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Geospatial Grey Areas: Utilizing GIS to Analyze Coastal Land Use Patterns



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ABSTRACT - Resulting from the regions' rich array of cultures, history, and beautiful landscapes, Dingle, Ireland has become a popular tourist destination within recent years. With tourism only expected to rise in coming years, it is imperative that actions be taken to ensure the persistence of these natural ecosystems and traditions. This research project utilized geographic information systems (GIS) to analyze the Dingle Harbor and Ballyferitter watersheds. The Dingle Harbor and Ballyferitter watersheds are both similar in size and composition of their coastal ecosystems, but the differences between the two are noteworthy. Dingle harbor watershed has approximately 2000 year-round residents, whereas Ballyferitter has roughly 270. More importantly, these areas differ vastly in the amounts of land allocated as undeveloped and developed territory. We conducted a geospatial analysis to classify land use by the following categories; farmland, arid scrub forest, developed areas, and livestock pasture. This project will lay the groundwork for future projects aimed at creating a model for sustainable tourism within the Dingle peninsula. The geospatial map produced here will be used for many years into the future as changes in land classification within the watersheds are monitored. This information will allow us to analyze changes in water quality across watersheds as a function of local land use development, tourism growth, changes within the natural system, and interactions between human beings and natural systems.

INTRODUCTION -

- Coastal tourism is dependent upon the health and quality of the coastal ecosystem, yet tourist activities may ultimately overload the natural ecosystem upon which the human system relies (e.g., water filtration).
- Local people in traditional tourist destinations are increasingly anxious to preserve their own identity; their environment; and their natural, historic, and cultural heritage, all of which can be degraded by excessive tourism.
- Tourism may lead to increased pressures on resources in the human system such as housing and transportation may degrade the ability of the human system to respond to increasing economic development and land use changes.
- Understanding the complexity of human-environment interactions and their impact on the sustainability and resilience of both human and natural systems are of critical importance for the development of sustainable management frameworks for tourism in any coastal community.
- How does land use differ between two adjacent coastal communities with significantly different year round population densities?

METHODS -

- Software utilized was Esri's ArcGis Pro ver. 1.3
- World Imagery selected as Base Map from Esri's Living Atlas. (Updated: March 16th, 2017.)
- Polygons representing boundaries of Ballyferitter and Dingle Harbor Watersheds were created using World Topography Base Map as an elevation reference.
- Regional characteristics defined as dwellings, farmland, scrub, forest, and livestock.
- Each regional characteristic defined as a feature layer and colors were selected for best visibility.
- Layers were defined and polygons were created around the border of each area (Figure 1.).
- Polygons were created to fill the entirety of each watershed boundary.
- Geodesic area of each polygon was calculated using the add geometry attributes utility.
- Total area (km²) for each land use were converted to % land cover
- Developed land was highlighted using 3D renderings generated within ArcGis Pro's extrusion utility within a 3D scene. Housing layers were added to the scene and extruded to a maximum height of 25 meters.
- Sheep were counted and quantity was added to an attribute table for each polygon.
- All figures were created using ArcGis Pro's integrated utility and exported as PDF files for use.



Figure 1.) Regional characteristics defined. Clockwise from top left: Forest, Scrub, Farm, Dwellings (Housing).

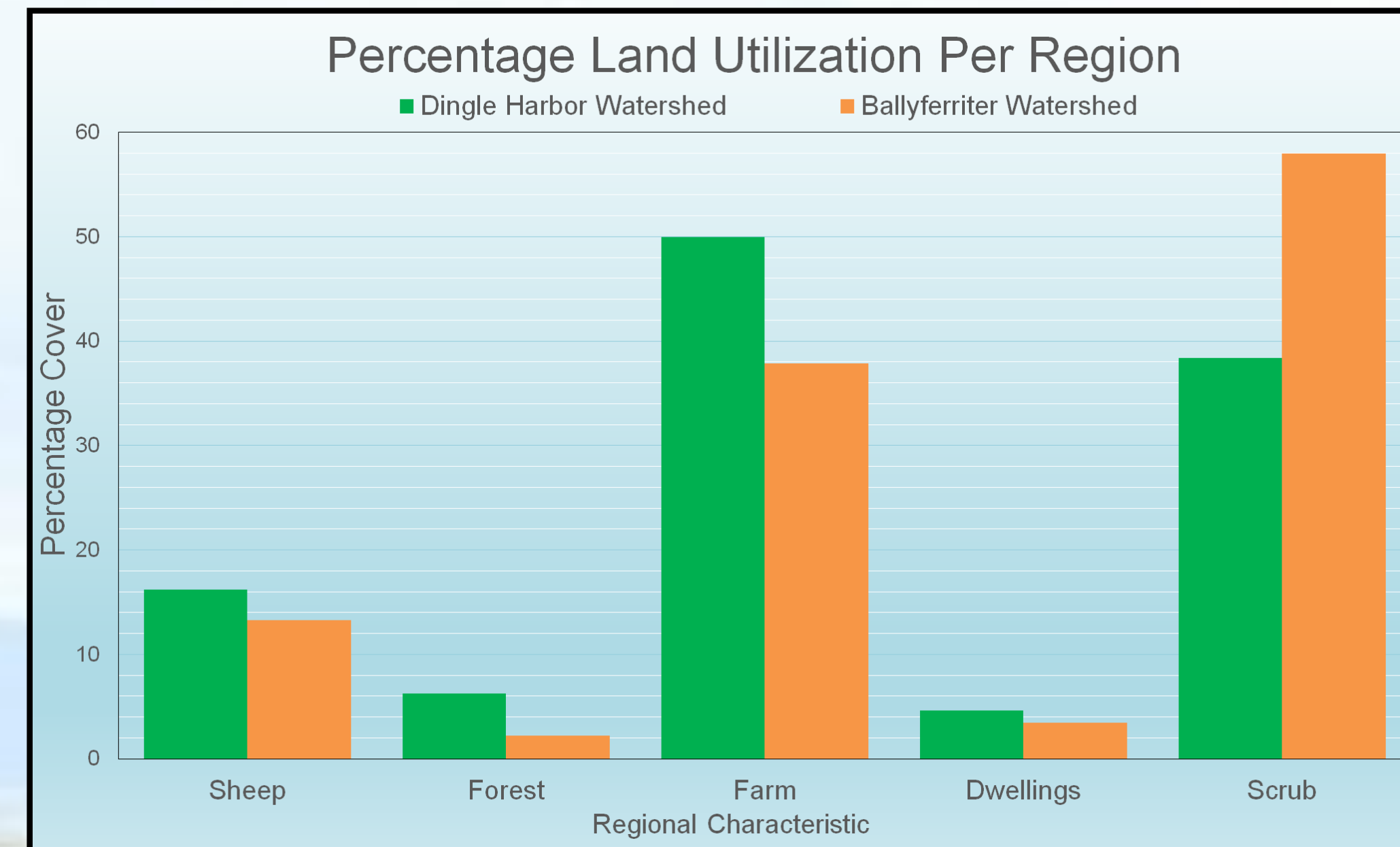


Figure 2.) Regional land use as percentages.

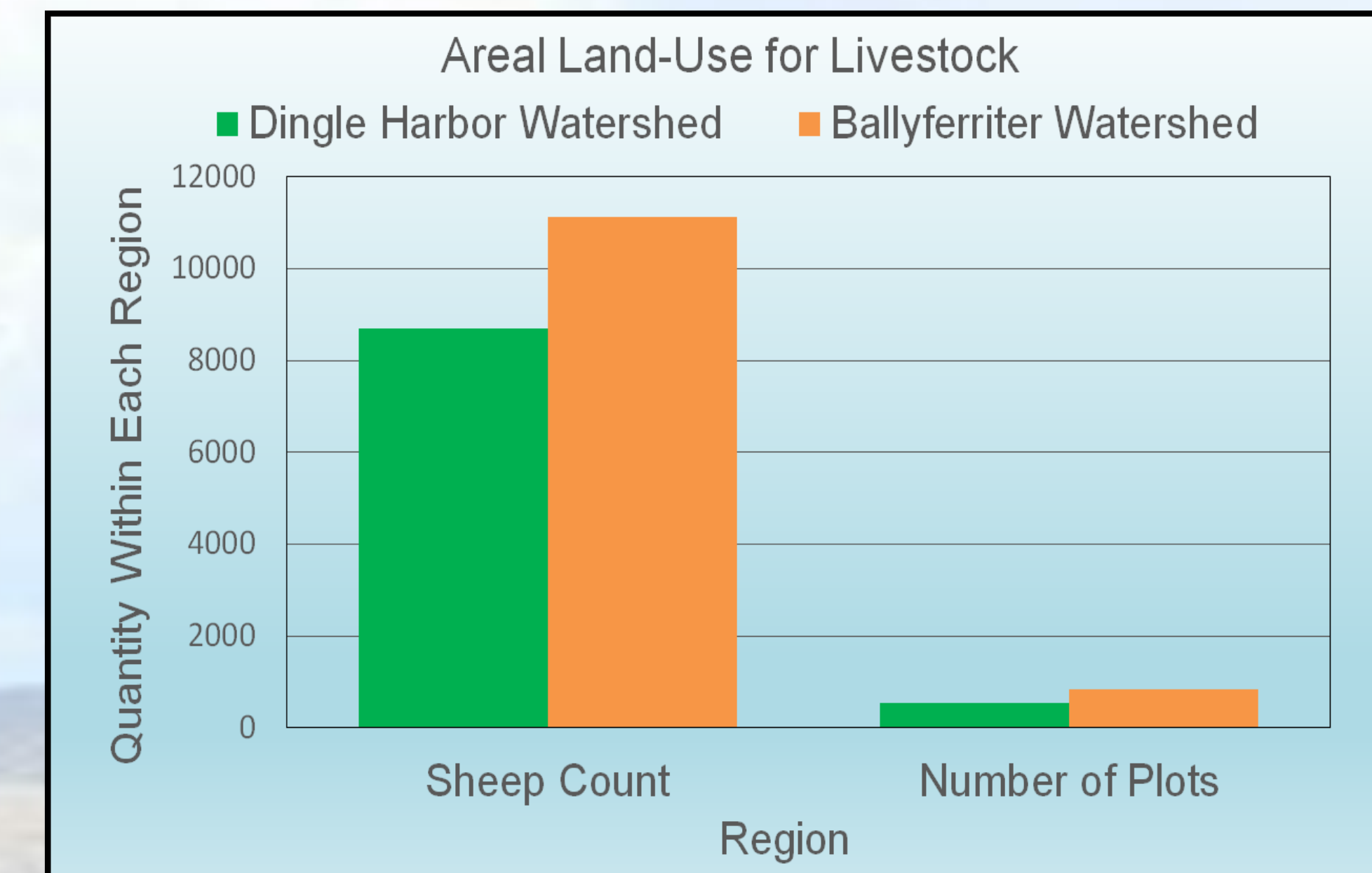


Figure 3.) Livestock per region.

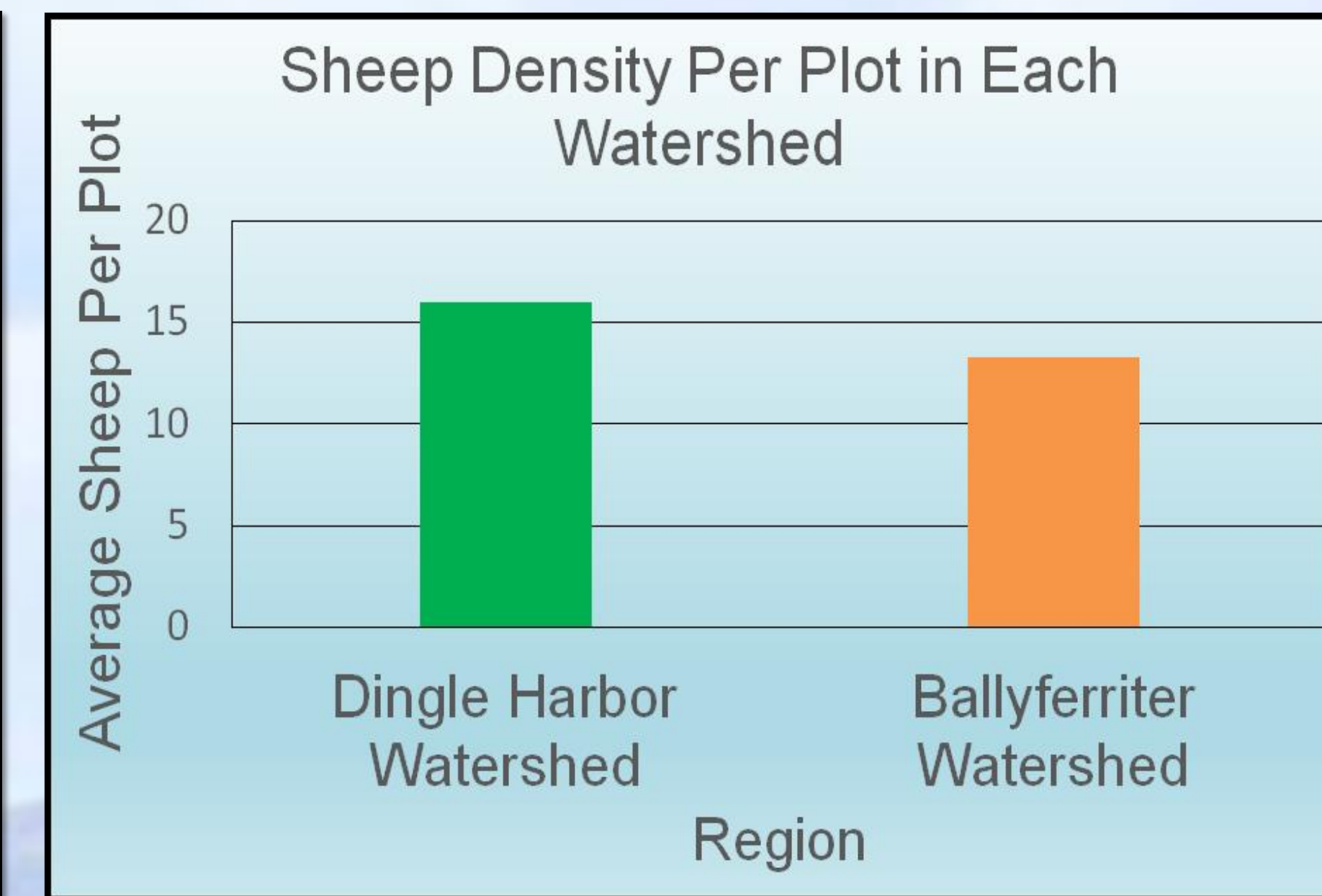


Figure 4.) Livestock density per region.

Results:

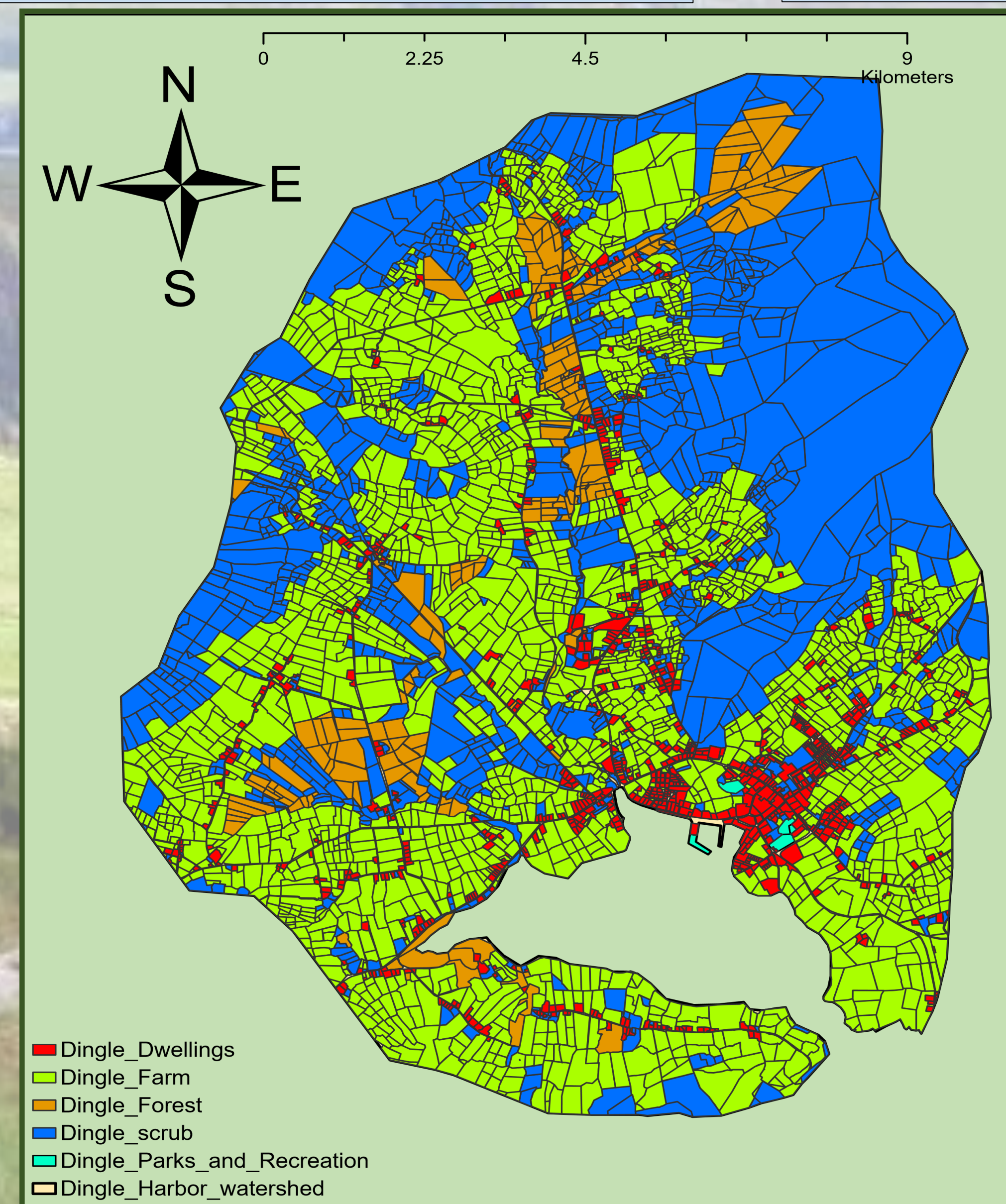


Figure 5.) Dingle land use

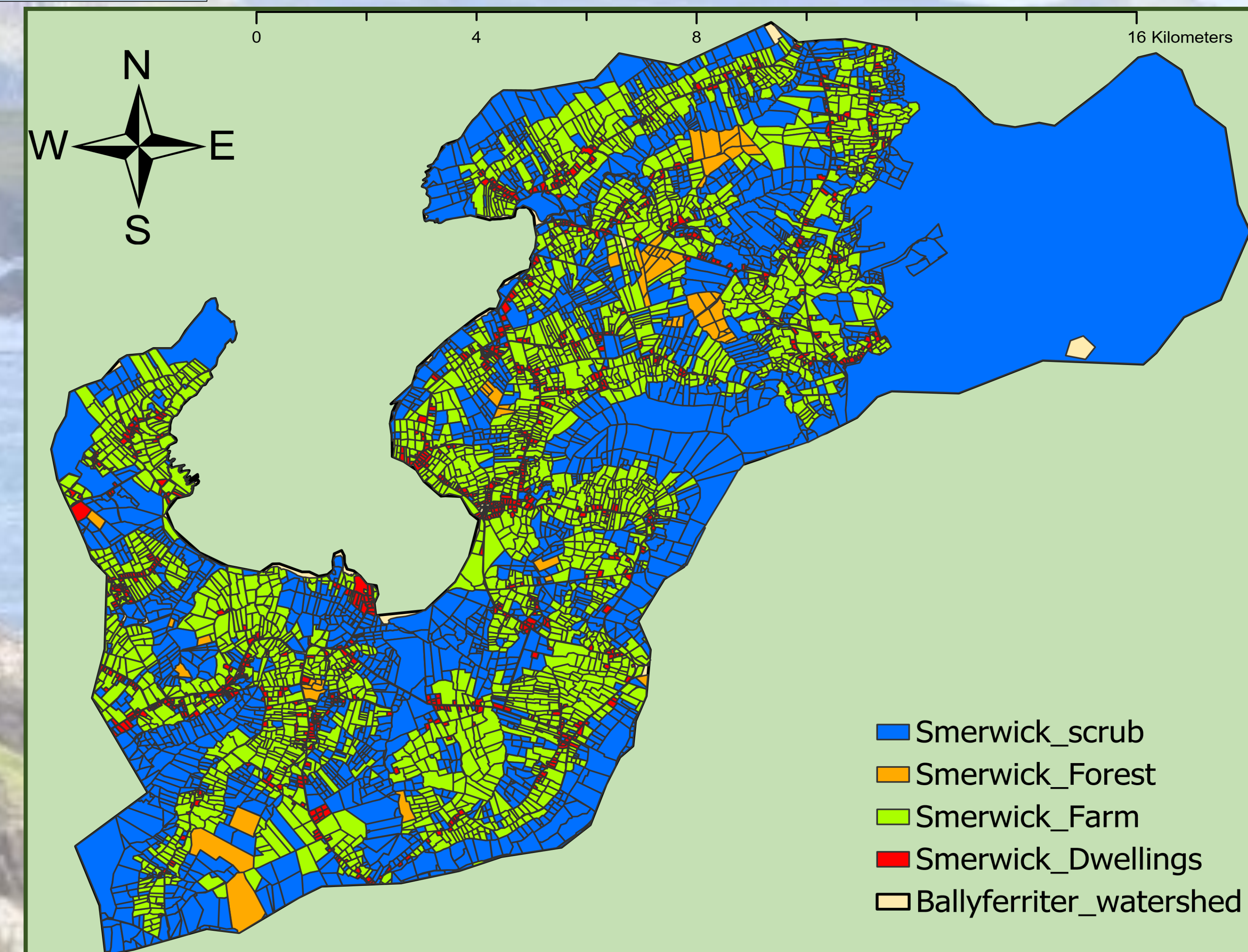


Figure 6.) Ballyferitter land use

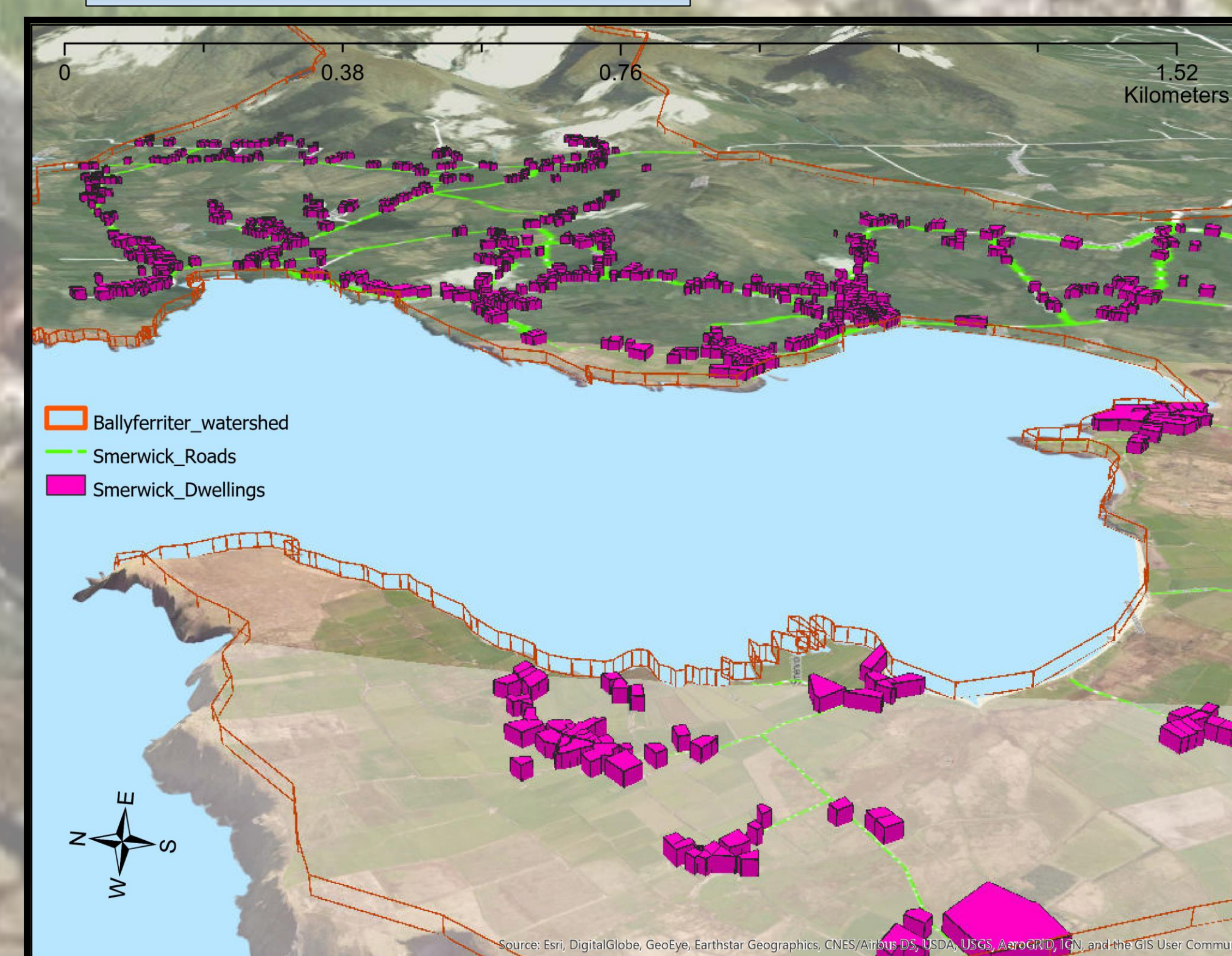


Figure 7.) Ballyferitter housing density (3D).

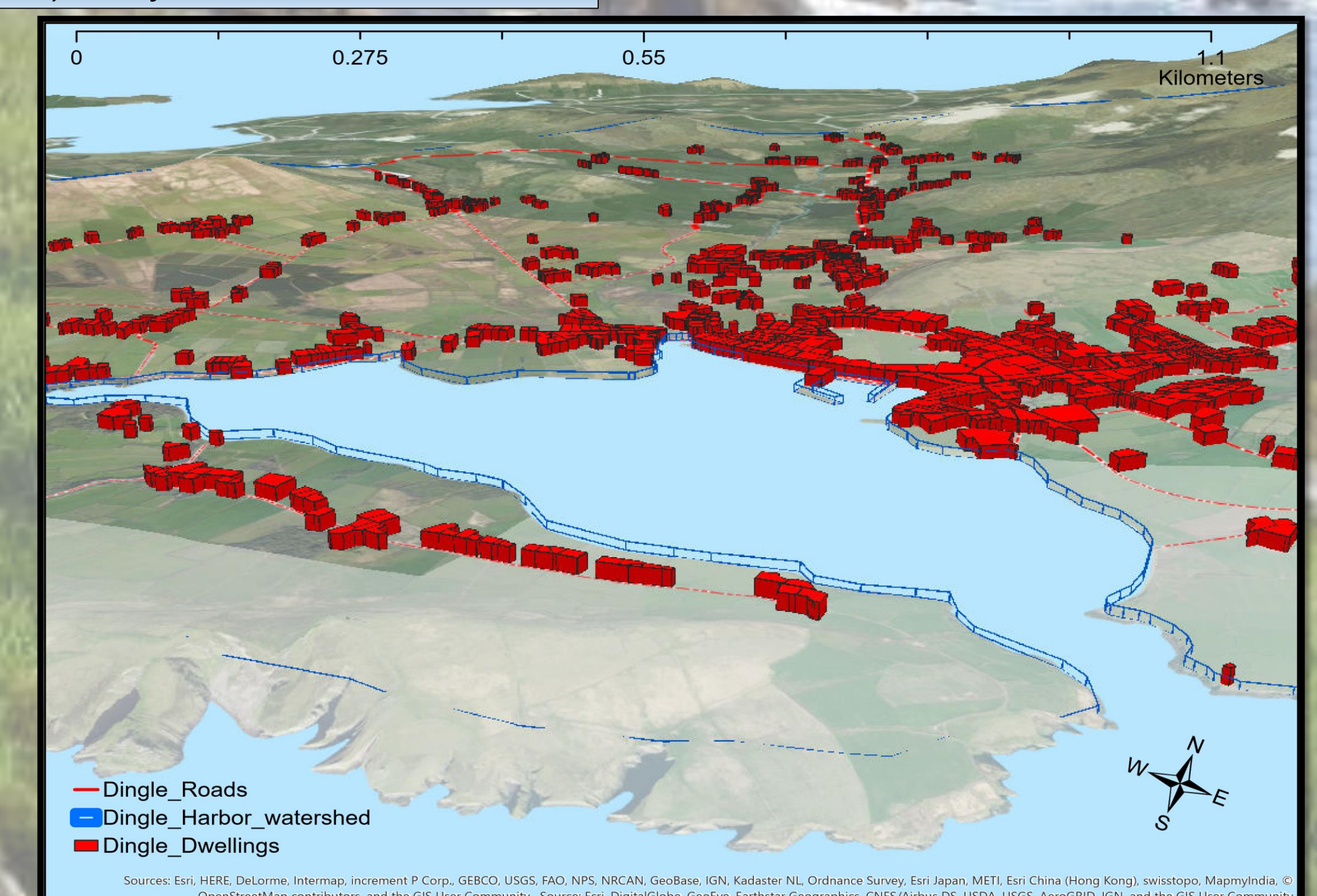


Figure 8.) Dingle housing density (3D).

Discussion:

- Dingle Harbor and Ballyferitter watersheds are very similar.
- Important differences between regional livestock quantity and density.
- Much higher housing density in Dingle, as expected from tourism industry.
- How will tourism change these regional characteristics in Dingle over time?

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