DEval
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THE GEODATA DECISION TREE: USING GEODATA FOR EVALUATIONS

Summary

When evaluating programmes that have a clear spatial dimension, the use of geographic data (Geodata) and methods offer many benefits: Geodata constitute an objective measure of environmental change, are more cost-effective than survey data, allow evaluations in remote or dangerous locations, and permit the retrospective collection of baseline data. This article introduces the Geodata Decision Tree as a set of guiding questions that help evaluators to decide when and how to use Geodata. The geographic methods range from a simple mapping of spatial characteristics to sophisticated Geospatial Impact Evaluations (GIE) that establish causality. In times where topics with a clear spatial dimension (e.g., climate change, infrastructure development, conflict regions, poverty distribution, etc.) increase in relevance and technological advances lead to an increase in the quality and availability of spatial information, evaluators may consider Geodata as a promising addition to their toolboxes.

What are Geodata?

Geodata are data for which we clearly know the location on Earth. Point, line, polygon, and raster data comprise the four primary types of Geodata (Figure 1). Point data are usually a simple combination of longitude and latitude and may show the location of cities on a map. Line data consist of two or more connected points, and are used to show geographic features such as roads. Polygon data are composed of irregular shapes and can represent administrative boundaries such as for villages or national parks. Finally, raster data are images made of grid cells (pixels), which can indicate, for example, temperature, precipitation, or the percentage of tree cover for each pixel.

Over the past few decades, technological developments have made geographic data more accessible. More satellites orbit the Earth, with wider coverage and shorter revisiting times. The resolution of satellite images has increased substantially, from 10 – 15 meters only 10 years ago to the ultra-high-resolution images of about 0.5 meters currently available from satellites such as WorldView or GeoEye.

Why are Geodata useful?

Many projects and programmes that address topics such as climate change, infrastructure development, poverty distribution, or conflict have a clear geographic dimension. When we evaluate such programmes, geographic data may offer unique insights into the development–environment nexus. While, in the past, evaluators collected predominantly survey data, geographic data have some major advantages.

Objectivity. Geodata constitute an objective measure of environmental changes. While it is possible to ask villagers about the amount of deforestation in the previous year, the information will be subjective and often inaccurate. In contrast, satellite data will provide a much more objective measure of deforestation.

Cost effective. Many satellite image products are available free of charge and cover a wide geographic area. For suitable topics, it can be more cost effective to use Geodata than to collect the same information using survey tools.

Temporal dimension. Archived Geodata go back in time for decades. As such, it is often relatively easy to collect pre-intervention baseline data. This is particularly useful when evaluating interventions that were commenced ad hoc, following, for example, a natural disaster or political crisis, when baseline survey data are not available. Moreover, Geodata offer possibilities for continuous programme and project monitoring and evaluation to assess the long-term sustainability of a project.

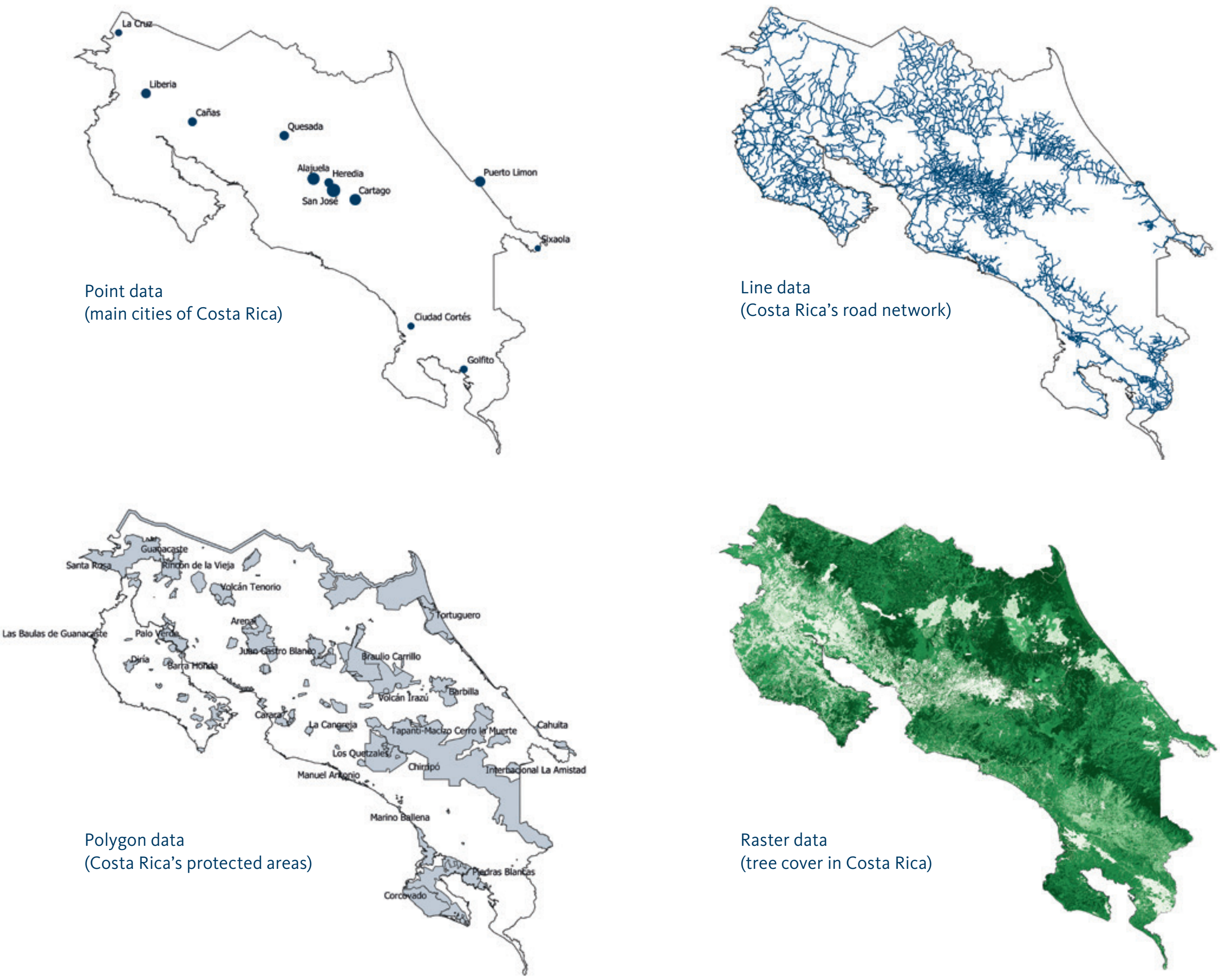
Accessibility. Remote sensing can provide data on environmental conditions in regions that are difficult to access because they are very remote, with no (or very poor) physical road access or located in politically unstable and dangerous regions.

Limitations. While Geodata offer many unique opportunities, they are not without limitations. First, organizations interested in using this technology need to allocate resources to train staff in geographic methods or employ experts. A cost-effective alternative may be collaboration with universities that provide the necessary expertise. Second, while large amounts of Geodata are available free of charge, specific evaluation questions may call for specialized geographic data products (e.g., ultra-high-resolution images), which may be costly. Finally, Geodata will seldom be a standalone tool when evaluating complex development projects and programmes. Rather, evaluators should integrate Geodata with appropriate other quantitative and qualitative tools within a multi- or mixed-methods research design.

When can we use Geodata?

Not all evaluation questions call for a geographic solution. The first question in the Geodata Decision Tree (Figure 2) therefore attempts to differentiate between geographic evaluation interests (e.g., impact of an irrigation system) and non-geographic ones (e.g., strategic alignment). Next, we need to know the geographic location of the evaluation unit (e.g., household, village, country). Evaluators may assign the evaluation unit a specific location (known as "Georeferencing") at a desktop computer using specialized software tools or with handhold devices such as tablets or smart phones.

Figure 1: Types of Geodata



Point data
(main cities of Costa Rica)

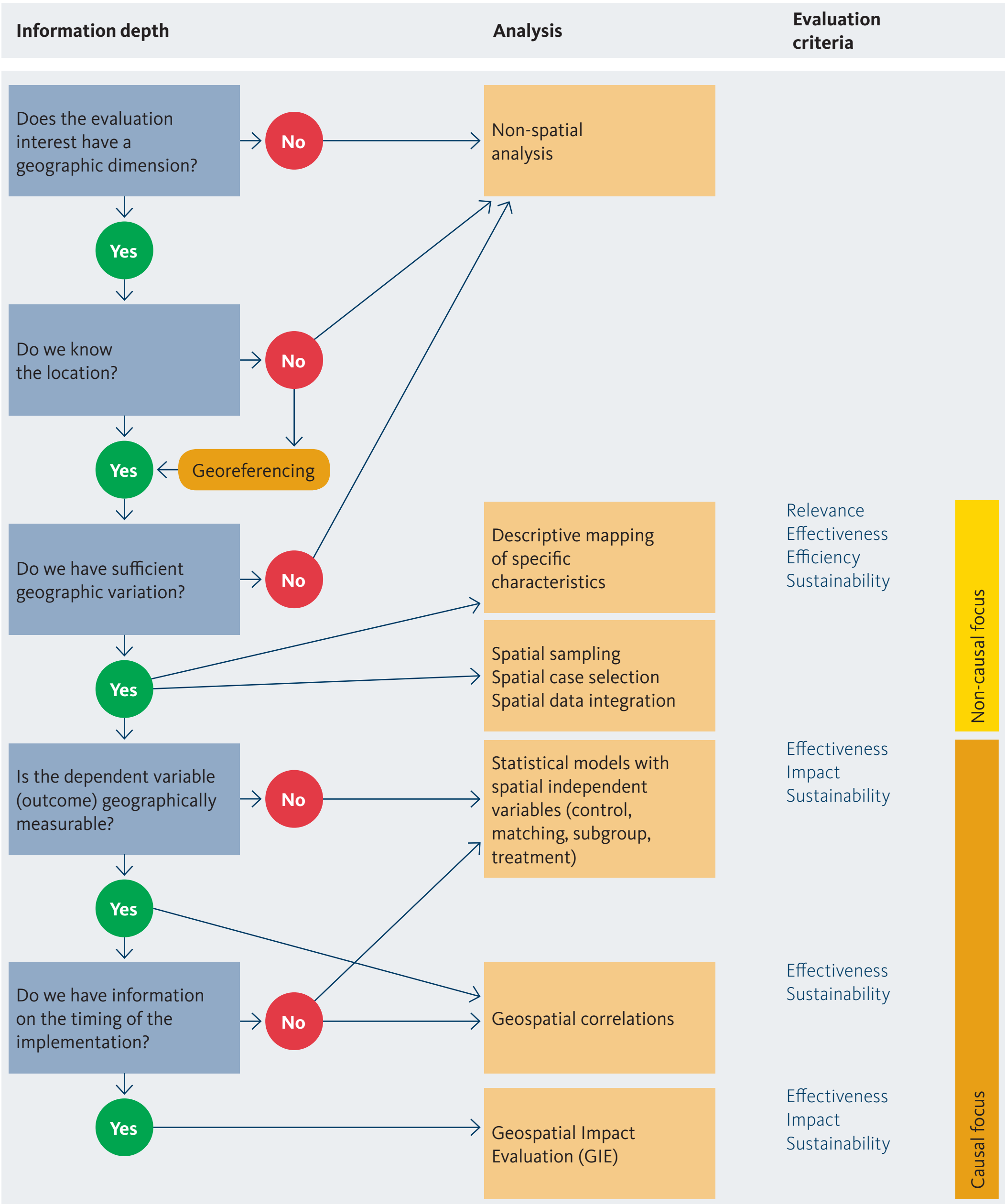
Line data
(Costa Rica's road network)

Polygon data
(Costa Rica's protected areas)

Raster data
(tree cover in Costa Rica)

Source: own figure.

Figure 2: The Geodata Decision Tree



Source: own figure.

Most geographic analysis requires some degree of geographic variation in what is being measured. Ideally, project sites are scattered across a large territory with varying geographic characteristics. With sufficient variation it is possible to perform descriptive mapping of area characteristics, spatial sampling and case selection, and to spatially integrate various data sets. Both the dependent (outcome) and independent (predictor) variable may be geographic, resulting in different methods being used. Evaluators can use geographic variables as controls in regression models or when matching treatment and control units. Similarly, geographic variables permit the stratification of the sample or the construction of spatial weight matrices to estimate diffusion and spillover effects (Leppert et al., 2018).

When the dependent variable is geographic, and we have information on the timing of the intervention, we are in a position to perform a full Geospatial Impact Evaluation (GIE). A GIE attempts to causally connect the intervention with geographically measurable changes in the environment (Bingham, 2018). Most GIEs have investigated changes in agricultural production and deforestation. However, researchers have used the physical environment (e.g., night-time lights) as indirect measures (proxy indicators) of socio-economic change.

Outlook

With technological developments over the past decades, the quality and availability of Geodata has strongly improved. At the same time, the world is facing large challenges that have a clear spatial dimension including climate change, a proliferation of regional conflicts, poverty and slums expansion, and inadequate infrastructure development amongst others. A global awareness of these problems and the need for action is reflected in the thematic focus of various Sustainable Development Goals (SDGs). In response, the number and size of international development programmes addressing these issues will likely increase substantially in future decades. Evaluators have a duty to ensure that such programmes lead to expected impacts. Geographic data and methods offer unique opportunities for the evaluation of programmes with a clear spatial dimension, and may be a useful addition to the evaluator's toolbox.

References

Bingham, B. (2018), *Geospatial Impact Evaluation Guidelines*, AidData, University of William & Mary, Williamsburg, VA, USA.

Leppert, G. et al. (2018), "Impact, Diffusion and Scaling-Up of a Comprehensive Land-Use Planning Approach in the Philippines. From Development Cooperation to National Policies", German Institute for Development Evaluation (DEval), Bonn.

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