



# **EXPLORING OPPORTUNITIES FOR WOODY BIOMASS UTILIZATION IN COCONINO COUNTY, ARIZONA**

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**MSUS CULMINATING EXPERIENCE PROJECT**

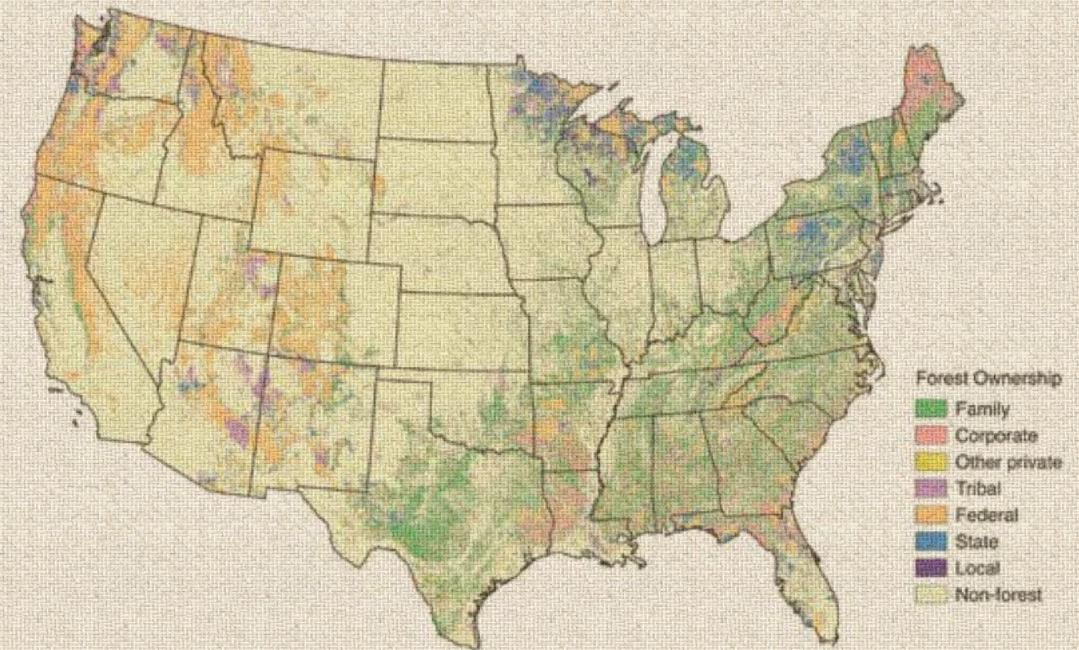
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# TABLE OF CONTENTS

1. INTRODUCTION TO THE PROBLEM
2. PROJECT PARTNERS
3. METHODS AND APPROACHES
4. PROPOSED SOLUTIONS
5. PROJECT OUTCOMES AND TAKEAWAYS
6. LOOKING TO THE FUTURE
7. REFERENCES

# FOREST RESTORATION BARRIERS IN COCONINO COUNTY

1. EXTENSIVENESS OF FEDERAL LAND IN THE REGION
2. THE MARGINAL VALUE OF STANDING TIMBER
3. THE LACK OF EXISTING SAWMILLS
4. THE LACK OF A BIOMASS PROCESSING INDUSTRY
5. RISING COSTS OF WILDFIRE SUPPRESSION



\*A=annual benefit or cost; L=benefit or cost of limited duration; O=One time benefit or cost.

FIGURE 2. DIVERSITY OF FOREST OWNERSHIP TYPES ACROSS THE UNITED STATES

FIGURE 3. Reductions in Forest Investment Appropriations (BY FUND) Retrieved from "Arizona's Forest Resources" (Shaw et al. 2018)

Retrieved from The Risk Costs of Wildfire Operations (2015, 2018)

# PROJECT PARTNERS

FLAGSTAFF WATERSHED PROTECTION  
PROJECT



FOREST STAKEHOLDERS IN COCONINO  
COUNTY

The City of Flagstaff Economic Development Department

The City of Flagstaff Sustainability Department

Flagstaff Watershed Protection Project

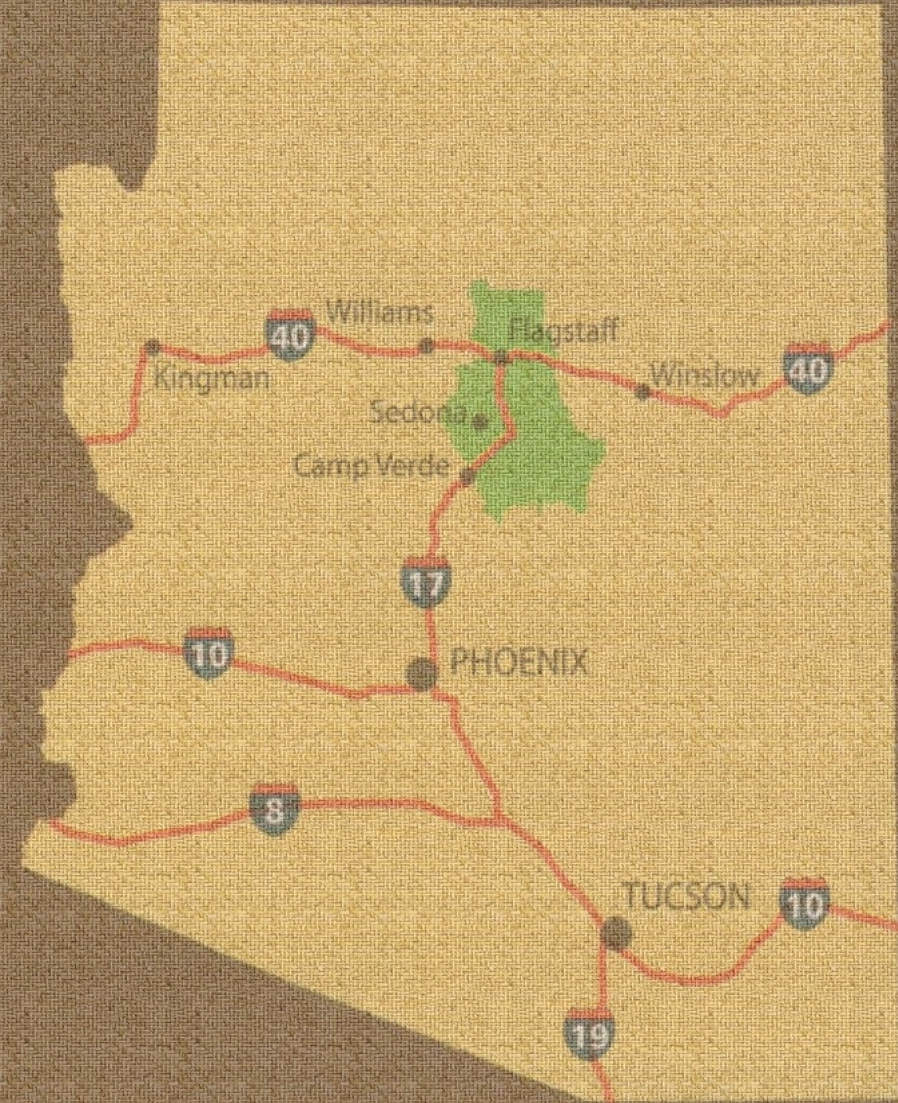
Northern Arizona University

Coconino County Forest Restoration Director

Natural Resource Advisors

Forestry Consultation Organizations

# ARIZONA





# METHODS AND APPROACHES:

## HOW TO AID FOREST RESTORATION IN COCONINO COUNTY

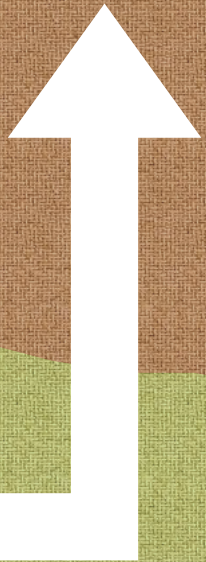
BIOCHAR

COMPOST

WOOD PLASTIC COMPOSITES

MUSHROOM CULTIVATION

- PRIORITIZE LOW-TECHNOLOGY PROCESSING METHODS
- FORM PARTNERSHIPS WITH LOCAL RESTORATION PROJECTS
- UTILIZE PRIMARILY MILLING RESIDUALS AND SLASH MATERIALS
- FOCUS ON LOCAL AND STATE MARKETS
- CREATE PRODUCTS WITH GROWING MARKETS
- PROMOTE MARKETING STRATEGIES THAT AID LOCAL RESTORATION EFFORTS



# TRANSFORMATIONAL SUSTAINABLE ENTERPRISE (TSE) FRAMEWORK

ANALYTICAL COMPONENT: Systems Approach

EVALUATIVE COMPONENT: Questions & Criteria

- Adapted to evaluate potential enterprises rather than established ones
- Used to assess research gaps, identify alternative business models suited to each enterprise, and evaluate the overall sustainability of each suggested enterprise

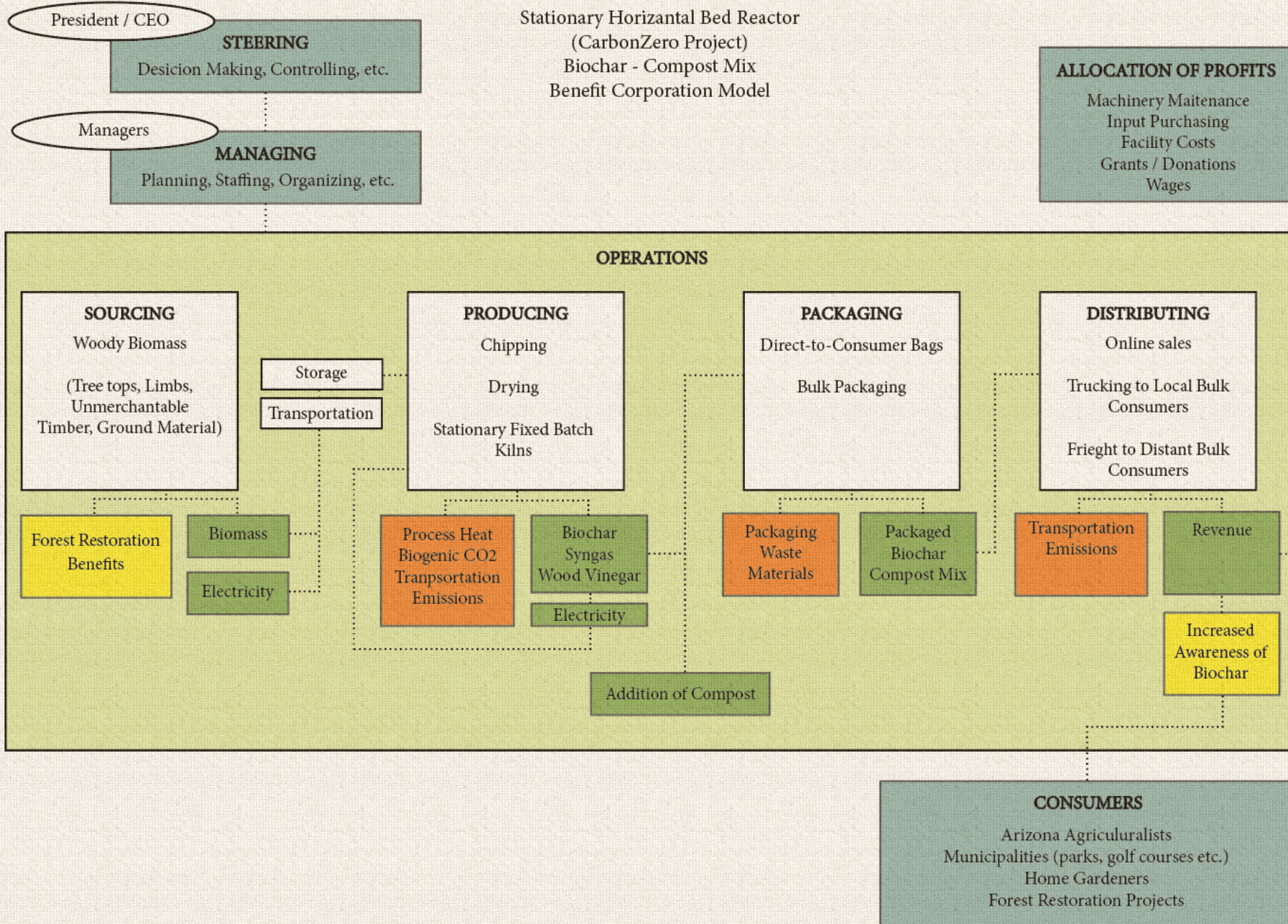
**ANALYTICAL  
COMPONENT**



**EVALUATIVE  
COMPONENT**

# BIOCHAR

Stationary Horizontal Bed Reactor  
 (CarbonZero Project)  
 Biochar - Compost Mix  
 Benefit Corporation Model



## TSE FRAMEWORK CRITERIA

## BIOCHAR

## COMPOST

## WPC'S

## MUSHROOM CULTIVATION

Color Key: CLEARLY MEETS MULTIPLE POSSIBILITIES DOES NOT MEET NOT APPLICABLE / INSUFFICIENT INFORMATION

## Sustainability Performance of the Product

Fulfills a basic or sufficient human need				
Product is fully biodegradable and non-toxic				
Product is of high quality				
Product is fairly priced				
Product is fairly accessible (limited exclusion)				

## Environmental Performance of the Enterprise

Closed water system (or releases clean water)				
Closed material system (biodegradable material)				
Closed substance system (or releases improved substances)				
Enterprise uses 100% renewable energy (or produces excess)				
Enterprise sources local material				
Enterprise leaves its sourcing environment intact or improved				
Enterprise positively contributes to the local environment				
Workforce has environmentally friendly lifestyle opportunities				

## Human and Social Performance of the Enterprise

Enterprise provides meaningful employment and work activities				
Enterprise employs people with disabilities				
Enterprise partners with local universities (employs graduates)				
Enterprise creates a healthy work environment				
Workforce has a healthy work-life balance				
Enterprise offers health promotion programs				
Workforce monitors, assesses, and improves sustainability of the enterprise				
Workforce volunteers for humanitarian or social causes				
Enterprise and workforce participate in capacity building programs				
Enterprise positively contributes to the wellbeing of the community				

## Financial and Economic Performance of the Enterprise

Enterprise generates sufficient revenue to cover the costs of operation				
Enterprise pays fair and just wages to all employees				
Enterprise has a fair and just ratio between highest and lowest wage				
Enterprise redistributes excess profits to employees or the community				

## Sustainability Performance of the Enterprise's Managing Practices

Managers plan for, implement, and control sustainability-oriented operations				
Observation, listening, and reflection inform management practices				

## Sustainability Performance of the Enterprise's Steering Practices

The enterprise is collectively owned and steered				
The workforce participates in the ownership and steering				
Owners enforce and control sustainability-oriented operations				
Owners promote a qualitative, instead of quantitative, growth strategy				
Owners keep the enterprise's size and complexity within its capacity				
Observation, listening, and reflection inform steering processes				
Owners promote sustainability beyond the boundaries of the enterprise				



# PROJECT OUTCOMES AND TAKEAWAYS



1. There was a high level of interest in this project in Coconino County; and similar endeavors are currently underway
2. There is an emerging body of literature regarding woody biomass utilization; but untested and expensive technologies have resulted in high capital costs

3. A large-scale sawmill is critical for the success of forest restoration projects in the region
4. Potential biomass utilization enterprises could benefit from working together and forming a “business cluster”



**LOOKING TO THE FUTURE...**  
**COLLABORATION AND INNOVATION ARE KEY**



# QUESTIONS?



# REFERENCES

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