Dedicated Fast Growing Wood Fibre Crops- Biomass and More

ABDC Biomass Securing a Sustainable Supply
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Natural Resources Canada
Ressources naturelles Canada
Canada

Presentation Outline

- What is dedicated fast growing wood biomass?
- Why willow for biomass?
- Growing and harvesting the crop.
- Costs.
- Advantages.
- Increasing production
- Combining with environmental services
- AROWRN

High Yield Afforestation

5-7.4 Odt/ha/yr

800-1600 stems/ha

Natural Resources Canada | Ressources naturelles Canada

Data and photos courtesy of Derek Sidders

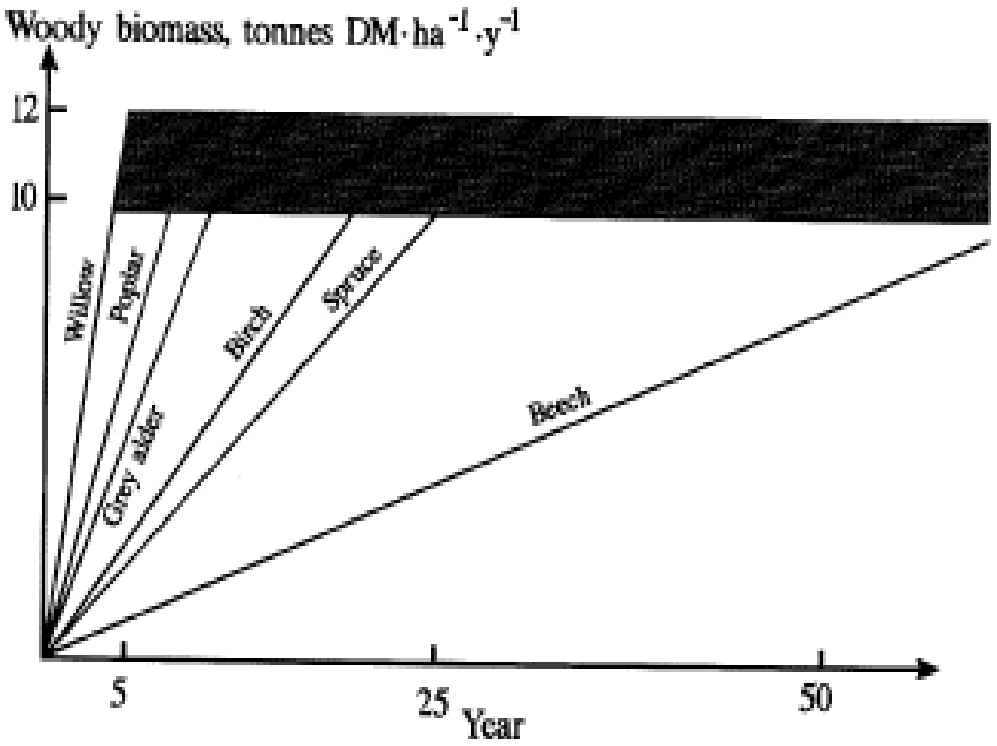
Canada

High Density Concentrated Biomass Plantations

- Often called SRC Energy Plantations
  - Short Rotation Coppice (SRC)
    - A fast growing woody crop, usually willow in northern latitudes, which is used to produce biomass
    - Very high density plantings (+15,000 stems/ha) to maximize **volume production** (6-10 Odt/ha/yr) on short rotations (3-5 years)
  - Can be willow or poplar

Willow for Biomass

- High volumes of biomass
  - Always in juvenile growth phase
  - Highest capacity to convert solar radiation to chemical energy
- Easily propagated.



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- Resprouts vigorously and is fast growing after each harvest.

One month after coppicing
From: Andy Oldridge, Strawson Energy Co. UK

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Photo from www.jprwillow.co.uk

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- High potential for genetic improvement
- Many species of willow to work with (450 world wide).

Photos from www.jprwillow.co.uk

Establishment

- Prepare fields like for any agriculture crop
- Weed control is critical

Establishment

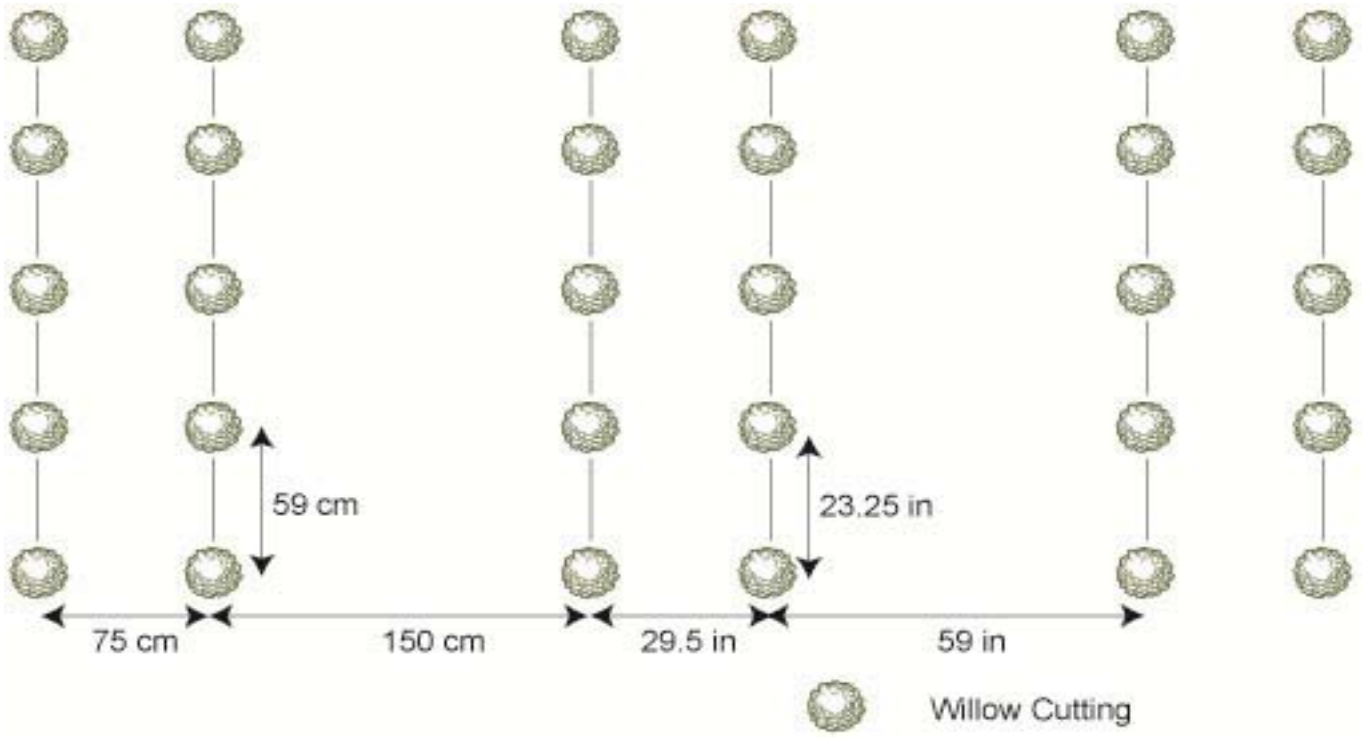
- Prepare fields like for any agriculture crop
- Plant 20 cm long cuttings, pre-cut or from rods

Establishment

- Prepare fields like for any agriculture crop
- Plant 20 cm long cuttings
- Planted operationally using ride-on machines

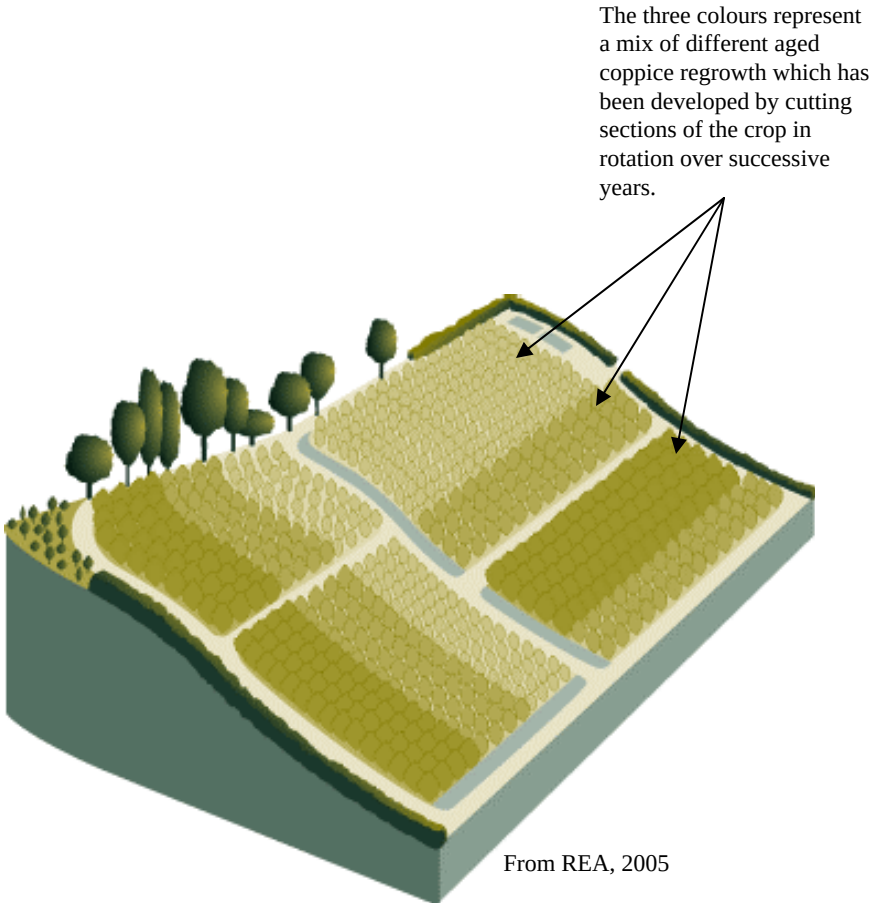
Photo from Coppice Resources Ltd
Great Britain

Establishment- Planting Pattern



Establishment- Planting Pattern

- Blocks planted over three years, with portions harvested in rotation
- The growing area always represents all age classes
- Biodiversity



From REA, 2005

Willow crop ready for harvest.

Harvesting

•Use modified agricultural equipment to harvest willow.

Claas HS-2 Wood Harvesting Head

Harvesting

•Use modified agricultural equipment to harvest willow.

BioBaler- Anderson Group

Harvesting

•Use modified agricultural equipment to harvest willow.

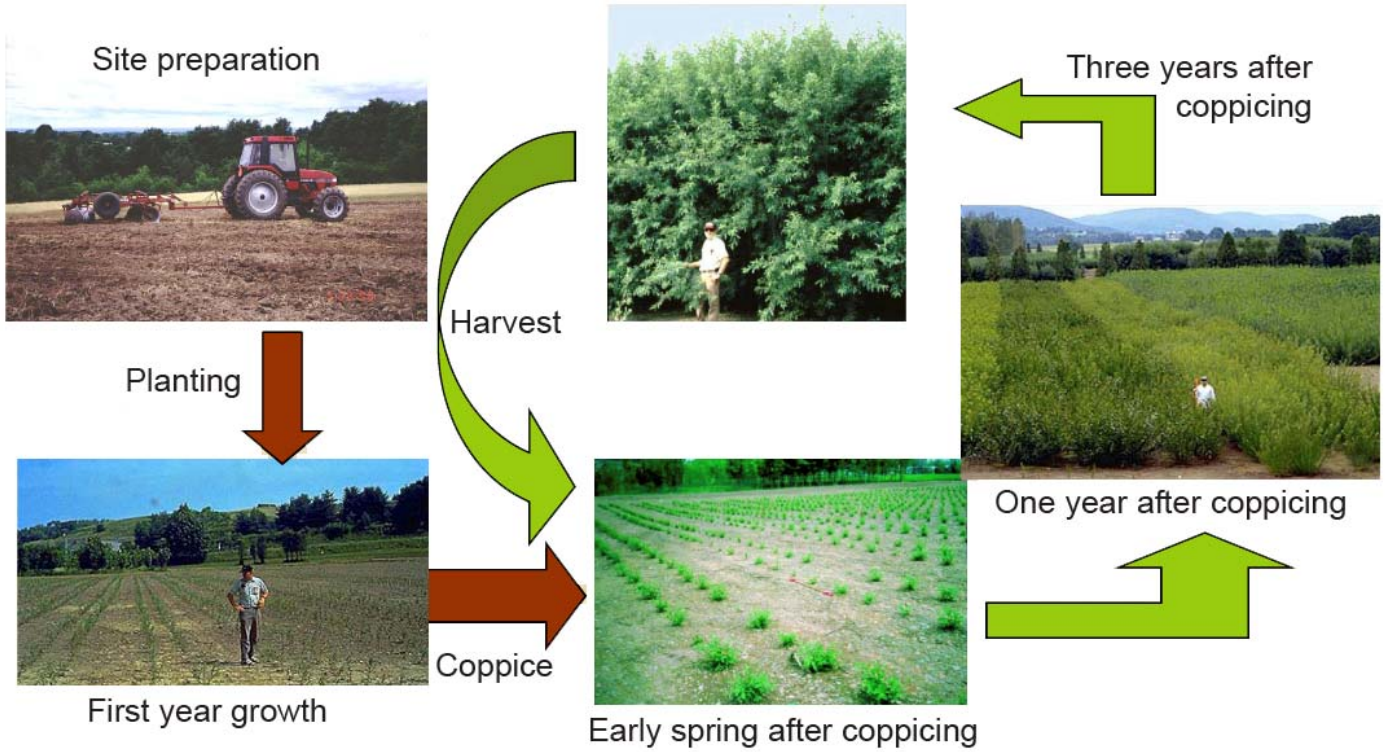
JF Harvester- Ny Vraa Bioenergy

Harvesting

•Only the tops are harvested, leaving the roots.
•Transport to end users by chip truck.
•Can harvest crops on a three year rotation for 20-25 years.

Wood Biomass

Growth Cycle



From T.A. Volk
State University of New York

Costs

Activity	$/ha	$/acre
Operational		
Site Preparation Spray	27	11
Ploughing	100	40
Power-Harrow/cultivate	106	43
Planting	466	188
Roll	13	5
Pre-emergent Spray	27	11
Subtotal	**738**	**299**
Material		
Glyphosate (4l/ha)	53	22
Weedkiller/insecticide	33	13
Pre-emergent Herbicide	80	32
Management Fee	200	81
Cuttings	2,527	1,023
Subtotal	**2,893**	**1,171**
Total Years 1-4	**3,631**	**1,469**

European Establishment Costs (Operational)

Assumptions

- Density: 18,000 stems/ha; Rotation Age: 3 yrs, 6-7 cycles;

  Biomass Yields: 10-12 ODT/ha/yr

Establishment Cost

- Northern Ireland $3,631/ha ($1,469/acre)

  (from SHORT ROTATION COPPICE WILLOW BEST PRACTICE GUIDELINES 2010)

Harvesting Costs

-chip harvesting- $33/dry tonne

Average Harvest Income
Europe- @$76/ODT
$1,400-$2,280/ha ($566-922/acre)

Alberta establishment costs from a commercial service provider: $5-6,000/ha using cuttings ($2-2,500/acre)

Advantages of Dedicated Fast Growing Wood Biomass

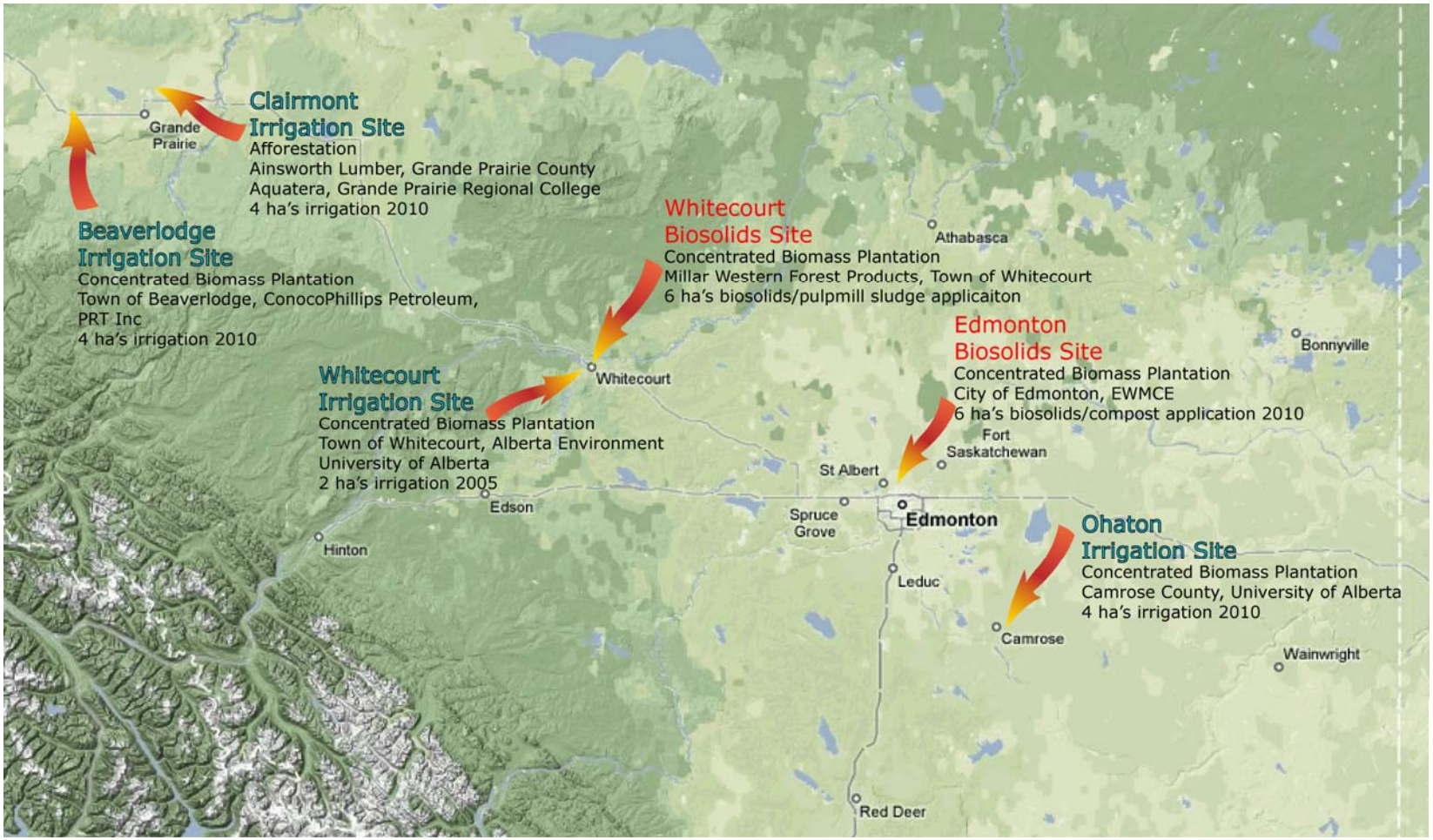
- Known and consistent fibre attributes
- Can be grown close to conversion facilities
- Not a residue- not subject to other's market conditions
- Three year cycle buffers against yield reductions due to drought
- Multiple benefits- social, economic and environmental

Increasing Production of Dedicated Fast Growing Wood Biomass

- Short term
  - combine with providing environmental services
    - Municipal- wastewater, storm water, biosolids, visual/sound buffers
    - Agricultural- wastewater, manure, riparian/visual buffers, surface runoff
    - Light industrial- process water, visual buffers
    - Decontamination

- Longer-term, larger-scale plantings
  - Requires demand- chicken and egg issue
    - contracts
  - Focus on marginal and stranded land?? Why?

The Alberta Initiative- Irrigation and Biosolids Sites



Combining Biomass with Environmental Services

Simple Scenario:

- 200 residents
- 100 m3 water/day= 36,500 m3/yr
- Current system address BOD using lagoons
- Must upgrade to address BOD and NH3 concerns
  - OPTION 1
    - Install aeration system to the existing infrastructure= $480,000 capital plus $37,000/year O&M (CCME Costing Template 2006)

http://www.ccme.ca/assets/xls/wastewater_treatment_cost_template_e.xls

Combining Biomass with Environmental Services

Simple Scenario:

- OPTION 2
  - Apply water to a SRIC willow crop to avoid discharge thus no need for system upgrade
  - Must be able to treat 36,500 m3/yr, assume application rate of 5,000 m3/ha/yr, need approximately 7 ha's (100 growing days).
    - Power lines, pump, float, lines and filter- $60K
    - Pipeline to field and four zones- $75K

Biomass Wood Boiler System- Camrose County

Alberta Rural Organic Waste to Resources Network (AROWRN)

- Voluntary network of participants in the Alberta Initiative
- Links participants
- Exchange knowledge and resources within the network
- Transfer practical knowledge to others
- Build the network

Please see www.arowrn.ca for more information and a conference announcement

Alberta Initiative Collaborators/Drivers

Municipal

1. Town of Whitecourt
2. Town of Beaverlodge
3. City of Edmonton
4. Camrose County
5. County of Grande Prairie

Irrigation

1. Ion Irrigation Management Inc.
2. Geoflow Inc.
3. Aquatera Ltd.
4. Southern Drip Irrigation Ltd.
5. Laqua Treatment AB
6. Design Irrigation Ltd.

Academic

1. University of Alberta
2. Grande Prairie Regional College
3. University of Calgary

Industrial

1. Millar Western Forest Products
2. Ainsworth Lumber
3. ConocoPhillips Petroleum
4. PRT Growing Services Ltd.
5. Benchmark Laboratories Group Ltd.
6. Sylvis
7. Terrawest Environmental Inc.

Other Government

1. Alberta Innovates Bio Solutions
2. Alberta Agriculture and Rural Development
3. Alberta Biomaterials Development Centre
4. Alberta Environment
5. Alberta Municipal Affairs
6. NRCan- Canadian Forest Service
7. Edmonton Waste Management Centre of Excellence
8. Alberta Innovates Technology Futures

Non-Government Organizations

1. Poplar Council of Canada

Thank You

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