Regional carbon dioxide implications of forest bioenergy production

Hudiburg, T. W. et al, Nature Climate Change, Vol 1, 23 Oct 2011, DOI: 10.1038/NCLIMATE1264
www.nature.com/natureclimatechange

Objectives:

- This letter describes a data-intensive approach used to study strategies of forest management on carbon emission in a variety of forest types and ecoregions.
- The authors studied 80 forest types in 19 ecoregions, in which they analyzed forest sequestration rates as well as tested forest thinning scenarios.
- The study combined spatially representative observational data from more than 6,000 federal Forest and Inventory Analysis plots, with remote sensing products on forest type, age and fire risks, with a global data compilation of wood decomposition data, and with data from 200 supplementary plots to provide new estimates of US West Coast forest biomass carbon stocks, NEP and NBP.
- Three forest management treatments were studied (fire prevention, economically feasible and bioenergy production) to reflect varying objectives for potential future forest management over the next 20 years, and these treatments were compared to "business as usual" (current forest harvest) methods.
- The time frame was limited to the short term (next 20 years) and did not take into account the potential effects of climate change.

New Science:

- The study found that fire prevention measures and large-scale bioenergy harvest in the U.S. West Coast forest leads to 2-15% higher emissions compared with current management practices over the next 20 years.
- In the 19 ecoregions studies, it was found that the current carbon sink in 16 of the ecoregions is sufficiently strong that it cannot be matched or exceed through substitution of fossil fuels by bioenergy.
- In the remaining three ecoregions, it was found that immediate implementation of fire prevention and biofuel policies may yield net emissions savings.

Significance:

- Policies are being developed and implemented worldwide to increase bioenergy production as a substitution for fossil fuel to mitigate fossil fuel derived carbon emissions.
- Such strategies include substitution of fossil fuel with bioenergy from forests, where carbon emitted is expected to be recaptured in the growth of new biomass to achieve zero net emissions, and includes forest thinning to reduce wildfire emissions.
- The effect of various strategies for carbon dioxide emissions reductions are complex.
- Because of the complexity, forest policy should consider current forest carbon balance, local forest conditions and ecosystem sustainability in establishing how to decrease emissions.
- Energy policy implemented without full carbon accounting and an understanding of underlying processes risks increasing rather than decreasing emissions.

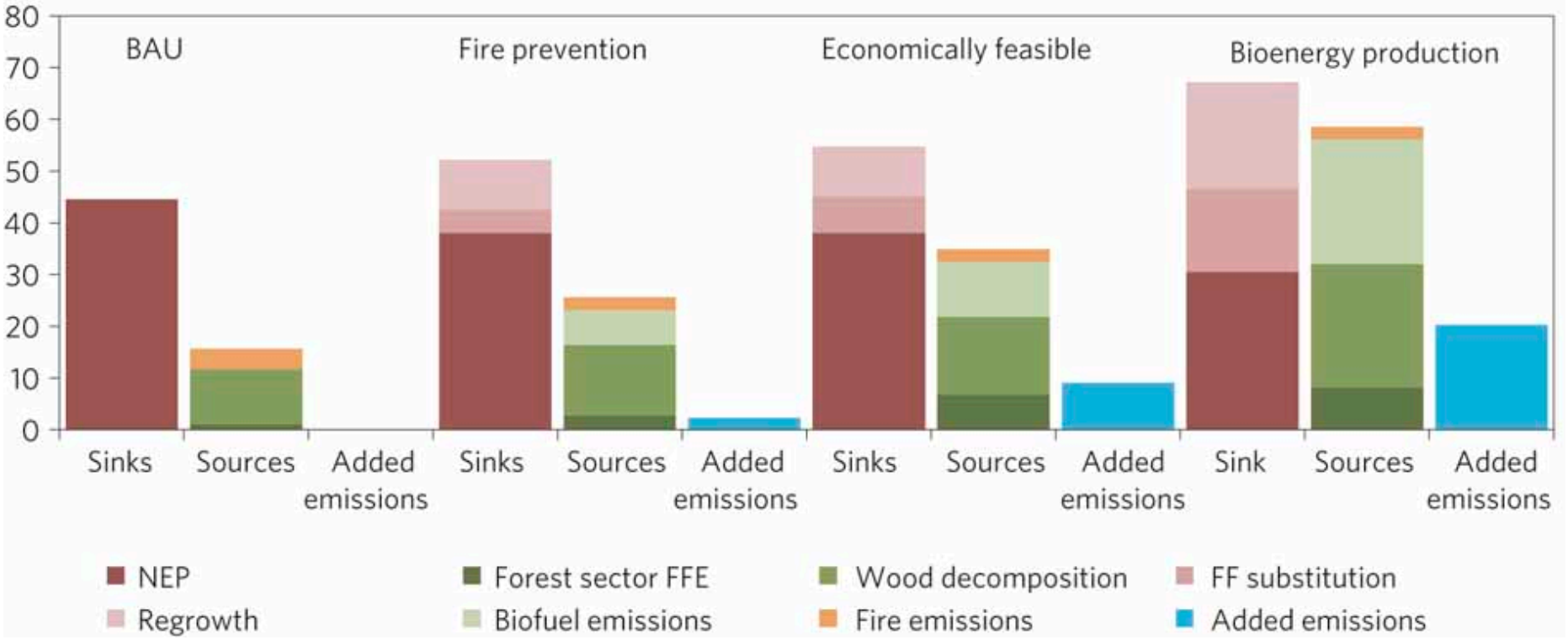

Figure 3

Total U.S. West Coast forest sector carbon sinks, sources and added emissions relative to BAU (business as usual) under various management scenarios. Units are in TgC yr^{-1}. Life-cycle assessment estimates account for changes in carbon on land in addition to emissions associated with production, transport and usage of wood, and substitution and displacement of fossil fuel emissions associated with use and extraction. BAU results in the lowest anthropogenic emissions from the forest sector.

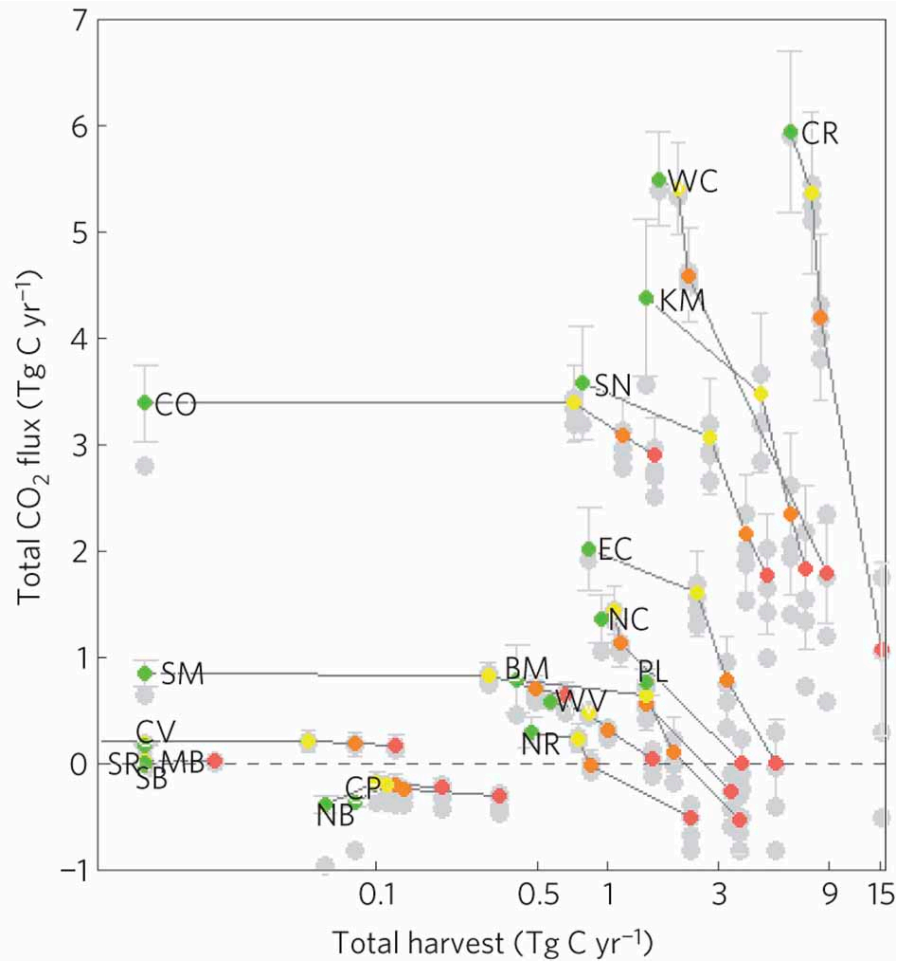

Figure 2

Life-cycle assessment carbon emission trends by ecoregion under various management scenarios. The *x* axis is the total harvest (BAU treatment) and the *y* axis is the total CO_2 flux in TgC yr^{-1} for each ecoregion. Colored circles represent each scenario (green, BAU; yellow, fire prevention; orange, economically feasible; red, bioenergy production). Grey circles are the values for each sensitivity analysis set of parameters and the error bars represent the estimate uncertainty. For most ecoregions, the treatments increase emissions to the atmosphere.