

Measure of forest protection: the width of mangrove on the path to the coast

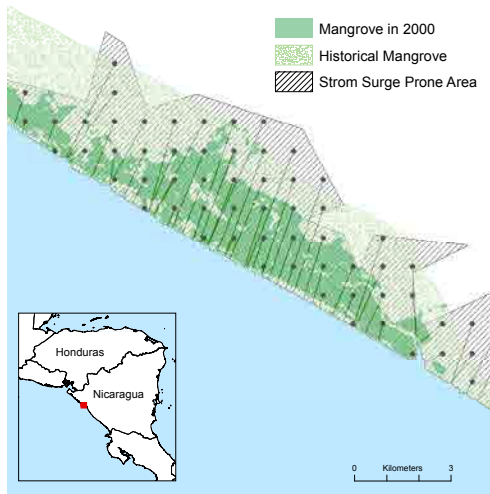
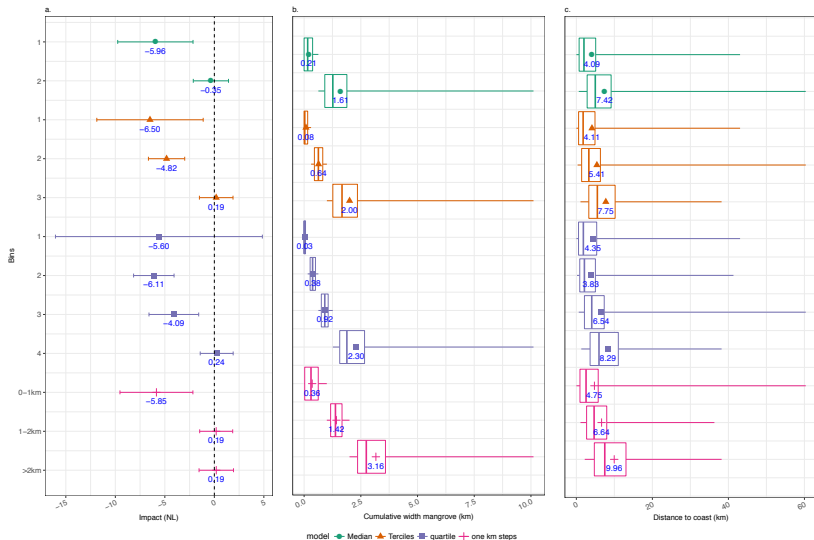
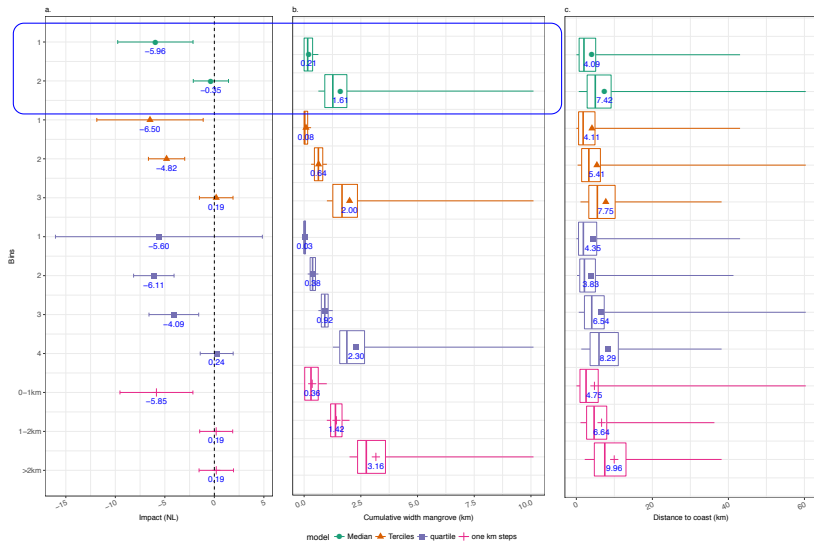


Figure: State of Leon, Nicaragua

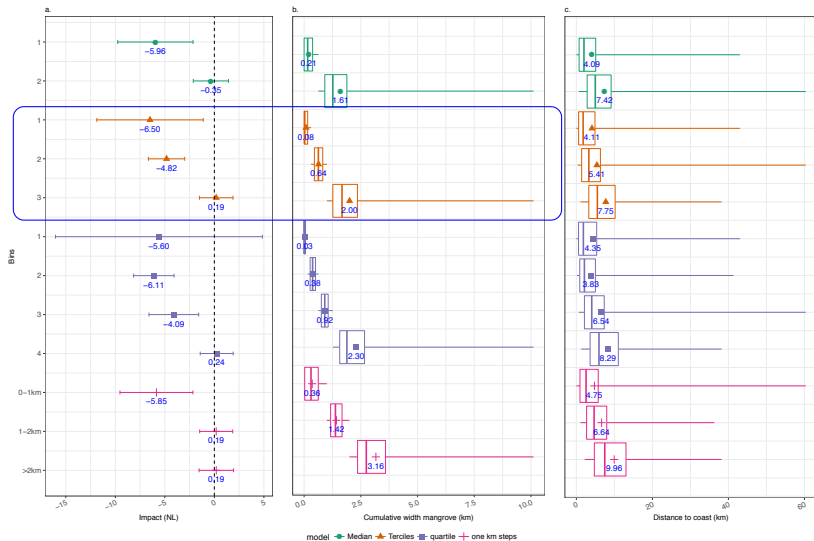
Impact of hurricanes on nightlights by mangrove width



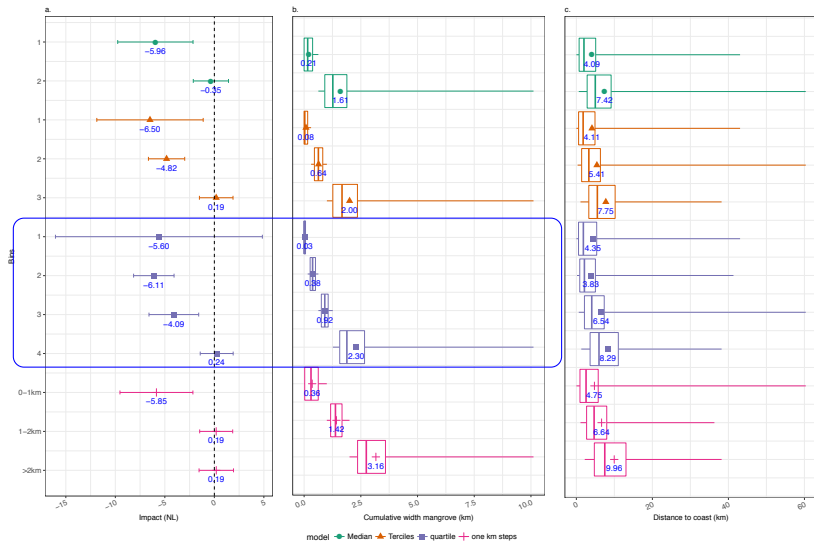
Impact of hurricanes on nightlights by mangrove width



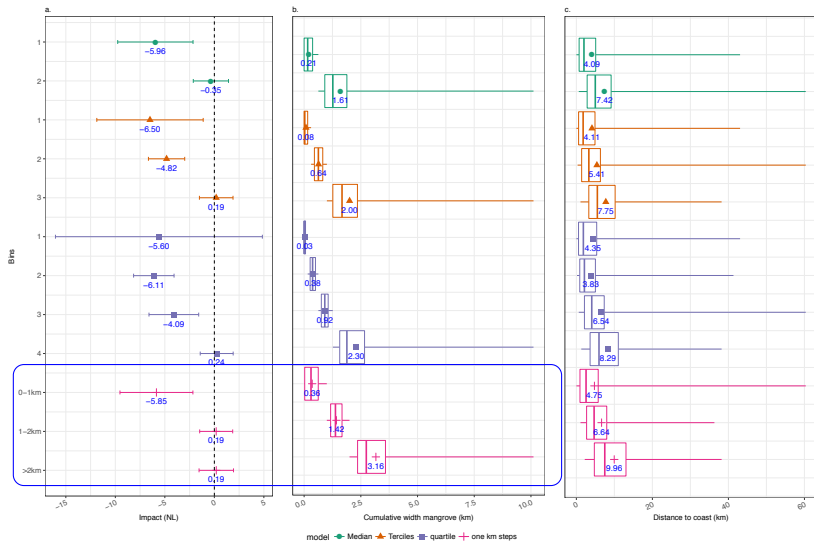
Impact of hurricanes on nightlights by mangrove width



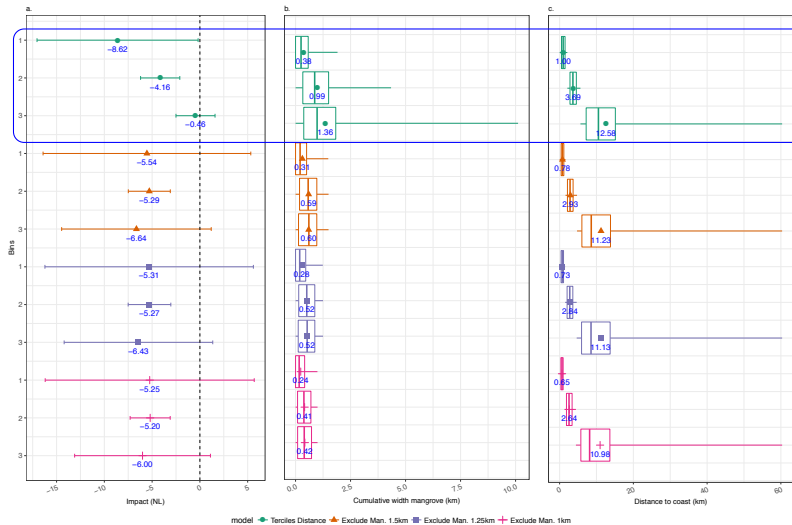
Impact of hurricanes on nightlights by mangrove width



Impact of hurricanes on nightlights by mangrove width

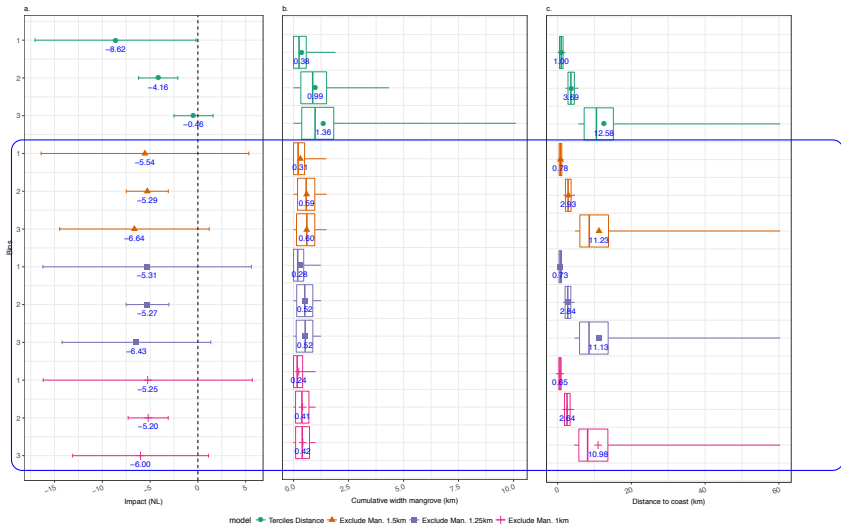


Impact of hurricanes on nightlights by distance to coast



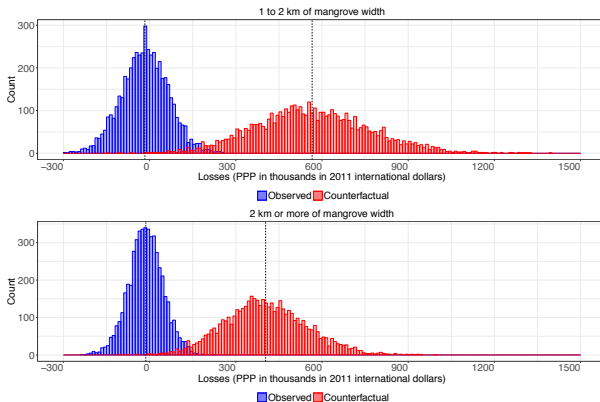
robustness

Impact of hurricanes on nightlights by distance to coast



Implied monetary value of mangrove protection

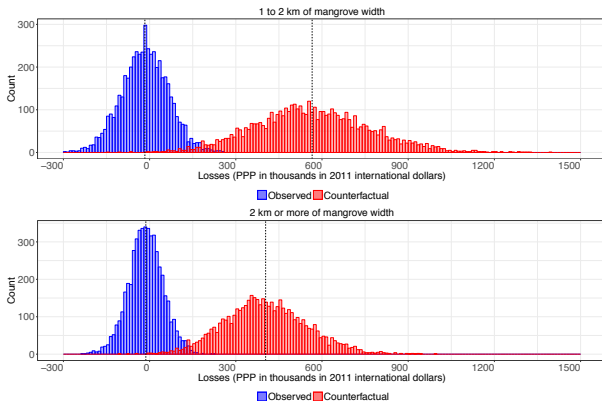
Distribution of observed and counterfactual monetary losses for hurricane Felix in coastal Nicaragua



► conversion factor of nightlights to GDP

Implied monetary value of mangrove protection

Distribution of observed and counterfactual monetary losses for hurricane Felix in coastal Nicaragua



Average combined avoided losses of \$969,416 or 2.5% of the economic activity in coastal Nicaragua.

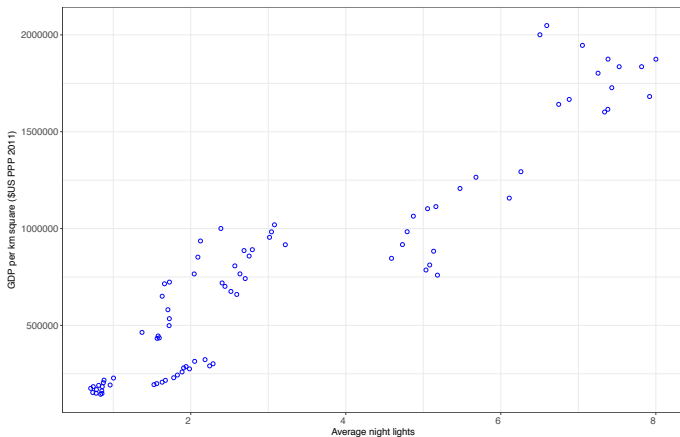
Mangroves can provide coastal protection

- Hurricanes in Central America have negative short-run effects on economic activity.
- Wide mangrove belts (one kilometer or more) can fully mitigate the damages caused by hurricanes.
- Mangrove valuation should encompass coastal protection, in addition to other valuable services (such as carbon storage, raw materials, biodiversity, recreation, water purification, erosion control, and nurseries for fish and other wildlife).

Robustness mangrove protection

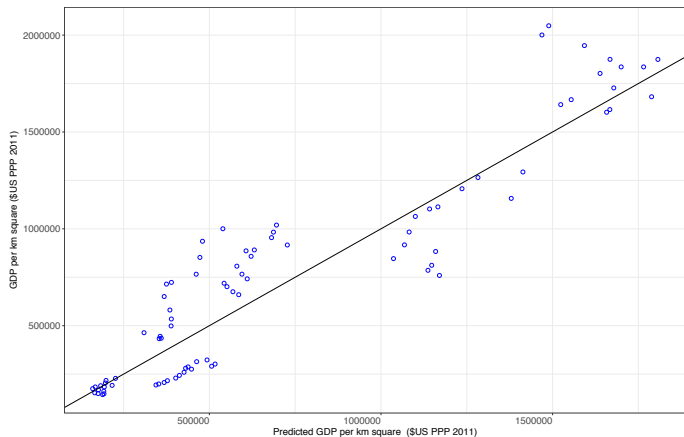
	(1) Standard Errors	(2) Max wind in cell	(3) Lower V half	(4) Lower V threshold	(5) Countries with Cat. 1	(6) State \times Year Fixed effects	(7) Dense Mangrove width
<i>f</i> 0-1 km mangrove width (Clust. Mun) [Clust. State] {Conley}	-5.849 (1.860) [2.307] {2.676}	-5.378 (1.875)	-1.768 (0.640)	-4.619 (1.807)	-9.049 (1.899)	-6.487 (2.946)	-5.852 (1.861)
<i>f</i> 1-2 km mangrove width	0.185 (0.842) [1.241] {1.975}	0.188 (0.842)	0.022 (0.277)	-0.231 (0.883)	-1.964 (0.825)	-0.793 (2.419)	0.166 (0.842)
<i>f</i> > 2 km mangrove width	0.195 (0.879) [1.295] {2.105}	0.198 (0.879)	0.029 (0.291)	0.363 (0.830)	-2.042 (0.863)	-0.828 (2.419)	0.254 (0.857)
Observations	50,089	50,089	50,089	50,089	24,011	50,076	50,089
Implied mangrove protection, cat. 3	1.209	1.209	0.961	1.111	1.401	1.132	1.221
V threshold (km)	92.6	92.6	92.6	75.63	92.6	92.6	92.6
V half (km)	277.8	277.8	203.72	277.8	277.8	277.8	277.8

Gross domestic product per square kilometer and average nightlight for each country and year



One unit increase in nightlights per km^2 is associated with a \$225,838 increase in GDP per km^2

Actual and predicted gross domestic product per square kilometer for each country and year

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