



SHRUB WILLOW

FACT SHEET SERIES



Renewable Energy & Environmental Benefits

EcoWillow 2.0 – Economic Analysis of Shrub Willow Crops

EcoWillow 2.0

Shrub willow is a short rotation woody crop (SRWC) that is being developed as a sustainable commercial enterprise. Shrub willow crops provide biomass in the form of hardwood chips that can be used to produce renewable heat and power, biofuels and bioproducts. EcoWillow 2.0 is a comprehensive financial analysis tool for willow that encompasses crop establishment, harvesting and transport to an end-user. Willow crops have been studied since 1986 at the State University of New York College of Environmental Science and Forestry (SUNY-ESF), and this research is now being applied and furthered by commercial willow operations in the Northeastern United States.

EcoWillow allows users to easily model how yield, management options and a variety of cost factors influence the cash flow and internal rate of return for willow crops. The model is flexible enough to be applied to a range of sites where willow crops can be grown across the Northern U.S. and Southern Canada. EcoWillow 2.0 is a Microsoft Excel workbook consisting of several linked worksheets containing input modules, graphical displays and a tutorial. There are five input modules in EcoWillow 2.0: *Fields, Input-Output, Plant, Harvest* and *Transport*.

Model Input-Output			Model Outputs	
General data			Financial analysis	
Total Field Area (from Fields module)	ac	25.0	Net Present Value (NPV)	\$ (520,190) (\$1,529)
Planned Area (from Fields module)	ac	23.0	NPV optimistic (R+10%, E-10%)	\$ (81,634) (\$2,269)
Average biomass yield delivered (wet)	ton/ac/yr	10.0	NPV pessimistic (R-10%, E+10%)	\$ (821,140) (\$34,049)
Crop rotation length	yr	3	Internal Rate of Return (IRR)	% -0.8% -4.4%
Interest rate	%	5.00%	IRR optimistic (R+10%, E-10%)	% 0.0% 4.1%
Land costs (tax, taxes) and insurance	\$/ac/yr	35	IRR pessimistic (R-10%, E+10%)	% #DIV/0! #DIV/0!
Internal administration costs	\$/ac/yr	5		
Biomass price paid at plant gate (wet)	\$/ton	27.50	Production costs and revenues	
Stock removal at project end	\$/ac	400		
Moisture content at harvest (for dry outputs)	%	45%	13 yrs	22 yrs
Incentive Program			Costs per acre	\$/ac/yr
Years of enrollment in incentive program	yr	0	Gross revenue	\$241 \$255
Annual acreage incentive payments (AIP)	\$/ac/yr	0	Net revenue	(\$61) (\$19)
Percentage of AIP paid in harvest year	%	0%	Net revenue per ton (wet)	\$/ton \$33 \$30
Biomass incentive co-payments (wet)	\$/ton	0	Startup costs prior to first harvest	\$ \$32,500
Establishment grants received	\$/ac	0	Startup costs per acre	\$/acre \$1,416
Crop Establishment			Costs for one commercial harvest	\$ \$6,515
Vegetation removal (brush hogging)	\$/ac	25		
Contact herbicide	\$/ac	30	Dry outputs (0% moisture)	
Flow	\$/ac	20	13 yrs	22 yrs
Rock picking and site improvements	\$/ac	0	Cost per ton (dry)	\$/ton \$65 \$54
Disc	\$/ac	20	Net revenue per ton (dry)	\$/ton (\$10.37) (\$3.75)
Plant cover crop	\$/ac	50	Harvest costs per unit biomass	\$/ton \$17
Kill cover crop	\$/ac	30	Transport costs per unit biomass	\$/ton \$19
Planting Costs (from Plant tab)	\$/ac	918		
Crop Maintenance				
Preemergent herbicide after planting	\$/ac	45		
Weed control - 1st growing season	\$/ac	15		
Replant/Miscellaneous - 1st growing season	\$/ac	0		
Copper (cut back)	\$/ac	10		
Fertilizer (excepting cost each harvest)	\$/ac	65		
Weed control - 2nd growing season	\$/ac	15		
Replant/Miscellaneous - 2nd growing season	\$/ac	0		
Total establishment cost	\$/ac	1,243		

The main Input-Output Module in EcoWillow 2.0

Information from these research and commercial ventures has been incorporated into EcoWillow 2.0 including the most recent data, logistics, best practices and possible incentive payments. EcoWillow 2.0 includes several key updates and a more user-friendly design. A series of suggested default values are pre-entered into the model, representing a conservative base case production scenario, with other possible scenarios summarized at the end of this fact sheet. Most of these parameters can be modified by the user to represent their conditions and costs. EcoWillow 2.0 and all supporting material can be downloaded at no cost from:

www.esf.edu/willow

Model Structure

EcoWillow 2.0 is a versatile analytical tool designed to be useful for farmers, land owners, investors, project developers, extension personnel, resource managers and others.

Fields Module

The Fields module is a new addition to EcoWillow 2.0 which allows users to combine multiple fields in various locations into one project. This module provides user input options for up to 20 individual fields to be modeled as one financial analysis. The Fields module also facilitates improved calculations of headlands/unplanted area and transport distance for each field and the project as a whole - important factors in estimating biomass output and costs.

Input-Output Module

The Input-Output module is the primary worksheet of EcoWillow 2.0. Inputs on this page include general model parameters, field data, incentive program payments, crop establishment and maintenance costs. Totals from all other modules (Fields, Plant, Harvest, Transport) also feed into this module. The model outputs include net present value (NPV), internal rate of return (IRR), and production costs/earnings per ton of biomass in both wet and dry weights. Model outputs are presented on the right side of this worksheet.



A tractor-mounted planter establishing willow in NY State



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Planting Module

The Planting module of EcoWillow 2.0 is based on data from commercial willow plantings recently conducted in New York State. Inputs cells on this page include the labor, equipment and supplies required to plant a willow crop. An option for refrigerated truck rental is included in this module to account for proper storage of planting stock, as cuttings should be kept cool until just prior to planting. Outputs of this module include categorized cost totals, total planting costs, and planting costs per unit land area.

Harvest Module

The Harvest module of EcoWillow 2.0 is based on commercial-scale harvesting of willow crops using a New Holland 9000 series forage harvester and 130FB short rotation woody crop cutting header. Total harvest time, fuel use, labor, equipment and other variables affecting harvest costs are calculated as a function of standing biomass in the field and the rate of harvest, which can be adjusted by the user. Outputs of this module include categorized cost totals, total harvest cost, cost per unit land area, and cost per unit biomass.



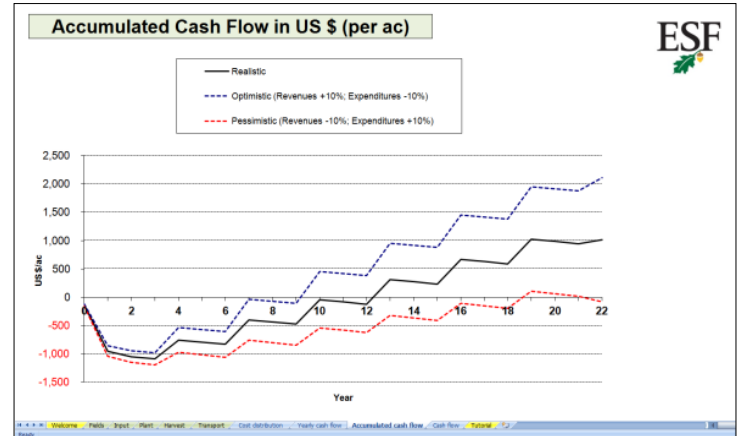
Commercial-scale harvesting of willow crops in NY State

Transport Module

The Transport module of EcoWillow 2.0 is based on logistics and cost estimates from commercial willow operations recently conducted in New York State, with user options for the size of transport vehicles, loading times, and method of chip transfer from collection to transport vehicles. Outputs include total transport cost, cost per unit land area, and cost per unit biomass.

Graphical Outputs and Cash Flow

EcoWillow 2.0 provides a series of graphical outputs which display the project cost distribution, the annual and accumulated cash flows.



Graphical output of accumulated cash flow for optimized crop production scenario in EcoWillow 2.0

Crop Production Scenarios

Four generalized willow crop production scenarios using EcoWillow 2.0 have been developed and tested by SUNY-ESF. These scenarios include the conservative base case pre-entered into the model upon downloading if for the first time, and three potential alternative scenarios that add system optimizations and possible incentive payments to the base case. For outputs and more information on these scenarios, please refer to the corresponding fact sheet “Willow Crop Production Scenarios” available for download at the address below.

Authors: Justin P. Heavey and Timothy A. Volk
Willow Biomass Program at SUNY-ESF
Department of Forest and Natural Resources Management
SUNY-ESF College of Environmental Science and Forestry, Syracuse, NY
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Or contact us by phone: (315) 470-6775 or email: willow@esf.edu