

NEW YORK STATE GIS ASSOCIATION

2021 GIS Applications Award WINNER

Climate and Applied Forest Research Institute (CAFRI)

As geospatial analysis becomes increasingly important across fields, analysts are regularly expected to perform large-scale reproducible analyses using whatever data they can get their hands on. In order to make such analyses easier, the terrainr project (developed by members of the Climate and Applied Forest Research Institute at SUNY-ESF in Syracuse, NY) provides a free and open source for the R programming language which allows users to easily obtain data from the USGS National Map family of web APIs. Through terrainr, users are able to access public domain data for the entire United States, including digital elevation models and orthoimagery. Data downloaded may then be imported into traditional GIS applications or used within R for further analysis.

In addition to its data retrieval functionalities, terrainr provides utilities for the visualization of spatial data, enabling users to produce both 2D maps within R and interactive 3D landscape visualizations within the Unity video game engine. As an extension for the R programming language, terrainr seeks to reduce the burden involved in producing interactive 3D visualizations by making it easy to translate data between the tools used for data manipulation and those used for producing large-scale landscape simulations. This shift helps to reduce the technical skill threshold required to use game engines for landscape visualization, and lets designers spend more time thinking about and developing visualizations and less on the tools and techniques required to develop them.

This application was developed in response to two main problems. First, while the United States government collects and makes public an incredible amount of high-resolution geospatial data, accessing this data often requires using multiple websites. A tool which provides a single point of access for these data products, and allows users to specify areas of interest using simple bounding boxes or by providing spatial data to extract a bounding box from, would greatly improve the accessibility of these public data sources.

Secondly, there is currently a great deal of interest in interactive 3D landscape visualizations as a method for scientific communication. In particular, recent work has investigated the potential of video game engines to serve as GIS for visualizations, as these tools are specifically designed to render large high-resolution scenes for users to interact with over the course of a video game. However, while video game engines have incredible potential for visualization production, they have much less ability to perform spatial analyses or to manipulate spatial data sets. As such, it would be useful to have a tool which allows users to treat video game engines as nothing more than an extension of the tools they use for spatial analyses, letting them create the layers they wish to visualize and the visualization itself in one fell swoop.

The package has been released as a free and open source extension for the R programming language, and has been accepted as part of the rOpenSci project for scientific computing.

terrainr has been installed more than 3,000 times since its initial release in March 2021, and has seen use in private sector, governmental, and research applications. By providing users with a consistent and straightforward interface to download multiple public data sources, terrainr has made it easier for analysts to incorporate data from the USGS National Map into their workflows and visualizations. By making it faster to produce 3D landscape visualizations within the Unity game engine, terrainr has provided the basis for exploratory work in simulating forest environments and other areas of interest as interactive experiences as a tool for scientific communication.

It is with great pleasure that we recognize the Climate and Applied Forest Research Institute (CAFRI) for their achievements in the development of **terrainr**



Awarded: September 2021

A handwritten signature in black ink, appearing to read 'Chris Badurek', written on a white background.

Chris Badurek, President

