



WILLOW BIOMASS

HISTORY

- Native Americans used willow for many applications, including medicine and construction
- Late 1800s/early 1900s: Onondaga County was the center of a thriving willow basket industry
- 1980s: Willow biomass crop research began at ESF in 1986, making it the longest-running program in United States
- Today: Willow biomass crops are used in numerous environmental applications and a source for renewable energy

FUNCTION

Shrub willows have several characteristics that make them appealing for biomass production:

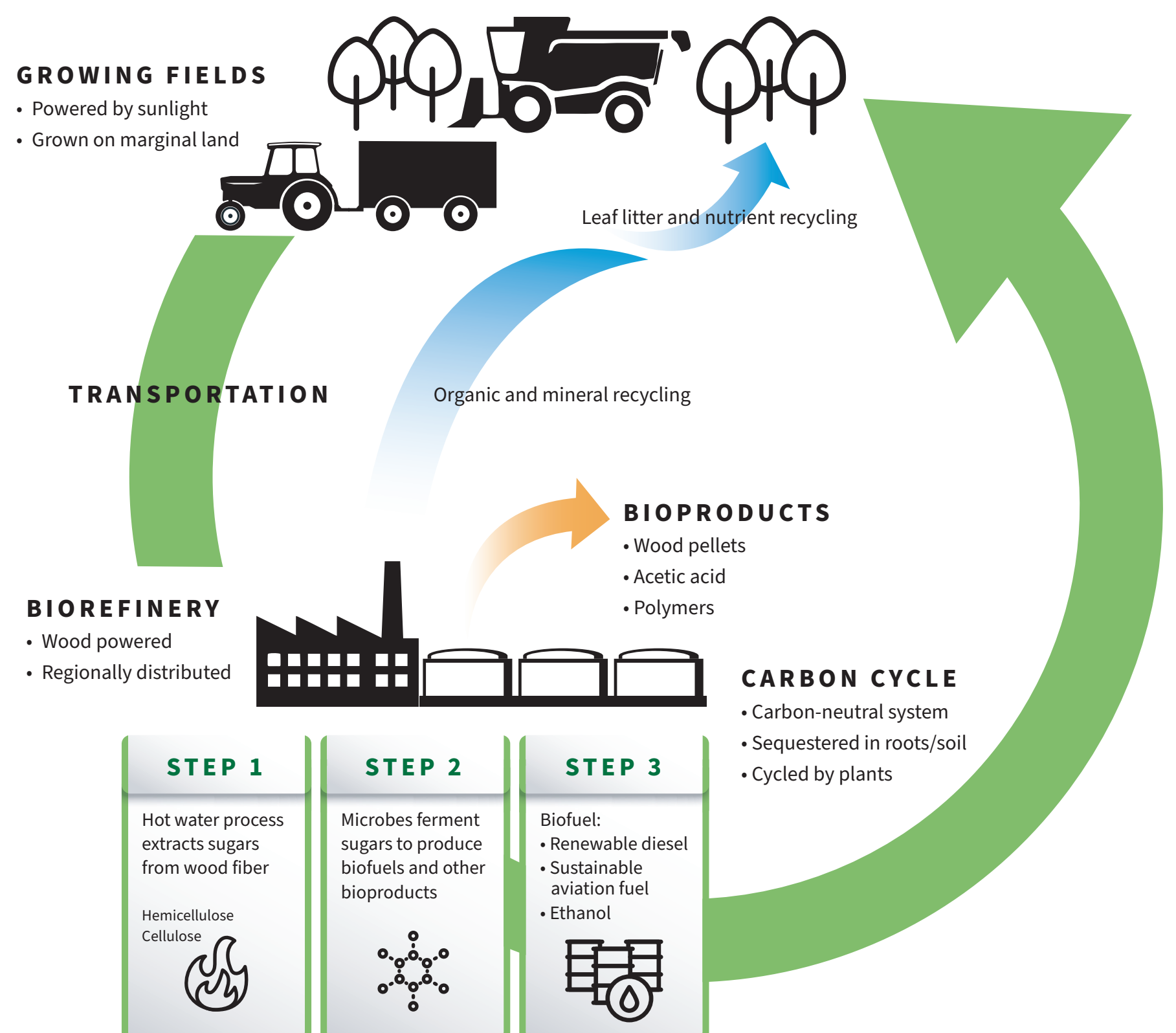
- High yields that can be obtained in three to four years
- Ease of propagation from a section of stem
- Large number of willow species with broad genetic diversity
- Ease of breeding for desirable characteristics
- The ability to resprout after multiple harvests
- Chemical composition and energy content similar to other northern hardwood species

The willow biomass crop system is built around planting genetically improved varieties on marginal agricultural land and managing the crop using the plant's ability to resprout after cutting. The willow is planted as 25-cm (~10 inch) cuttings of one-year-old stems. The plants are left to grow for three to four years and are then harvested during the late fall or winter. The willows resprout the following spring and start a new three-to-four-year rotation. A single planting can be grown and harvested for approximately 20 to 25 years.

Compared to annual crops, the perennial nature and extensive fine-root systems of willow crops reduce soil erosion and non-point source pollution, promote stable nutrient cycling, and enhance carbon storage in roots and the soil. Providing an alternative crop for marginal agricultural land will create new income streams and job opportunities in rural communities.

The low inputs required to grow willow biomass crops as an energy source and their perennial nature result in a negative carbon footprint. This means that willow biomass chips that are delivered to the gate of a biofuel, heating or power plant have stored more CO₂ than has been emitted during crop management, harvesting and transportation. ESF research has shown that biofuels made from willow also have a negative carbon footprint. This means that you can drive a vehicle down the road on biofuels made from willow and rather than emitting CO₂, a net small amount of carbon will be removed from the atmosphere.

ESF WOOD BIOPROCESSING SYSTEM



RESEARCH

The ESF willow project focuses on improving crop production, sustainability, and economics of the system.



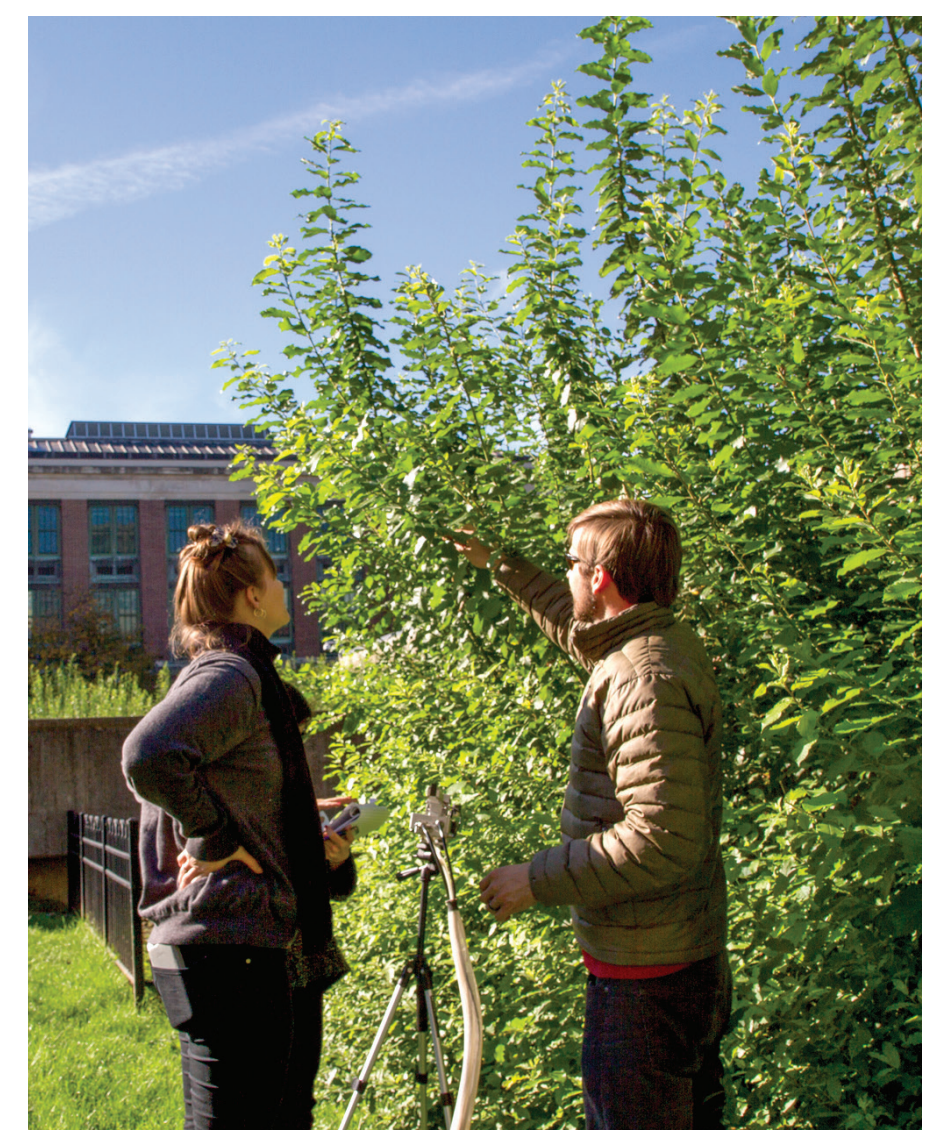
HARVESTING

Three-year-old willow plants harvested during the dormant season will resprout in the spring.



MOON LIBRARY DEMONSTRATION PLOT

The three varieties of willow in these plots were originally planted in 2010 and are harvested every 2-3 years.



STUDENT INVOLVEMENT

From field work to the lab, the bioprocessing system provides a teaching tool for students in multiple departments.

FUTURE

- There is potential for significant advancement of willow biomass cropping systems
- Continued research will help improve production techniques and plant varieties through breeding
- Increased deployment of shrub willow can help:
 - Offset dependence on fossil fuels
 - Create living snow fences
 - Provide re-vegetation
 - Clean up former industrial sites
 - Stabilize stream banks and support pollinators in the early spring

LEARN MORE AT WWW.ESF.EDU/WILLOW | GREEN INITIATIVES | PRACTICING WHAT WE TEACH