



Anaerobic Digestion: Sustainable Energy and Nutrients from Food Waste

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Florida's food waste problem

- 1.7 million tons reported in 2007
- ~5% of total municipal solid waste (MSW)
- Only 1% recycled



Florida food waste sources

- 80,935 food service vendors
- 9,789 food store producing 625,000 tons annually
- Other locations: schools, prisons, processing plants, residences



Problems with current disposal methods

Landfilling

- Land requirement
- Transportation
- Methane emissions
- Leachate problems
- Nutrient lock-up
- Aesthetics

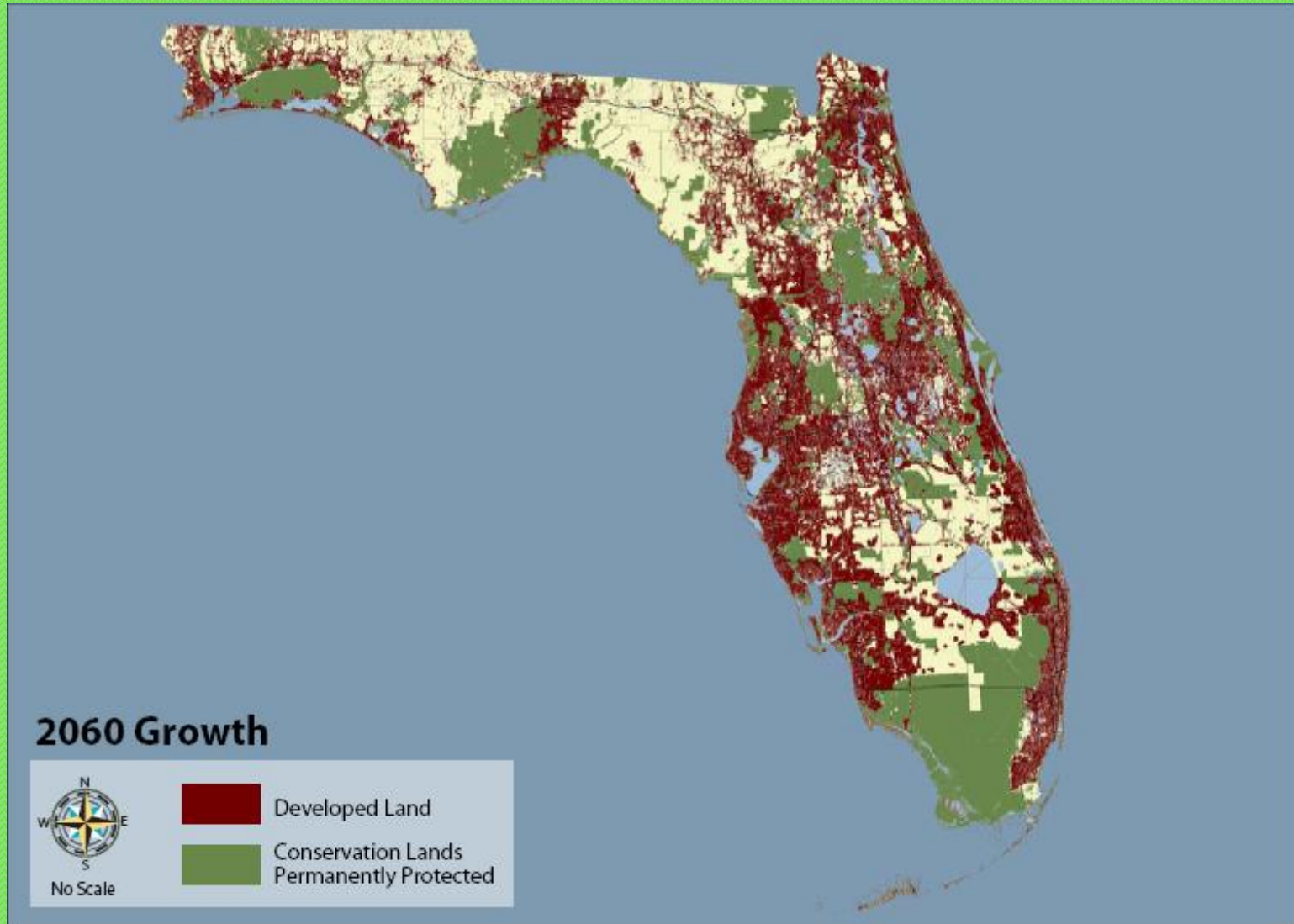


Sewage Treatment

- Overburdens treatment plant
- Energy costs
- Transporting biosolids
- Loss of nutrients



Florida is running out of land



Source: 1000 Friends of Florida

Florida's 75% Recycling Goal

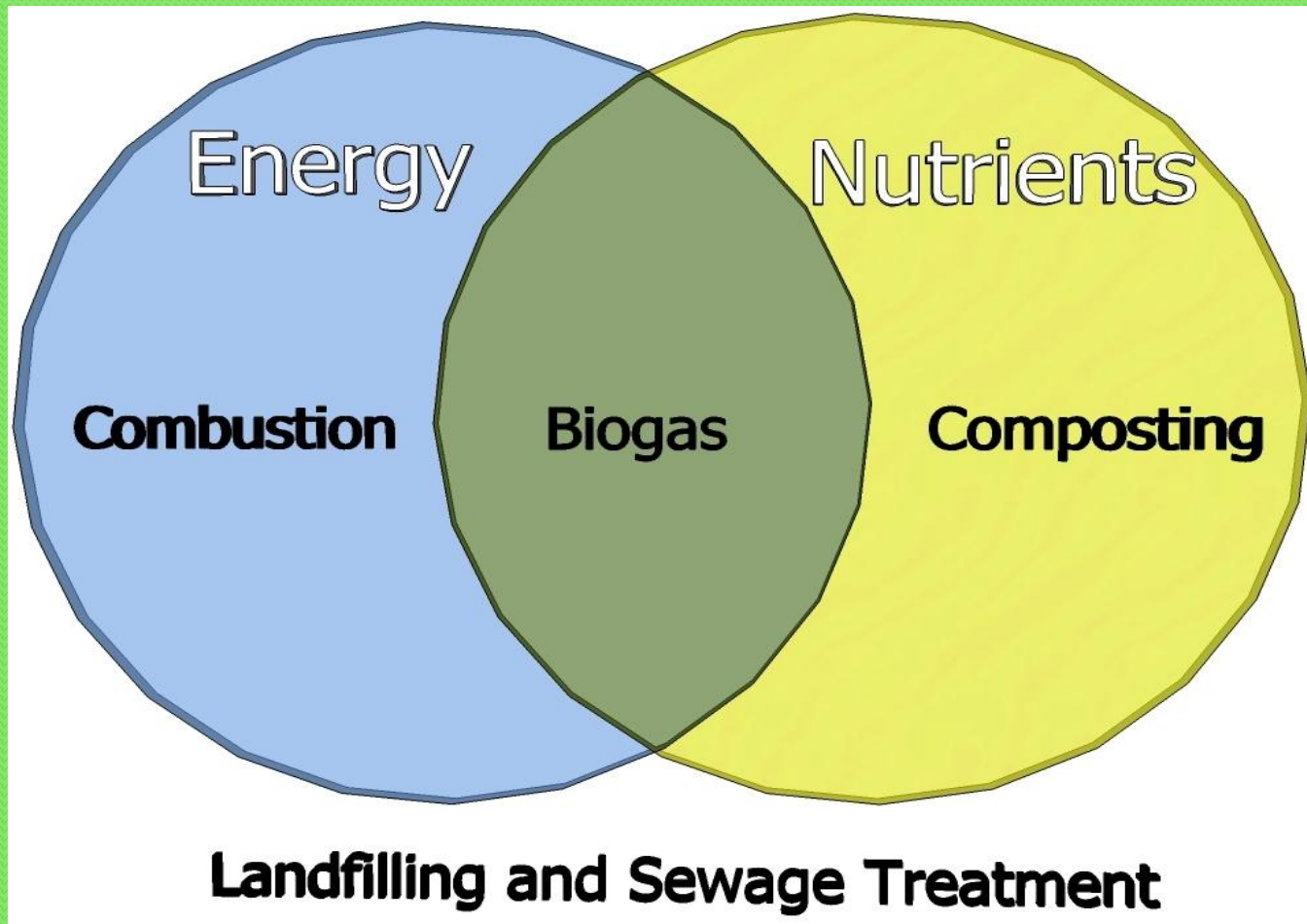
- Statute within the Energy, Climate Change, and Economic Security Act of 2008
- 75% recycling rate by 2020
- Currently recycling rate: 28%
- Creative options will need to be employed to reach goal
- Organics represent significant proportion of MSW

Florida 75% Recycling Goal

One solution: Anaerobic Digestion

- Natural, microbial decomposition of organic material
- Occurs naturally where anaerobic conditions occur (wetlands, ruminants)
- Releases carbon from material as CO₂ and methane.
- Methane captured as usable biogas
- Nutrients remain in liquid and solid effluent

Benefits of AD



Benefits of AD

- Sustainable energy
- Sustainable nutrients
- Scalable and local
- Closed-loop process
- Diverts food waste from landfills and aerobic treatment plants

Sustainable Energy

- Biogas is gaseous by product of AD
- Primarily methane (65-80%) and CO₂
- Can be combusted directly or refined to natural gas equivalent



Sustainable energy

- Carbon neutral
 - Combats global warming
- Captures energy from waste
 - No need for energy crops
- Offsets fossil fuel use
 - Stretches energy reserves

Sustainable energy

- Uses of biogas
 - Cooking
 - Heating (water/air)
 - Electricity
 - Gas lighting
 - Vehicle fuel
 - Hydrogen fuel cells



Landfill gas vs. biogas

Landfill gas

- Slow, passive process
- Gas contaminated with many pollutants
- Transportation of waste to landfill
- Good solution for existing landfill



Biogas

- Fast, active process
- Gas significantly cleaner
- Energy and nutrients
- Can be produced throughout community
- Saves space in landfill



Sustainable nutrients

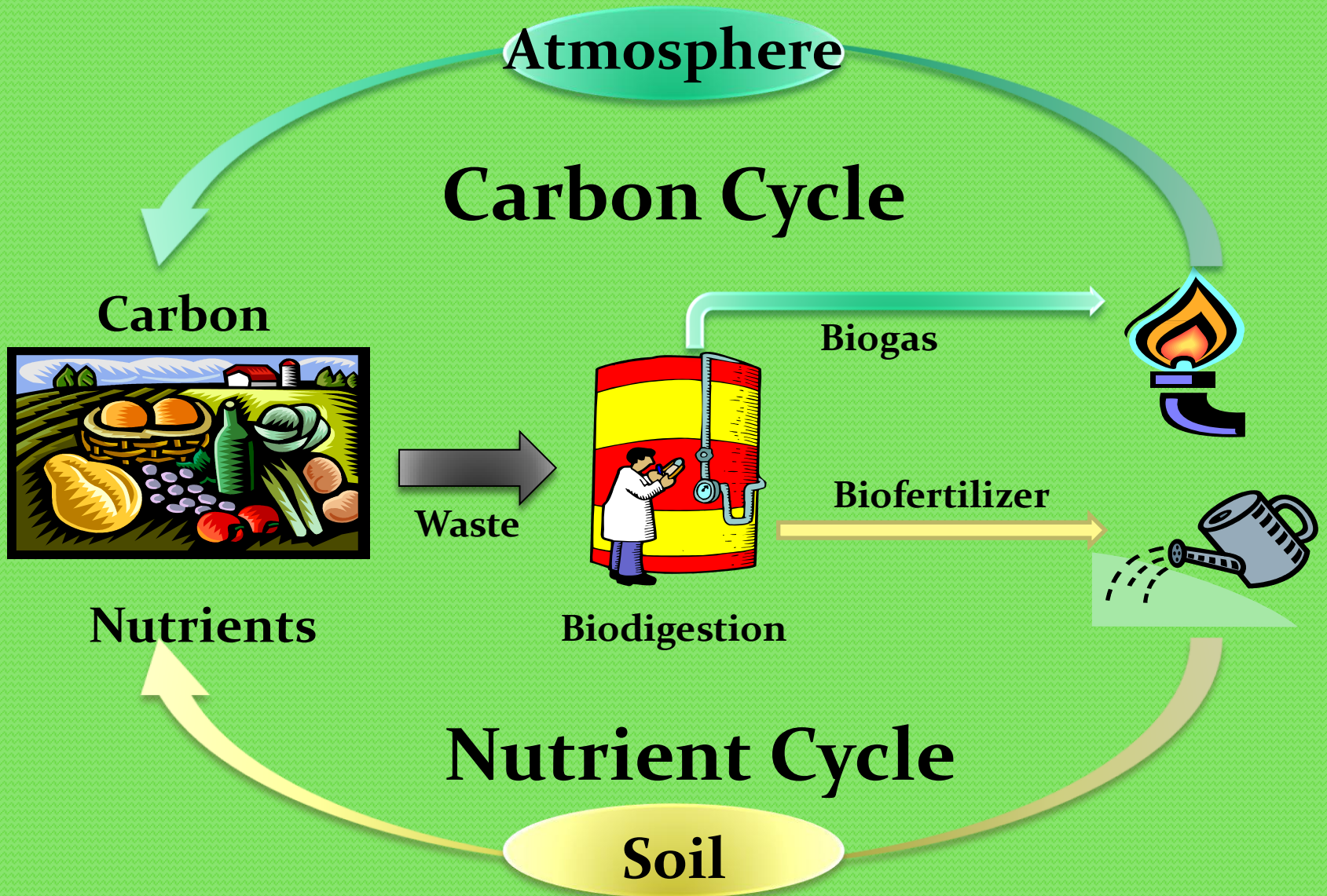
- Effluent is a nutrient-rich organic biofertilizer
- Nutrients mineralized for better plant availability
- Content depends on feedstock
(e.g. high protein=high N)



Sustainable nutrients

- Reduces use of synthetics
 - Synthetics- fossil fuel derived
- Reduces cost of organic fertilizer
- Increased organic production
- Keeps nutrients within productive cycle

Closed-loop process



Scalable and local

- Applicable to small farm or large city
- Biogas produced on-site or at centralized digester
- Can fit into any municipal waste plan



Anaerobic digestion vs. aerobic composting

Digestion

- Captures both energy and nutrients
- Faster turnover rate
- Less land required
- Not hindered by fats, grease, and oils

Compost

- Bulkier material (i.e. yard waste)
- Smaller scale (neighborhood, community gardens)
- Energy infrastructure not always feasible
- Entry-point for recycling food waste

- Possible integration of both processes

Role of Florida Universities

- “Living laboratories” for a working demonstration
- Close contact between research and implementation
- High volume waste stream from dining halls and cafeterias
- Partnership with food vendors = cost-sharing
- Education – exposure - experience

What is needed

- Determining the “low-hanging fruit” for food waste collection
- Spreading public awareness
- Pilot scale projects

BIOGAS

a renewable biofuel



<http://biogas.ifas.ufl.edu>

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