Global Gravity of Coral Reefs Spatial Layer

SUMMARY

Global polygon layer which gives total gravity estimates within 500km for tropical and sub-tropical coral reef for each 10 x 10 km grid of reef in the world.

DESCRIPTION

Global gravity estimates of every populated pixel within 500km for coral reefs as a spatial layer for each 10 x 10 km grid of reef in the world

The gravity concept posits that human interactions with a reef are a function of the population of a place divided by the squared time it takes to travel to the reefs (travel time instead of linear distance to account for the differences incurred by travelling over different surfaces such as water, roads, tracks. The gravity index relies on both population estimates and a surrogate for distance: travel time.

Population estimates

We gathered population estimates for each 1 by 1 km cell within a 500 km radius for each 10 x 10 km grid of reef in the world using LandScan™ 2011 database. We chose a 500 km radius from the reef as a likely maximum distance fishing activities for reef fish are likely to occur.

Travel time calculation

For each populated cell within the 500 km radius, travel time was computed using a cost-distance algorithm that computes the least 'cost' (in minutes) of travelling between two locations on a regular raster grid. In our case, the two locations were the centroid of each 10 x 10 km grid of reef in the world and populated cell. The cost (i.e. time) of travelling between the two locations was determined by using a raster grid of land cover (extracted from the Global Land Cover 2000 (1)) and road networks (extracted from the Vector Map Level 0 (VMap0) from the National Imagery and Mapping Agency's (NIMA) Digital Chart of the World (DCW®) and converted vector data from VMap0 to 1km resolution raster) with the cells containing values that represent the time required to travel across them

We calculated our cost-distance models in R using the accCost function of the 'gdistance' package. The function uses Dijkstra's algorithm to calculate least-cost distance between two cells on the grid taking into account obstacles and the local friction of the landscape (2).

Gravity computation

To compute gravity, we calculated the population of cell and divided that by the squared travel time between the reef cell and the cell. We summed the gravity values for each cell within 500 km of the reef cell to get the "total gravity" within 500 km. We used the squared distance (or in our case, travel time), which is relatively common in geography and economics, although other exponents can be used (3).

DATA

reef_ID: initial ID extracted from the Global Accessibility of Coral Reefs Spatial Layer Spatial Layer version 2.0 (4).

Grav_tot: cumulative gravity of every populated pixel within 500km.

Zero means there is no population within 500km.

SOURCE
CINNER, J. E. et al. (2018) The gravity of human impacts mediates coral reef conservation gains. PNAS 115(27): E6116-E6125.

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USE LIMITATIONS

For display and use of data please check and cite data sources according to full source provided with the corresponding publication cited as source.

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LICENSE INFORMATION

REFERENCES

1. Bartholomé E, et al. (2002) GLC 2000: Global Land Cover mapping for the year 2000: Project status November 2002 (Institute for Environment and Sustainability).

2. Nelson A (2008) Travel Time to Major Cities: A Global Map of Accessibility. in Global Environment Monitoring Unit-Joint Research Centre of the European Commission (Ispra, Italy).

3. Anderson JE (2011) The gravity model. Annual Review of Economics 3(1):133-160.

4. Maire E, et al. (2016) How accessible are coral reefs to people? A global assessment based on travel time. Ecol Lett 19(4):351-360.

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