Agricultural Afforestation for Carbon Sequestration Under Carbon Markets: Leakage Behavior from Regional Allowance Programs

David Haim | Eric White | Ralph Alig

Western Forest Economics, 2016

May 3rd, Seattle, WA

Haim. D., White. E.M. And Alig., R.J. 2015 "Agriculture afforestation for carbon sequestration under carbon markets in the United States: Leakage behavior from regional allowance programs". Applied Economic Perspectives and Policy 37(3): pp.1-20.

Forest Eligibility to Produce Carbon Offsets

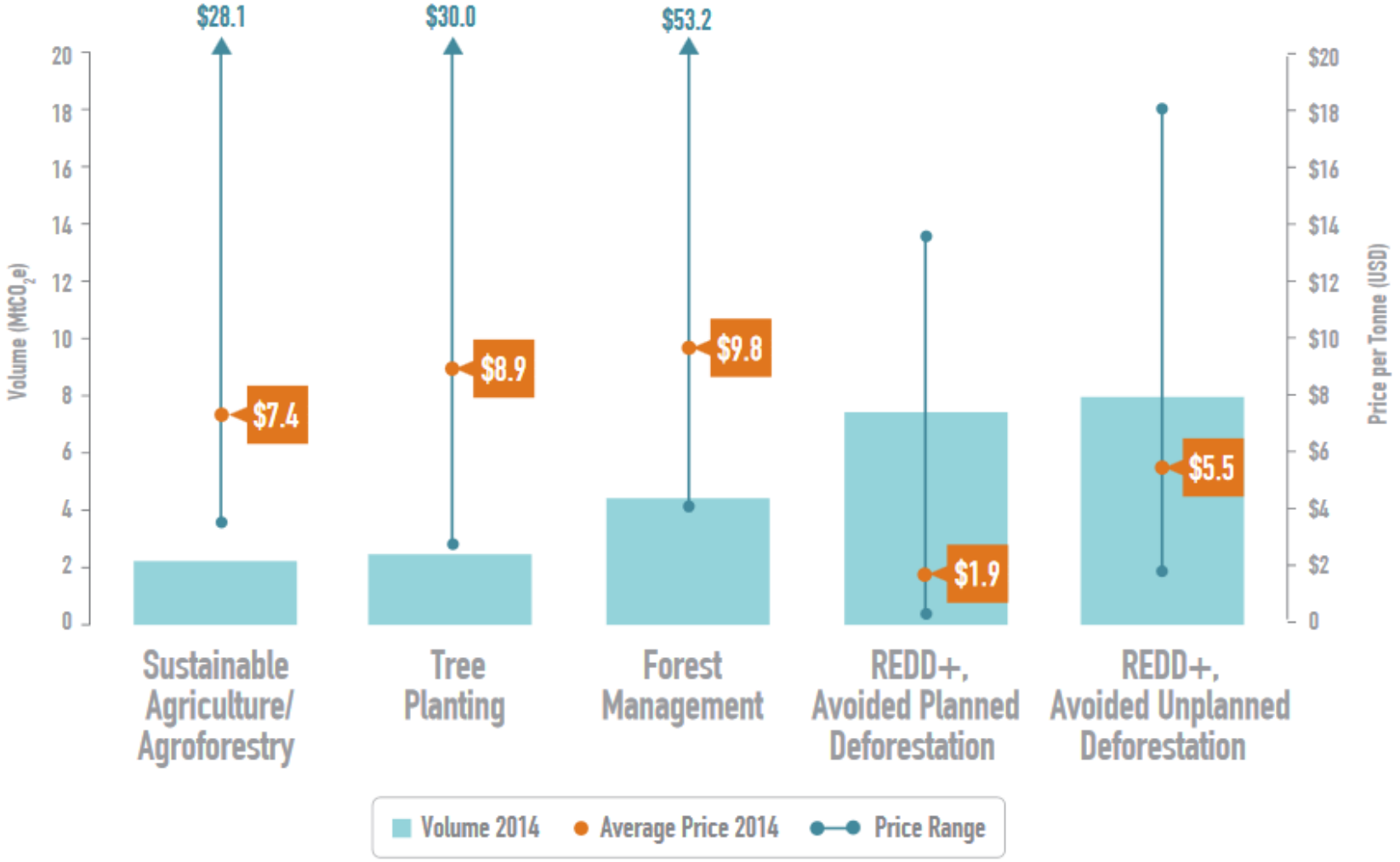
- In the US
  - Mainly via the CA cap-and-trade
    - Avoided conversion
    - Improved forest management projects
    - Afforestation/reforestation projects
  - RGGI: only projects located within one of the RGGI states (only CT and NY for afforestation projects)

Forest-based Carbon sequestration

- Significant capacity to sequester carbon (Alig et al, 2010; Gorte 2009)
- Increase in net farm income (Baker et al, 2010)
- Cost effective in achieving a substantial portion of US reduction targets (Lubowski et al, 2006; Richards & Stokes 2004)

Carbon Prices by Project Type

Figure 4: Transacted Volume and Average Price by Project Type, 2014



Note: Based on 24.5 $MtCO_2e$ in 2014 transaction volume associated with a project type and price.

Source: Forest Trends' Ecosystem Marketplace, *State of Forest Carbon Finance 2015*.

Source: Forest Trends http://www.forest-trends.org/documents/files/doc_5020.pdf

Objective

- Quantify leakage behavior from Ag. Afforestation under carbon markets
  - Regional allowance programs
  - Focus on programs in US South
  - Intensification of Ag. Production

Agricultural Afforestation Integrity

- Intensification within the agricultural sector:
  - Conversion of pasture to cropland
  - Adoption of more intense management practices

- Leakage:
  - Intensification of agricultural production **within** the afforestation program's boundaries
  - Emissions displacement **outside** the afforestation program's boundaries

Leakage – Literature

- Electricity sector:
  - Leakage of CO_2 emissions to unregulated regions is a significant concern in regional programs (Bushnell & Chen 2012)
  - CO_2 Leakage from regional programs is negatively related to carbon prices (Chen 2009)
- Forest sector:
  - 20-40% for a 10 million acres afforestation program (Murray et al, 2004)

FASOM-GHG

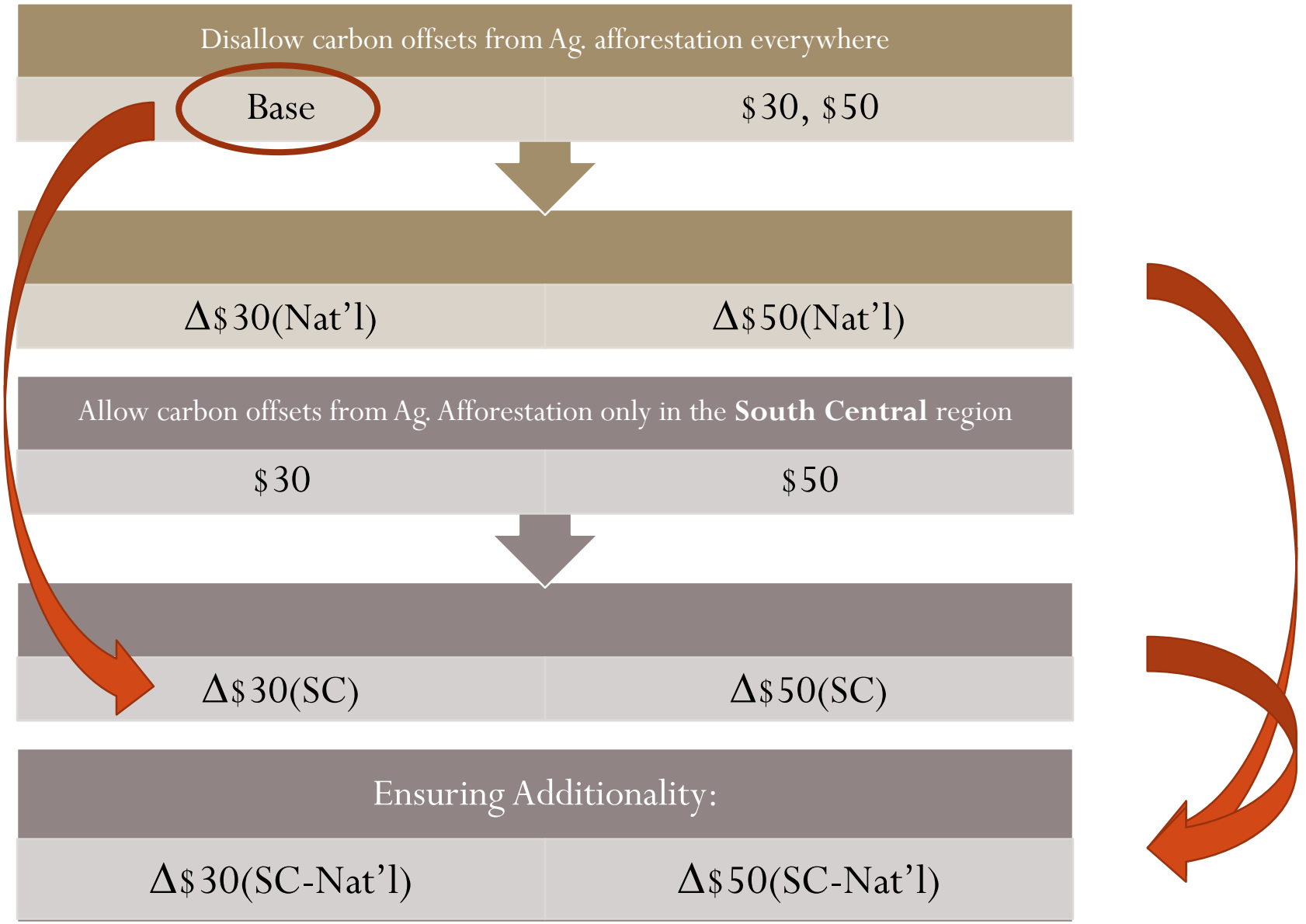
- An equilibrium linked model of U.S. agricultural and forest sectors
- Utilizes a dynamic optimization approach to simulate markets for agricultural and forest products
- Commodity and factor prices are endogenous
- Regionally-explicit
- Tracks a variety of agricultural and forest resource conditions and management actions

GHG – Accounting

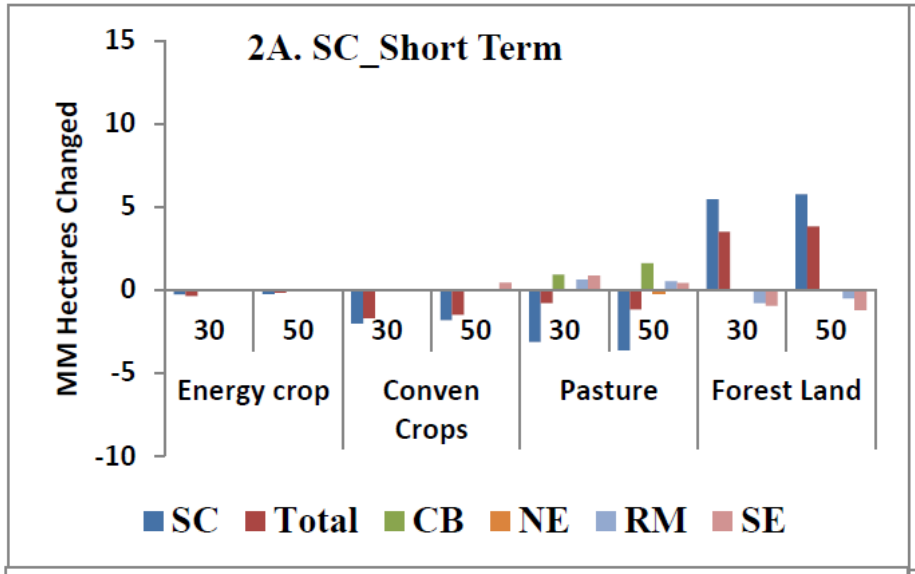
Land-based GHG accounting in agricultural and forest sectors from:

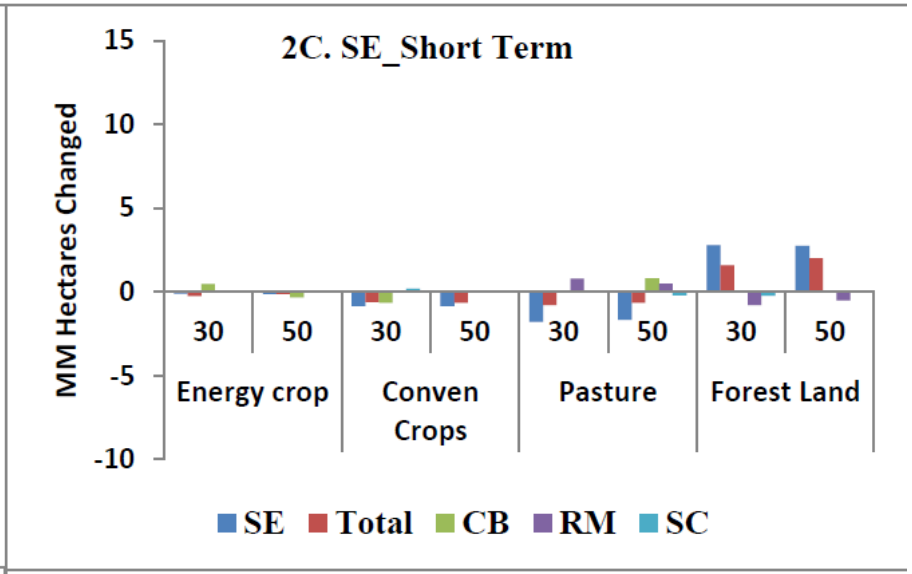
- Carbon in agricultural and forest biomass and soils
- Carbon change due to movement of land (afforestation/deforestation) between agriculture and forest
- Emissions from agricultural and forest production activities
- Emissions from livestock
- Carbon in wood products

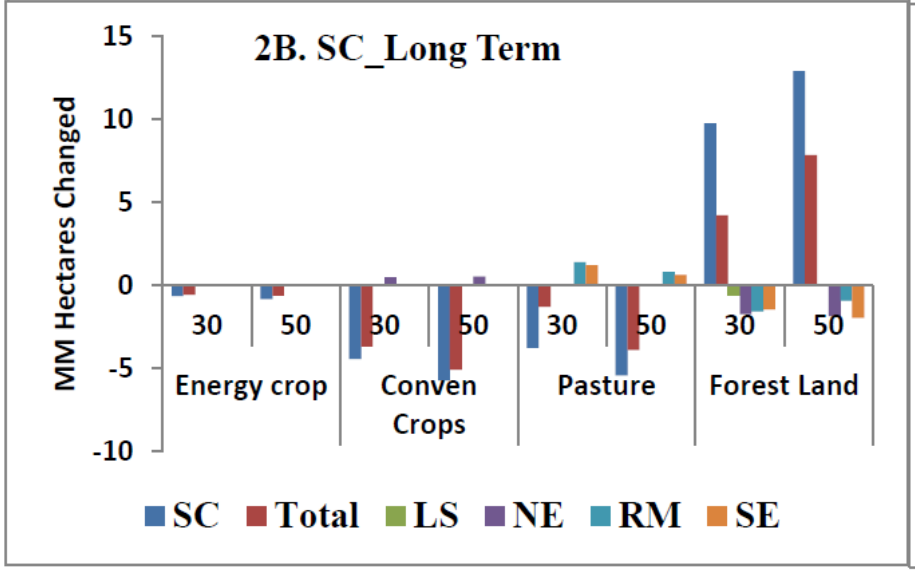
Simulations – ensuring additionality

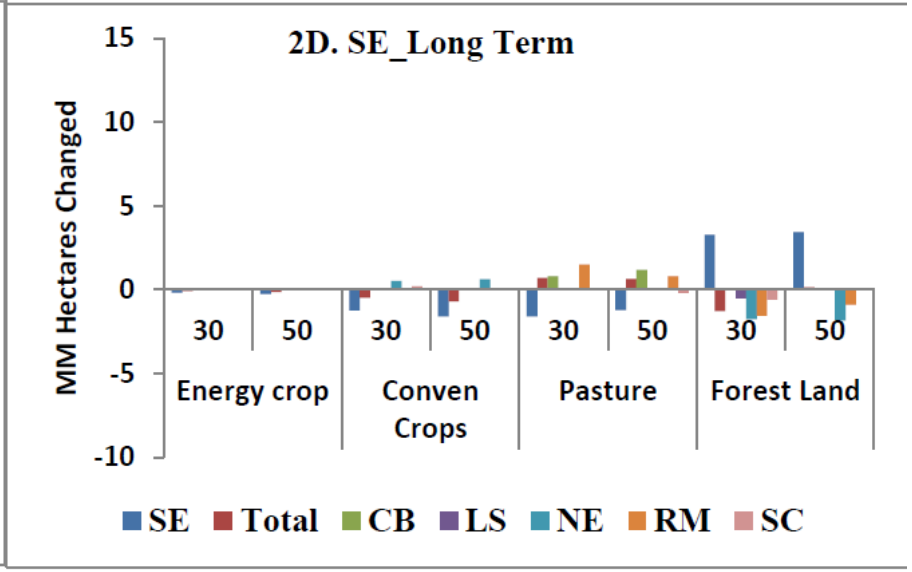


Area Changes Under Regional Allowance Prg.

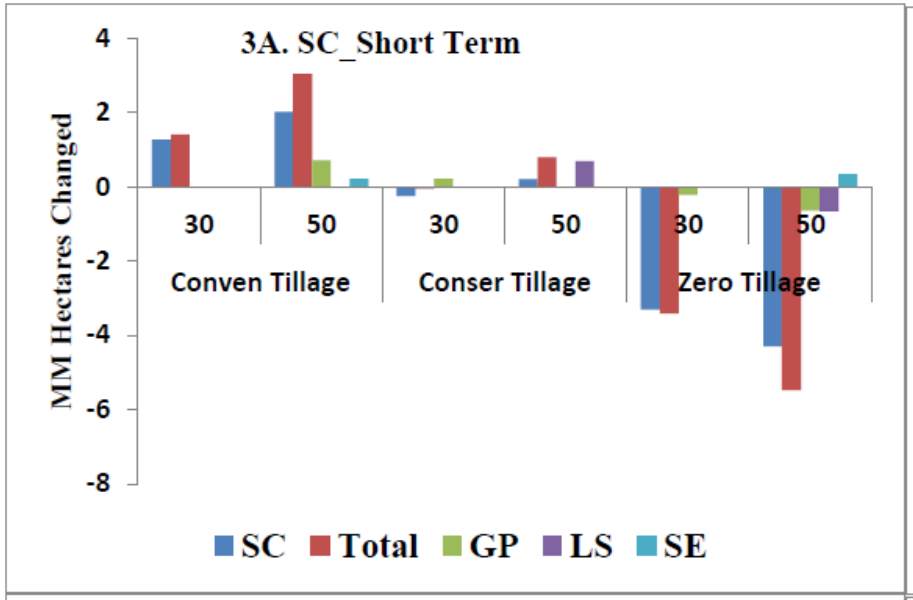


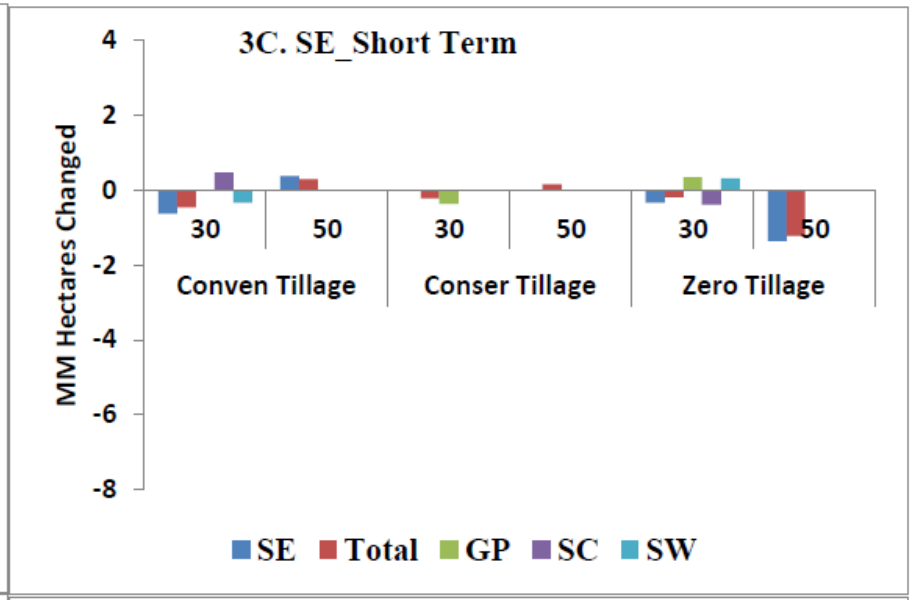


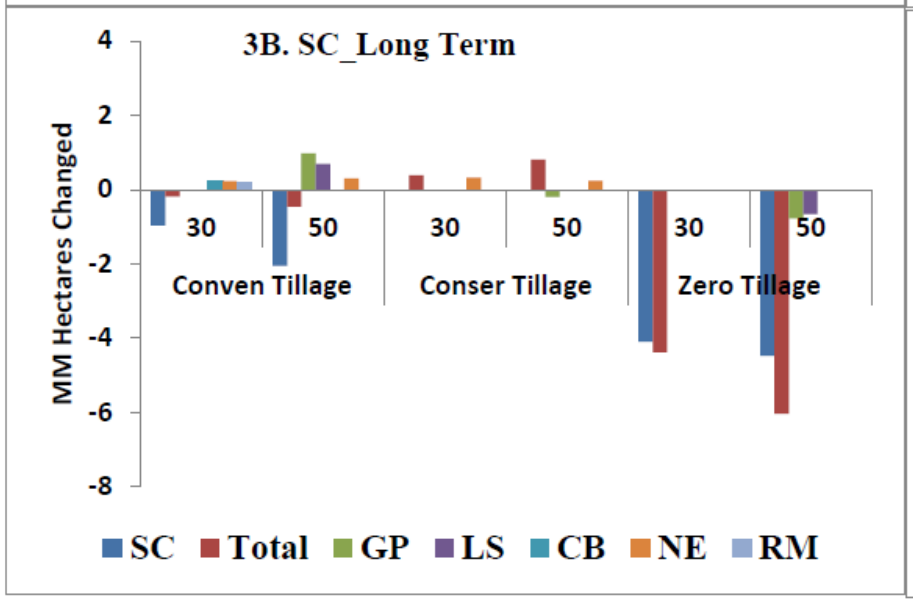


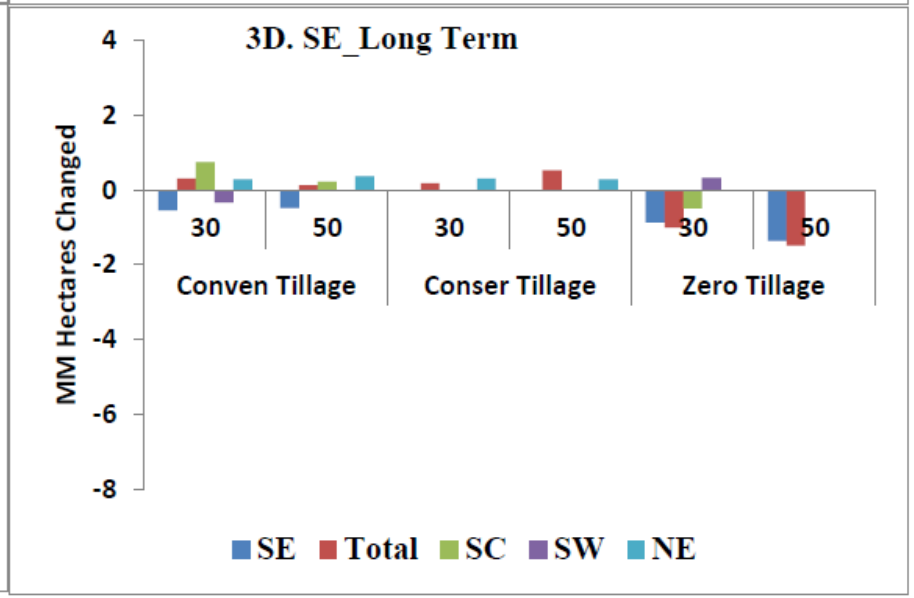


Changes in Intensification of Ag. Production

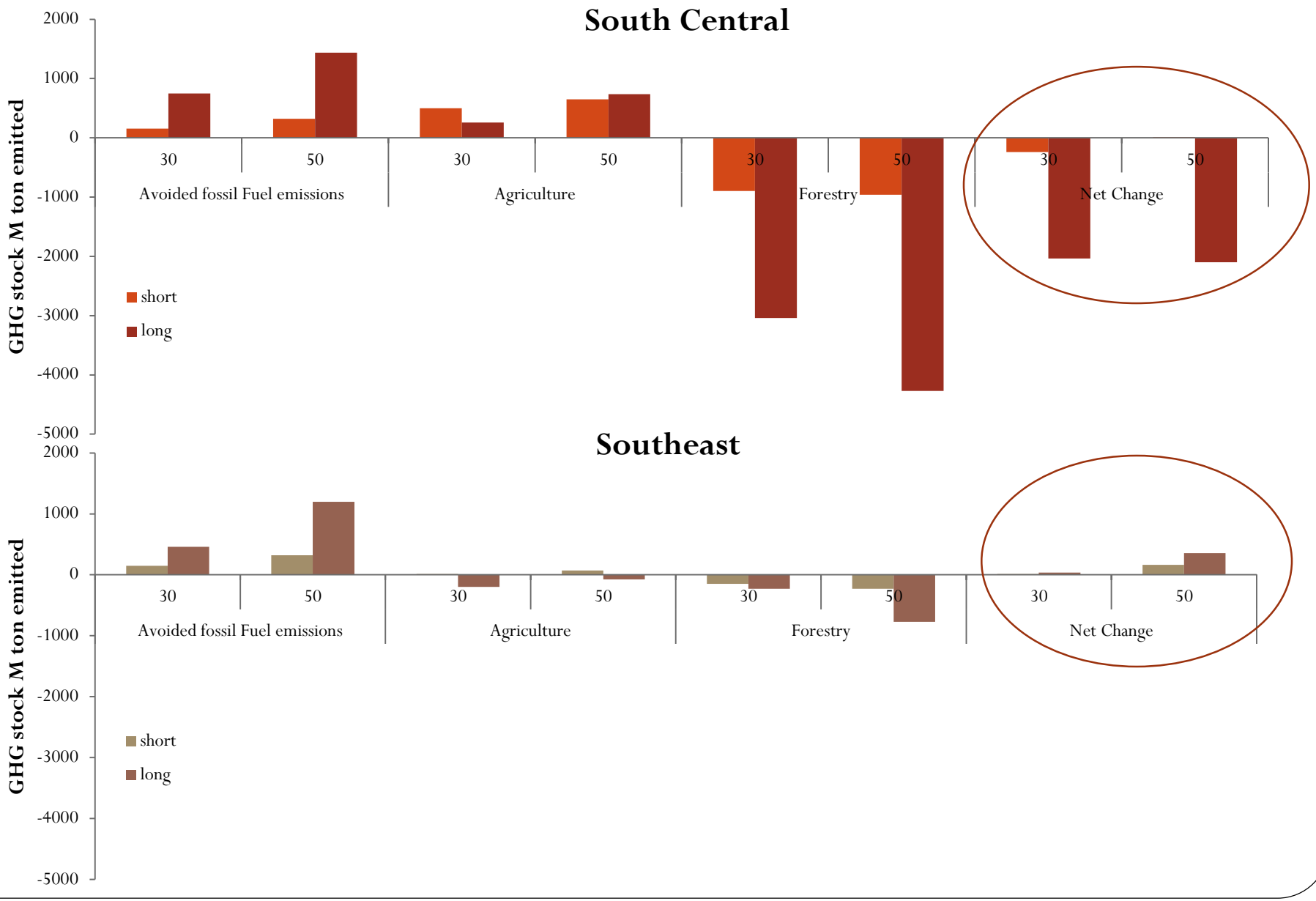




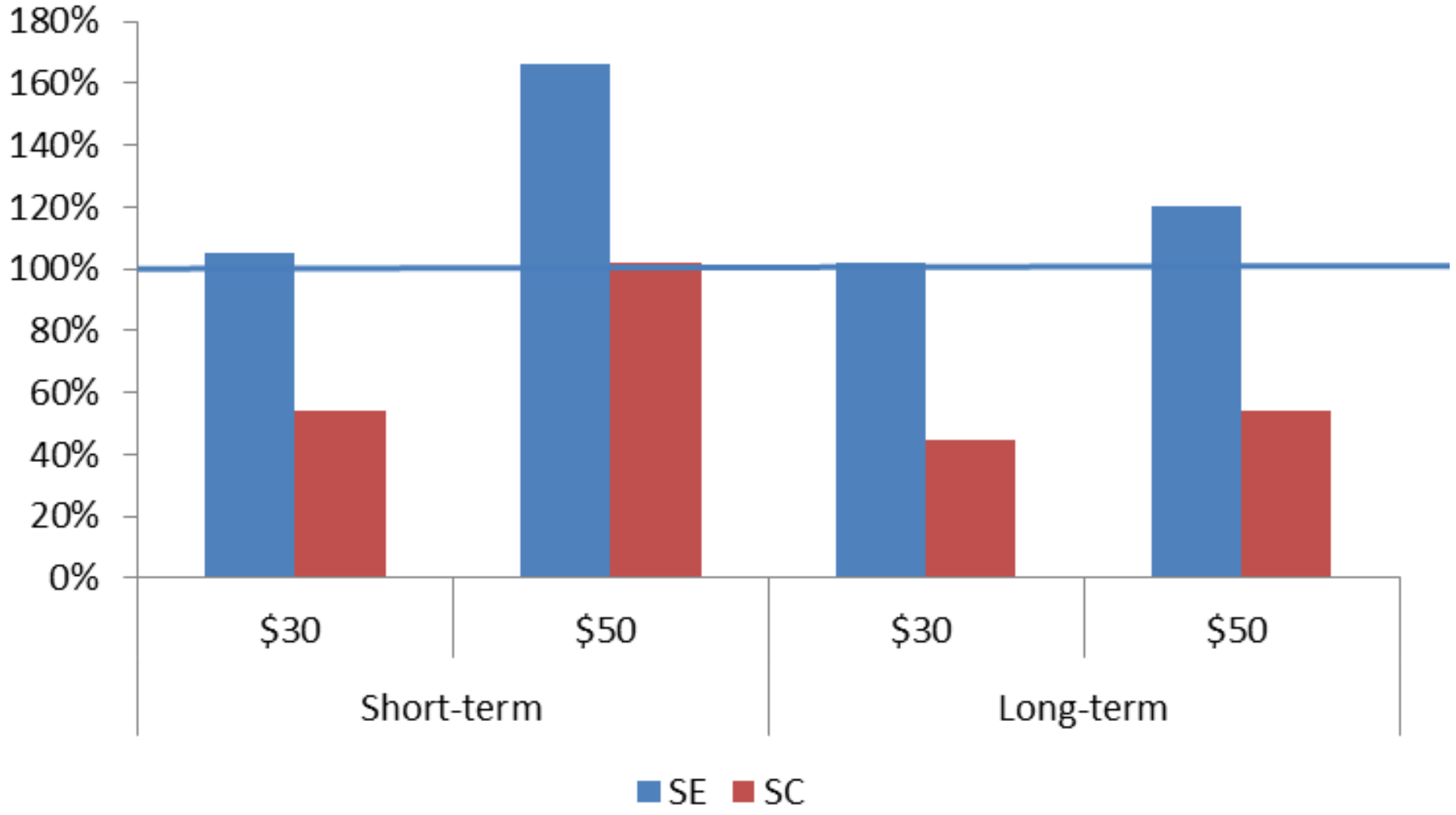




Net Gains in GHG Reductions



Leakage estimates



Policy Implications – Regional Variability Ex.

- SC regional program ➡ Intensifies Ag. Production in the GP & LS regions (short- and long-terms).
- Incentivize farmers to keep zero tillage ➡ higher GHG net gains
- But, similar policy in the SE regional program is inefficient:
  - No Ag. Intensification in the LS region
  - In GP region, land shifts to zero tillage, from the other two tillage practices.

Conclusions

- Regional characteristics are very important
- Could result in as much as an additional 400 million tons, on average, per year of GHG stored. ≈ 6% of US GHG emissions in 2010 (EPA 2013)
- Higher carbon prices do not necessarily lead to higher net gains in GHG reductions
- Regional programs represent second-best solution

Thank you