

Economic Impact of Federal Incentives on Short Rotation Woody Crops (SRWC) Willow Projects in New York

Thomas Buchholz^{*a}, Timothy A. Volk^a, Michael J. Kelleher^b, Lawrence P. Abrahamson^a

State University of New York, College of Environmental Sciences and Forestry (SUNY-ESF)

Abstract:

Economics of SRWC depend on site productivity and the delivered price for biomass. Under current management practices willow biomass crops with yields of 12 odt ha⁻¹ yr⁻¹ (5 odt A⁻¹) with a delivered price of \$60 odt⁻¹ have an internal rate of return of about 6.2%. When yield drops below 9 odt ha⁻¹ yr⁻¹ (3.5 odt A⁻¹) the IRR drops below 0% in the absence of incentive programs. Sites with higher productivity and similar costs are economically viable without subsidies. We examined the economic impact of two existing incentive programs under New York conditions - the Conservation Resource Program (CRP) and the Biomass Crop Assistance Program (BCAP) – as well as the impact of generic incentive schemes based on annual incentive payments (AIP) and establishment grants (EG). Through the CRP, low productivity sites need at least a 50% establishment grant to become economically viable and several years of annual incentive payments. Average AIPs currently paid through the CRP vary with an average about \$130 /ha/yr (\$53/A/yr) in New York State. The current regulations for the Biomass Crop Assistance Program consists of an 75 % establishment grant, an AIP paid through 15 yrs except in years of harvest, and a Cropping, Harvest, Storage, Transport (CSHT) match of \$1 per odt up to 45 \$ total for each odt delivered to a bioenergy facility. BCAP does not favor any given site productivity as it increases the Internal Rate of Return (IRR) by a similar percentage point across all site ranges. Looking at the BCAP program from a payee's perspective, it is more cost-efficient to support high productivity sites measured in how many tons are delivered per \$ spent. For instance, the cost to BCAP for a site productivity of 4 or 20 odt/ha/yr (1.6 or 8 odt/A/yr) is \$184 or \$73 per odt produced, respectively. Experiences from Sweden have shown that a well designed incentive program can boost establishment of SRWC. However, results from these programs have also shown that the establishment grants need to be performance-based (e.g. survival rate >80 % after the first year) as many of those plantations failed due to neglect in planting and best management practices.

Keywords: SRC, willow crops, economic analysis, policy, incentive, market barriers.

^a Department of Forest and Natural Resource Management

^b SUNY Center for Sustainable and Renewable Energy

* Corresponding author:

SUNY College of Environmental Science and Forestry, 340 Illick Hall, 1 Forestry Drive, Syracuse, NY 13210, USA; Phone: +1 (802) 881 5590 ; Email: tsbuchho@syr.edu

Subject Area: 5. Commercializing SRWC: Linking Feedstock Production with End Use and Policy Considerations

A Protocol for Identifying Suitable Testing and Deployment Sites of Poplar Energy Production Systems in the Midwest, USA

Ronald S. Zalesny Jr.^{1,*}, Deahn M. Donner¹, David R. Coyle², William L. Headlee³, Richard B. Hall³

¹U.S. Forest Service, Northern Research Station, Institute for Applied Ecosystem Studies, Rhinelander, WI

²University of Wisconsin, Department of Entomology, Madison, WI

³Iowa State University, Department of Natural Resource Ecology and Management, Ames, IA

It is difficult to predict establishment success of short rotation poplar energy crops in landscapes where the trees have not been previously grown. Therefore, we are merging our knowledge of poplar biology with large-scale spatial analysis to predefine zones of potential plant adaptation that are ecologically sustainable and economically feasible across the landscape. We identified in a spatially-explicit manner candidate areas within Minnesota and Wisconsin, USA for potential field testing by combining key climatic and soil properties with land ownership and use constraints. We ranked lands based on current land use (i.e., open land cover types), land ownership (private vs. public), suitability of soil for agriculture (marginal vs. prime), and economic thresholds. Next, to define the candidate areas, we determined the range of variability (i.e., mean and variance) in climate properties (e.g., growing degree days, temperature, precipitation) and key soil properties (e.g., available water holding capacity, bulk density, pH) for the resulting land base. We are also combining empirical data from prior regional field testing networks (see Zalesny et al. – poplar database) with productivity models to predict establishment and long-term yield of favorable genotypes throughout the candidate areas. We are conducting field reconnaissance and surveys to assess the potential opportunities for maintaining soil health, water quality, and other ecosystem services, assuming poplars are tested and/or deployed within the candidate areas. The presentation will highlight the development of the GIS-based siting protocol, along with results from the productivity modeling and ecosystem services assessment.

Keywords: energy security, feedstock production, *Populus*

*** corresponding author:**

5985 Highway K, Rhinelander, WI 54501, USA; Phone: (715) 362-1132; rzalesny@fs.fed.us

Expert Survey on Adoption Issues Related to Four Short-Rotation Afforestation and Agroforestry Systems

Sylvain Masse* and Pierre P. Marchand

Canadian Forest Service

This survey deals with R&D on four systems: short-rotation woody crops of willow or hybrid poplar, block plantations of hybrid poplar, willow-based riparian buffer systems, and willow or hybrid poplar-based alley cropping systems. Its general objective is to assess the relevance of addressing over the short term (0-5 years) 44 adoption issues perceived by landowners. These issues are technical, financial, legal, environmental or other in nature. They deal with the development and/or application of the systems across Canada. They were identified through a series of focus groups conducted with landowners from Quebec and the three Prairie provinces (Marchand and Masse, 2008).

A standard questionnaire was designed in such a way that respondents assessed the relevance of addressing an issue over the short term based on three criteria: the importance of taking the issue into account for the development or the application of a system; the availability of solutions for this issue; and the availability of minimal knowledge required before addressing an issue. A mixed-method approach involves rating scales with ordinal measures as well as comments and explanations.

About 200 experts, mostly Canadians, participated in this survey. On average, they commented on five issues they were familiar enough with to be able to comment on. These experts came from different types of organizations, including universities, governments, private-sector companies, and non-profit organizations.

The presentation will describe the objectives, the method, and the preliminary results of the survey.

Keywords: short-rotation woody crops, expert survey, adoption issues, willow, *Salix*, hybrid poplar, *Populus*

* **Corresponding author:**

Laurentian Forestry Centre, 1055 du PEPS, PO Box 10380 - Stn. Sainte-Foy, Quebec, QC, Canada G1V 4C7

Phone: (418) 648-7152; Email: smasse@rncan.gc.ca

Subject Area: Production Systems and Operations

Nutrients supply rate, bioavailability and uptake in a short rotation willow coppice system receiving varying rates of organic and inorganic soil amendments

Amos K. Quaye* and Timothy A. Volk

Department of Forest and Natural Resources Management, SUNY College of Environmental Science and Forestry, Syracuse NY

Abstract

The seasonal variations in nutrient supply and uptake was assessed in a short rotation willow coppice system that has received two levels each of commercial fertilizer as urea (CF1, CF2), biosolid compost (BC1, BC2) and digested dairy manure (DM1, DM2) at 150 and 200 kg available N ha⁻¹ and a non-amended control (CT0). Plant roots simulator (PRS[®]) probes were buried outside root exclusion cylinders (RECs) to measure bioavailable nutrient amidst root competition and inside RECs to measure nutrient supply rate excluding root competition. Probes were buried in situ for a 2 week period in September 2008 (outside RECs only) May, August and October of 2009. Foliage was collected at each sampling time to determine nutrient concentrations. Fertilization regimes had no effect on NO₃⁻, NH₄⁺, K, Mn, B and Al bioavailability and supply rate. P supply rate was significantly high in BC1 than in CF1 (p = 0.01). BC1 and BC2 increased Ca and S bioavailability and supply rate significantly (p<0.02). Bioavailable Mg in BC2 and DM1 were significantly higher (p<0.05) compared to CT0. Bioavailable NO₃⁻, P and K in May were significantly higher (p = 0.03), NH₄⁺ was higher in Oct (p = 0.01) whereas S was higher in Sept (p < 0.0001) and Ca and Mg bioavailability were higher in Aug p < 0.006) than in the other sampling times. NO₃⁻ supply rate was significantly higher in May (p = 0.007), NH₄⁺ was higher in Aug (p=0.002) while K, Ca and Mg supplied rates were higher in Aug (p<0.002) compared to other sampling times. Foliar N and Ca concentration was significantly higher in May (p<0.0001) while P and Mg concentrations were higher in Oct (p< 0.03) and S concentration in August was significantly higher (p<0.0001). The high NO₃⁻ supply rate and foliar N concentration in May suggest the dominant role played by mineralization in supplying plant available N in the spring. The relationship between soil moisture and soil and foliar nutrients also indicates the importance of soil moisture on nutrient mineralization.

Keywords: nutrients, bioavailability, supply rate, ion exchange membranes, shrub willow

*Correspondence: 340 Illick Hall, 1 Forestry Dr. Syracuse NY 13210; akquaye@syr.edu; Tel: 315-4706775; Fax: 315-4706934

Subject Area: 2. Environmental and Landscape Processes and Benefits

The Canadian Wood Fibre Centre Short Rotation Woody Crops Program: Scientific, Operational, and Technical Development Activities

Derek M. Sidders*, Brent N. Joss and Tim J. Keddy

Canadian Wood Fibre Centre

Woody biomass feedstocks, originating from short rotation woody crops (SRWC), occupy a very small amount of land in Canada at present (about 23,550 hectares). However, given that the species/cultivars (hybrid poplar and hybrid willow) commonly used in these crops can achieve high mean annual increments, that approximately 15 million hectares are deemed highly suitable for the establishment of these species, and that the energy values related to short-rotation species/clones are significant (19-21 GJ/ODT), these types of plantations represent enormous potential with respect to future sources of wood fibre, bioenergy and/or sinks for carbon sequestration.

The Canadian Wood Fibre Centre (CWFC), a division of both Natural Resources Canada and FPInnovations, has tested and demonstrated short-rotation feedstock system designs, field operations and site/species suitability across a broad network of Canadian sites over the last 10 years. The CWFC is currently engaged in activities to refine the biological and operational components of these systems to improve production efficiencies, reduce costs, and enhance site sustainability. Development, assessment and validation of value-chain options for the establishment, recovery, transportation, handling and conditioning phases of these short-rotation woody feedstock systems is also being performed. The information presented highlights the numerous scientific, operational and technical development activities undertaken by the CWFC as part of its SRWC program. Topics covered include: 1) high-yield afforestation and concentrated biomass crop options, 2) site suitability modelling and assessment, 3) site establishment and management protocols, 4) harvesting technologies and efficiencies, 5) realized growth and yields, 5) product options, and 6) value-chain modelling and evaluation. This comprehensive suite of scientific, operational, and technical activities is helping to promote the concept of short-rotation woody crop plantations from basic research and development to the point of commercial uptake in Canada.

Keywords: short rotation woody crops, hybrid poplar, hybrid willow, high-yield afforestation, concentrated biomass, value-chain.

***corresponding author:** Canadian Wood Fibre Centre, Natural Resources Canada / FPInnovations. 5320-122nd Street, Edmonton, Alberta, Canada; Phone: +1 (780) 362-1132; Email: Derek.Sidders@nrcan.gc.ca

Subject Area: 1. Production Systems and Operations / 3. End Use Applications