The Carbon Life Cycle
Assessment of the Production of Shelterbelt species in Saskatchewan

Lindsey Rudd
Introduction - Shelterbelts

- Shelterbelt adoption in Saskatchewan throughout the 1900s (Amichev et al., 2015)
- Prairie Farm Rehabilitation Administration (PFRA)
- Saskpower’s Shand Greenhouse provides approximately 500,000 seedlings a year (SaskPower, 2019)
Introduction – Carbon and LCA

- Carbon sequestration/storage in shelterbelts as a mitigation tool (Amichev et al., 2016)
Objective

- Estimate CO$_2$eq emissions during the production of shelterbelt seedlings as part of a comprehensive carbon LCA.
Methods

- Data collection
  - Relevant LCA and forestry literature review
  - Interviews with management at Shand Greenhouse
  - Greenhouse heating calculator (ACF Inc., 2019)

- SimaPro – Life Cycle Assessment Software
  - EcolInvent
  - Run analyze using data → IPCC GWP 100a (PRé, 2018)

https://simapro.com/
Preliminary Results
IPCC GWP 100a
Natural Gas Heating

- Irrigation
- Nitrogen fertiliser
- Gasoline (regular)
- Polystyrene
- Electricity (medium voltage)
- Heat (natural gas)

- Irrigation: 0.17%
- Nitrogen fertiliser: 1%
- Gasoline (regular): 0.11%
- Polystyrene: 2%
- Heat (natural gas): 14%
- Electricity (medium voltage): 83%
Discussion

- Overall CO$_2$eq of the first life cycle stage
- Highlight the highest CO$_2$eq producing facets of a process:
  - Electricity for all operations (greenhouse, office space, storage, etc.) = 83% of CO$_2$eq
  - Natural gas for heating greenhouse year-round = 14%
  - Other inputs register as miniscule in comparison*

*Miniscule ≠ insignificant
Limitations

- Choices and Assumptions (ISO, 2006)
- Data gaps
- Proxies
- Manipulation
Conclusion

- Electricity and heating are highest contributors to CO$_2$eq
- Each life stage must be understood in order to have a comprehensive carbon LCA
Take home message

- Tool to inform policy
- LCA research must be **transparent** and **justified**
- Importance of understanding individual steps as well as the LCA as a whole
Acknowledgments

▪ Supervisors:
  • Dr. Ken Belcher and Dr. Suren Kulshreshtha

▪ AGGP team:
  • Beyhan Amichev, Ken Belcher, Murray Bentham, Rafaella Carvalho Mayrinck, Brooke Howat, Paul Krug, Suren Kulshreshtha, Colin Laroque, Ken Van Rees, and Tricia Ward

▪ Shand Greenhouse Managers:
  • Bruce Hesslink and Shelley Heidinger

▪ Susan MacWilliam

▪ Agriculture and Agri-Food Canada
References


▪ Rempel, J. 2014. Costs, Benefits, and Barriers to the Adoption and Retention of Shelterbelts in Prairie Agriculture as identified by Saskatchewan Producers (master’s thesis). University of Saskatchewan, Saskatoon, Saskatchewan.

Image references

In order as they appear

- https://simapro.com/
- https://www.colourbox.com/image/background-from-transparent-dried-fall-leaves-image-8260375
Questions?