Appendix 1. Driftwood economics model.

Appendix 1 provides details about the economics model and analyses presented in the paper above.

Table A1.1 defines the parameters used to estimate costs and identifies the source for the parameterization. The fuel equivalent (D_{fuel}) of each substitute fuel type used to meet any wood deficit (Def_{annual}) was estimated based on specified proportions of each potential fuel type used as a driftwood substitute ($\%_{fuel}$) in the entire village (Eqn. A1.1). The potential substitute fuel types include stranded driftwood, standing deadwood, and fuel oil.

Eqn. A1.1
$$D_{fuel} = \%_{fuel}(Def_{annual})$$

Fuel = stranded wood, standing wood, or fuel oil

The number of trips ($Trip_{fuel}$) needed to gather sufficient stranded or standing wood to meet the village's demand (D_{fuel}) for that fuel type were estimated from the amount of the fuel (H_{fuel}) that could be harvest on each trip (Eqn. A1.2). The financial costs ($Cost_{fuel}$) associated with the number of trips were also calculated. We used the number of trips, the mean travel distance ($\overline{Dist}_{fuel}$), estimated miles traveled per gallon of gasoline ($MPG_{vehicle}$), and the unit cost of gasoline ($UnitCost_{gas}$)]. From this we subtracted the cost to harvest and process the equivalent amount of mobilized driftwood [based upon the villages annual driftwood deficit (Def_{annual}), the boats fuel consumption rate (GPH_{drift}]), the unit cost of gas, and the harvest rate for driftwood (H_{drift})] (Eqn. A1.3).

Eqn. A1.2
$$Trip_{fuel} = D_{fuel}/H_{fuel}$$

Fuel = stranded or standing wood

Eqn. A1.3
$$Cost_{fuel} = \left\{Trip_{fuel}\left[\frac{\overline{Dist}_{fuel}}{MPG_{vehicle}}\right]UnitCost_{gas}\right\} - \left\{\frac{Def_{annual}GPH_{drift}UnitCost_{gas}}{H_{drift}}\right\}$$

Fuel = stranded or standing wood

The amount of time required to collect and process (cut, split, and stack) sufficient wood ($Time_{fuel}$) to meet the village needs were calculated from number of trips, estimated time per trip ($\overline{Time}_{trip}$), number of people per trip ($People_{trip}$), village demand for that fuel type, estimated time for processing ($\overline{Time}_{process}$), and estimated number of people involved in processing ($People_{process}$)]. From this we subtracted the estimated time to collect and process the equivalent amount of mobilized driftwood [calculated from estimates of driftwood harvest rate (H_{drift}), time required for harvesting driftwood ($\overline{Time}_{drift}$), and the number of people involved in the harvest of driftwood ($People_{drift}$)] (Eqn. A1.4).

Eqn. A1.4 $$Time_{fuel} = \{Trip_{fuel}\,\overline{Time}_{trip}\,People_{trip} + D_{fuel}\,\overline{Time}_{process}\,People_{process}\} - \{H_{drift}\,\overline{Time}_{drift}\,People_{drift}\}$$

Fuel = stranded wood or standing wood

Additionally, the cost of using fuel oil ($Cost_{oil}$) to meet the equivalent energy demand (D_{oil}) of the village was calculated using the energy equivalent of fuel oil relative to driftwood ($Equiv_{oil}$) and the unit cost of fuel oil ($UnitCost_{oil}$) (Eqn. A1.5).

Eqn. A1.5 $$Cost_{oil} = D_{oil} Equiv_{oil} UnitCost_{oil}$$

Estimates of the total financial and temporal costs were also calculated (Eqn. A1.7 and Eqn. A1.8) by summing the individual costs for each fuel type.

Eqn. A1.7 $$Cost_{total} = Cost_{stranded} + Cost_{standing} + Cost_{oil}$$

Eqn. A1.8 $$Time_{total} = Time_{stranded} + Time_{standing} + Time_{oil}$$

Table A1.1. Input and output parameters for the economic analyses of the driftwood harvest alternatives.

	Parameter	Symbol	Assigned value
Wood / driftwood	Deficit (cords)	Def_{annual}	903
	Demand (cords equivalent)	D_{fuel}	Calculated
	Harvest rate (mobilized driftwood, cord/ hour)	H_{drift}	0.25
	People (number during driftwood harvest)	$People_{drift}$	2
	Processing rate (cut and split) (cord/hour)	$Time_{process}$	0.5
	Processing people (person)	$People_{process}$	2
	Gallons per hour (boat)	GPH_{drift}	1
	Estimated economic costs – driftwood	$Cost_{drift}$	Calculated
	Time estimate - harvest and process (hours)	$Time_{drift}$	Calculated
Stranded driftwood	Deficit replacement from stranded driftwood (%)	$\%_{stranded}$	25
	Average round trip miles traveled for stranded driftwood	$Dist_{stranded}$	3
	Boat fuel economy (miles / gallon)	$MPG_{vehicle}$	2
	Gas costs ($/gallon)	$Cost_{gas}$	$6.85
	People (number / trip)	$People_{trip}$	3
	Harvest rate (Cords stranded driftwood / trip)	$H_{stranded}$	1
	Average time (hour / trip)	$Time_{trip}$	8
	Number of trips - stranded driftwood	$trip_{stranded}$	Calculated
	Estimated economic costs - stranded driftwood	$Cost_{stranded}$	Calculated
	Time estimate (man-hours)	$Time_{stranded}$	Calculated
Standing dead wood	Deficit replacement from standing wood (%)	$\%_{standing}$	25
	Average round trip miles traveled for standing wood	$Dist_{standing}$	2
	Snow machine fuel economy (miles / gallon)	$MPG_{vehicle}$	7
	Gas costs ($/gallon)	$Cost_{gas}$	$6.85
	People (number / trip)	$People_{trip}$	2
	Harvest rate (Cords standing wood / trip)	$H_{standing}$	0.3
	Average time (hour / trip)	$Time_{trip}$	4
	Number of trips - standing wood	$trip_{standing}$	Calculated
	Estimated economic costs - standing wood	$Cost_{standing}$	Calculated
	Time estimate (man-hours)	$Time_{standing}$	Calculated
Fuel oil	% fuel oil replacement	$\%_{oil}$	45
	Gallons equivalent (Gallons fuel oil / cord)	$Equiv_{oil}$	122†
	Fuel oil costs: ($/gallon)	$UnitCost_{oil}$	$6.00
	Estimated Fuel costs	$Cost_{oil}$	Calculated
	Time estimate (man-hours)	$Time_{oil}$	Calculated
Total	Total Economic Costs	$Cost_{total}$	Calculated
	Total Time Investment (man-hours)	$Time_{total}$	Calculated

†(USDA Cooperative Extension Service 2008)