

# Scale up of an ultra-low cost in-forest thermal processing of biomass.



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## Introduction

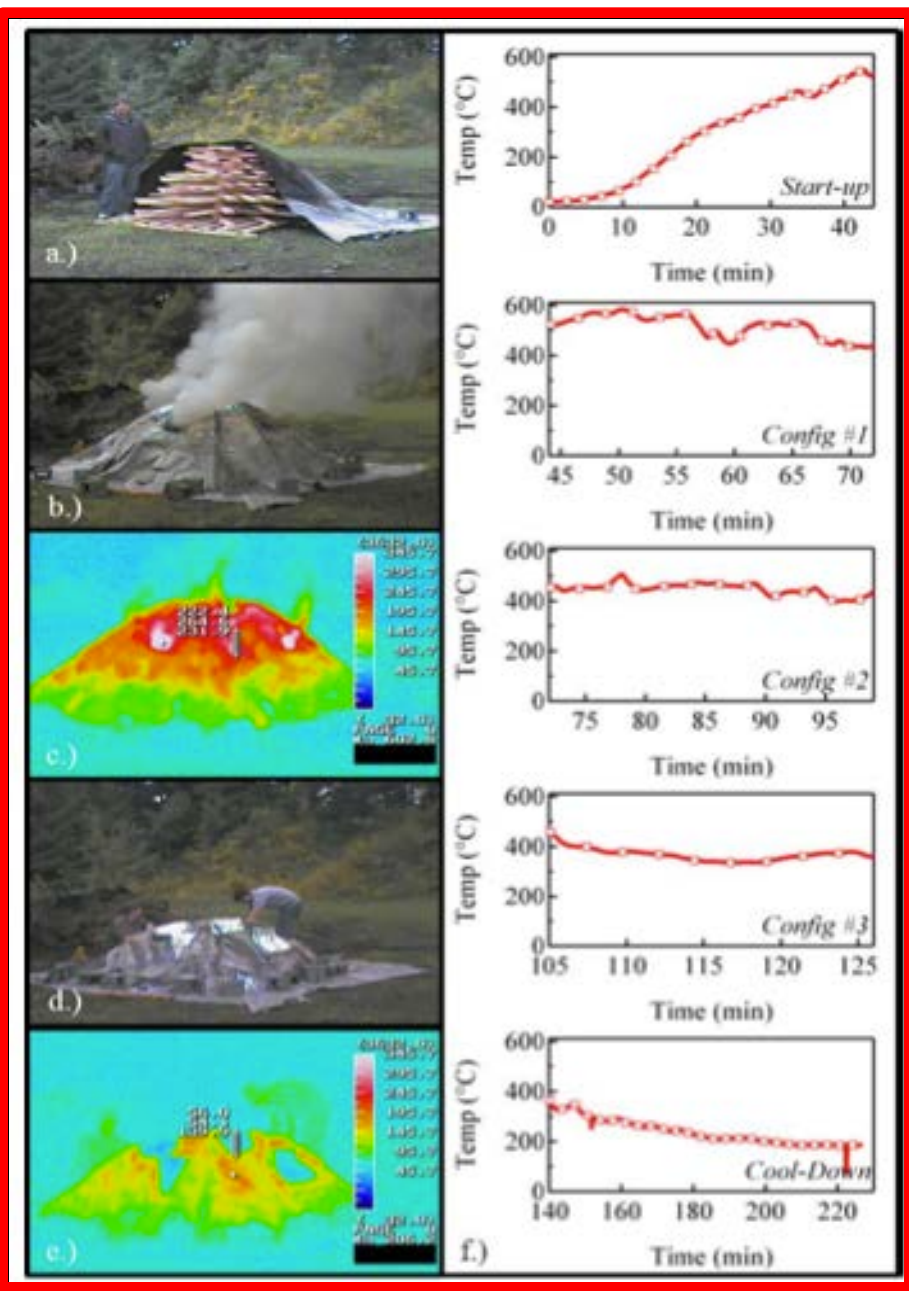
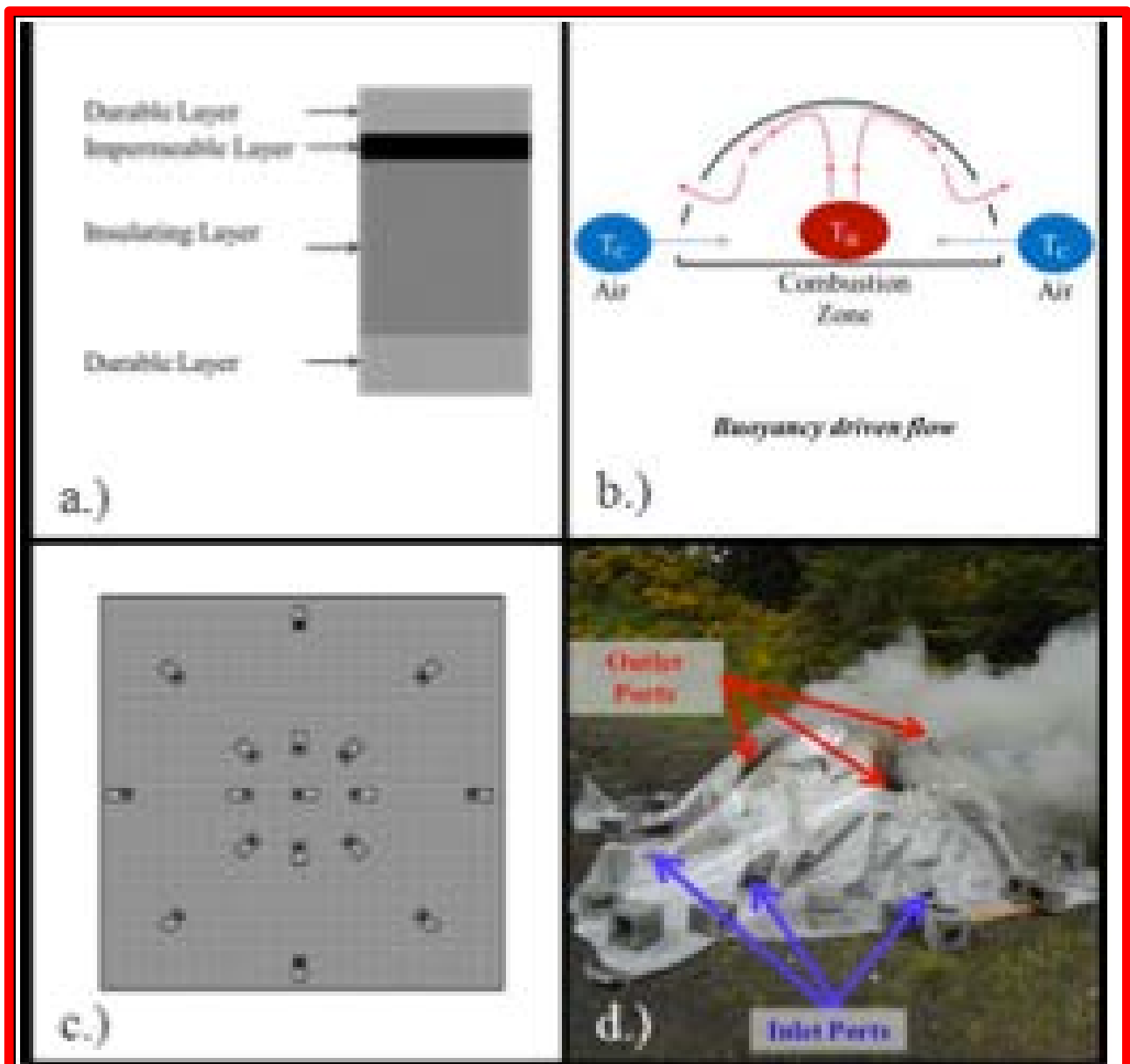
An ultra-low cost thermal processing method of biomass has been demonstrated using a portable unit that we sometimes call a pyrolysis blanket or a portable kiln. Because of the ultra-low capital and operating costs, our method can be used to dry wood prior to chipping and hauling, simplifying the transportation economics, or to pyrolyze the feedstock to produce high quality bio char in the forest.

## Background

The University of Washington's Bio-energy IGERT Group developed the prototype of the 16" x 16" mobile pyrolysis blanket. Experimented with 2"x 4" lumber stacking 226 kg replicating a small slash pile manipulating inlet/outlet air flow of the blanket/kiln to create bio char.

The system is a low cost four-layer laminate with vents used to control the temperature

The unit is based on the South American Kilns and dirt mounds used to create charcoal and Terra Preta soils.



- The IGERT group's 5<sup>nd</sup> generation design was restructured to increase thermodynamic flow range and with stronger lower cost effective materials.
- Basalt insulation was replaced with low cost high intensity ceramic insulation.
- Produced 30 - 35% bio mass conversion. Increasing the percentage % of the convetional methods



## Methods

- Conducting the experiment for the mass balance of the slash pile
- Seperate wood by dimension
- Sorting in small bags - terra weight

### Conducting Burn

#### Pre Burn

Collect Slash Pile  
Separate wood pile and bag into portions  
Weigh each bag pre burn  
Set up portable unit/ pour in the slash  
Seal the blanket  
Set up 3 thermal couples

#### Burn

Ignite with torch/gasoline  
Record temperatures and time  
Extinguish fire

#### Post Burn

Cool Biochar with water  
Separate bio char into 100% converted and 50% converted  
Determining level of frangibility  
Weigh 100% converted bio char  
Weigh 50% converted bio char – conservative estimate

## Data

Burn #1	7/11/12	Pack Forest Alder	Total time: 75 min
Time (min)	Temperature (measured 2 ft above ground level)		
	First Side	Second Side	
10	302	500	
20	293	511	
30	601	521	
40	607	589	
50	617	635	
60	710	691	
63	737	688	
68	752	715	
73	860	755	
Average	608.7777778	622.7777778	Combined Average 615.7777778
Burn #2	7/11/12	Pack Forest Alder	Total time: 63 min
Time (min)	Temperature (measured 2 ft above ground level)		
	First Side	Second Side	
10	337	199	
20	445	270	
30	472	503	
40	699	525	
50	716	572	
58	688	619	
Average	559.5	448	Combined Average 503.75
Burn #3	7/12/12	Pack Forest Alder	Total time: 85 min
Time (min)	Temperature (measured 2 ft above ground level)		
	First Side	Second Side	
10	34	40	
20	173	153	
30	287	277	
40	383	336	
50	460	468	
60	508	655	
70	545	560	
80	630	706	
83	671	755	
Average	410.1111111	438.8888889	Combined Average 424.5

## Discussion

Cost – The over all cost of the blanket will decrease when we increase the portable unit in size.

### The current \$/kgs per sq ft

Stainless - \$1.27 Per sq ft  
Foil - \$1.61 Per Sq ft  
Insulation – 30 cents per Sq ft  
The current units average cost is \$881.20

Yield – The unit produces at a 30% - 35% conversion rate producing 53.27 kgs of bio char per burn. Our average slash pile weighs 170.33 kgs. This has been a consistant rate over units past 3 generations. The conventional method converts 8% to 25%. Industrial conversion rates avg at 42%

### Profit

Current Price- \$10.00 ~ lb  
\$800.00 ~ ton

## Future Direction

- The next version of the conversion unit is to make it a 8 times bigger and more cost effective. Saving on the capitol and operational costs
- 1500 kgs slash piles
- The next version would cost on avg \$7049.73
- The next version of the blanket will increase in yield and conversion rates.
- The materials are inexpensive and decrease the over all cost, because of the ultra-low capital and operating costs. The entire unit will be welding the, not using any screws, nuts, or bolts

## References

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