Assessment of the impacts of wood substitution for steel and cement in building materials on climate change mitigation

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Background

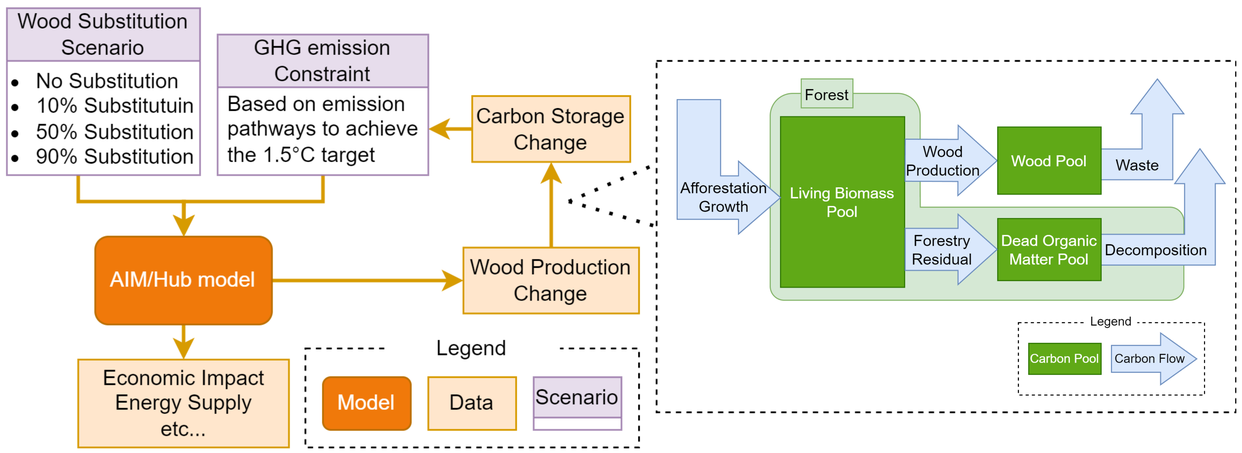
- The Paris Agreement sets a long-term goal of keeping the global average temperature increase well below 2℃ above pre-industrial levels, with the aim of limiting it to 1.5℃.
- The steel and cement sectors are considered to be high GHG emitting industries where emission reductions are difficult.
- **Using wood instead of steel and cement** as a building material can mitigate climate change.
  - **Material Substitution Effect**... GHG emissions from energy and industrial processes are reduced because less energy-intensive materials are produced.
  - **Carbon Storage Effect**… Trees absorb CO_2 from the atmosphere and grow, so their use as wood can fix CO_2 in buildings for a long time.

Purpose

- Identify **the role of wood substitution** as a climate change mitigation measure in scenarios to achieve the 1.5℃ target.
- Analyze **the economic and energy impacts** of wood substitution as a mitigation measure.

Methodologies

Overview



Calculation of carbon storage

- Scenarios in which wood is substituted for steel and cement in the construction sector under GHG emission constraints to achieve the 1.5℃ target are simulated by CGE model, AIM/Hub.
- To account for carbon storage effects, carbon storage is calculated from wood production and added to GHG emission constraints.
  - Total Carbon storage change is calculated from change in the three pools of living biomass, wood, and dead organic matter as it varies with wood production.
- The results of the simulation after varying the GHG emission constraints are analyzed.

Results

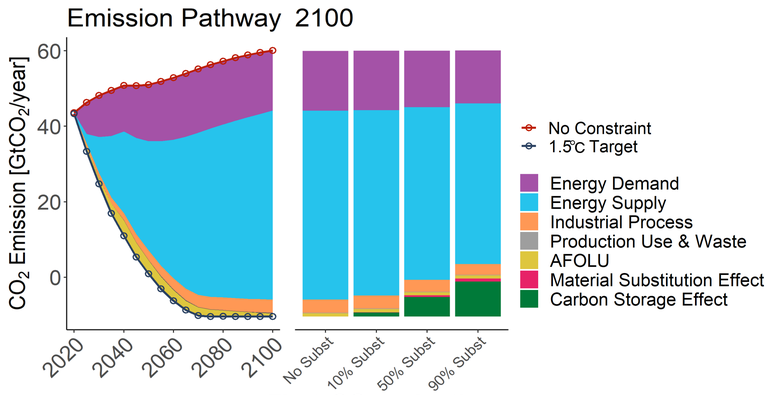


Fig.1 CO_2 reduction

- Fig.1 shows the emission reductions required in each sector to achieve the 1.5℃ target.
- Wood substitution reduces emission reduction requirements in energy-related sectors.
- 90% Subst scenario for 2100
  - Material Substitution Effect… 0.8 $GtCO_2$/year
  - Carbon Storage Effect… 9.2 $GtCO_2$/year

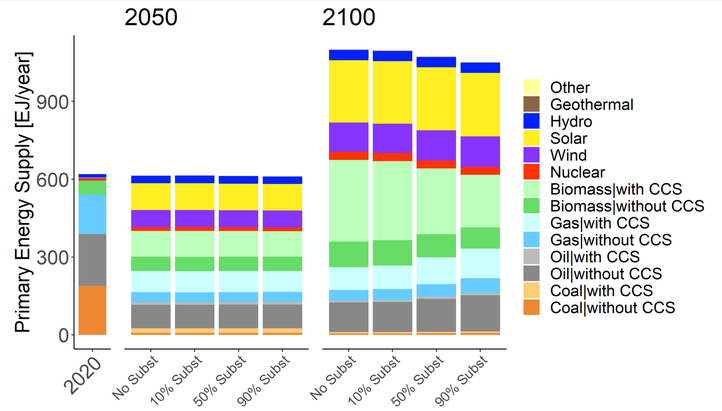


Fig.2 Primary Energy Supply

- 2050
  - There is little difference despite the increase in wood substitution.
- 2100
  - Total primary energy supply decreases as wood substitution increases.
  - Fossil fuels supply increases and biomass energy supply decreases.

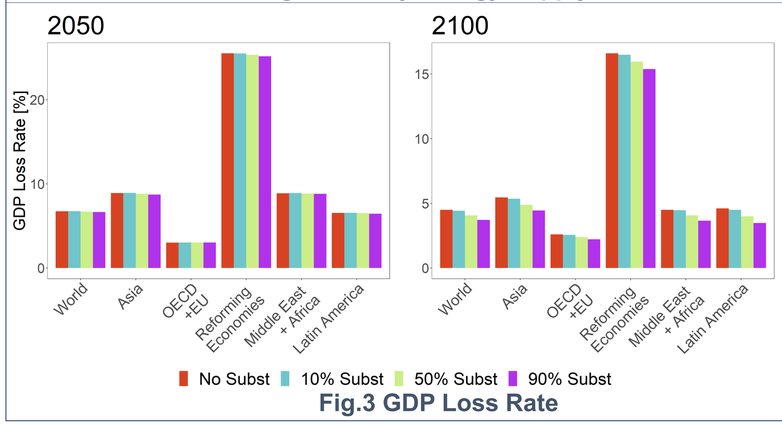


Fig.3 GDP Loss Rate

- 2050
  - There is little difference despite the increase in wood substitution.
- 2100
  - GDP losses decrease in all regions due to wood substitution.
  - Global GDP loss decreases from 4.6% to 3.7%.

Discussion・Conclusion

- There is a time lag before the carbon storage effect becomes apparent.
  - The effect of wood substitution becomes significant in the second half of the century.
- Additional emission reductions decrease demand for biomass energy and increased fossil fuel use.
- Wood substitution reduces GDP losses through lower emission reductions in energy-related sectors.
- This research doesn't consider the disadvantages of wood substitution, such as transition costs to wooden buildings, changes in productivity and differences in service life.
- Considering the above, the economic impact of wood substitution may be estimated smaller.

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