

Supplemental Material for

Select but diverse countries are reducing both climate vulnerability and CO₂ emissions

Martina Grecequet¹, Eri Saikawa², Jessica J. Hellmann^{1,3}

¹Institute on the Environment, University of Minnesota, St. Paul, Minnesota 55108, USA

²Department of Environmental Sciences, Emory University, Atlanta, Georgia, 30322, USA

³Department of Ecology, Evolution and Behavior, College of Biological Sciences, University of Minnesota, St. Paul, Minnesota 55108, USA

Association between sensitivity, adaptive capacity scores and per capita CO₂ emissions

Our selection of particular components of vulnerability (sensitivity versus adaptive capacity) may affect our assessment of the relationship between adaptation (reduction in vulnerability) and greenhouse gas emissions. To explore this, we analyze the association between distinct components of vulnerability - sensitivity, adaptive capacity score and per capita CO₂ emissions from 1995-2015.

Sensitivity and adaptive capacity scores are composites of 12 different indicators (Table S1). The sensitivity score refers to the extent to which a country is affected by, or is responsive to, a climate hazard. The relationship between changes in sensitivity scores and changes in per capita CO₂ emissions from 1995-2015 is negative, $r_s = -0.270$, $p = 0.01$ and not linear. This suggests that increases in CO₂ emissions are not always associated with decreases of sensitivity to climate hazard and vice versa. More than 100 countries (103; 57% of the total) show decreasing sensitivity to climate hazard while also increasing their per capita CO₂ emissions, and only 24 countries (12% of the total) are able to reduce sensitivity to climate hazard and CO₂ emissions together. In contrast, 54 countries (30% of the total) have increasing sensitivity over time, about half of them ($n = 27$) with increasing per capita CO₂ emissions (Figure S1).

The adaptive capacity score is a measure of the ability to prepare and respond to a climate hazard. The relationship between changes in adaptive capacity and changes in per capita CO₂ emissions is not negative $r_s = -0.279$, $p = 0.01$ and not linear. This suggests that increases in CO₂ emissions is not always associated with decreases in adaptive capacity. About 66% of countries (119) are increasing their adaptive capacity, a majority of them at the expense of CO₂ emissions. Yet, 43 countries (24% of the total), largely corresponding to those that reduce their vulnerability while decreasing CO₂ emissions (Group 2, Figure 4), are able to reduce CO₂ emissions and increase their adaptive capacity together (Figure S2).

Analyzing the two groups of indicators that constitute the sensitivity and adaptive capacity scores shows that reducing sensitivity and adaptive capacity together is associated with increasing per capita CO₂ emissions. However, reducing sensitivity to climate hazard may be more difficult than increasing the adaptive capacity. This is because sensitivity indicators often refer to population characteristics that are related to topography (e.g., population living in flood zones) and demography (e.g., large elderly population). These indicators are less correlated with economic development. In contrast, adaptive capacity indicators (e.g., access to electricity, or medical resources) are highly correlated with Gross National Income (GNI) (Chen et al., 2016). This is seen in countries of Sub-Saharan Africa that reduce their vulnerability by increasing adaptive capacity. Countries that fail to reduce their vulnerability, while

decreasing their CO₂ emissions (Group 3, Figure 4), are increasing their sensitivity to climate hazard but failing to build their adaptive capacity (see Table S1 in supplementary materials). These observed increases in sensitivity can be attributed to indicators that have a positive relationship to GNI, including, for example, urban concentration (i.e., increasing population in urban areas) (Chen et al., 2016).

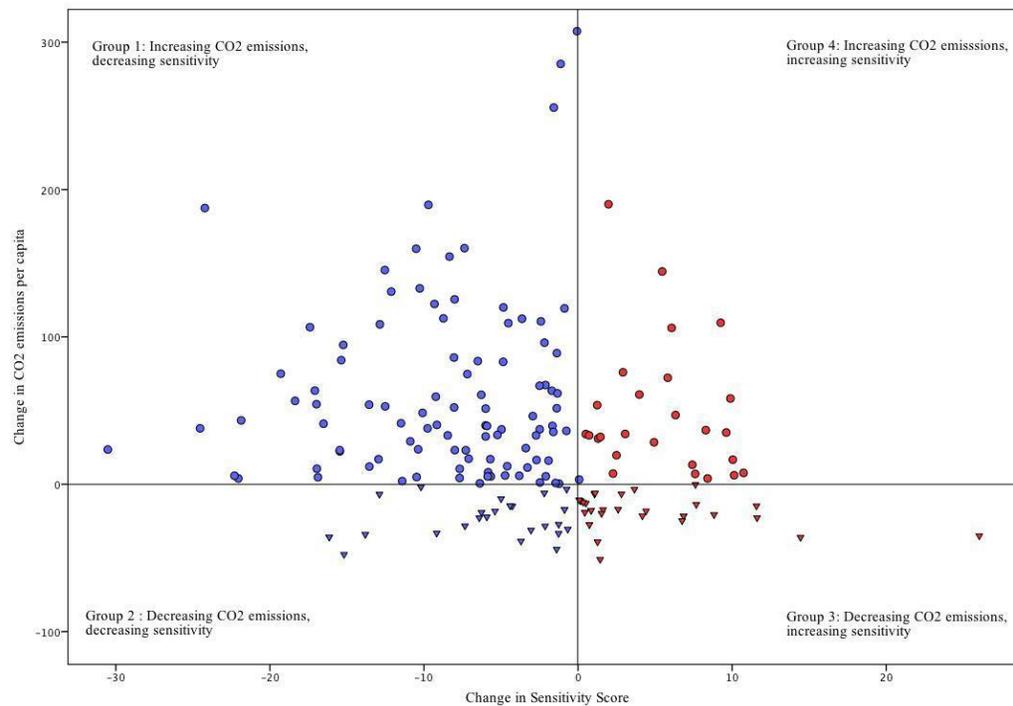


Figure S1. Change in CO₂ emissions per capita and change in sensitivity score over time, 1995-2015. Group numbers refers to the groups in the Figure 1.

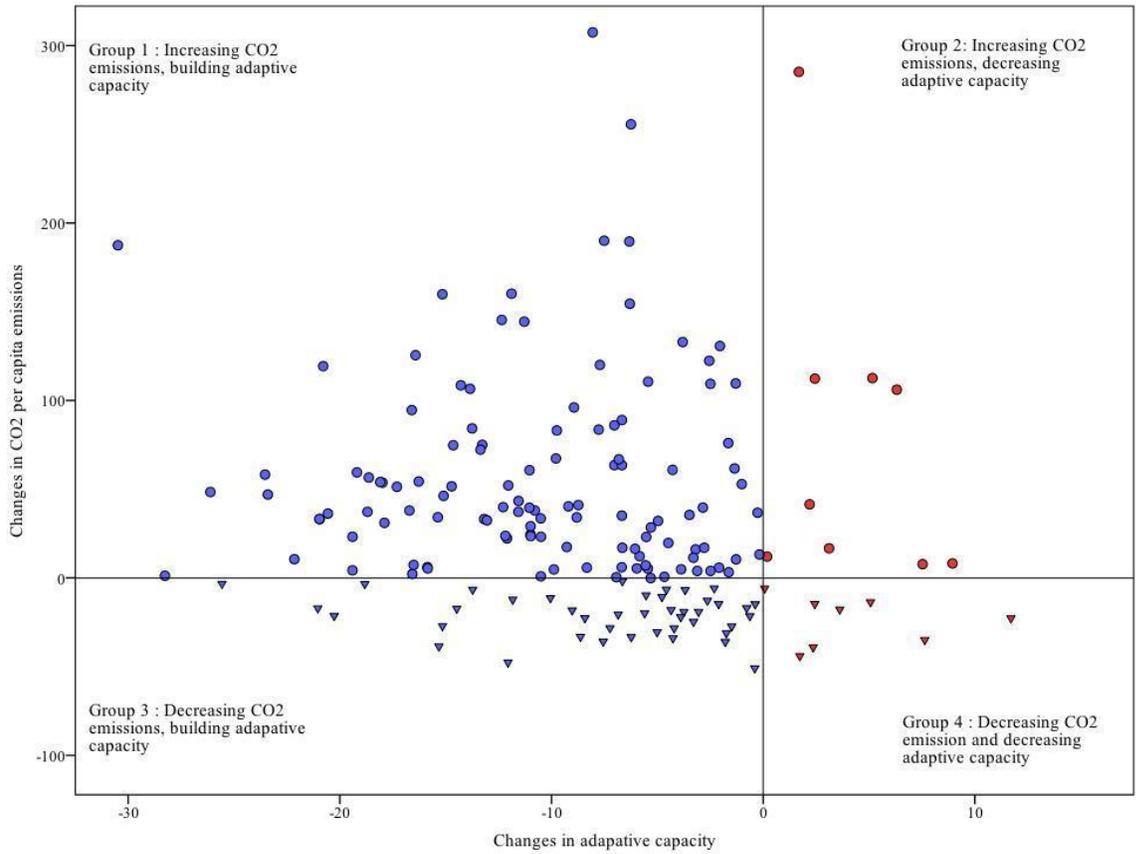


Figure S2. Change in CO₂ emissions per capita and change in adaptive capacity over time, 1995-2015. Group numbers refer to the groups in the Figure 1.