NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

How can terrestrial carbon science contribute to the success of future climate agreements?

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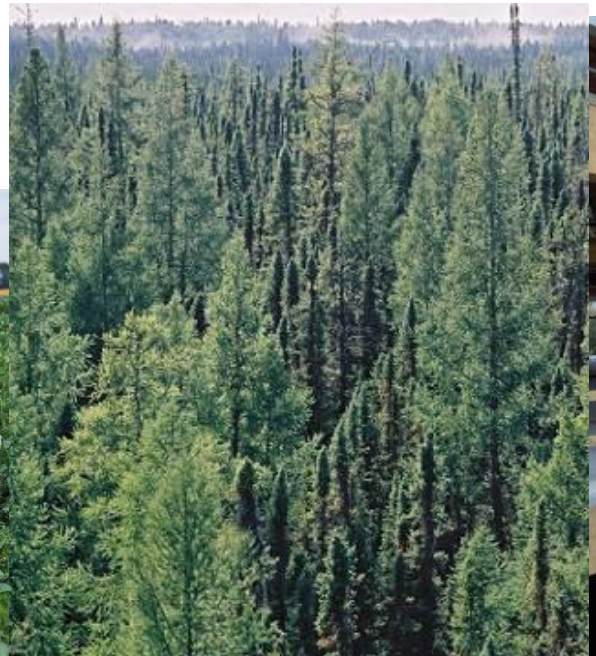
Outline

- Background
- Examples of past contributions of terrestrial C science
- Current status of negotiated agreements
- Requirements for future contributions
- Conclusions



Terminology 101:
Estimation, Reporting, Accounting, Review

Estimate

- Calculate carbon (C) stock change and GHG emission and removal estimates using methodological guidance of the IPCC

Report

- Provide estimates and other information in national reports, using formats and guidelines agreed by Parties

Account

- Use reported estimates and other information to show progress toward, or compliance with, a target

Review

- Process of examination (by others) of reported information in relation to an objective

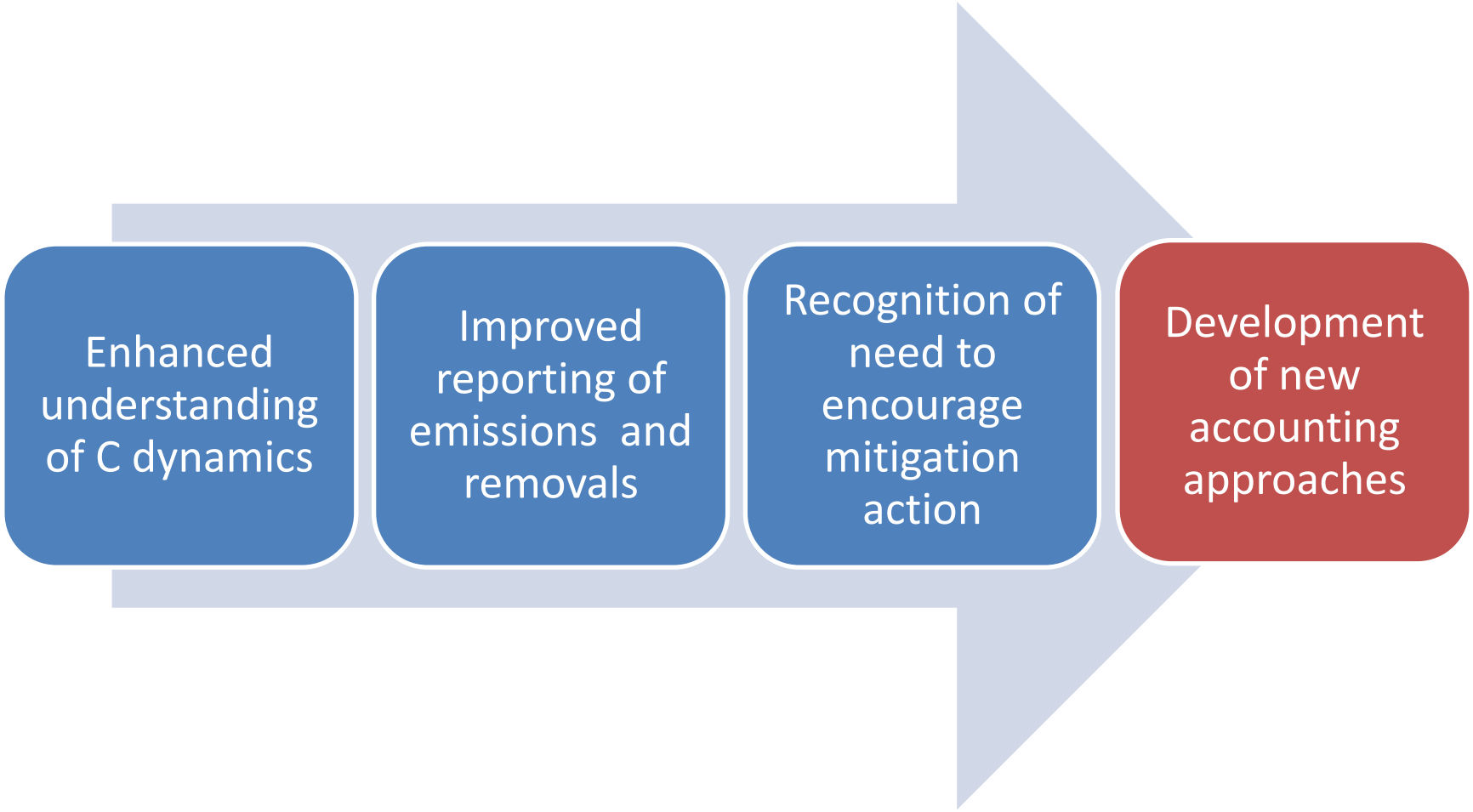
Why is terrestrial C important to a new climate agreement?

- Deforestation and other land uses cause ~10% of global anthropogenic emissions
- Terrestrial ecosystems responsible for removing ~30% of global anthropogenic emissions from the atmosphere
- Meeting long-term targets to minimize climate change is not possible without a land sector contribution.

Therefore, an effective new climate agreement should:

- address land sector emissions and removals
- provide incentives to implement climate change mitigation actions in the land sector
- avoid credits for C sinks that do not result from changes in land management

How has terrestrial C science supported past climate agreements?



One example:
Improved accounting of forest C

Prior to 2012, forest C accounting rules under the Kyoto Protocol created barriers to achieving mitigation potential:

- Managed land proxy intended to capture human activities but emission estimates include natural disturbance emissions
- Accounting of absolute stock changes during 5-yr period
- Rules did not address age-class legacy effects resulting from pre-1990 natural or anthropogenic disturbances
- C contained in harvested wood was assumed instantly oxidized
- Crude measures, e.g. caps on possible credits, used to minimize the potential for natural and indirect removals to enter accounts

… continued

One example:
Improved accounting of forest C

Rules and caps failed to create incentives

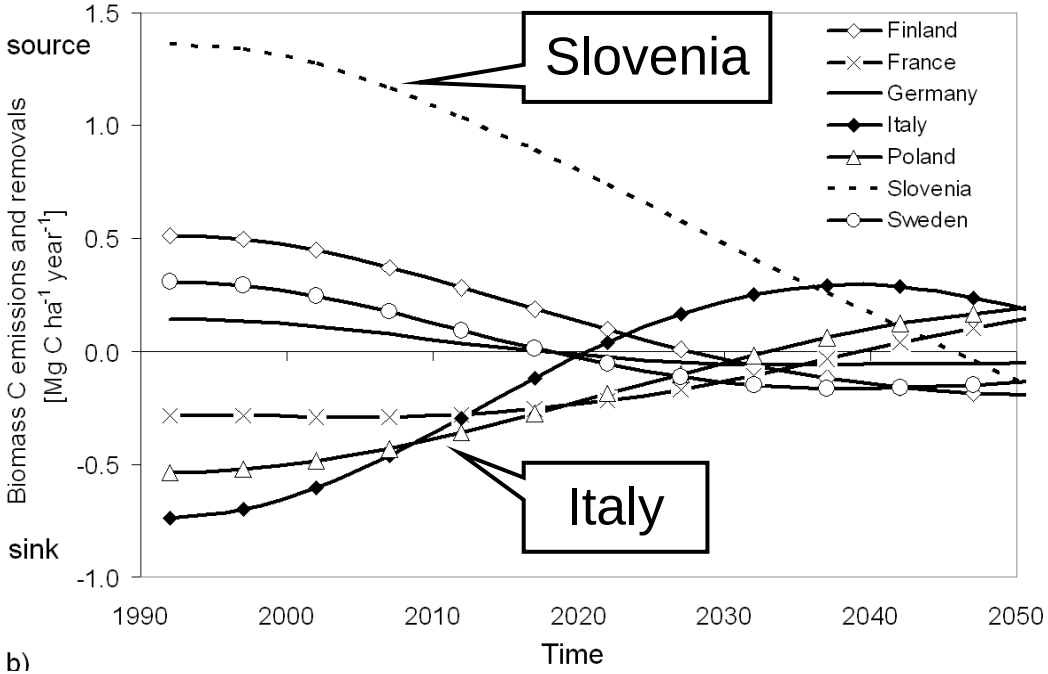
- to include forest management activities in reporting,
- to change management,
- to extend C retention in harvested wood products, and
- to improve landfill management.

Challenge:

- **Design an accounting approach that removes non-anthropogenic impacts and encourages mitigation actions to reduce emissions or enhance sinks**

Forest management reference levels: a science-policy solution

- **Science contribution**: better understanding of forest C
  - Past and current management activities
  - Past and current natural disturbances (e.g. fire, insect outbreaks)
  - Age-dependent stand dynamics (growth, mortality, and decay)
  - Age-class legacy effects



Source: Böttcher et al. 2008

Forest management reference levels: a science-policy solution

- **Science contribution**: better understanding of forest C
  - Past and current management activities
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  - Age-dependent stand dynamics (growth, mortality, and decay)
  - Age-class legacy effects
- **Proposal**: reference level approach to isolate human impacts
  - Consistent with UNFCCC focus on anthropogenic impacts
  - Removes age-class and natural disturbance impacts
  - Creates incentive for countries to improve forest management
- **Result**: agreement to apply RL accounting starting in 2013
  - Accounting for forest management made mandatory
  - Concept extended to REDD+ for developing countries

Forest management reference levels: a science-policy solution

- **Reference–level approach compares two time series of emission estimates**
  - The projected reference level represents expected forest and HWP emissions and removals with current management policies, estimated prior to the start of accounting.
  - Actual emissions and removals resulting from management with climate mitigation activities estimated at the end of the period.
  - Difference in net emissions represents estimate of the consequences of **changes** in management
- **Technical correction of reference levels**
  - Possible to correct the reference level in order to ensure methodological consistency e.g. use improved science, actual climate, and same models used to report at end of period (2020);
  - Not possible to change policy assumptions in RL.

Other negotiated improvements

- **Inclusion of Harvested Wood Products**:
  - C stocks in HWP in use (and landfills) are increasing
  - IPCC methodological options for HWP estimation and reporting
  - Consensus on “Production Approach” estimating emissions where and when they occur, reporting and accounting by country in which wood was harvested
- **Natural Disturbance Provision**
  - Allows countries to mitigate impacts of natural disturbances on GHG accounts by **not** accounting emissions (and removals in subsequent regrowth)
  - Consistent with UNFCCC focus on anthropogenic impacts
  - Various rules and complexities associated with implementation
  - Increased monitoring and data requirements

Current Status of International Agreement

- **Increased incentives to manage land to mitigate climate change and improved estimates of human impacts**
- **More land areas are included**
  - E.g. mandatory accounting of forest management, wetland drainage and rewetting
  - But still a patch-work of included and excluded lands (not estimated, reported or accounted).
- **Accounting rules have become increasingly complex, difficult to implement, comprehend, and review**
  - Chapter 4 of 2003 IPCC Good Practice Guidance addressed requirements of the Kyoto Protocol: 50 pages
  - Replaced by 2013 IPCC Kyoto Protocol Supplement: 268 pages
- **A cap remains – but with RL more difficult to reach it.**
  - Reflects various concerns e.g. uncertainties in estimates.

Looking forward, how can C science support future climate agreements?

- **What will COP21 Paris post 2020 agreement look like?**
  - C science has informed the negotiations (to date) but the ultimate outcome will be a political, negotiated solution
  - Focus is on nationally-determined contributions (bottom up approaches)
  - Enhanced transparency and broader participation will be key
  - Desire to build on previously negotiated approaches

Looking forward, how can C science support future climate agreements?

- **How can we implement the post-2020 agreement to increase its effectiveness?**
  1. Enhance transparency through development of MRV systems
  2. Facilitate broader participation through technology transfer
  3. Increase comprehensiveness of coverage through scientific advances
  4. Increase accuracy of reporting of human impacts on emissions and removals
  5. Develop and assess efficient mitigation strategies

1. Enhance transparency through development of MRV systems

C Science

- Continue to improve methods and tools for estimating and reporting C stock changes, emissions and removals, including ecosystem inventories and observation

Remote sensing

- National and global time series of land-cover changes, with attribution of disturbance cause; validation using regional data
- New technologies to obtain and process information (Lidar, etc.)
- Opportunities for independent verification (review) of activity data

Data integration and modelling

- Ongoing need for improved data integration and analyses

Inverse modelling

- Opportunities to estimate terrestrial sources and sinks, but not all areas are reported which limits verification ability.

2. Facilitate broader participation through technology transfer

- **Open access to Landsat archives and development of tools to generate time series of activity data**
  - While new data are very useful, major challenges remain in national-scale use (software, hardware, expertise, etc.)
- **Provide tools, documentation and training**
  - E.g. CBM-CFS3 freely available, widely used internationally
  - 2-3 training workshops per year. (500+ trainees in 25 sessions)
  - Consistent methodology allows for comparison (e.g. EU JRC compared CBM-CFS3 estimates with 26 country reports).
  - But Tier 3 models require data, expertise and long-term commitment to building national teams that can support their use
- **Many other examples of technology transfer**

3. Increase comprehensiveness of coverage through scientific advances

- **Long-term objective of UNFCCC is full coverage GHG estimation and reporting of human impacts**
  - Science informs the development of new estimation methodologies to extend coverage to new lands/activities
  - 2013 IPCC Wetland Supplement includes wetland drainage and rewetting
  - Emerging issue: coastal and marine ecosystems (“blue carbon”, mangrove forests)
- **Once scientific methods are developed, accounting approaches will need international agreement**

4. Increase accuracy of reporting of human impacts on emissions and removals

- **Accounting ‘fixes’ exist, but non-anthropogenic impacts still in estimates, e.g. natural disturbances**
  - Accounting is less transparent – numbers differ from National GHG Inventories
  - Variability from natural disturbances can obscure improvements in forest management

- **Tension between objectives to simplify accounting, to improve estimates of human impacts, and to maintain integrity of the estimates.**

5. Develop and assess efficient mitigation strategies

- **Many land-based mitigation options identified, but design of efficient strategies requires analyses to inform policy:**
  - Methods development and agreement on common approaches to evaluating mitigation portfolios
  - Quantification of terrestrial ecosystem responses to mitigation actions (and their interactions with climate change impacts)
  - Harvested wood products – estimate C stocks and emissions
  - Substitution effects (avoided emissions) from HWP use
  - Bioenergy – life cycle analysis based on actual impacts
  - Assessment of mitigation costs (abatement curves)
  - Growing recognition that assessment may have to include broader impacts, e.g. changes in albedo.

Conclusion:
How can terrestrial C science contribute?

- Develop systems that integrate data from multiple sources
- Improve monitoring (e.g. land cover changes)
- Improve estimates of human impacts
- Communicate uncertainties and limitations
  - Numerical estimates, missing processes, human errors
  - Focus on uncertainty in estimates of human impacts
- Identify and assess available mitigation strategies
- Transfer technology and build capacity

Conclusion:
How can terrestrial C science contribute?

Provide information, tools and methods
to support a negotiated agreement
that **fully accounts for human impacts and effectively incorporates land sector activities**
in climate change mitigation.

- Transparent (as simple as possible)
- Comprehensive (integrated systems approach)
- Effective (no ‘mitigation’ that increases emissions)
- Focussed on human impacts

Communicate the risks associated with terrestrial C cycle feedbacks and the urgency for climate action.

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Thank you

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