

Agriculture and

Agriculture et Agri-Food Canada Agroalimentaire Canada

Canada

A snapshot of agroforestry research in Canada

Tricia Pollock **3rd Agroforestry Academy** Columbia, Missouri USA July 23, 2015

Linkage of agroforestry between Canada and the United States

- Common landscapes, climate, soils, wildlife, land management and farming systems.
- Utilize the classification of agroforestry systems of the Association for Temperate Agroforestry (AFTA).
- MOU signed in 2012 between AAFC Agroforestry Development Centre and USDA National Agroforestry

Center.





The agricultural landscape in Canada







- Historically, diversified farming systems were the norm in Canadian agriculture, however with increasing farm size, crop specialization, increased inputs and an aim to maximize crop profitability agroecosystems have been simplified.
- Average farm in Canada is 800 acres.
- Associated habitat reduction has contributed to a loss of diversity and is negatively impacting pollinators and other beneficial insects, particularly on the Prairies.

Conquest, Saskatchewan





Regional adoption trends and constraints

- Lack of agroforestry knowledge
- High initial capital and labour costs
- Farm operations and land resource tenure
- There is a need for viable long range markets and adoption incentives
- Preferred agroforestry practices and designs differ regionally in the second Saskatchewan Quebec

The way forward

- Address environmental concerns
 - Water quality
 - Carbon sequestration
 - Habitat for pollinators
- Economic interest
 - Biomass harvest
 - Emerging commodity crops



Agroecosystem productivity and health

- Increase agricultural productivity
- Improve environmental performance
- Improve attributes for food and non-food uses
- Address threats to the value chain





Potential pollinator habitats



Willow Riparian Buffers

- Field trials in PEI 2006-2012
- Regular harvest of willow biomass is an effective nutrient management tool for potato production systems
- Harvested biomass exports intercepts nutrients and sustains buffer function
 - up to 7 tons per acre per year
- Over 3 years, a 1-acre willow buffer can intercept 120 lbs N and 18 lbs P





Wetland willow rings for sustainable small scale feedstock and bioenergy production



- Significant areas of under utilized land
- Periodic flooding, inaccessible field locations and irregular field shapes, salinity impacting production, or unfavourable soil textures or topography
- Small scale agroforestry willow systems have the potential to provide a sustainable and renewable clean energy resource

Agricultural Greenhouse Gases Program

AGROFORESTRY

for greenhouse gas mitigation in Canada

Trice Pelods", David Trotter¹, Boot Charg¹, Edward Book², Ken Van Hees⁴, Ryan Canaff, Andree Godorf, Hannesh Thevahanan², and David Trotter¹, Boot Charg¹, Edward Book², Ken Van Hees⁴, Ryan Canaff, Andree Godorf, Hannesh Thevahanan², and David Book³, Canada Santa Hannesh Calabia Comparation in Anna 2014 (Section 2014), Section 2014, Section 20

The Agricultural Greenhouse Gases Program (AGOP) is part of Canada's contribution to the Global Research Allance. It is a proposal-based federally-funded program running from September 1, 2010 to August 31, 2015. Canada is focussing on four priority areas through this program, including agrotorestry. The focus of the research is on discovery science and also the transfer of technology and best practices to local producers and famers.

The objective of the AGGP is to enhance the understanding and accessibility of apricultural inchnologies, beneficial management practices (BMPs) and processes that can be adopted by farmers to mitigate greenhouse gas emissions in Canada. Results will contribute to research efforts that can be shared with other countries to realize a more environmentally sublanable and food-secure world.

Six projects were approved for total funding of 54.45 million within the prority area of appropriative. These projects have a good mix of partners and supporters, both from Canada and abroad. The appropriate are focusing on the development of beneficial management practices for Canada, particularly as they relate to sheltenetlis, nation tothers, alley coropia and silvopational systems.

The intended outcome of these projects is to bring farmers, the agricultural community and academia together to work towards a common goal advancing research, technology transfer and the adoption of beneficial management practices to mitigate agricultural greenhouse gas emissions. The results of these projects will help to elevate Canada's international regulation in agricohestry science and greenhouse gas mitigation.



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Canada

- Part of Canada's contribution to GRA
- Proposal-based
- First time in research funded proposals that agroforestry has appeared
- Extended to March 31, 2016
- 6 projects were funded for \$4.85 million (CAD)

Engagement and collaboration is necessary for successful agroforestry projects



Premier's Award for Interior/Northern BC Region in the category of Partnerships Evaluating silvopasture systems for economic and environmental performance and GHG mitigation potential



Trees Can Help Save the World

https://www.youtube.com/playlist?list=PLeR2DZtnlTQtik4SxT9unDrVP5Gu2aEPb

Tree-based intercropping: An agroforestry land-use for GHG mitigation in Canadian agricultural systems



Emerging Commodity-Based Agroforestry Crops in Canada

- Increased consumer demand for "super-fruits"
- Agroforestry systems undervalued for their economic contribution to the agricultural sector







3-pronged approach

Agronomic trials

Metabollite profiling



Genomics



Seabuckthorn

- Dioecious, berry producing shrub
- Mature height of 16 ft, mature width of 12 ft
- Lifespan of 30 to 40 years
 - Tolerant of extreme temperatures (-45°F to 104°F), drought and salinity
 - Low fertility requirements
 - N-fixing
 - All plant parts (bark, leaves, berries and seeds) have either nutritional or medicinal value
 - 3.5 M planted in the Prairies from 1970-2013

Timeline of seabuckthorn in Canada

	Hippophae spp. (Seabuckthorn)
1950s	• AAFC Tree Nursery receives seabuckthorn accessions from Morden Research Station, Manitoba
1962	• Seabuckthorn trial sites established in regional test sites
1969	• Improved seabuckthorn seed strain identified
1970s	• Nursery production of seabuckthorn and distribution to farmers for shelterbelt planting initiated
1995	• AAFC-PFRA Shelterbelt Centre initiates seabuckthorn breeding and orchard management research program
1997	Indian-Summer seed strain released
1998	• North America's largest seabuckthorn germplasm collection established at Indian Head, Saskatchewan
2005	Release of AAFC developed cultivars Harvest Moon and Orange September
2012	 Quantification of phytochemical profiles and N-fixing capacity Release of cultivars AC Autumn Glow and AC Prairie Sunset
2013-15	• New project to explore transcriptome, metabolome, propagation and alley cropping production system initiated.

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AAFC Breeding accomplishments

- High yielding cultivars with few thorns
- High pollen producing male
- Extremely hard cultivars adapted to cold, semi-arid continental climate
- High sugar content and low titrable acidity
- Cultivars trademarked and available through licensing agreements
 ✓ AC Harvest Moon
 ✓ AC Orange September
 ✓ AC Autumn Glow™
 ✓ AC Prairie Sunset™
- Main nursery supplier is PrairieTech Propagation <u>www.prairietechpropagation.com</u>

Emerging Product Industry



Pet Food Supplement

Before



After



Assessing woody plants for bio-active compounds and bioenergy

- Genetic improvement of willows:
 - Study the physiology, wood chemistry and genetics of Salix focusing on opportunities toward utilization of the genus as bio-energy feedstock.
- Cultivar release and bio-prospecting:
 - Demand for bio-active compounds of natural origin and energy alternatives has progressed sharply recently.
 - Over 600 million trees and shrubs have been planted in prairie agriculture, providing a large potential resource for extraction.
 - Assessing wood, bark, flower, seed and foliage from 120 genotypes of woody cultivars of the genera Acer, Crataegus, Fraxinus, Hippophae, Larix, Quercus, Picea, Pinus, Populus, Prunus, Rosa, Salix, Sherpherida, Sorbus and Symphoricarpus





- In the 1970's there were only a handful of individuals in North America working in agroforestry including John Bene (BC) and Gene Garrett (MO), and now there is AFTA, EURAF, etc. An agroforestry network will continue to emerge.
- Many older editions of agroforestry books are in their 2nd edition including Temperate Agroforestry Systems (Gordon & Williams eds.) which will be published in 2016.
- Awareness of agroforestry will increase and garner more respect as long-term data accumulates and papers continue to be published.
- While promoted as a tool for climate change mitigation and adaption, agroforestry species and systems will likely be negatively impacted.





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