

# **Sustainability and Bioenergy**

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# Dimensions of Sustainability

- Economic
  - Markets (supply, demand, price)
  - Trade
- Environmental
  - Direct & Indirect effects
  - Ecosystem services
- Social
  - Regional, National, and International
  - Food, Fuel, Feed and Fiber

# Example Sustainability Criteria

## Environmental

- Conserve Carbon
- Conserve Biodiversity
- Sustainable water
- Soil Conservation
- Air Quality

## Social

- Worker's rights
- Land rights
- Food security and availability
- Share benefit locally

“the right crops and trees in the right place with the right techniques”

**World Wildlife Foundation**

# Not all biofuels are the same!

- Grain-based (food, feed)
- Sugar-based (food)
- Oil plant (food, oilseeds)
- Cellulosic (herbaceous energy crops)
- Cellulosic (woody energy crops)
- Waste recycling (tallow, grease)
- Residues (crop, forest, urban wood diversion from landfills)

# Not all Biofuels Production is the Same!



Photo: Jake Eaton, Podtatch Corporation



## Feedstock

- Forest Residues
- Hazardous Fuel Treatments
- Short Rotation Woody Crops
- Wood Waste
- Conventional Forestry
- Mill Wastes & Residues

## Conversion

- Manufacturing
- Co-firing
- Combustion
- Gasification
- Hydrolysis
- Digestion
- Pyrolysis
- Extraction
- Separation

## Uses

### Fuels:

- Ethanol
- Other Liquid Fuels
- Hydrogen

### Electricity and Heat

### Biobased Products

- Composites
- Specialty Products
- New Products
- Chemicals
- Traditional Products

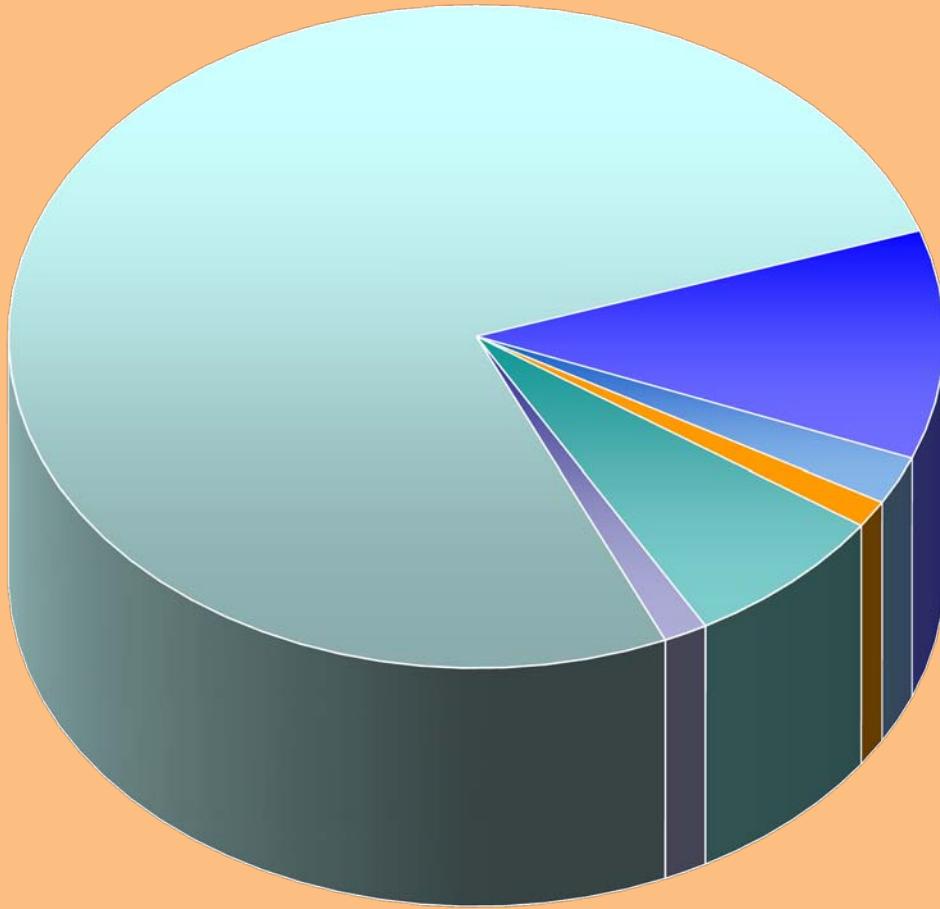
# Biofuels that make sense...

- Use material that have negative environmental consequences
  - Reduces wildfire, improves forest health/habitats, and protects watersheds.
- Produced on marginal lands with minimal inputs
  - Water, fertilizer, and low impact harvesting
- Production is scaled to match feedstock availability and provide value in maintaining landscapes
- Have favorable net energy and net GHG profiles

# Benefits to Air Quality

cents per kwh

Relative benefit of biomass use  
vs. open burning  
NREL Study (Gregg Morris)



■ Nox & SOx = 0.14¢

■ PM-10 = 0.71¢

■ CO = 0.15¢

■ Methane = 7.52¢

■ Non-Methane HCs = 1.1¢

■ CO2 = -0.23¢

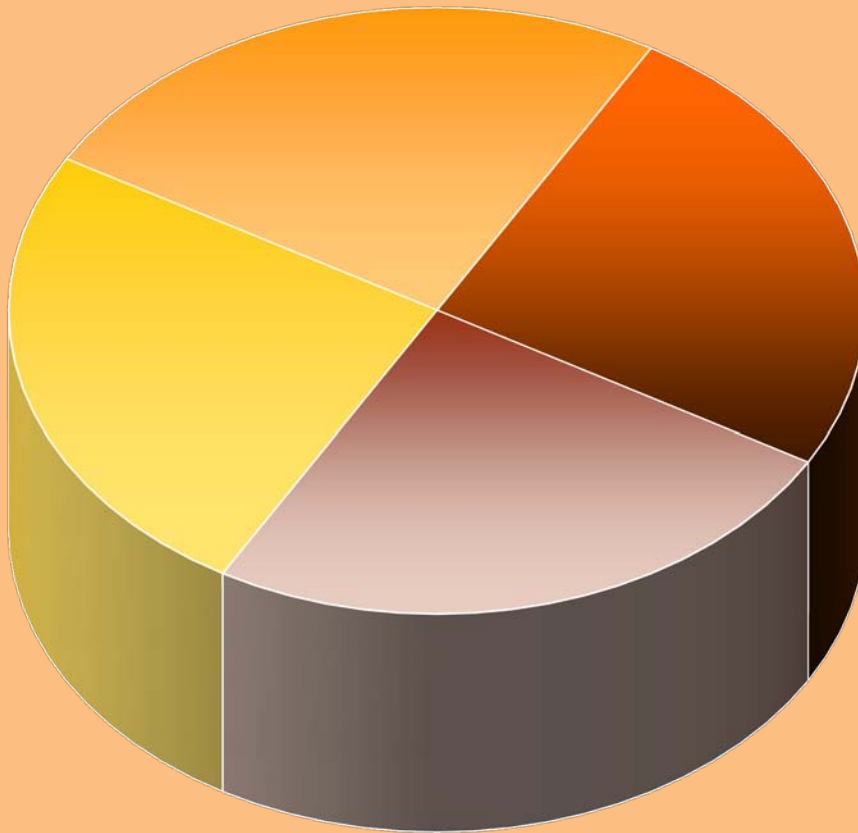
**Total = 9.39¢ / kwh**

# Societal Benefits

- **4-5 Rural Jobs per MW**  
(WGA Report)

- **Stable, family wage jobs**

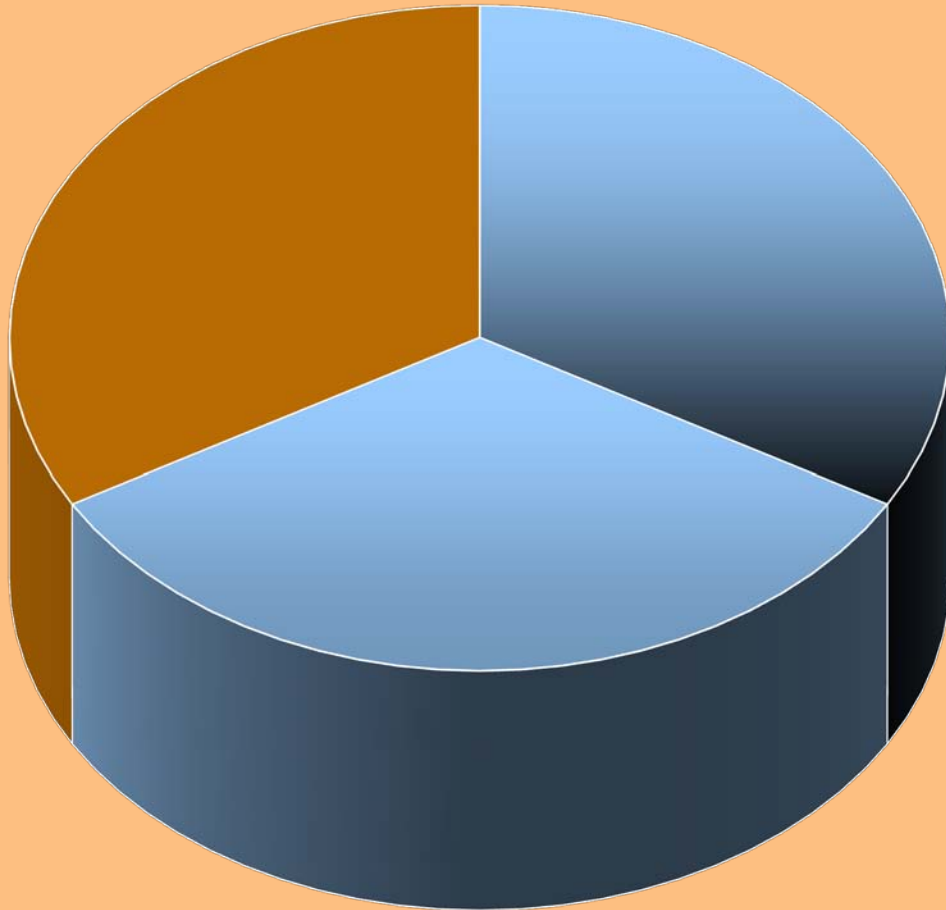
- **Protection or maintenance of scenic values and recreation opportunities**



- **Respiratory impacts**
- **Smoke & fire related safety, injuries, or mortality**
- **Facility, traffic, and fire closures**
- **School or business closures**



# Benefits of Converting Waste to Energy

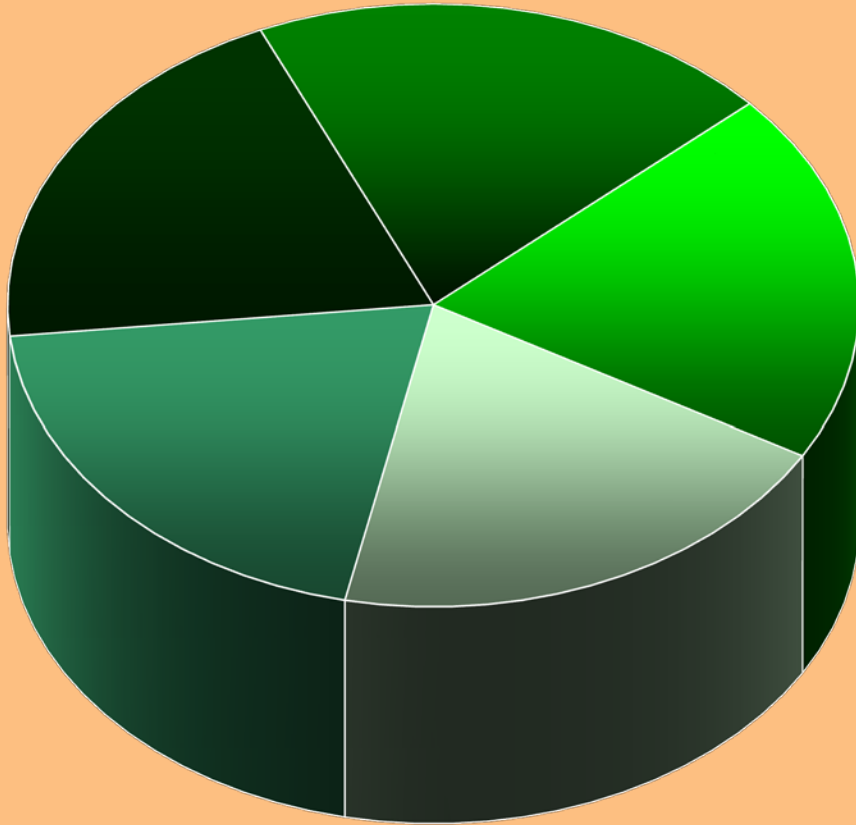


**■ Landfill Diversion**  
Reduced need for compaction  
Increased recycling capacity  
Avoided siting, permitting

**■ Energy Security**  
Energy Credits  
Foreign debt and trade  
National and economic security

**■ Grid Stability**  
Load centered, off-grid  
Line voltage support  
24/7 energy capacity

# Forest Health Benefits



## ■ Forest Health

Wood and biomass value  
(Eagle Lake RD = \$267/acre)

Increased fiber yield and value

Reduced insects and disease

## ■ Fire Prevention

Avoided Wildfires = \$856/acre

Public & Private Property Values

Avoided Rehab Costs

## ■ Wildlife Enhancement

Protect snags & downed logs

Improved fish and wildlife habitat

## ■ Watershed Protection

Avoided sediment delivery  
(Hayman Fire = \$268/acre)

Increased water quality, yields and timing

## ■ Range Improvement

Improved Rangelands and Forage

# Fundamental Concepts

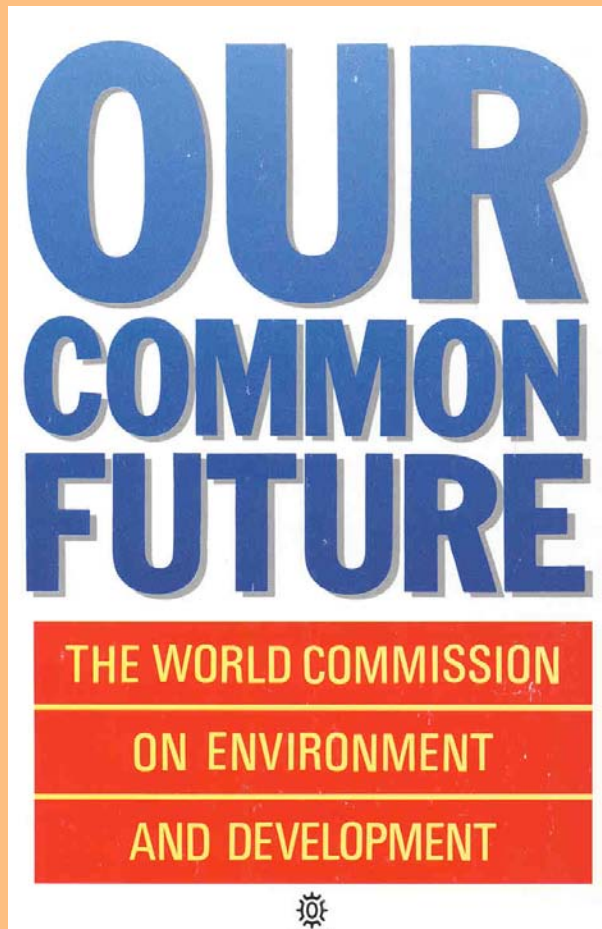
# Sustainability

...

- Intergenerational...is present and future oriented
- “Triple bottom-line”...integrates environmental, social, and economic concerns and outcomes
- Place-based...connects actions within and across geographical and political levels or scales



# Present and Future Oriented

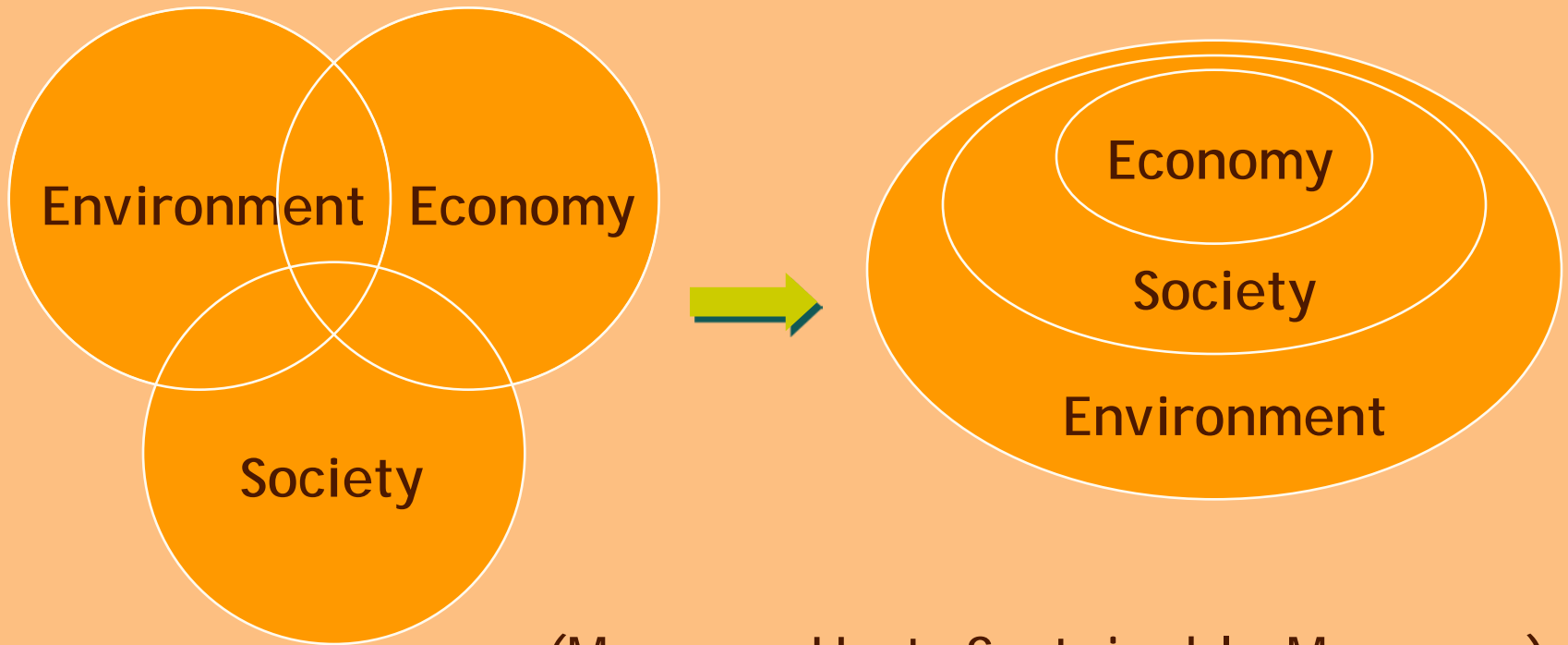


“...the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs”

(Brundtland Commission, 1987)

# “Triple Bottom-Line”

*Interconnected and integrated*



(Maureen Hart, Sustainable Measures)

# Policy

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- National
  - Energy Policy
  - Climate Change Policy
  - Forestry Policy including new Farm Bill Incentives
- Regional
  - Western Climate Initiative
  - Western Governor's Task Forces- Bioenergy and Forestry
- State
  - State Renewable Energy Goals
  - State Climate Change Goals
  - State Bioenergy Strategies
- Local collaborative efforts
  - Implementing Community Wildfire Protection Plans
  - Accomplishing forest restoration goals

# Public policy toward sustainability

- State Renewable Portfolio Standards for electrical energy
- State Climate Action Plans
- National Renewable Fuels Goals
- Community Planning- sustainable development
  - Landfills
  - District Heating
  - Sewage Treatment
  - Conserving natural areas
  - Sustainable business operations

# Closing Thoughts

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- Policies are moving quickly (energy and climate).
- Sustainable forestry principles applied equally to practices
- Biomass standard and definitions (saw logs/pulp wood)
- Restoration and sustainable forest management principles (bioenergy and ecosystem services)
- Organization of “biomass market”
- Competition between uses of biomass (energy / pulpwood markets).