An integration of digital twin technology, GIS and VR for the service of environmental sustainability

Chen Wang¹, David Miller¹, Alessandro Gimona¹, Maria Nijnik¹, and Yang Jiang²

¹The James Hutton Institute, Aberdeen, United Kingdom of Great Britain – England, Scotland, Wales (chen.wang@hutton.ac.uk)
²School of Computing, Robert Gordon University, UK

A digital twin is a digital representation of real-world physical product, system, or process. Digital twins potentially offer a much richer capability to model and analyze real-world systems and improve environment sustainability.

In this work, an integrated 3D GIS and VR model for scenarios modeling and interactive data visualisation has been developed and implemented through the Digital Twin technology at the Glensaugh research farm. Spatial Multi-criteria Analysis has been applied to decide where to plant new woodlands, recognizing a range of land-use objectives while acknowledging concerns about possible conflicts with other uses of the land. The virtual contents (e.g., forest spatial datasets, monitored climate data, analyzed carbon stocks and natural capital asset index) have been embedded in the virtual landscape model which help raise public awareness of changes in rural areas.

The Digital twin prototype for Glensaugh Climate-Positive Farming was used at the STFC workshop 2021, GISRUK 2022, 2022 Royal Highland Show which provides an innovative framework to integrate spatial data modelling, analytical capabilities and immersive visualization.

Audience feedback suggested that the virtual environment was very effective in providing a more realistic impression of the different land-use and woodland expansion scenarios and environmental characteristics. This suggests considerable added value from using digital twin technology to better deal with complexity of data analysis, scenarios simulation and enable rapid interpretation of solutions.

Findings show this method has a potential impact on future woodland planning and enables rapid interpretation of forest and climate data which increases the effectiveness of their use and contribution to wider sustainable environment.