

Buffer strips for biomass production and riparian protection

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Background:

There is increasing interest in the development of willow biomass as a renewable source of energy and woody ligno-cellulosic feedstock for bio-products. Riparian buffers have been identified as an effective barrier to soil and nutrient movement from agricultural fields into watercourses.

This project involves evaluating the use of native and non-native willow clones as vegetation filters decreasing leaching and runoff of nutrients from agricultural fields to riparian zones. Willow is an ideal riparian species in that it is well adapted to growing conditions in riparian zones and it re-grows vigorously following coppicing which allows harvest to occur on 3-4 year cycles. The multiple benefits derived from producing willow biomass in riparian buffers can provide increased value while at the same time providing valuable environmental benefits.

Project Objectives:

1. To evaluate the potential of woody biomass production from riparian buffers
2. To evaluate the impact of coppicing (harvesting) willows on nutrient uptake.

Methods:

Two sites were established in PEI on June, 2006 (Photo 1 & 2). One site is located on a hog operation (Wilting) on the West River and the other on a potato operation (Waugh) along the Wilmot River. Four willow rows spaced 2.5m apart with in-row spacing of 1.0m were planted adjacent to the riparian zone. A 5.0m grass buffer was planted on the field edge of the buffer. Crop rotations along the buffer include potatoes as well as barley and soybeans.

The Wilting site included planting of native (*Salix discolor* and *S. eriocephala*) and non-native (*S. viminalis* and *S. dasyclados* 'SV1') clones as well as traditional tree and shrub species. The Waugh site consists exclusively of the non-native species.

After three growing seasons willow biomass will be harvested from coppice treatments by removing all willow top growth leaving a 15 cm stump. Harvest will occur in the late fall. Select numbers of willow are being harvested annually at both sites after year 1 to determine annual biomass accumulation and impact of coppicing on nutrient uptake.

Shallow groundwater samples are collected to measure attenuation of the concentration of nitrate, ammonium and phosphorous. Willow nutrient status will be determined by sampling stem and leaf tissue. Sampling of above ground leaf and stem tissue were combined with root cores to estimate the total standing biomass and the pool of N and P in plant tissue.

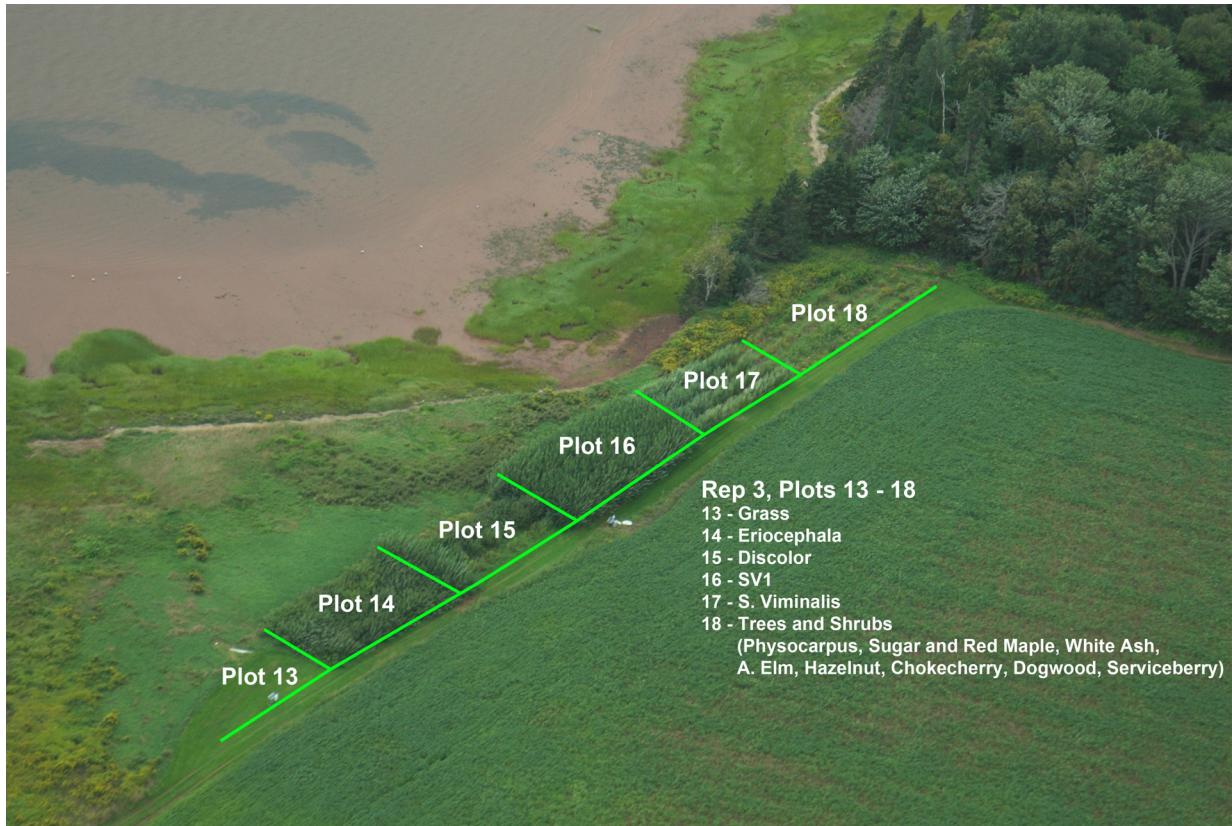


Photo 1. Willow buffer trial at Hovingh/Wiliting (Site B) site in Prince Edward Island

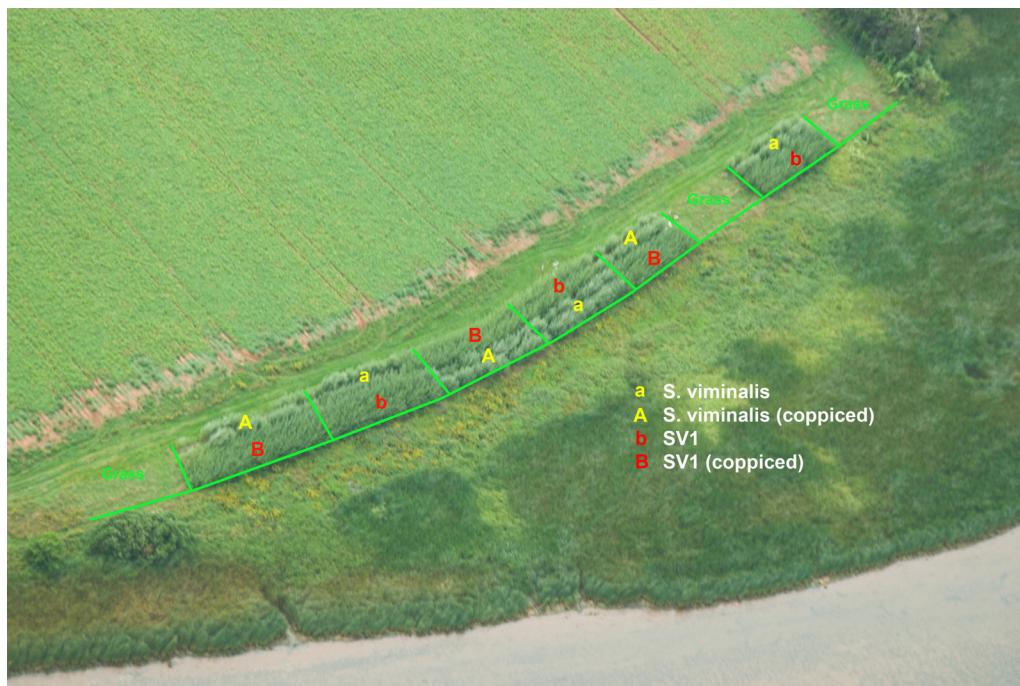


Photo 2. Willow buffer trial at Waugh (Site A) site in Prince Edward Island.

Results:

Preliminary data has shown that willows are effective bio-filters that intercept and remove non-point source pollutants such as nitrogen and phosphorous. First year coppice biomass production of SV1 was superior to viminalis at the Wilting (Site B) site but similar at the Waugh (Site A) site (Figure 1). At the Wilting site, biomass accumulation of plots that trapped surface runoff sediment (Site B-Plot3) had significantly greater growth than plots where no sedimentation occurred (Site B-Plots 1&2). At a planting density of 4,000 willow plants/ha., our data showed a potential nitrogen removal of up to 55 kg/ha/yr nitrogen and 8kg/ha/yr for phosphorous (Figure 2), while producing up to 25 odt/ha of woody biomass (Figure 3). Non-coppiced biomass production of SV1 was superior to all other treatments.

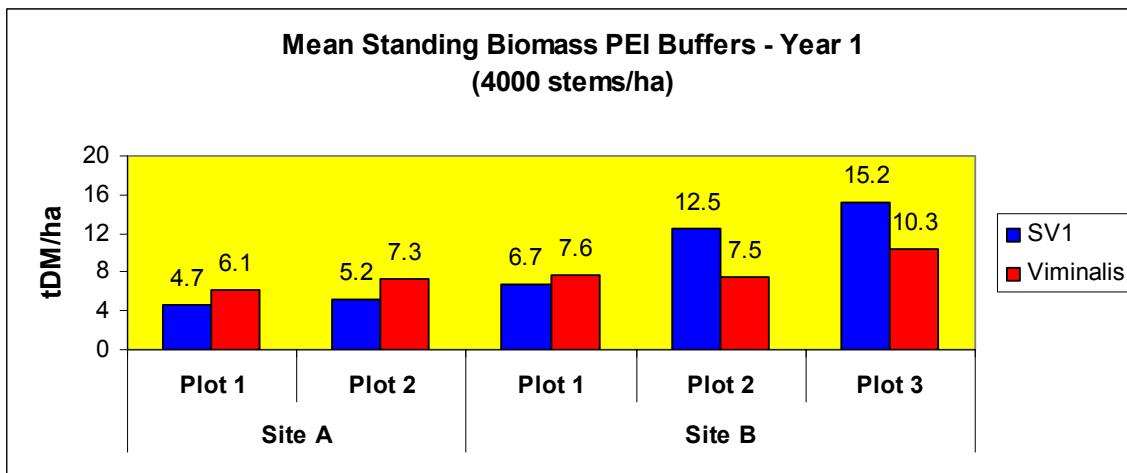


Figure 1. Non-destructive biomass estimates one year after coppice.

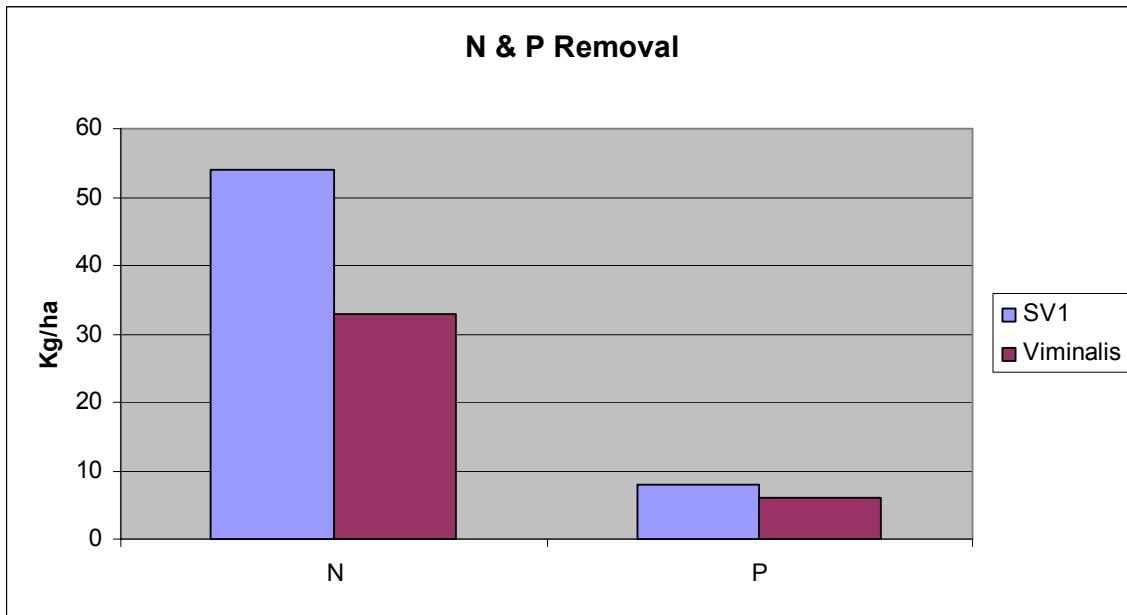


Figure 2. Nitrogen and phosphorous uptake by coppiced and non-coppiced willow species planted in a riparian buffer.

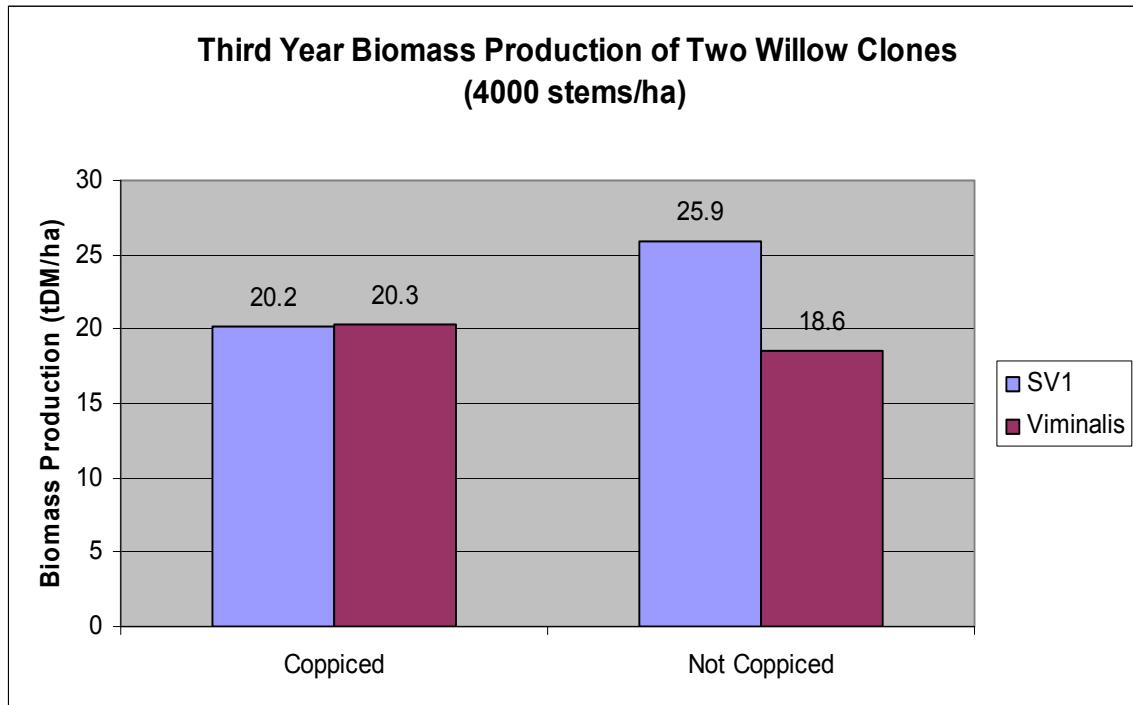


Figure 3. Biomass production of two willow clones in year three following coppice.

Key Findings:

- Preliminary data has shown that willows are effective bio-filters intercepting and removing non-point source pollutants such as nitrogen and phosphorous.
- At a planting density of 4,000 willow plants/ha, our data showed potential nitrogen removal over 50kg/ha/yr, while producing up to 25 dt/ha of woody biomass.
- There was no evidence of serious pest or disease pressure at the PEI sites.
- Bi-annual harvest may be possible in nutrient rich sites.
- Use of plastic mulch has been effective in suppressing weed pressure during establishment.