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Research article

Advancing towards a sustainable energy model, uncovering the untapped potential of rural areas

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Appendix A – Procedure for calculating the RE potential of alternative RE sources

The potentials of the different RE sources, that is, the solar, wind, geothermal, biomass and hydraulic potentials, were calculated using Geographic Information Systems (GIS), through a free license software, QGIS 2.18.

The wind potential was obtained from the wind energy density map for Galicia (see Figure A.1.). which is available on the Global Wind Atlas (GWA) website [1]. The GWA is an online platform to explore wind resources, its development is the result of collaboration between the World Bank and the Technical University of Denmark. For the wind potential, two base layers were used: the first one is a raster layer where the wind potential for Galicia is found, which is imported into QGIS through a WMS (Web Map Server); the second base layer is a vector layer of the municipalities of Galicia, available in the geographic information services of the Xunta de Galicia [2]. Through the *area statistics* tool of the GIS program, we calculated the average wind potential for each municipality in the province of Ourense.

The procedure for calculating the other potentials is similar to that used in the case of wind potential; in the case of solar potential, the raster layers of the Atlas of Solar Radiation for Galicia (see Figure A.2.) developed by Meteogalicia are used [3]; for the geothermal potential, the map of geothermal potential for Galicia (see Figure A.3) developed by the Laboratory of Cartography and GIS of the University of Valladolid [4] is used; the biomass potential (see Figure A.4.) is available through the Bionline application of the Institute for Energy Diversification and Saving (IDAE) [5], allowing to download different maps for biomass potential (Forest Remains, Complete Tree, Agricultural Remains, Agricultural Crops, Forest Crops and To be implanted in forest land); The small hydro potential is

obtained through the surface water maps available on the page of the Ministry of Agriculture, Fisheries and Food, Ministry for Ecological Transition [6]; the Biogas potential was obtained through the data available in the IGE for the number of bovine and porcine animals, following the methodology proposed by Iglinski [7], that considers the biogas potential that could be obtained from the remains of these animals.

Potential Maps

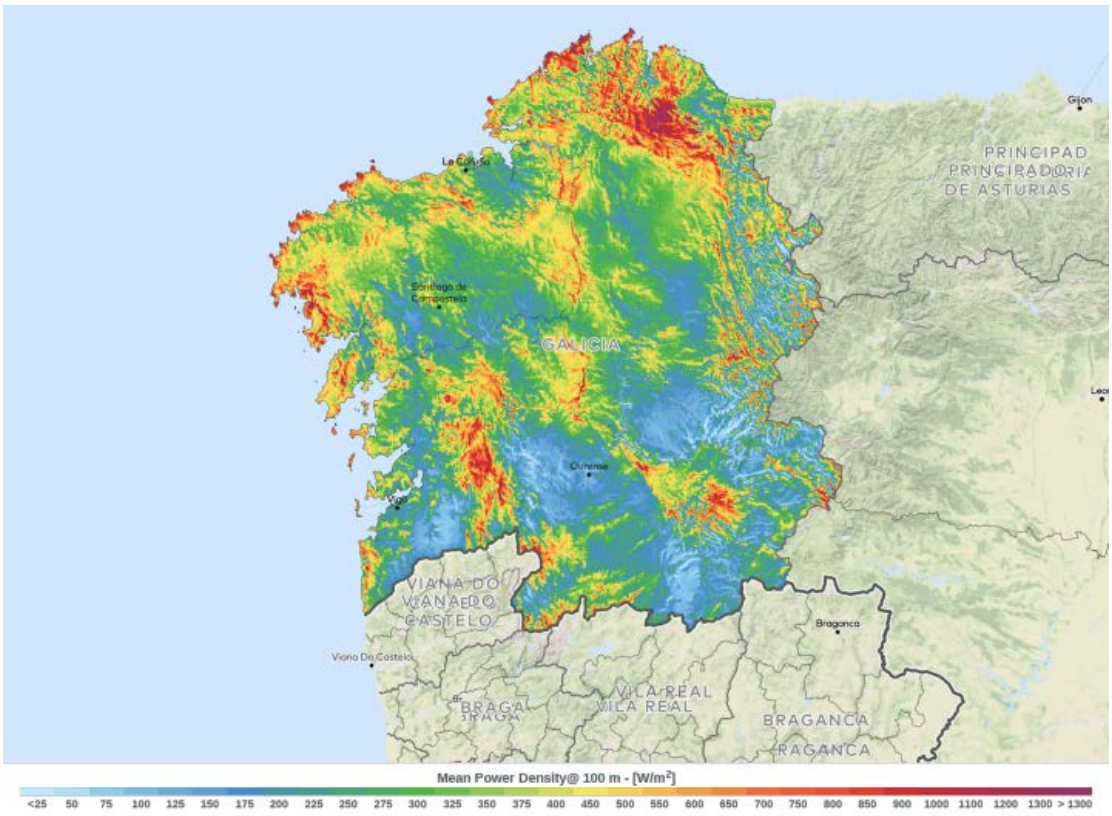

Figure A.1. Wind Energy density map for Galicia (W/m^2) - Source: [1].

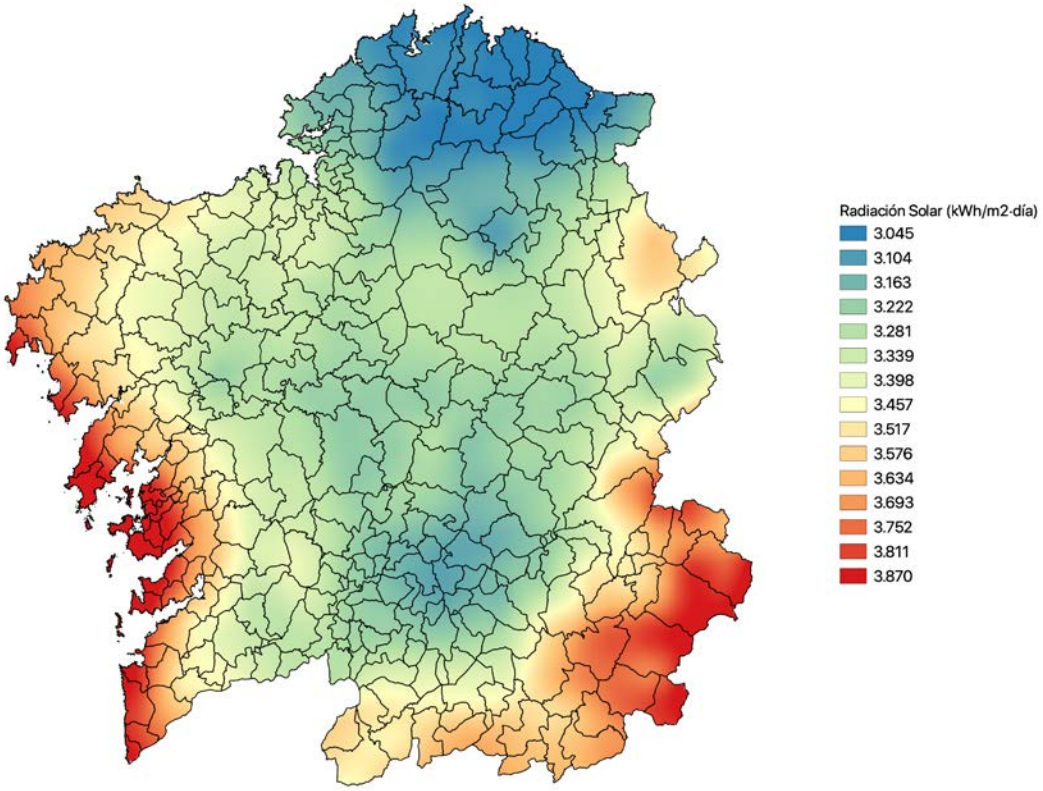

Figure A.2. Daily global insolation map (kWh /m^2 day) - Source: [3].

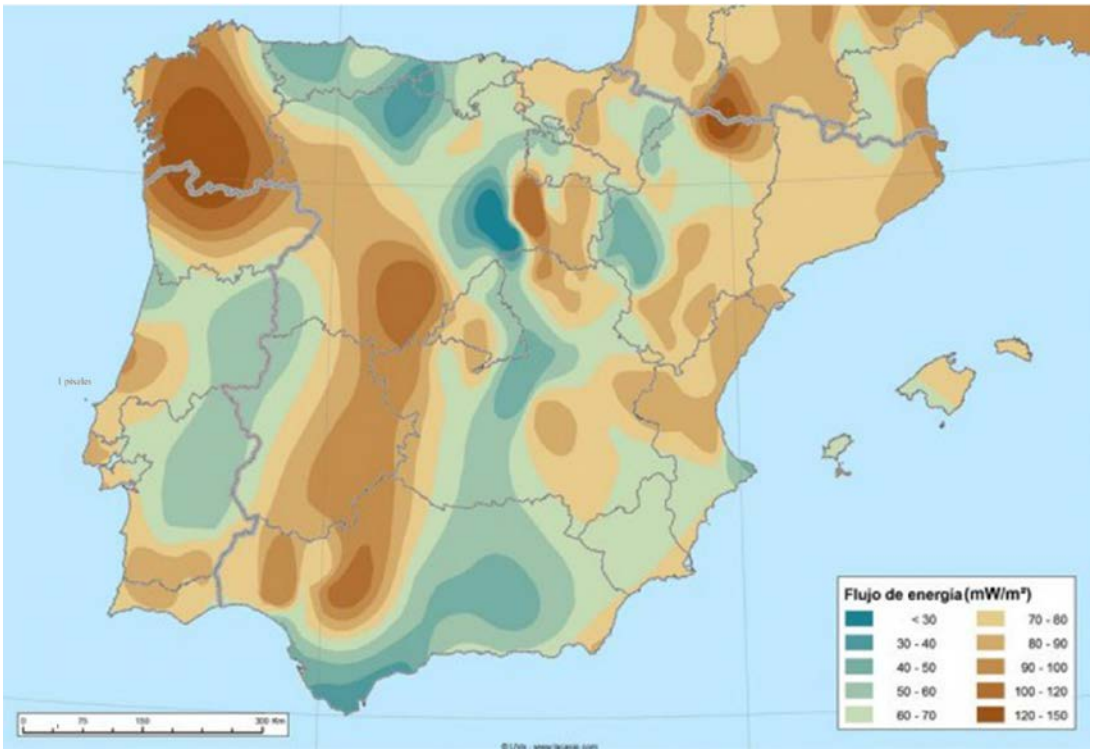

Figure A.3. Map of geothermal potential (mW/m^2) - Source: [4].

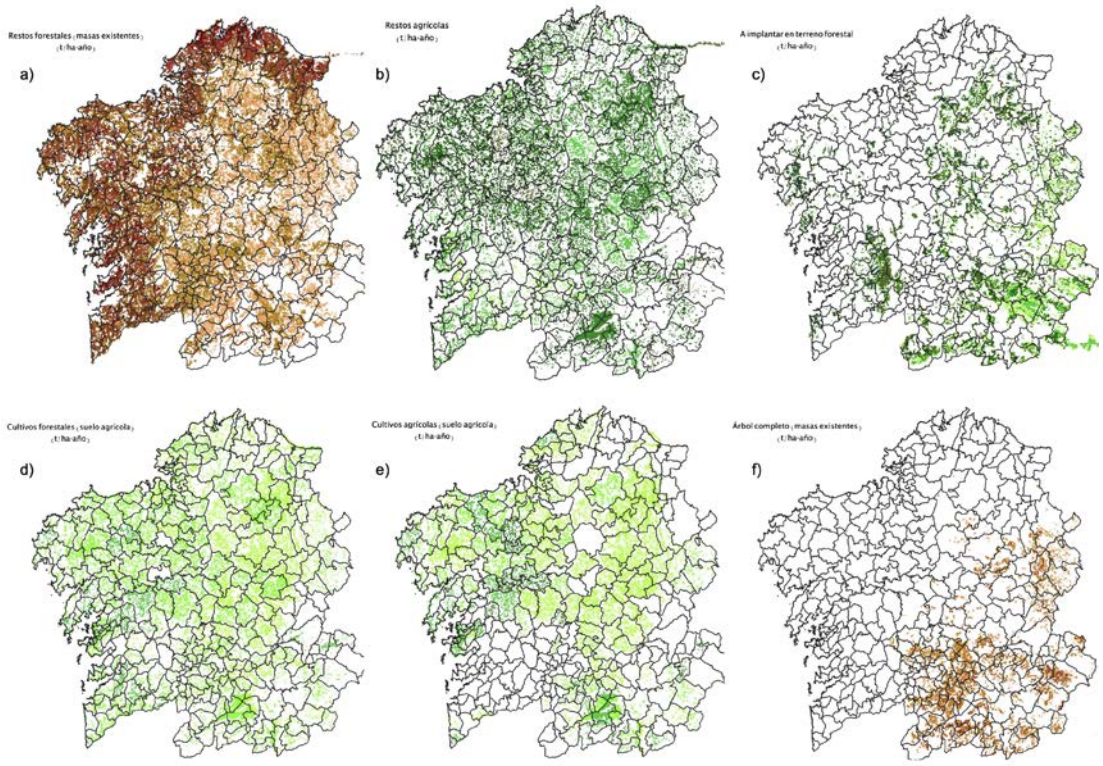

Figure A.4. Maps of biomass potential for Galicia (ton/ ha·year) a) Forest remains (existing stands), b) Agricultural remains, c) To be implanted on forest land, d) Forest crops (agricultural land), e) Crops (agricultural land) and f) Complete tree (existing stands) – Source: Adapted from the IDAE Bionline page [5].

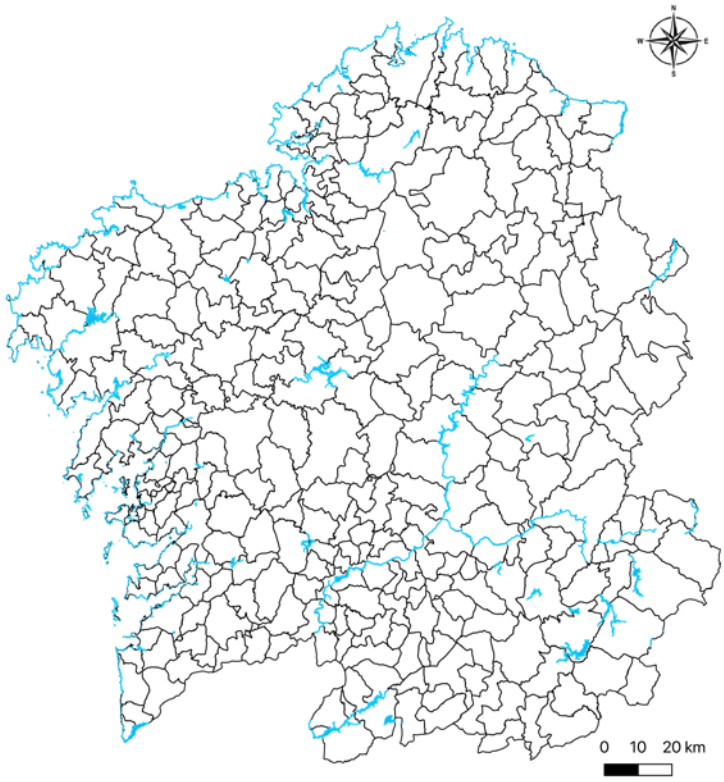

Figure A.5. Small hydro potential, surface water masses (km^2) - Source: Adapted from the cartographic information of the Basin Hydrological Plans 2015 – 2021 [6].

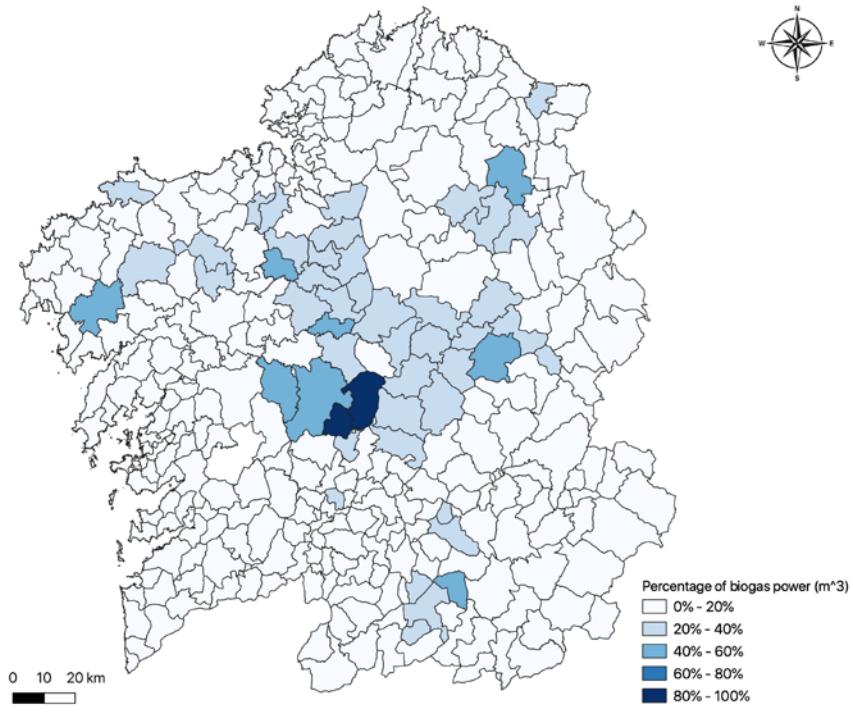

Figure A.6. Biogas potential (m^3) - Source: Own elaboration following the methodology of Iglínski and others [7].

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