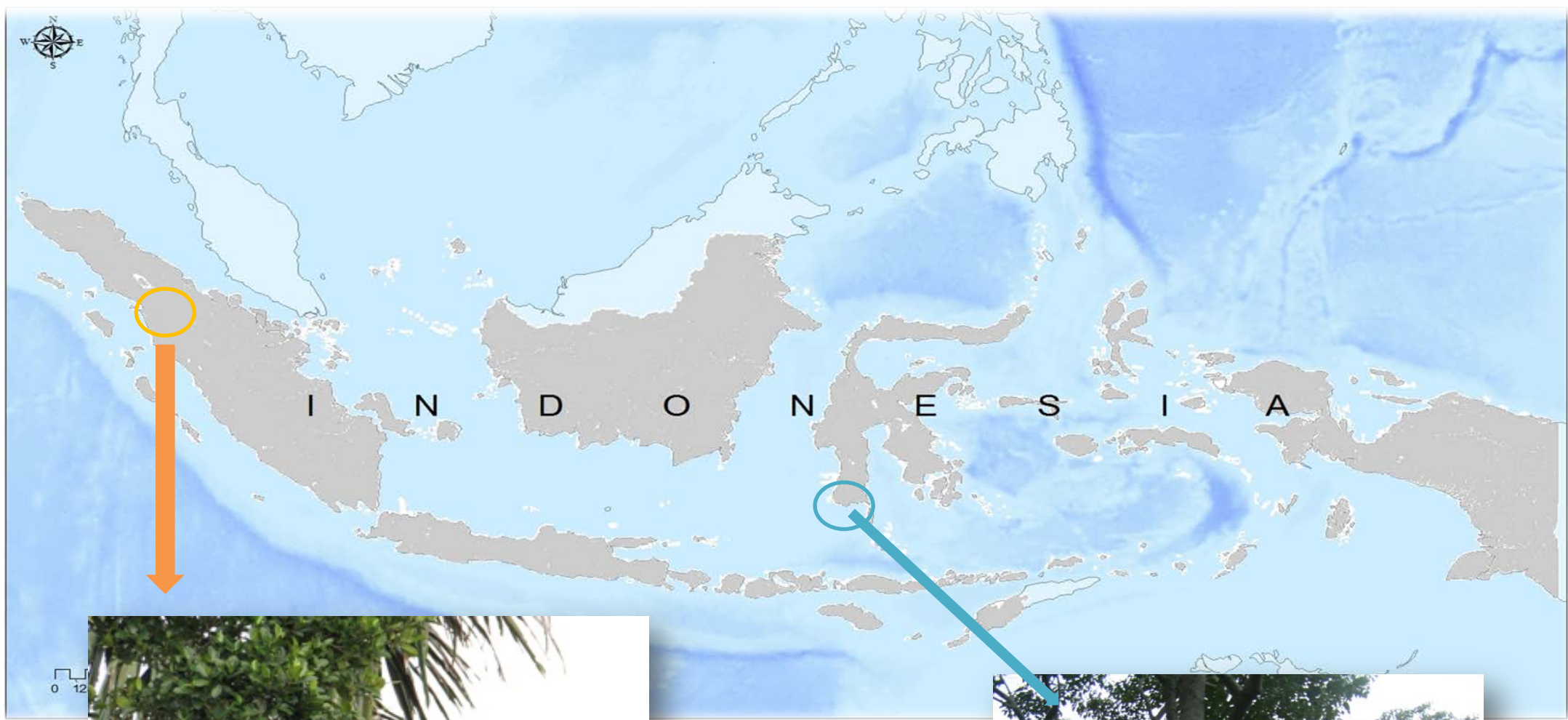
The use of biofuel is expected to increase: government mandatory on biofuel, subsidy for biofuel transportation and supplying global demand.

Thus, we evaluated aren and candlenut opportunities for biofuel supply in Indonesia.



Data collection and analysis

Data used in this study was compilation of survey conducted in North Sumatra in 2008 for Aren and South Sulawesi in 2012 for candlenut. We evaluated smallholder aren and candlenut system to analyze its productivity for biofuel production. The evaluation includes labor engagement and financial return as represented by equivalent annual annuity (EAA). The estimation of financial return using the following indicators: exchange rate to USD at IDR 9700, discount rate at 8%.



Aren (*Arenga pinnata*) in Batangtoru, North Sumatra



Candlenut (*Aleurites moluccana*) in Banteang, South Sulawesi



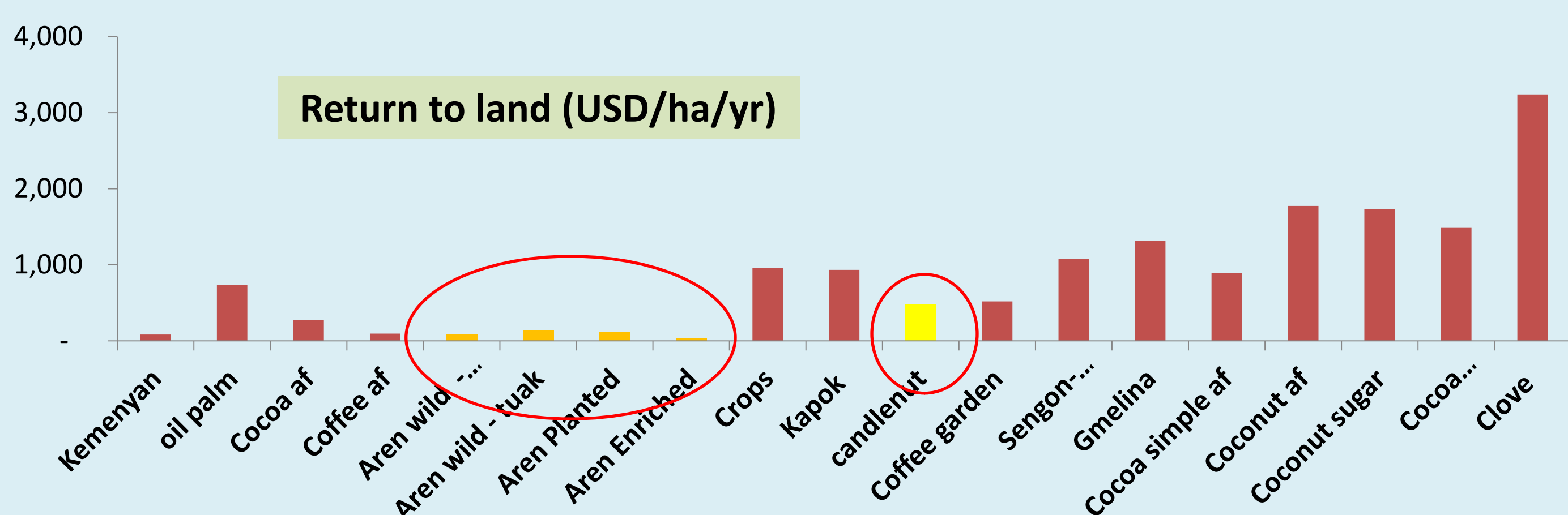
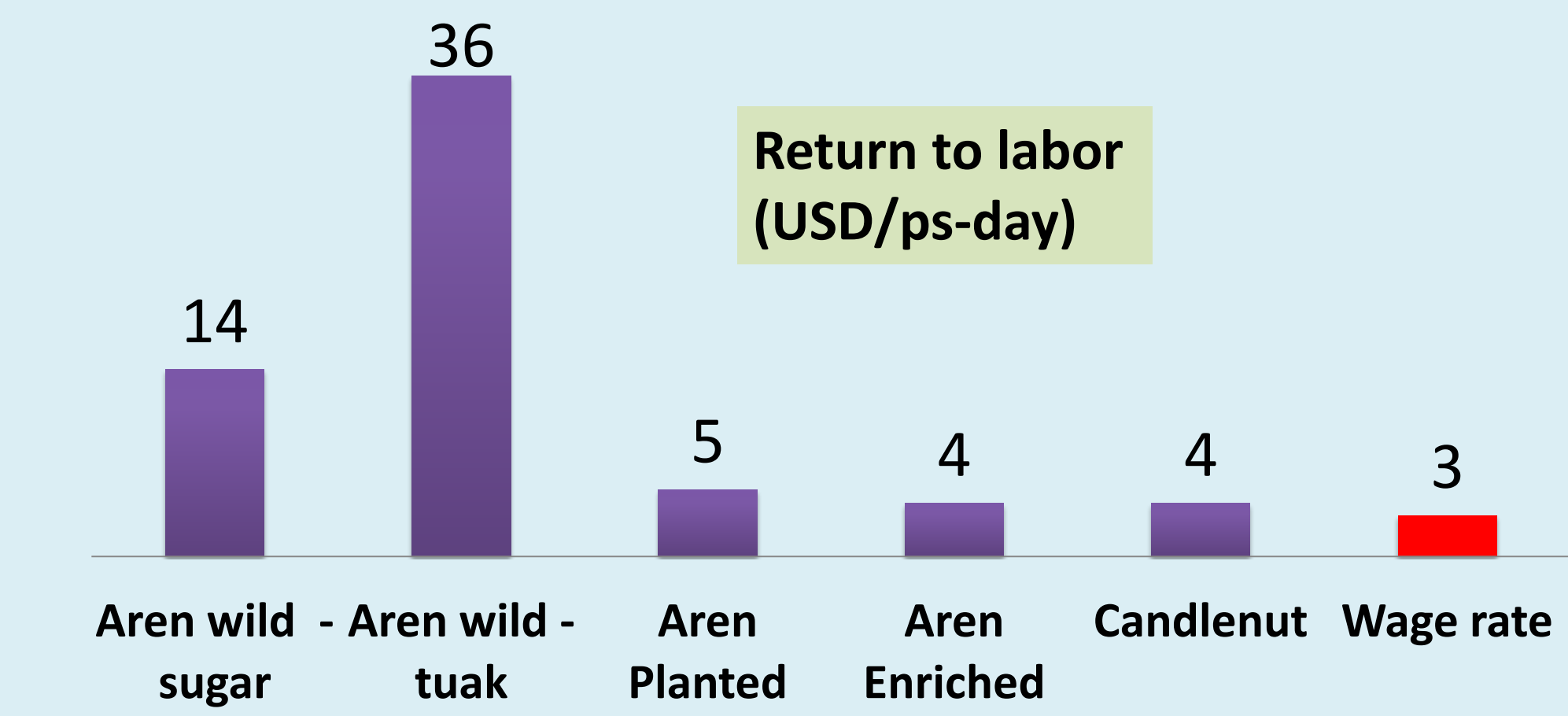
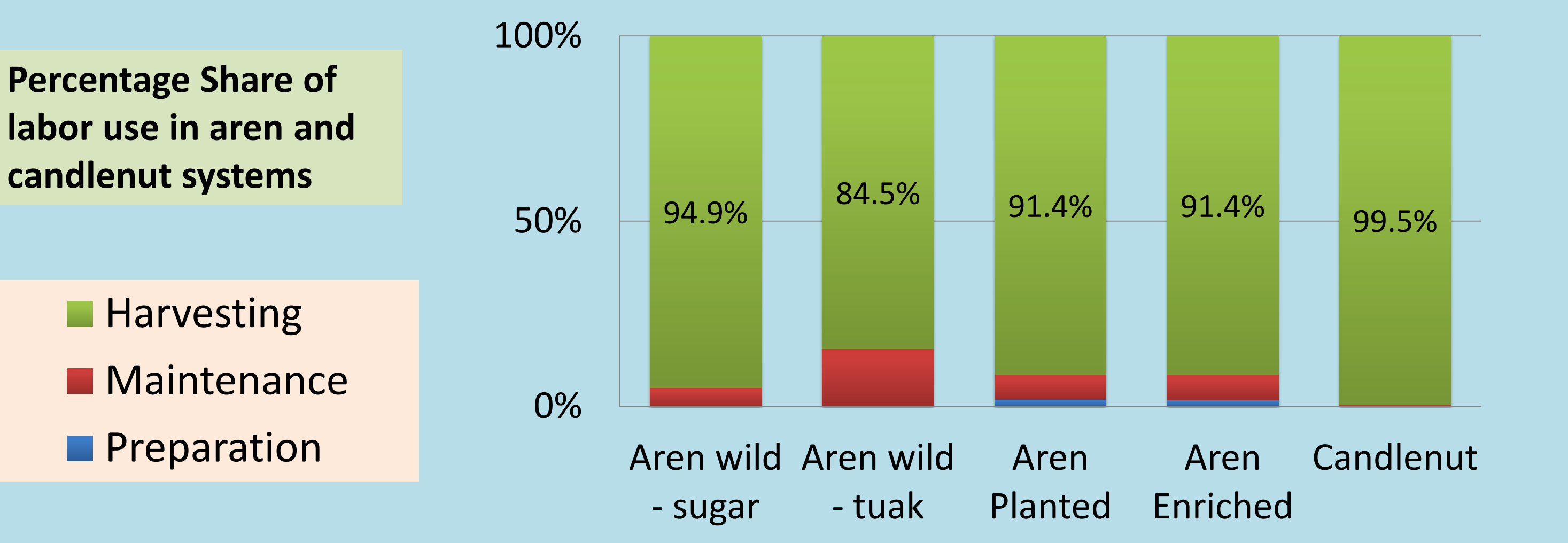
Aren (*Arenga pinnata*) is commonly found in smallholder systems with high precipitation level. Tree domestication level of aren in Batang Toru can be identified as: wild, enriched and planted. Currently, farmers tap aren juice for sugar and alcoholic beverage. They also collect its thatches (*ijuk*) and fruits (*kolang-kaling*).

Candlenut (*Aleurites moluccana*) tree was popular in rehabilitation trees program of many places in Indonesia in the 1980-ies. Fruits and timber are its common products. Now, less farmers manage and plant candlenut due to low income from selling its fruits. Tree domestication level of candlenut in South Sulawesi is medium, however now its domestication is neglected.



Aren and Candlenut Potentials for Biofuel

Both aren and candlenut system was economically profitable, however both systems require high labour input in the harvesting periods.



Parameter	Unit	Aren	Candlenut
Productive tree	Tree/ha	5-12	100
Production			
Juice	L/tree/yr	180	-
Nuts	Kg/tree/yr	-	19
Biofuel potentials			
Ethanol	L/tree/yr	60-120*	-
Candlenut oil	L/tree/yr	-	2.8-5.7*

What are the opportunities for developing the potentials?

Potentials productivity of aren and candlenut are still low for supplying biofuels, thus improvements need to be focused on:

- tree productivity in producing raw materials;
- garden management system through labor efficiency;
- raw material processing via appropriate technology innovations;
- enhancement in scale of activities to strengthen farmers' bargaining power in the supply of production.

Development area	Recommendations
Tree productivity & Farmers Livelihood	<ul style="list-style-type: none"> Tree domestication efforts to produce quality planting materials Tree maintenance improvements
Garden management	<ul style="list-style-type: none"> Efficient harvesting techniques
Yield processing	<ul style="list-style-type: none"> Advancing the technology in producing aren ethanol percentage to close to 99,5%
Scale of Operation	<ul style="list-style-type: none"> Farmer's capacity building in entrepreneurship Collective marketing Market value and value chain potential

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