Appendix A. Supplementary data

Mapping of outdoor recreation

As shown in **Figure A1**, the model follows a composite mapping procedure based on the aggregation of the three components (i.e., degree of naturalness, nature protection and water). Each component was developed through one or several factors considered relevant in the case study of the BMR and for which spatial input data was available (**Table A1**). All the scores assigned to the water component factors and to the 'remarkable trees' factor of the nature protection component were subject to a distance decay modelling, assuming that the recreation potential decreases as the distance from the specific feature (e.g., a beach) increases. The following inverse logistic function (1) was applied to these factors:

$$f\ (d) = \frac{1+K}{K+e^{\alpha \cdot d}} \cdot w \qquad (1)$$

Where: d is the distance from the specific feature, α and K are the size and shape parameters of the function adjusted according to a distance threshold assessment, and w is the assigned score. The parameters α and K were respectively set at 0.0035 and 30 for the factor 'beaches', corresponding to a distance thresholds of 1000 m at which the score is decreased by 50% and 2000 m at which the score is zero, and 0.008 and 30 for the rest of factors, corresponding to distance thresholds of 500 m and 1000 m (see also **Table A1**). The distance thresholds were defined based on the expert consultation process.

Factors within each component were aggregated by a simple linear summation method and normalized between 0 and 1 following equation (2). The three components were aggregated in the same way in order to obtain the final recreation potential index (RPI). Unlike the factors, all the components were given equal weights under the assumption that they cover complementary aspects of the recreational potential (Paracchini et al., 2014).

$$v' = \frac{v - min}{\max - min} \tag{2}$$

Table A1

Recreation potential components and data sources. Factors, scores and distance function thresholds defined in the expert consultation process.

Component	Factors (spatial dataset)	Data source	Assigned score	Distance function thresholds (m)		Comments
				50%	0%	
Degree of naturalness	Closeness to potential native vegetation	SITxell database – Habitats dataset (Barcelona Regional Council)	0-1	N/A	N/A	Based on an ecosystem assessment of its ecological succession stage. Originally scores ranged from 0 (artificial land covers) to 4 (climax ecosystem).
Nature protection	Areas designated as natural parks	Environment geodatabase (Catalan Government)	1	N/A	N/A	
	Areas designated as regional protected areas or Natura 2000 sites	Environment geodatabase (Catalan Government)	0.8	N/A	N/A	It excludes areas which are also designated as natural parks.
	Remarkable protected trees	Environment geodatabase (Catalan Government)	0.8	500	1000	
	Areas designated as geological heritage	Environment geodatabase (Catalan Government)	0.5	N/A	N/A	
Water	Lakes, ponds, reservoirs and wetlands	SITxell database – Habitats dataset (Barcelona Regional Council)	1	500	1000	
	Beaches	SITxell database – Habitats dataset (Barcelona Regional Council)	1	1000	2000	
	Main river network	Environment geodatabase (Catalan Government)	0.5	500	1000	Rivers usually having permanent water flow all the year.
	Angling river areas	Environment geodatabase (Catalan Government)	0.3	500	1000	

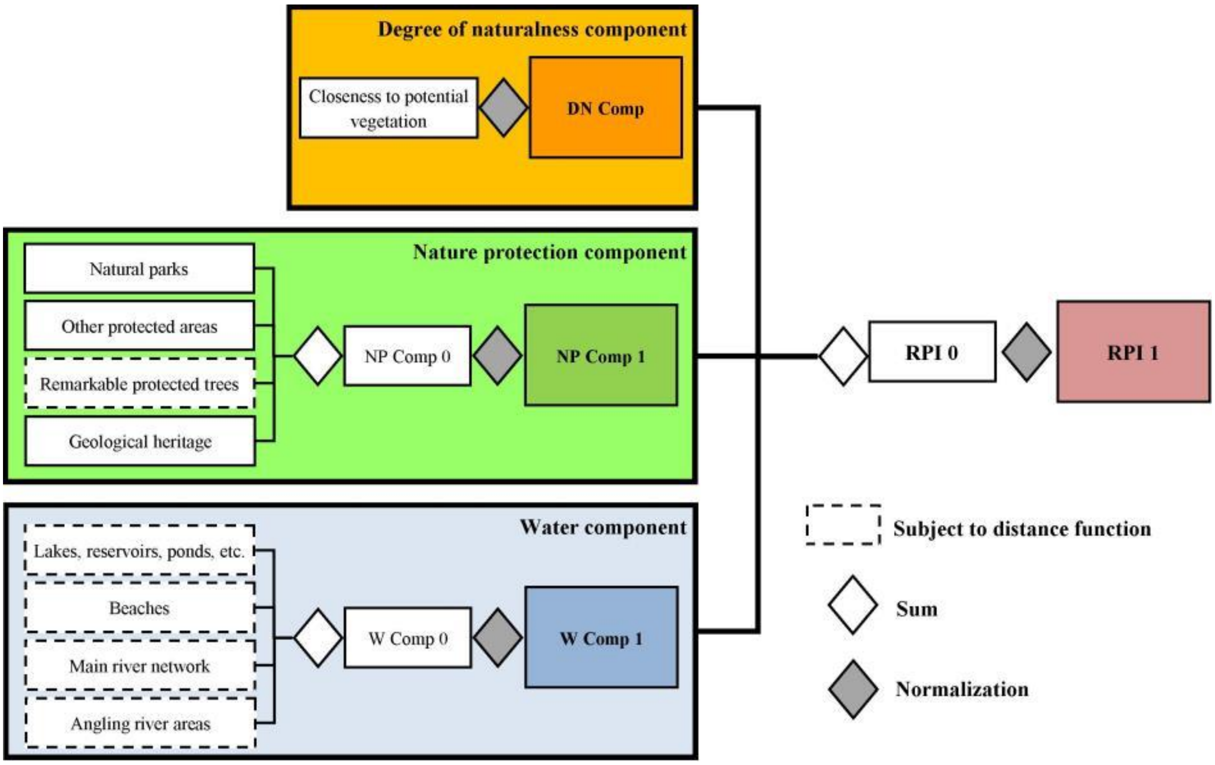

Fig. A1. Flowchart of the procedure to obtain the recreational potential map (adapted from Paracchini et al., 2014).

Potential trips for mapping the expected outdoor recreation flow were estimated using a neighbor operator with a custom matrix. The custom matrix was based on the distance decay function (1) considering $\alpha = 0.008$ and $K = 30$ (see also **Fig. A2**).

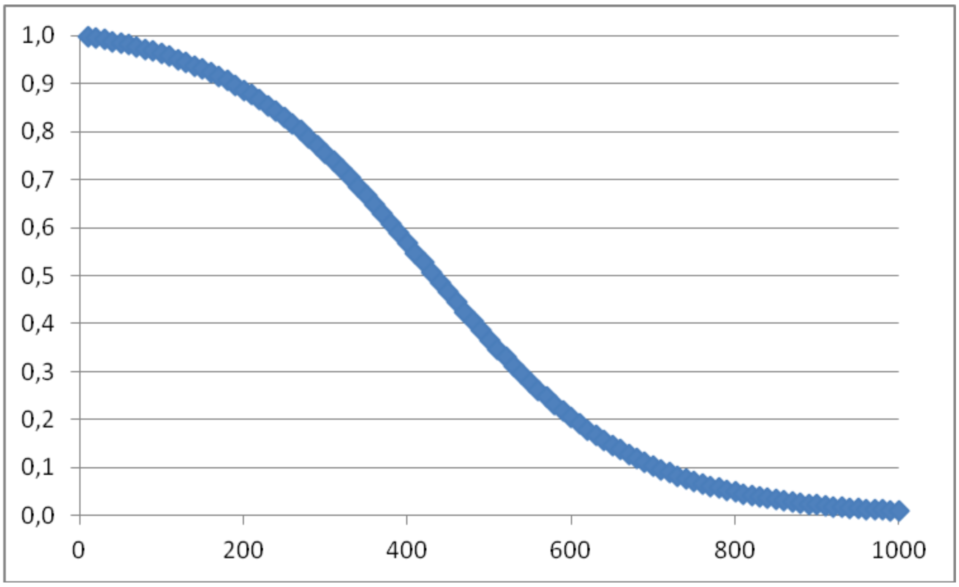

Fig. A2. Distance function (in m) applied for mapping the expected outdoor recreation flow. The function shape shows that the probability of travelling beyond 500m decreases below 0.5 (Paracchini et al., 2014).

Table A2.

Cross-tabulation matrix between a reclassified raster of Euclidian distances to recreation sites and the population density grid used to obtain the outdoor recreation demand values (legend on the right). It assumes that all inhabitants in the case study area have similar desires in terms of (everyday life) outdoor recreational opportunities, but their level of fulfillment depends on proximity to recreation sites. Distance breaks consider the recommended standards by regulatory agencies (Stanners and Bourdeau, 1995; Barbosa et al., 2007).

Legend	
0	Lowest demand
1	
2	
3	
4	
5	Highest demand

Population density (inhab. ha^{-1})	Distance to recreation sites (m)					
	< 300	300 - 600	600 - 900	900 - 1200	1200 – 1500	> 1500
< 5	0	0	0	0	0	0
5 - 50	0	1	1	2	2	3
50 – 100	0	1	2	2	3	4
100 - 200	0	2	2	3	3	4
200 – 400	0	2	3	3	4	4
> 400	0	3	4	4	4	5

Mapping of air purification

Table A3 includes the complete list of the parameters considered for the modeling. Some of the predictor variables reflect sources or sinks of air pollution such as the road network, different types of land use and population density. The latter was considered also a proxy for traffic flow levels since no complete information is currently available. Furthermore, factors such as elevation, topographical exposure, distance to the sea, annual mean temperature, and annual mean wind speed also influence the spatial concentration of pollutants and were included in the modeling.

Annual air pollution removal was estimated as the total pollution removal flux in the areas covered by vegetation, where the removal flux (F; in t ha^{-1} $year^{-1}$) is estimated as:

$$F = V_d \cdot C \cdot 0.365 \qquad (3)$$

where V_d is the deposition velocity of the pollutant to the leaf surface (in m s^{-1}) and C is the pollutant concentration (in µg m^{-3}), and 0.365 a coefficient used for units adjustment. Areas covered by vegetation were calculated by a combination of detailed land cover maps of urban green areas and forest, aggregated to 100 m resolution. For urban vegetation, the green layers of the Global Human Settlement Layer (GHSL) (JRC, IPSC, Ferri et al., 2014) were used. For forests, the High Resolution Global Forest map developed by Hansen (2013) was used. Both GHSL and Hansen map are by now the most detailed information available on vegetation cover in the case study area. In overlapping areas, the maximum value of both maps was applied. Final map of vegetation had values between zero (i.e., no vegetation) and one (i.e., totally covered by vegetation).

Table A3

Input data for the processing of the air purification model. All the input variables were computed at 100 m of resolution (pixel size).

Component	Data description	Data source	Comments
Air pollution measurements	Average annual pollutant concentrations in BMR monitoring stations (NO_2) - year 2013	Air quality database (Catalan Government - http://qualitatdelaire.cat)	Exported to vector data (points)
Spatial predictors	Land cover dataset	SITxell database (www.sitxell.eu) (Barcelona Regional Council)	Converted from vector data (polygons)
	Digital Elevation Model (DEM)	SITxell database (www.sitxell.eu) (Barcelona Regional Council)	Resampled from 15x15m raster (bilinear resampling)
	Average mean temperature (annual)	Climatic Digital Atlas of Catalonia (www.uab.es/atles-climatic)	Resample from 180x180 m raster (bilinear resampling)
	Average mean precipitation (annual)	Climatic Digital Atlas of Catalonia (www.uab.es/atles-climatic)	Resample from 180x180 m raster (bilinear resampling)
	Average wind speed at 60m altitude from land surface (annual)	Environment geodatabase (Catalan Government)	Resample from 200x200 m raster (bilinear resampling)
	Population density grid	Census tract dataset (INE, 2011) Residential use classes extracted from land cover map (LCMC, 2009)	Intersect assuming equal population distribution within residential land for each census tract
	Road network	TeleAtlas® MultiNet™ dataset (update 2014)	
Vegetation map	Urban vegetation	Global Human Settlement Layer (GHSL JRC, IPSC, Ferri et al., 2014)	
	Forest vegetation	High Resolution Global Forest map (Hansen, 2013)	
	Permanent crops	SITxell database (www.sitxell.eu) (Barcelona Regional Council)	Extracted from land cover dataset

Table A4

Cross-tabulation matrix between NO_2 concentration levels and population density used to obtain the air purification demand values (legend on the right). It assumes that the higher NO_2 concentration and population density the higher demand values. NO_2 concentration break consider the current NO_2 concentration limit in Europe (EU, 2008).

Demand value	
0	Lowest demand
1	
2	
3	
4	
5	Highest demand

Population density (inhab. ha^{-1})	NO$_2$ concentration (µg m^{-3})					
	< 10	10 - 20	20 - 30	30 - 40	40 - 50	> 50
< 5	0	0	0	0	0	0
5 - 50	0	1	1	2	2	3
50 – 100	0	1	2	2	3	4
100 - 200	0	2	2	3	3	4
200 – 400	0	2	3	3	4	4
> 400	0	3	4	4	4	5

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