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Preliminary AAFC work on modeling future land use change in Canada

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Outline of the presentation

- Origins of and motivation for the project
- Overview of the Canadian Regional Agricultural Model (CRAM) and the major modifications made to the model
- Preliminary results for Land Use Change
- Conclusions and next steps

Origins of and motivation for the project

- In late 2007, work began on developing future bioenergy scenarios for Canada with the intent of using quantitative models to determine their impact on the Canadian Agriculture sector

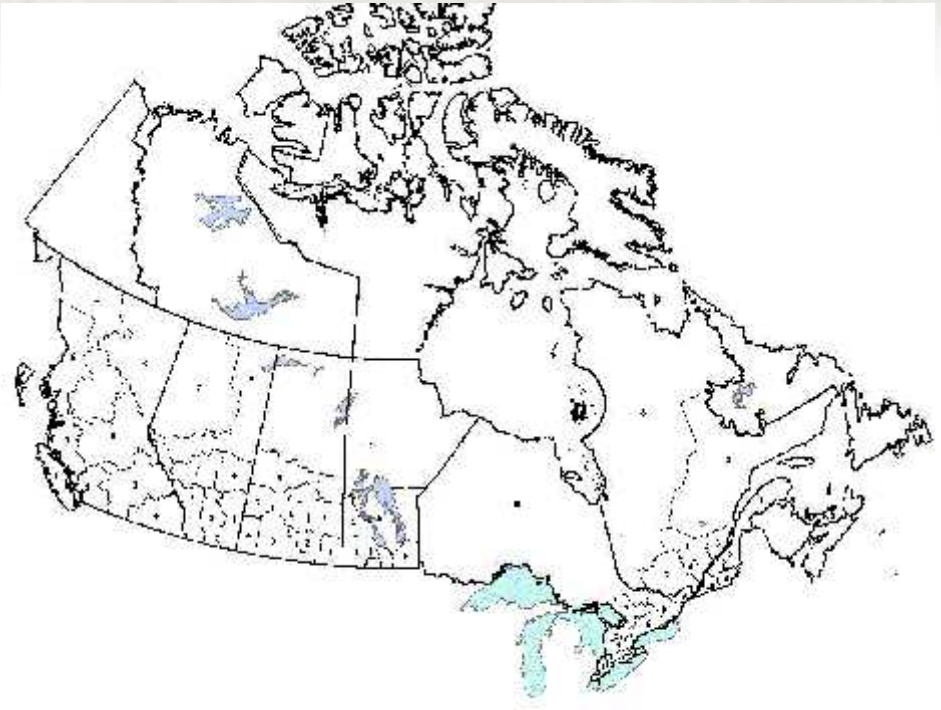
- In spring 2008 a proof of concept analysis was completed with some preliminary results showing some potential impacts of various futures on the agriculture sector

- Following the first analysis, several areas were identified as critical to improving AAFC's modeling capacity for future work. Modeling land use change from agriculture was at the top of this list

- Having this capability would allow us to address uncertainty regarding the impact of the agriculture sector on land use change

Overview of the Canadian Regional Agricultural Model (CRAM)

- CRAM is a static, partial equilibrium model of the Canadian Agriculture sector, covering all of primary production (crops and livestock) and some processing activities



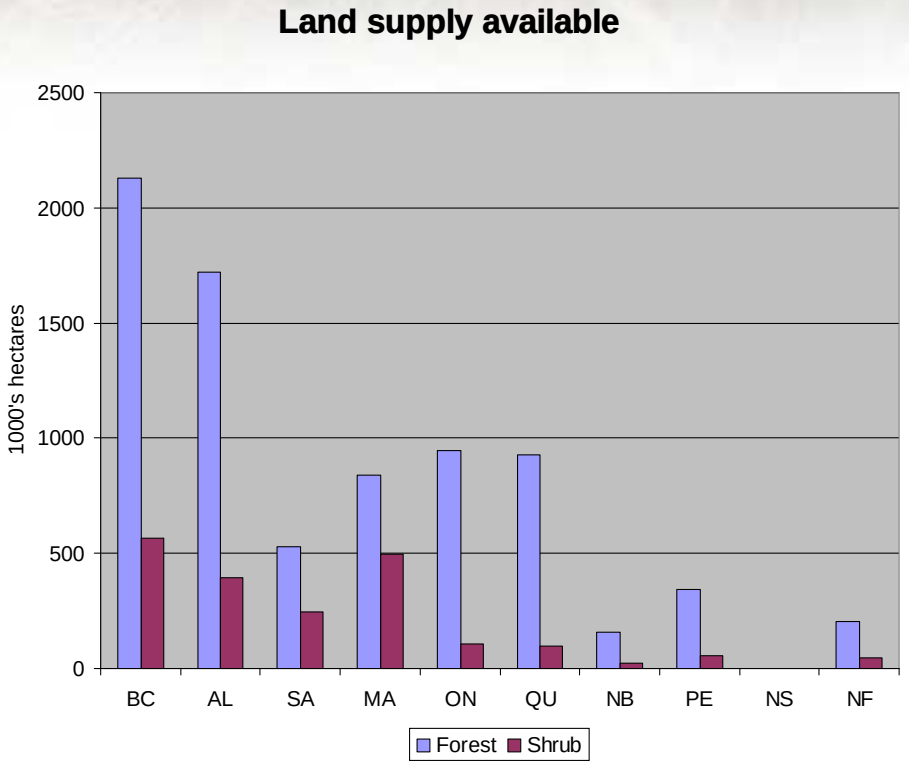
- CRAM is divided into 55 regions and can provide a very detailed regional breakdown of scenario results

- The primary constraint in CRAM is land availability. Land supply in CRAM is determined exogenously based largely on Census of Agriculture data

- This was a weakness in the model in that the land base was fixed and could contract but not expand

CRAM was modified to allow some flexibility in determining land use change impacts

- In consultation with AAFC research scientists, land under forest or shrub cover that could be converted to agricultural use was identified and mapped
- CRAM was then modified to be able to clear this land and bring it into agricultural production
- The level of land clearing is endogenously determined based on land clearing costs and land values in the model



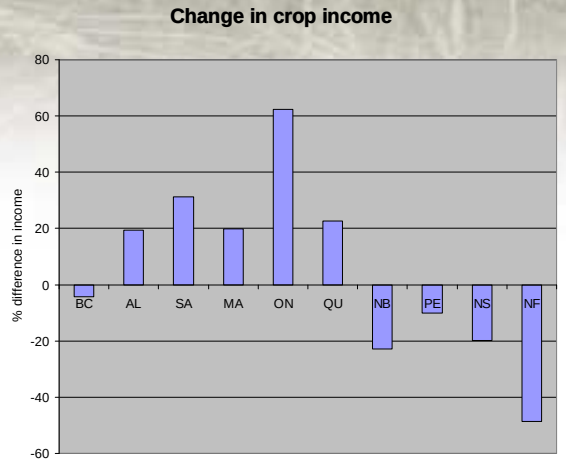
To test these modifications, several scenarios modeling aggressive future renewable energy targets were examined

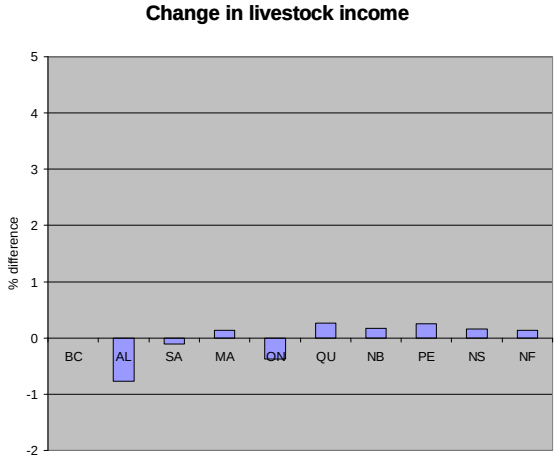
- Scenarios with higher targets for ethanol and electricity from direct combustion were modeled using CRAM

- In this scenario in which there were high targets for both ethanol and electricity, there is a significant impact on crop income

- Livestock income impacts are generally small and varied due to many offsetting factors

- These scenarios will also have an impact on land use change



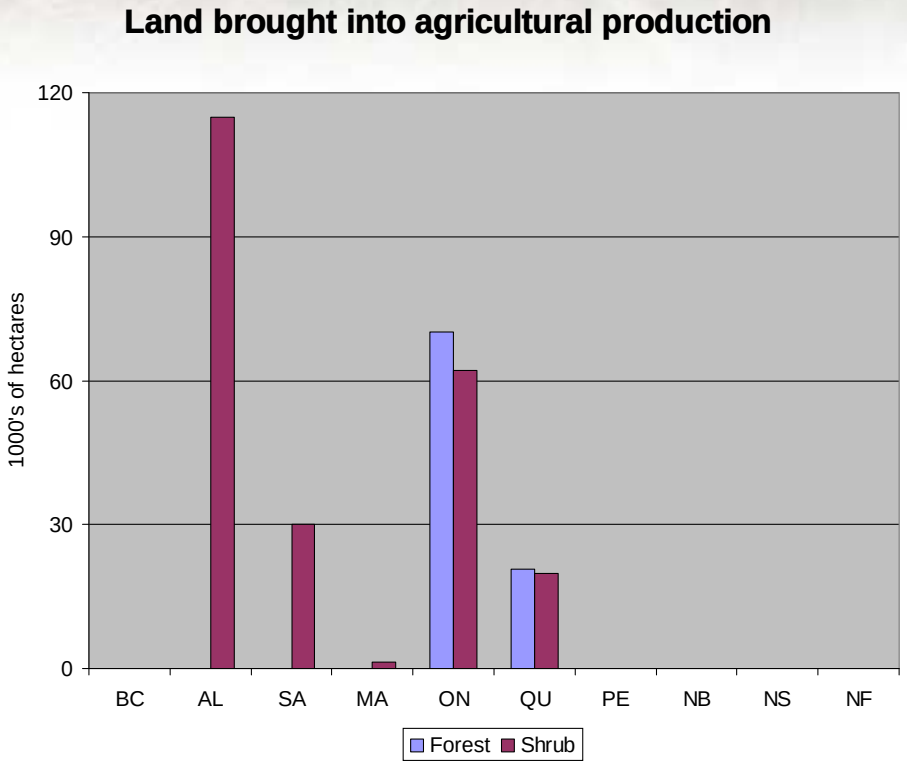


As a result of high renewable energy targets for agriculture, land clearing occurs in several provinces

- The higher renewable energy targets increase land values in the model, which increases pressure to clear land for agricultural production

- Most land cleared is shrub land due to lesser costs, but forest land is cleared for agricultural production in some regions

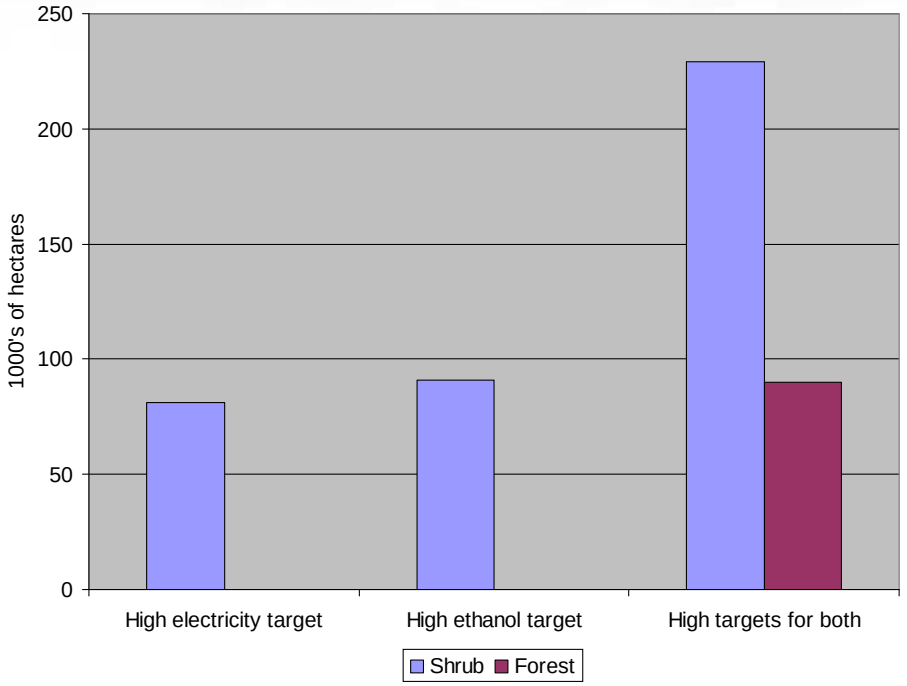
- CRAM is able to give an even more detailed breakdown below the provincial level for land use change



The type and quantity of land use change can vary in response to the strength of the incentive

- The effect of possible future targets for both ethanol and electricity could result in land clearing from both forest and shrub cover
- Lesser targets for renewable energy, such as either ethanol or electricity do not have as strong response and only result in clearing of shrub land
- This level of land clearing is very small compared to the size of the Canadian agricultural land base

Land use change across the main scenarios



Conclusions and next steps

- This modification to CRAM can generate new information on land use change in Canada, allowing for the enhancement of current and future analysis and reducing uncertainty regarding land use change

- There are still several areas where there is uncertainty, in particular with the data. Time horizon, costs of clearing, opportunity costs of removing shrubs/trees and other costs all factor into the level of land clearing

- Work will be continuing at AAFC to improve the accuracy and capability of these modifications for future analysis

- Understanding the impact that this has on carbon balances and emissions will be very important to any future analysis dealing with climate change or carbon markets. The level of land clearing in these scenarios is small but even small changes in forestry and shrub land cover can result in large GHG impacts

Questions and comments

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