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Applied Systems Analysis
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science for global insight

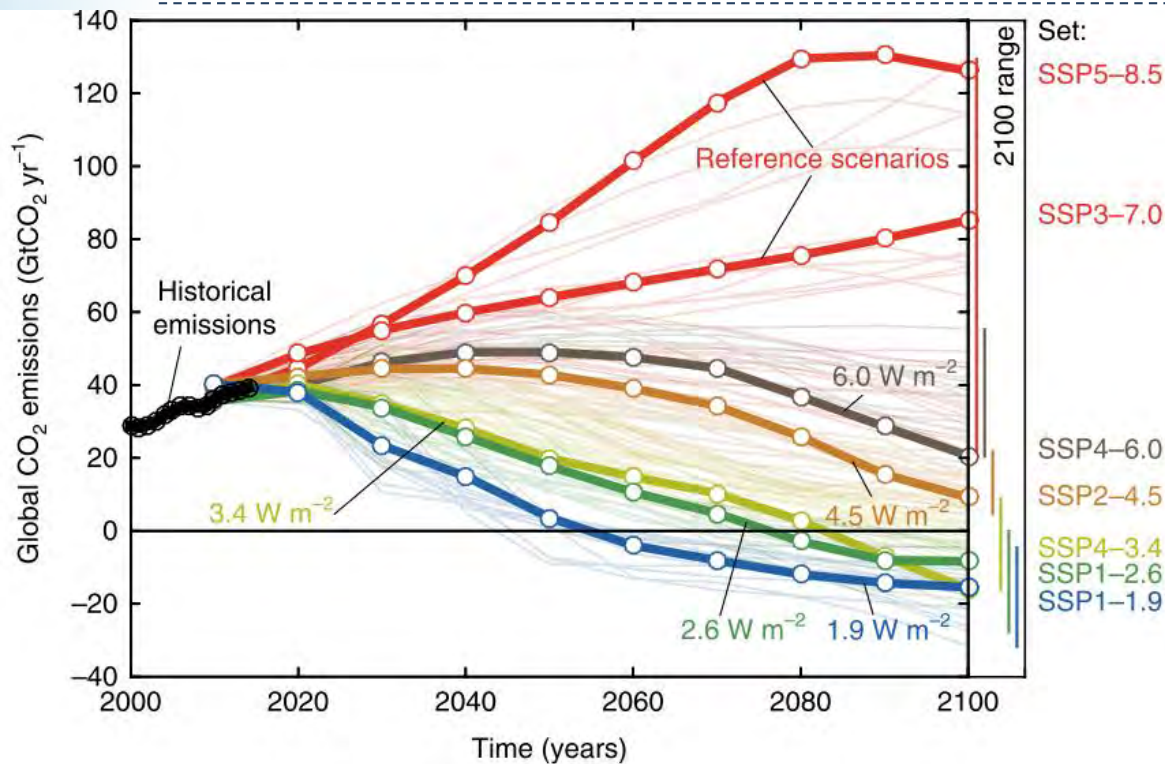
Land use contribution to decarbonization pathways: An integrated assessment modeling perspective

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IIASA, International Institute for Applied Systems Analysis

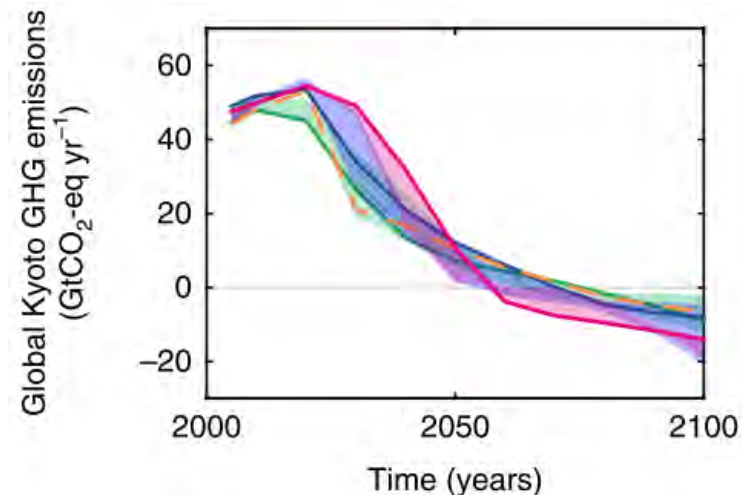
Carbon and GHG neutrality in Paris Agreement



Source: Rogelj et al. 2018 NCC

Net zero GHG emissions compatible with
 2 degrees: 2080-2100
 1.5 degrees: 2060-2080

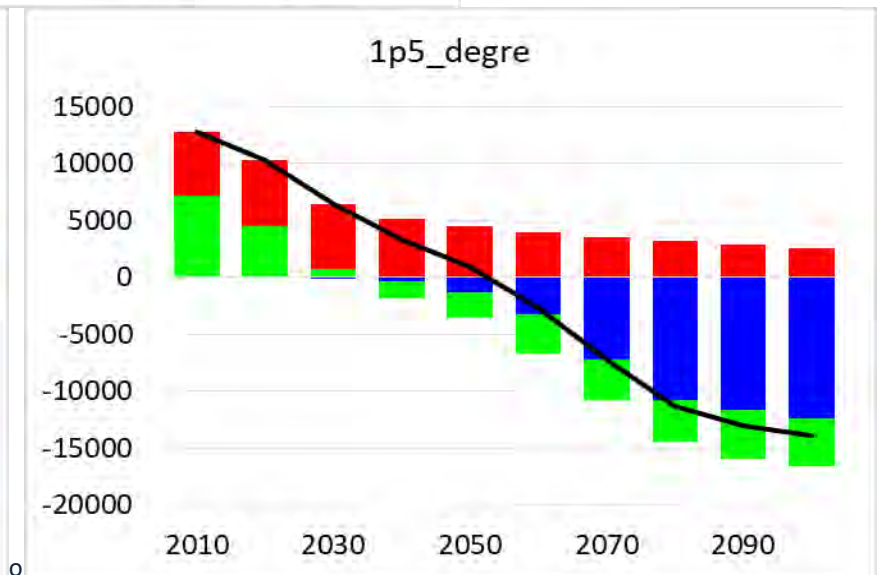
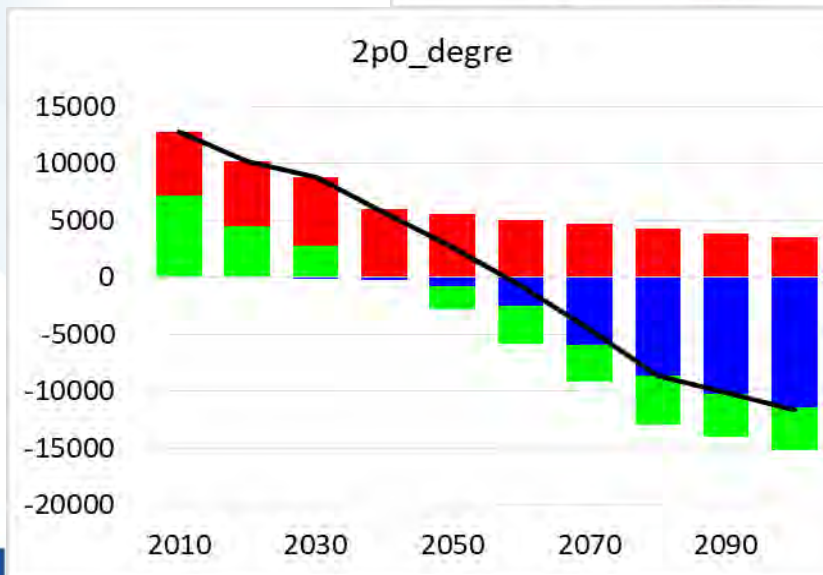
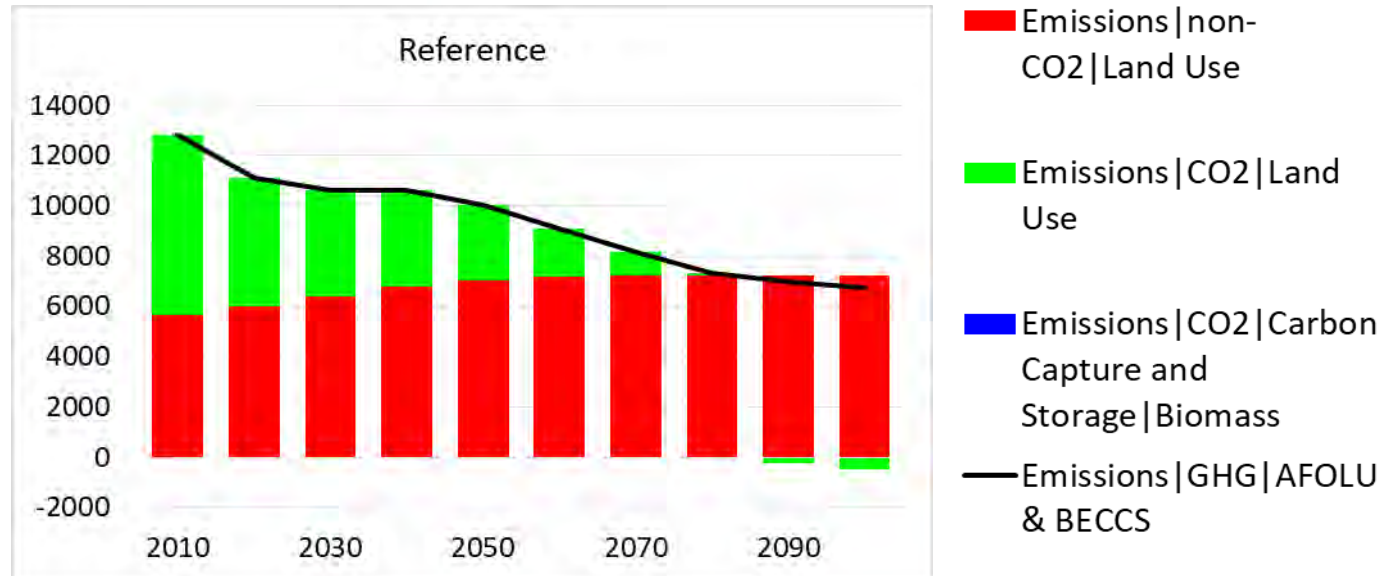
Carbon neutrality compatible with
 2 degrees: 2055-2080
 1.5 degrees: 2045-2070



Multi-model integrated mitigation assessment

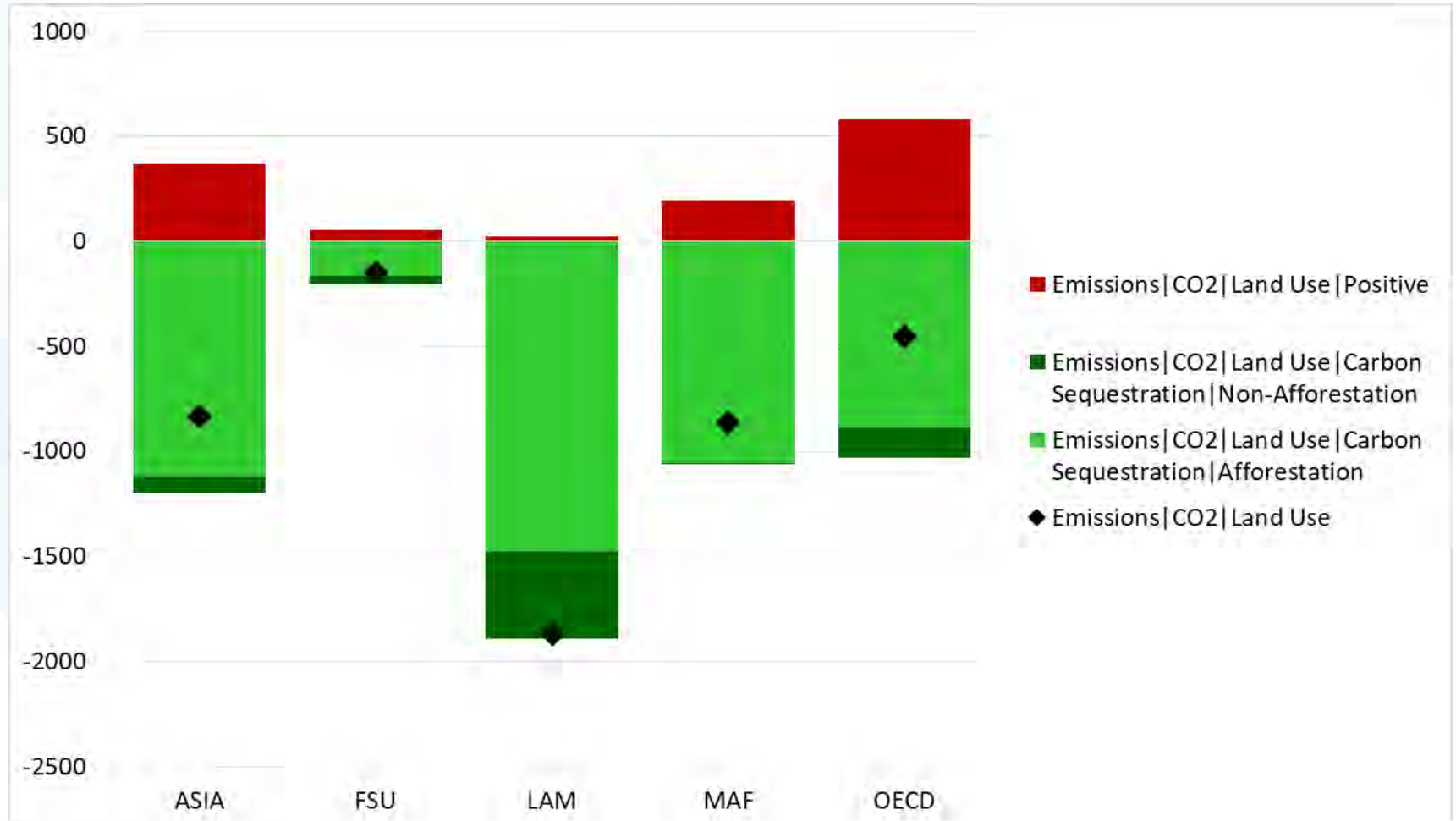
- ▶ Global Environmental Change (GEC)
 - ▶ Special Issue In press
 - ▶ Relevant papers
 - ▶ Land use overview (Popp et al. 2017)
 - ▶ SSP1: IMAGE-MAGNET (van Vuuren et al. 2017)
 - ▶ **SSP2: MESSAGE-GLOBIOM (Fricko et al. 2017)**
 - ▶ SSP3: AIM/CGE (Fujimori et al. 2017)
 - ▶ SSP4: GCAM (Calvin et al. 2017)
 - ▶ SSP5: REMIND-MAGPIE (Kriegler et al. 2017)
- ▶ Rogelj et al. NCC 2018 for 1p5 degree assessment

Total land use related GHG emissions [MtCO₂eq]



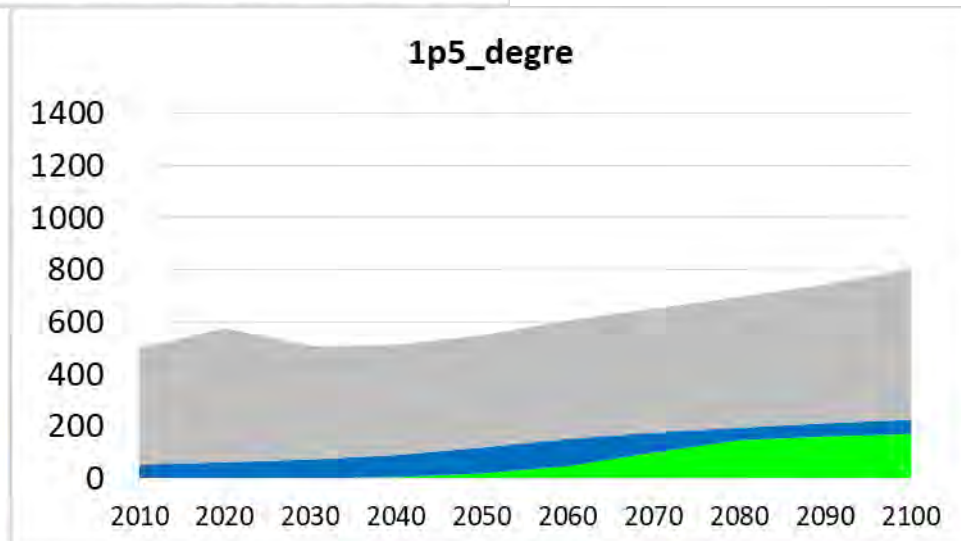
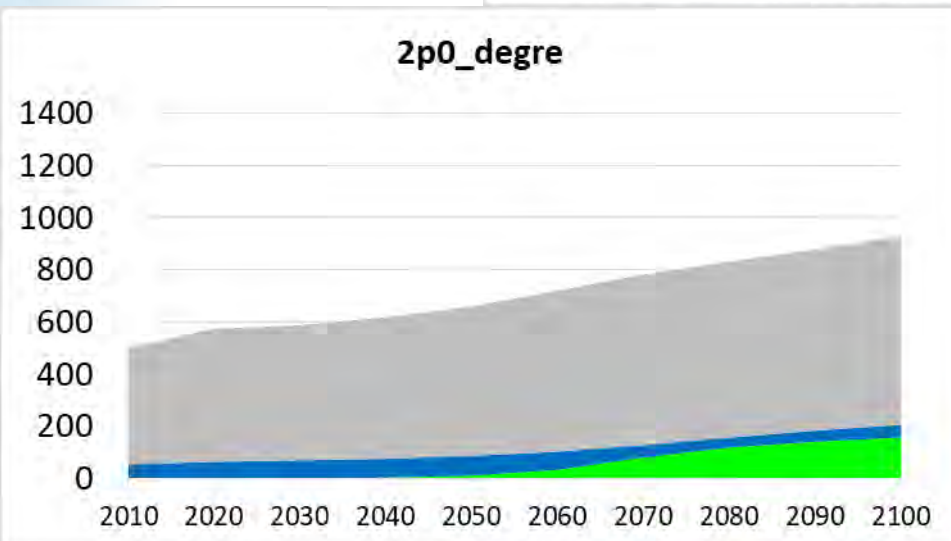
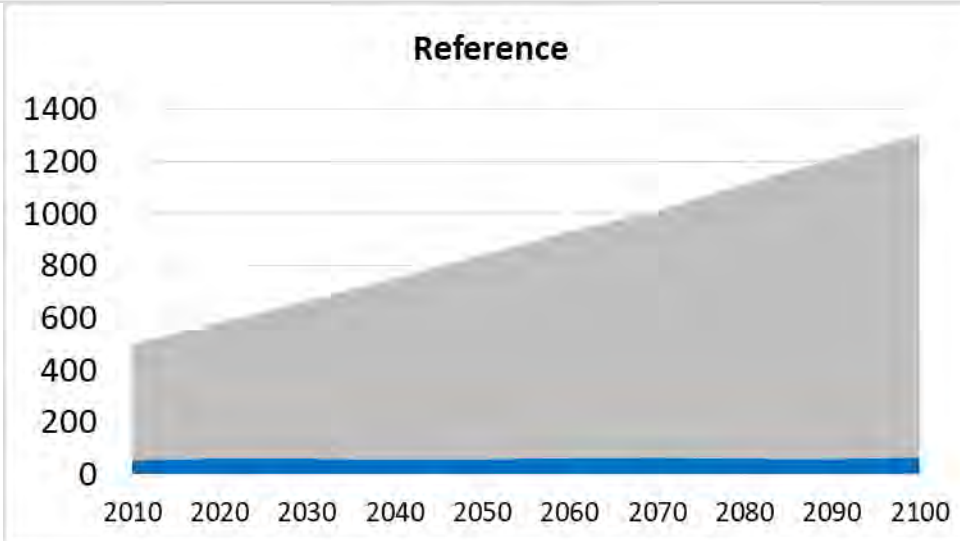
Land use CO2 emissions/sinks [MtCO2eq/yr]

► Global CO2 emissions/sinks for 1.5 degree scenario in 2100



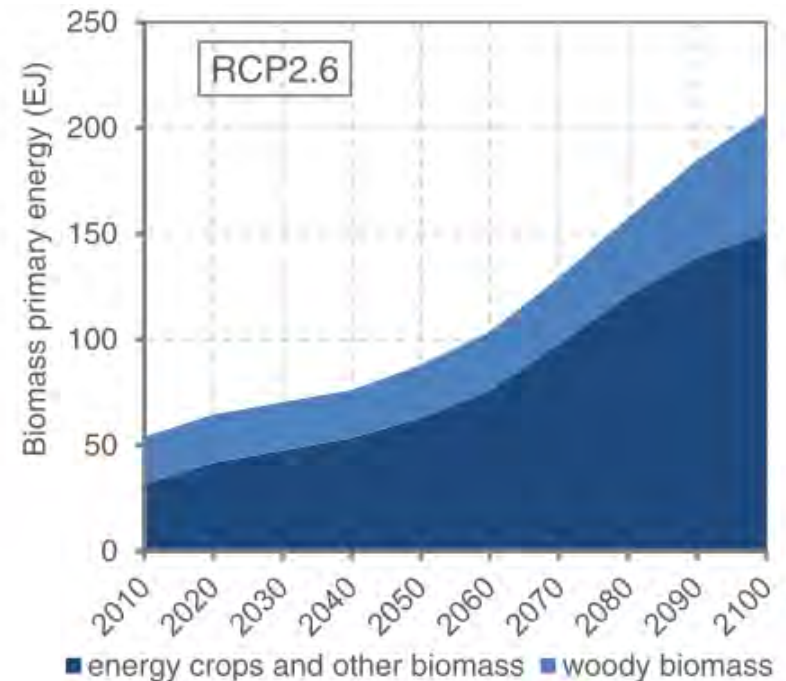
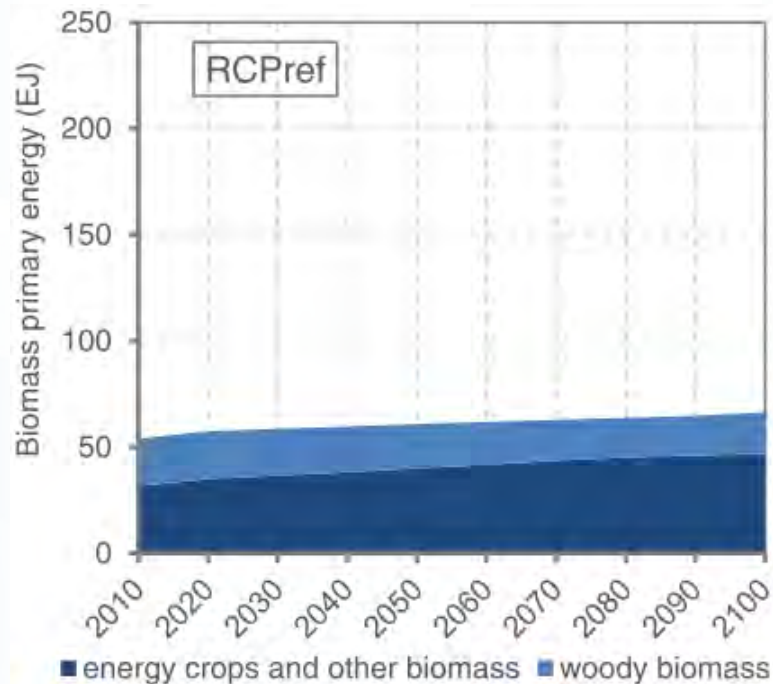
Primary energy supply [EJ/yr]

■ Primary Energy|Biomass|w/ CCS ■ Primary Energy|Biomass|w/o CCS ■ Primary Energy|Non-Biomass



Biomass for energy by source

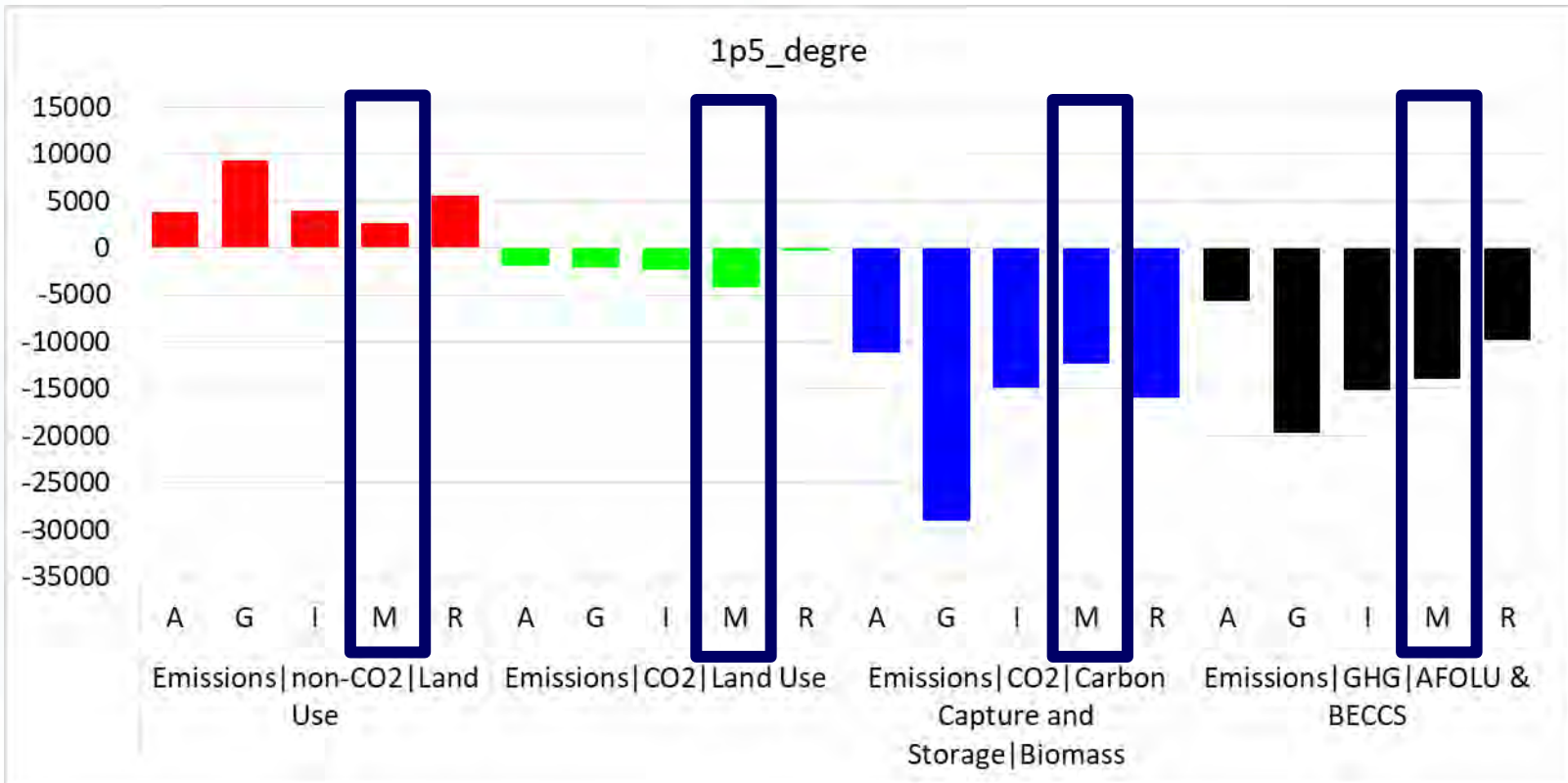
▶ Total global biomass use for energy



Source: Lauri et al. 2017

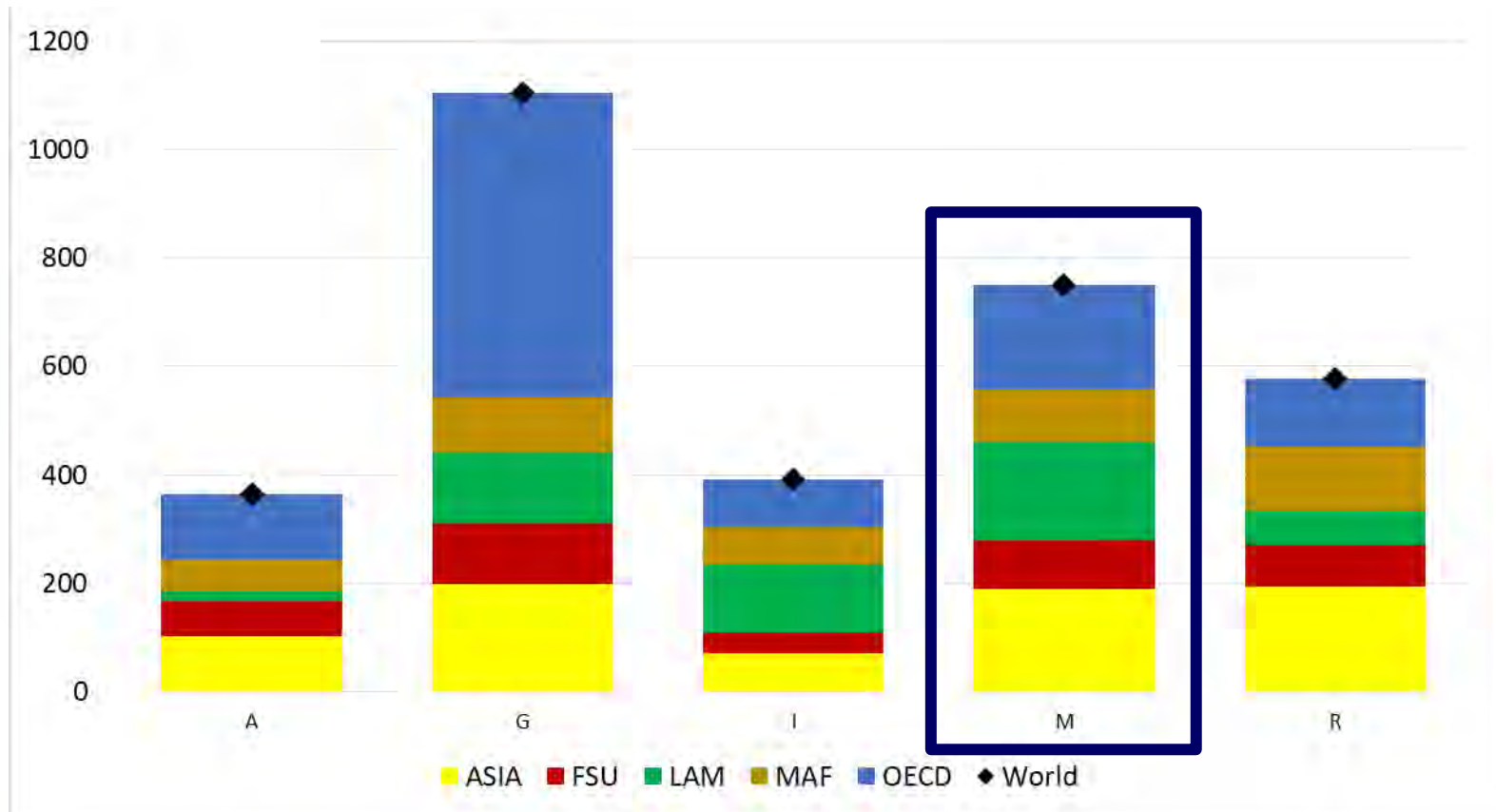
Need for land based solutions across IAMs

- ▶ Global GHG emissions/sinks for 1.5 degree scenario in 2100



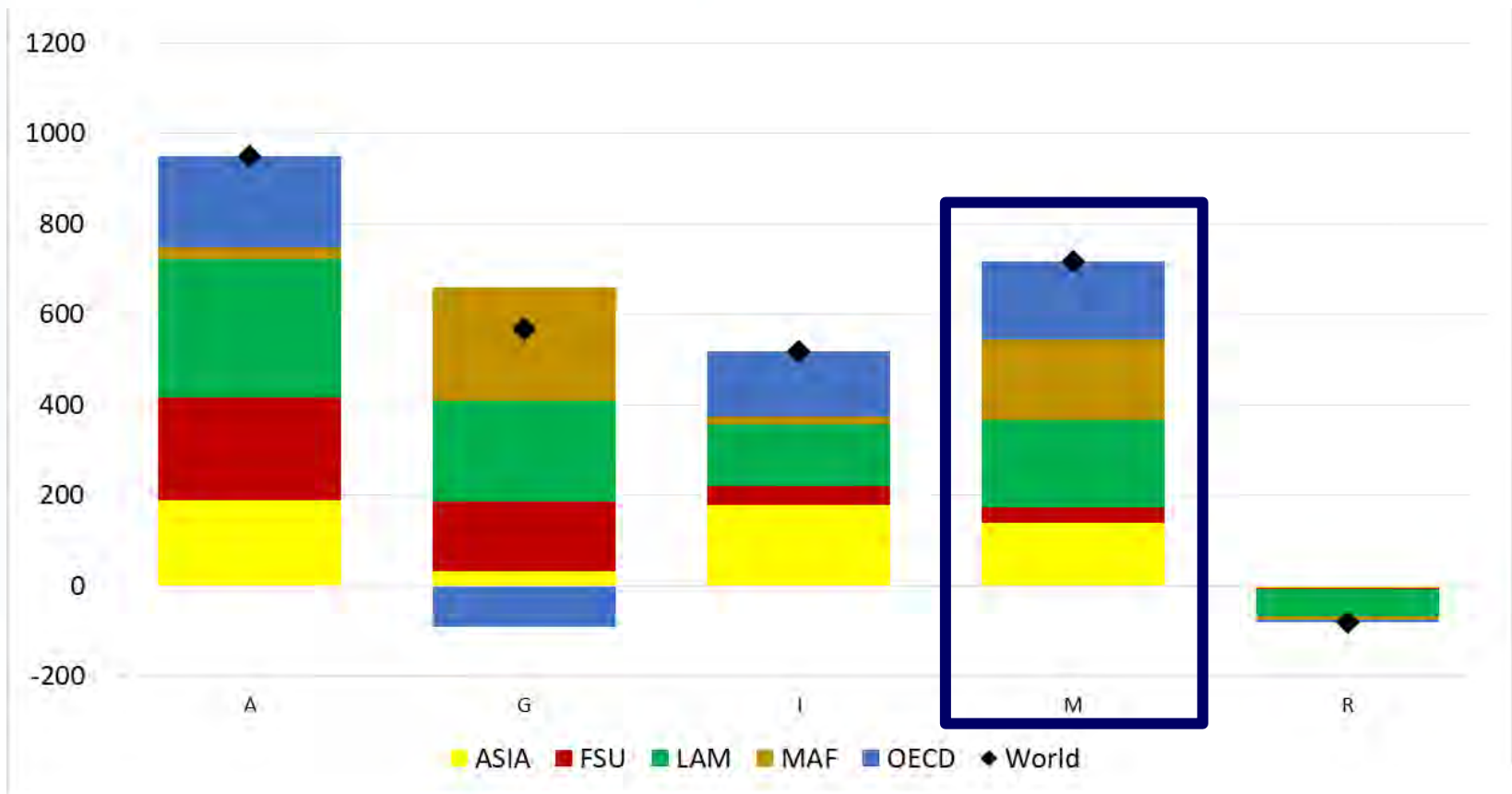
Land use implications

- ▶ **Energy crops area for 1.5 degree scenario in 2100 compared to 2010 [Million hectares]: + 750 Mha**



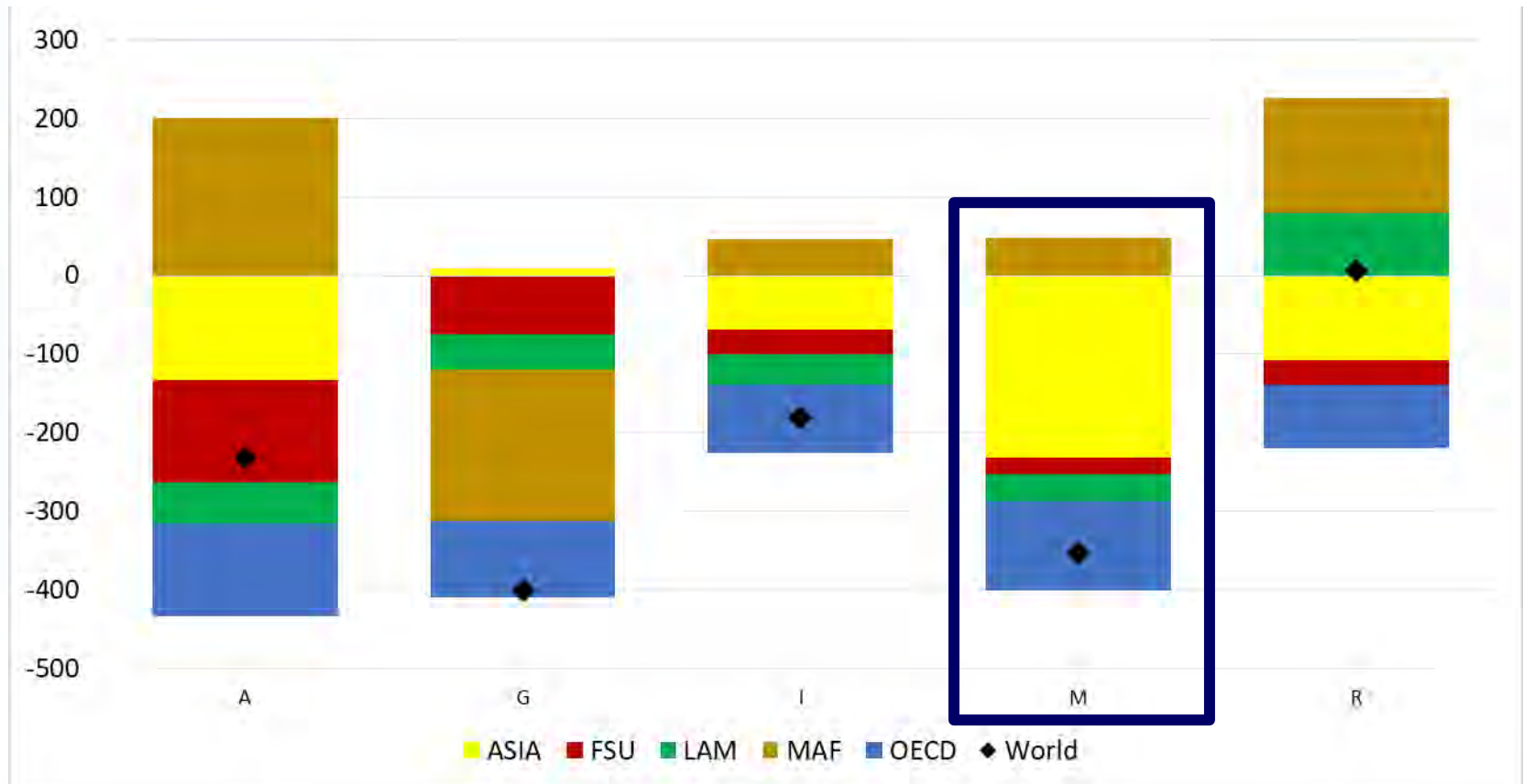
Land use implications

- ▶ **Forest area for 1.5 degree scenario in 2100 compared to 2010 [Million hectares] : + 720 Mha**



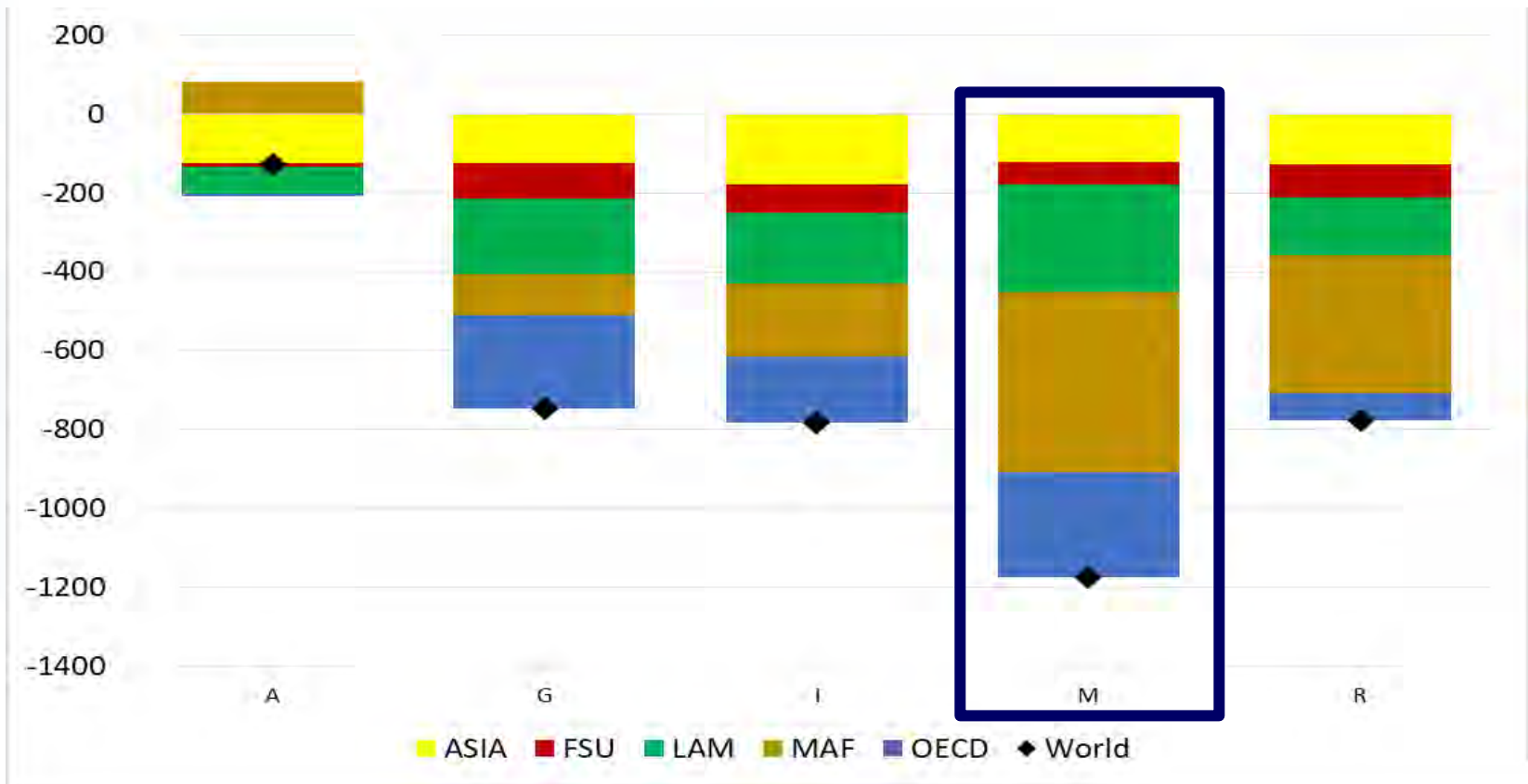
Land use implications

- ▶ **Conventional cropland area for 1.5 degree scenario in 2100 compared to 2010 [Million hectares] : - 350 Mha**



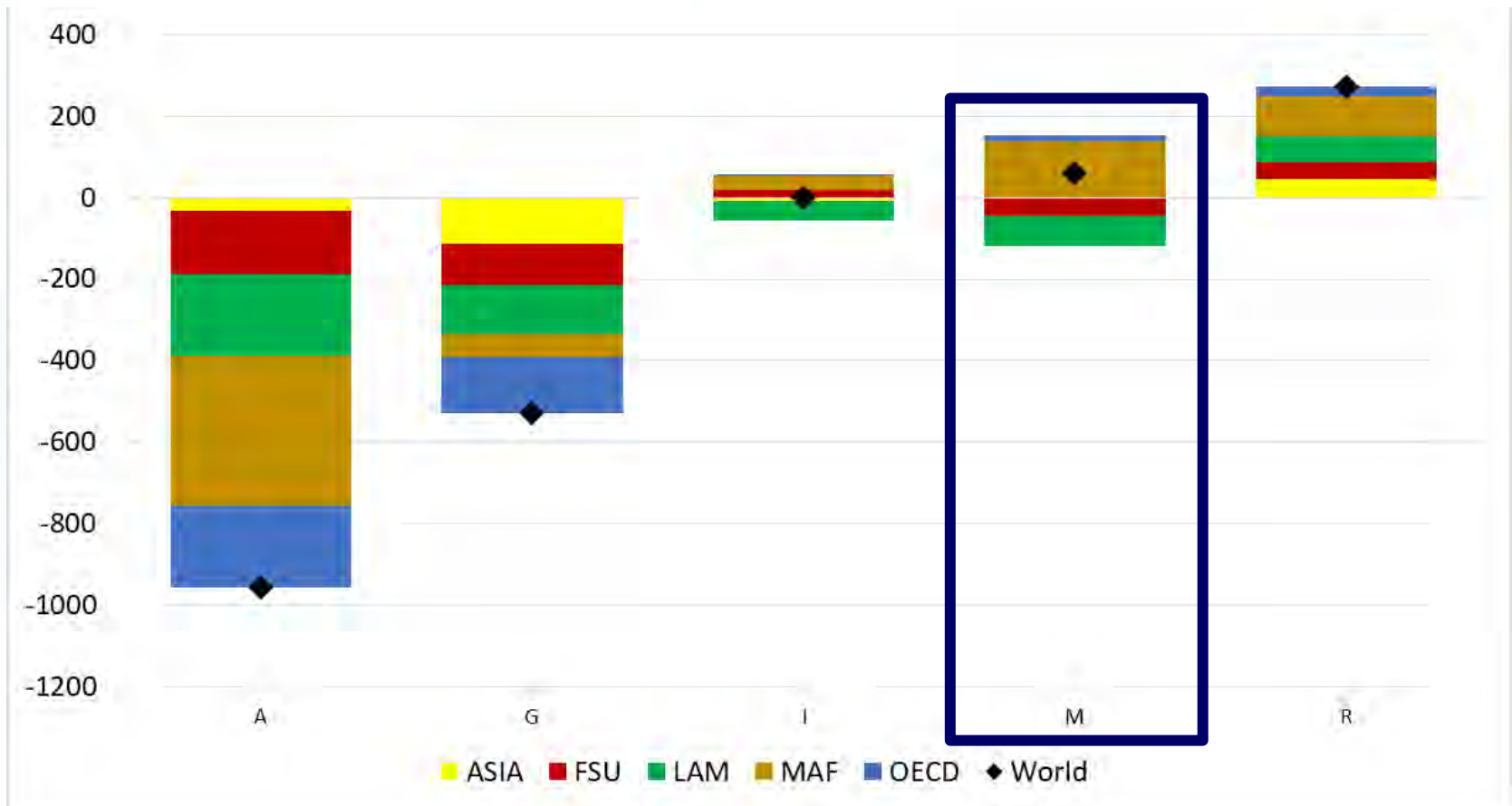
Land use implications

- ▶ **Pasture area for 1.5 degree scenario in 2100 compared to 2010 [Million hectares] : - 1280 Mha**



Land use implications

- ▶ **Other natural land** for 1.5 degree scenario in 2100 compared to 2010 [Million hectares] : + 80 Mha



Take-homes

- ▶ IAMs agree on the need for net negative emissions for reaching the Paris climate target - af/re-forestation and BECCS considered as options
- ▶ The overall need for net negative emissions differs substantially with very different implications for land use development
- ▶ Disagreement among models increases with increasing regional resolution and contributes to uncertainty in sustainability outcomes

Take-homes

- ▶ New scenarios being explored by members of the IAM community, relying on major life style change among other, with limited or no need for BECCS
- ▶ IAMs rely on land use components representing the state-of-the-art economic land use/sector models. But still can be improved...

Thank you!

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