Novel approach for weighting in Geographic Information System focused on a multi-stakeholder problem: Case for residual biomass processing system

Supporting Information

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Table S1: Data layers, description and sources used for qualifiers group

Data layer	**Description**	**Source**	**Viability criteria**
Municipalities	Limits of the 2,457 municipalities in the country	[1]	
Slope	Terrain slope in percent, generated from a DEM with 30 m pixel size	[2]	• Slope < 15 % $\Rightarrow$ 5 (very High) • Slope > 15 % $\Rightarrow$ 0 (Non suitable)
Roads & highways	All paved roads and highways outside of urban polygons	[3]	• Buffer up to 2,000 m $\Rightarrow$ 5 (Very High) • Buffer up to 5,000 m $\Rightarrow$ 4 (High) • Buffer up to 10,000 m $\Rightarrow$ 3 (Medium) • Buffer up to 15,000 m $\Rightarrow$ 2 (Low) • Buffer up to 24,000 m $\Rightarrow$ 1 (Very Low)
Population	Data on energy potential demand based upon the 2010 census	[4]	• 500 to 4,000 inhabitants, 10 km buffer $\Rightarrow$ 5 (Very High) • 4,000 to 30,000 inhabitants, 15 km buffer $\Rightarrow$ 5 (Very High) • 30,000 to 200,000 inhabitants, 20 km buffer $\Rightarrow$ 5 (Very High) • More than 200,000 inhabitants, 24 km buffer $\Rightarrow$ 5 (Very High) • 500 to 1,000 inhabitants, 1 km $\Rightarrow$ 5 (Very High) • 1,000 to 5,000 inhabitants, 2 km $\Rightarrow$ 5 (Very High) • 5,000 to 10,000 inhabitants, 5 km $\Rightarrow$ 5 (Very High) • More than 10,000 inhabitants, 10 km $\Rightarrow$ 5 (Very High)

Table S2: Data layers, description and sources used for restrictors group

Data layer	Description	Source	Viability criteria
Vegetation	Areas with priority vegetation types classified as primary vegetation	,[4 5]	Priority vegetation types 1
Slope	Terrain slope in percent, generated from a DEM with 30 m pixel size	[2]	• Slope < 15 % $\Rightarrow$ 5 (very High) • Slope > 15 % $\Rightarrow$ 0 (Non suitable)
Natural Protected Areas	Areas with protection defined by either federal or state governments.	[6]	• If it has presence $\Rightarrow$ 0 (Non suitable) • If it does not have presence $\Rightarrow$ 5 (Very High)
Hydrology	Water bodies: Lakes and Reservoirss	[4]	• A distance larger than 500 m around each perennial feature $\Rightarrow$ 5 (Very High) • A distance larger than 50 m around each non-perennial feature $\Rightarrow$ 5 (Very High)
Population	Data on energy potential demand based upon the 2010 census	[4]	• 500 to 4,000 inhabitants, 10 km buffer $\Rightarrow$ 5 (Very High) • 4,000 to 30,000 inhabitants, 15 km buffer $\Rightarrow$ 5 (Very High) • 30,000 to 200,000 inhabitants, 20 km buffer $\Rightarrow$ 5 (Very High) • More than 200,000 inhabitants, 24 km buffer $\Rightarrow$ 5 (Very High) • 500 to 1,000 inhabitants, 1 km $\Rightarrow$ 5 (Very High) • 1,000 to 5,000 inhabitants, 2 km $\Rightarrow$ 5 (Very High) • 5,000 to 10,000 inhabitants, 5 km $\Rightarrow$ 5 (Very High) • More than 10,000 inhabitants, 10 km $\Rightarrow$ 5 (Very High)
Airports	Polygons of the existing airports	[7]	• International: distance $>$ 8,046 m $\Rightarrow$ 5 (Very High) • Military: distance $>$ 8,046 m $\Rightarrow$ 5 (Very High) • National: distance $>$ 3,048 m $\Rightarrow$ 5 (Very High) • Municipal: distance $>$ 1,524 m $\Rightarrow$ 5 (Very High)
Transmission lines	Electric grid	[4]	Buffer of 100 m around each feature $\Rightarrow$ 5 (Very High)
Roads	Paved roads network	[4]	• For paved, 2 lines: Buffer 80 m $\Rightarrow$ 5 (Very High) • For paved, 4 lines: Buffer 100 m $\Rightarrow$ 5 (Very High) • For paved, 6 or mode lines: 150 m $\Rightarrow$ 5 (Very High)
Railroads	Railroad network	[4]	Distance larger than 50 m around each feature $\Rightarrow$ 5 (Very High)
Historical sites	Archeological and historical sites and monuments	[8]	Distance larger than 800 m around each feature $\Rightarrow$ 5 (Very High)

References

(1) INEGI, Marco Geoestadístico 2010, versión 5.0.A (Censo de Población y Vivienda 2010. 2010; http://www.beta.inegi.org.mx/app/biblioteca/ficha.html?upc=702825292805, (Accessed: February 24, 2017).

(2) INEGI, Continuo de Elevaciones Mexicano 3.0. 2019; https://www.inegi.org.mx/app/geo2/elevacionesmex/, (Accessed: July 24, 2019).

(3) IMT, Red Nacional de Caminos. 2017; https://datos.gob.mx/busca/dataset/red-nacional-de-caminos-rnc, (Accessed: July 24, 2019).

(4) INEGI, Proyecto Básico INEGI. 2017; http://www.inegi.org.mx/geo/contenidos/mapadigital/, (Accessed: January 10, 2017).

(5) INEGI, Carta de Vegetación y Uso del Suelo, Serie V. 2011; http://www.inegi.org.mx/geo/contenidos/recnat/usosuelo/default.aspx, (Accessed: April 27, 2017).

(6) CONABIO, Sistema Nacional de Información sobre Biodiversidad. 2017; http://www.conabio.gob.mx/informacion/gis/, (Accessed: January 10, 2017).

(7) LABSIG-ITESM, Repositorio del Laboratorio de Información Georreferenciada-Tecnológico de Monterrey. 2017.

(8) CONABIO, Red de zonas arqueológicas del INAH. 2017; https://www.inah.gob.mx/en/2015-06-12-00-10-09/catalogo, (Accessed: January 10, 2017).