Supplemental Materials

Exploring Biochar Options for the Hunter Valley Region

Team Members:

- Jack Waterman
- John Pattinson
- Zachary Chapins
- Ricardo Ferrúa

Sponsors:

- Beyond Zero Emissions (Dr. Dominique Hes)
- Aimee Mehan

Advisors:

- Professor Lorraine Higgins
- Professor Uma Kumar

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Section A: Screenshot of Community Survey

Gauging your opinion on green waste use for a thriving Hunter

This survey will only take about 5 minutes, there are only 9 questions. Below is a brief summary of our project and the purpose of this survey. We thank you for taking a few moments to fill out our survey.

The purpose of this study is to support local researcher Aimee Mehan and solutions think tank Beyond Zero Emissions, to identify effective strategies for the people of the Hunter to use green waste from gardens, food, clippings etc. to create biochar.
https://pacificbiochar.com/definition-of-biochar/

The survey is completely anonymous, the questions below will help us understand Hunter Valley home garden practices, opportunities, and plant material recycling.

Kind thanks,

Zachary, John, Ricardo, and Jack

All four of us are currently studying at Worcester Polytechnic Institute in Worcester, Massachusetts in the United States.

A few terms:

Biochar - Biochar is a soil additive that improves soil fertility, lowers greenhouse gas emissions, traps carbon from the atmosphere, and increases water retention reducing the need for watering.

Green Waste - Clippings, pruning, garden waste, food waste, the bits from the production of timber products when you turn a round tree into square planks and posts.

* Required

1. What council in the Hunter area do you reside in? *

- ◯ Cessnock City Council
- ◯ City of Newcastle Council
- ◯ Dungog Shire Council
- ◯ Lake Macquarie Council
- ◯ Maitland City Council
- ◯ Midcoast Council
- ◯ Muswellbrook City Council
- ◯ Port Stephens Council
- ◯ Upper Hunter Shire Council
- ◯ Singleton Council
- ◯ Other: _____

2. Do you have a home garden or is there a community garden near you that you participate in? *

- ◯ Yes
- ◯ No

3. How do you handle excess garden plant waste in your home or community garden?

- ◯ Compost
- ◯ Landfill (rubbish bin)
- ◯ Green Bin
- ◯ Other: _____

4. If green waste from your home could be used to make biochar, please rate the following options from a scale of 1 to 4 (1 is least preferable, 4 is most preferable). Please only use each number once. *

	1	2	3	4
I would like to make biochar at home	○	○	○	○
I take my green waste to a local community facility, and I take back the biochar for use in my own garden	○	○	○	○
The council collects my green waste and the biochar produced is used in council gardens and parks, and I can buy some biochar back for a small fee for use in my own garden	○	○	○	○
My green waste is collected and taken to a biochar production plant in the Hunter where my green waste is turned into biochar and can be used by Hunter farmers and councils	○	○	○	○

5. Any comments or suggestions based on the options above?

Your answer

6. On a scale from 1 to 5, please rate your interest in composting *

	1	2	3	4	5	
Not Interested	○	○	○	○	○	Very Interested

7. On a scale from 1 to 5, please rate your interest in recycling *

	1	2	3	4	5	
Not Interested	○	○	○	○	○	Very Interested

8. Are there any ecological and/or environmentally friendly practices you partake in at home? (i.e. permaculture, sustainable agriculture, etc...) If so, please describe them below.

Your answer

9. Are you interested in more information on biochar and the outcomes of the research? If so, please leave your email below.

Your answer

Section B: Interview Summary Table

Interviewee	Subject Covered
John Shiel	Energy Sector
Annabel Kater & Su Morley	Forestry Management & Community Engagement
Tim Askew	Sustainable System Economics & Material Flow Chart
David Holmgren	Permaculture
Catherine Pepper & Elfi Blackburn	Green Waste Collection & Management
Jonathan Wood	Project Feasibility
Michael Askew	Bioeconomy
Joe Herbertson	Biochar Production
Kerry Bowen	Local Kon Tiki user & Biochar Producer

Section C: Maitland City Council Waste Management Data - Garden Organics Mileage

Garden Organics Mileage						
DATE	**2633**	**2634**	**2635**	**2636**	**2637**	**TOTAL**
11/2/2020	126	183	0	0	0	309
11/3/2020	60	206	0	0	0	266
11/4/2020	190	216	0	0	0	575
11/5/2020	68	142	5	0	74	289
11/6/2020	0	106	212	0	0	318
	444	**853**	**217**	**0**	**74**	**1757**
11/9/2020	0	192	249	0	0	441
11/10/2020	200	221	268	0	82	771
11/11/2020	0	133	179	0	0	1212
11/12/2020	140	166	0	0	120	426
11/13/2020	96	0	169	194	0	459
	436	**712**	**865**	**194**	**202**	**3309**

Section D: Maitland City Council Waste Management Data - Green Waste Collected by Month

	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	total
Kerbside collected organics	537.16	443.21	552.94	877.84	533.34	418	454.69	929.48	1128.59	1093.87	553.34	572.84	8095.62
Organics dropped off at Waste Management Centre	158.72	133.18	229.96	188.14	167.74	116.84	111.14	143.1	168.82	245.88	189.04	169.9	2022.46
Total	695.88	576.39	782.9	1065.98	701.08	535.16	565.83	1072.58	1297.41	1339.75	742.38	742.74	10118.1
Contamination - Kerbside organics bin	0.20%												

Section E: Hunter Joint Organization Report Summary

Council	Area (Km^2)	Population	Distance (No Population)	Distance (Population based)
MidCoast	10,053	93,288	105,760	118,579
Cessnock	1,966	59,101	20,683	14,692
Dungog	2,251	9,200	23,681	2,618
Lake Macquarie	648	204,914	6,817	16,789
Maitland	396	83,203	4,166	4,166
Musswellbrook	3,405	16,383	35,821	7,053
Newcastle	187	165,571	1,967	3,914
Port Stephens	979	72,695	10,299	8,998
Singleton Shire	4,893	23,496	51,475	14,536
Upper Hunter Shire	8,096	14,220	85,172	14,557
Total	32,874	742,071	345,841	205,902

Section F: Authorship

Booklet Assembly:
Zachary Chapins

Abstract:

Author: Jack Waterman
Editor(s): Ricardo Ferrua, John Pattinson, Zachary Chapins

Introduction:

Effects of Greenhouse Gas Emissions and Climate Change
Author: Ricardo Ferrua
Editor(s): Jack Waterman

Bio-friendly Practices and Biochar
Authors: Jack Waterman & John Pattinson
Editor(s): Zachary Chapins, Ricardo Ferrua

Chapter 1: The Hunter Valley and Potential of Biochar

Hunter Valley Background
Author: Jack Waterman
Editor(s): John Pattinson

Opportunities for the Hunter to Adopt Biofriendly Practices
Authors: Jack Waterman, Ricardo Ferrua
Editor(s): John Pattinson

Forestry Residue
Author: Zachary Chapis
Editor(s): Jack Waterman

Agricultural Biomass
Author: Zachary Chapins
Editor(s): Jack Waterman

Green Waste
Author: Zachary Chapins
Editor(s): John Pattinson

Timber Waste
Author: Zachary Chapins
Editor(s): John Pattinson

Regenerative Forestry
Author: Zachary Chapins
Editor(s): John Pattinson

Feedstock Life Cycle
Author: Zachary Chapins
Editor(s): John Pattinson

Biochar
Author: John Pattinson
Editor(s): Zachary Chapins

Biochar Production
Author: John Pattinson
Editor(s): Zachary Chapins, Jack Waterman

Chapter 2: Community Support & Stakeholder Interest

Interview Data and Results
Author: Jack Waterman
Editor(s): John Pattinson, Ricardo Ferrua

Benefits of Biochar
Author: John Pattinson
Editor(s): Jack Waterman

Timber and Forestry
Author: Zachary Chapins
Editor(s): Jack Waterman

Agricultural Sources
Author: Zachary Chapins
Editor(s): Jack Waterman

Residential Sources
Author: Ricardo Ferrua
Editor(s): Jack Waterman

Policy Changes Regarding Waste
Author: Jack Waterman
Editor(s): Ricardo Ferrua, John Pattinson

Small Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua

Medium Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua, Zachary Chapins

Large Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua, Zachary Chapins

Challenges
Author: Jack Waterman
Editor(s): Ricardo Ferrua

Community Support Survey
Authors: Jack Waterman
Editor(s): Ricardo Ferrua

Rating of the Scales
Author: Jack Waterman
Editor(s): Zachary Chapins

Discussion of Survey & Interview Results - Small Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua

Discussion of Survey & Interview Results - Medium Scale
Author: Jack Waterman
Editor(s): Zachary Chapins

Discussion of Survey & Interview Results - Large Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua

Chapter 3: Life Cycle Assessment

Introduction
Author: John Pattinson
Editor(s): Ricardo Ferrua

Goal and Scope
Author: Ricardo Ferrua
Editor(s): John Pattinson, Jack Waterman

Life Cycle Inventory
Author: Ricardo Ferrua
Editor(s): John Pattinson, Jack Waterman

Life Cycle Impact Assessment
Author: Ricardo Ferrua
Editor(s): John Pattinson, Jack Waterman

Small Scale Results
Author: Zachary Chapins
Editor(s): Jack Waterman, John Pattinson

Medium Scale Results
Author: Jack Waterman, John Pattinson
Editor(s): Ricardo Ferrua

Large Scale Results
Author: John Pattinson
Editor(s): Jack Waterman

Interpretation of LCA Results
Author: Jack Waterman
Editor(s): Ricardo Ferrua

Life Cycle Costing and Results
Author: Zachary Chapins
Editor(s): Ricardo Ferrua, Jack Waterman

Chapter 4: Recommendations

Small Scale
Author: Ricardo Ferrua
Editor(s): Jack Waterman, John Pattinson

Medium Scale
Author: Jack Waterman
Editor(s): Ricardo Ferrua, John Pattinson

Large Scale
Author: Ricardo Ferrua
Editor(s): Jack Waterman, John Pattinson