BC Agricultural Climate Adaptation Research Network

Summary of Research on Management Practices for Climate Change Mitigation

Hedgerows & Riparian Buffers

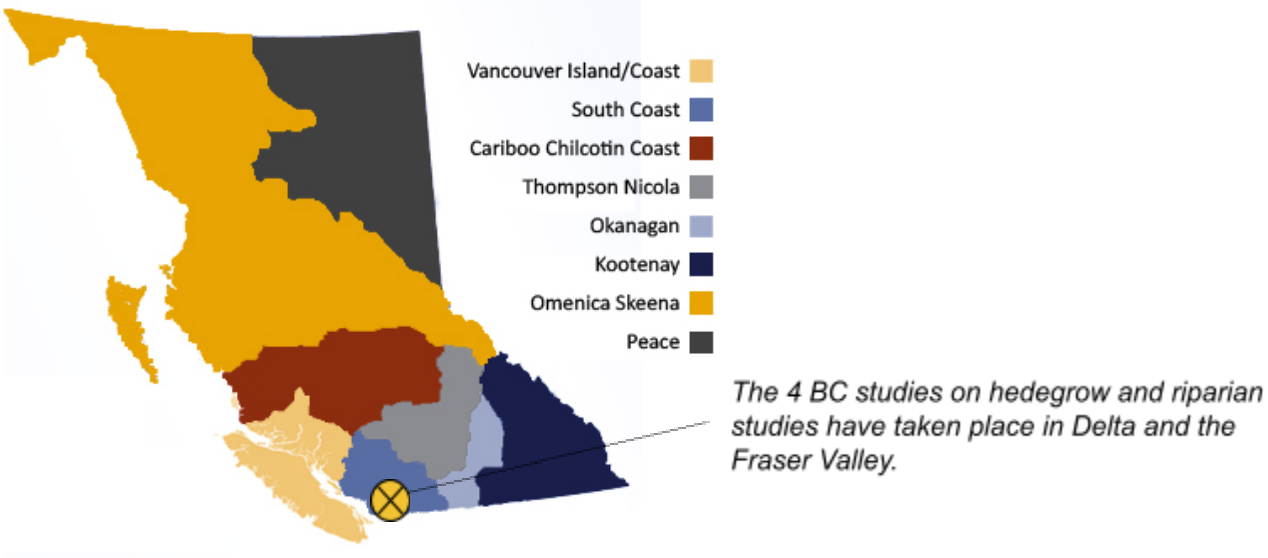
SCOPE

This document is a high-level overview of recent, primarily BC-based, published research and research in progress investigating management practices with potential to mitigate climate change. Many practices are in early stages of evaluation for their impacts to carbon (C) sequestration and/or greenhouse gas emissions (primarily N_2O), and/or have not been trialled in the BC context. Therefore, the objective of this research summary is to provide a brief overview of what research has been done, where it took place, and a short description of key methods and results. This review does not include an exhaustive inventory of relevant research outside of BC. It is intended to provide an introduction to past research and research in progress.

OVERVIEW

Non-production woody perennials on agricultural land, including riparian buffers and hedgerows, can sequester carbon both in the soil and in above-ground woody biomass. The management practice description is provided in Table 1, and the region where research took place is shown in Figure 1.

FIGURE 1: LOCATION OF HEDGEROW RESEARCH SITES



The 4 BC studies on hedegrow and riparian studies have taken place in Delta and the Fraser Valley.

TABLE 1: MANAGEMENT PRACTICE DESCRIPTIONS and MITIGATION POTENTIAL

Management Practice Area	Description and Potential for Climate Change Mitigation
Hedgerows and Riparian Buffers	Hedgerows (also known as field margins, shelterbelts or windbreaks) and riparian buffers can increase soil C and can also store C in the woody biomass of trees and shrubs.

RESEARCH SUMMARY: HIGHLIGHTS AND GAPS

RESEARCH HIGHLIGHTS

- The amount of carbon sequestered in the biomass of hedgerows and riparian buffers is dependent on the species present.
- Greater biodiversity in planted hedgerows is correlated with increased soil C (10-20 years after planting).
    - In the same study, cumulative CO_2e emissions (year-round) from planted hedgerows (10-20 years old) were not different than emissions from remnant hedgerows (~38 years old, natural, and unmanaged). However, emissions from the planted hedgerows were greater than paired, cropped fields, whereas emissions from remnant hedgerows were numerically, but not statistically, higher than paired, cropped fields.
- One study found that when soil C was measured using a mass-based approach (approximating a 30 cm depth), high-diversity hedgerows and woody riparian buffers had greater soil organic C mass than managed grasslands. No differences were observed between either high-diversity hedgerows or woody riparian buffers and annual cropland.

RESEARCH GAPS

- All BC research to date has taken place in the South Coast region.
- Research to date has not included full greenhouse gas budgets, (i.e. life cycle analyses). Measuring both emissions and C sequestration would improve the understanding of mitigation impacts.
- There is a lack of studies looking at production characteristics and benefits for farm operations beyond carbon sequestration, i.e. harvestable hedgerows or other farm benefits.
- There has been no province wide analysis of the potential for additional planting of hedgerows or riparian buffers.

TABLE 2: RESEARCH HIGHLIGHTS

Management Practice Area	Research Highlights [c]	Research Limitations
Hedgerows and Riparian Buffers **[SC, 4]**	Fraser Valley, remote-sensing non-production perennial vegetation [H1] Based on local and global parameters, estimated largest forest stands (>9ha) and riparian buffers contain 44 to 131 Mg C/ha (average=87.5 Mg C/ha), and small forest stands (<9ha) and hedgerows contain 31 to 92 Mg C/ha (average=61 MgC/ha) in above ground biomass Delta (8 sites), hedgerow C storage, 1yr [H2] Planted hedgerows (10-20 years old), had greater biodiversity, and greater soil C, than remnant hedgerows (~38 years old, natural, and unmanaged). Only planted hedgerows had greater soil C than paired cropped fields (whereas remnant hedgerows did not). Overall, both types of hedgerows had greater total C (below- and above-ground) than paired cropped fields. Delta (8 sites), hedgerow C storage, 1yr [H2] Cumulative CO_2e emissions (year-round) from planted hedgerows (10-20 years old) were not different than emissions from remnant hedgerows (~38 years old, natural, and unmanaged). However, emissions from the planted hedgerows were greater than paired, cropped fields, whereas emissions from remnant hedgerows were numerically, but not statistically, higher than paired, cropped fields. Fraser Valley (61 sites), hedgerow C storage, 2 yrs [H3] When measured using a mass-based approach (approximating a 30 cm depth), high-diversity hedgerows and woody riparian buffers had greater SOC mass than managed grasslands. No differences were observed between either high-diversity hedgerows or woody riparian buffers and annual cropland.	• Lacking full greenhouse gas budgets from studies measuring both emissions and C sequestration (i.e. life cycle analyses) • Lacking studies looking at production characteristics, i.e. harvestable hedgerows or other farm benefits • Studies limited to the South Coast

[a] [Agricultural region [b], number of studies in the region]
[b] BC Agricultural Regions: Vancouver Island/Coast (VC), South Coast (SC), Cariboo Chilcotin Coast (CC), Thompson Nicola (TN), Okanagan (OK), Kootenay (KT), Omenica Skeena (OS), and Peace (PC)
[c] References include both peer-reviewed publications and Master's theses and can be found in the published research and research in progress spreadsheets
* Research with an asterisk (*) is in progress or manuscripts in prep

Acknowledgements

This research summary was prepared by Amy Norgaard and the BC Agricultural Climate Adaptation Research Network (ACARN) technical working group on climate change mitigation. ACARN would like to thank those who shared information about their previous and continuing research projects.

This project was supported by the Investment Agriculture Foundation of BC, with funding provided by Agriculture and Agri-Food Canada programs.