

work, including collaborations with Southall and others, explored a variety of topics including changing migration patterns over time and changing patterns of poverty in England and Wales over the twentieth century. Work on poverty has been taken further to explore causal relationships between living conditions and health inequalities, although these studies have a primarily statistical rather than geographical emphasis. Gregory's recent work has focused on how data from multiple dates can be interpolated onto a single administrative geography to allow them to be compared over time. Key to this is the ability to perform the interpolation as accurately as possible but also to explicitly handle the error that the results of any interpolation inevitably contain. Further work has concentrated on techniques for analyzing both the geographical and temporal nature of data contained in a national historical GIS. This work has particularly focused on the potential of geographically weighted regression building on the analysis presented in *Mapping the Great Irish Famine* by Kennedy et al. (1999).

A second aspect to Gregory's work has been in establishing how GIS can best be used within historical research. To this end he has written *A Place in History: A Guide to Using GIS in Historical Research* (Oxbow, 2002 and online [see URL below]), which includes an extensive bibliography of historical GIS scholarship. He and Paul Ell are currently writing a monograph titled *GIS for Historical Research* (Cambridge University Press) that will provide a more extensive overview of the field and its methods.

GBHGIS Resources Online

- Boundary data: <http://www.edina.ac.uk/ukborders>.
- Demographic data: <http://hds.essex.ac.uk/studybrowse> (then go to "GBHD Online").
- Vision of Britain through Time: <http://www.visionofbritain.org.uk>. See also: <http://www.gbhgis.org>.
- Ian N. Gregory, *A Place in History: A Guide to Using GIS in Historical Research*: <http://hds.essex.ac.uk/g2gp/gis/index.asp>.

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A Historical GIS for Ireland

The Centre for Data Digitisation and Analysis (CDDA) at the Queen's University, Belfast has a long-standing interest in the computerization, visualization, and statistical analysis of large numeric, spatially referenced historical databases. The Centre has, for example, digitized most of the

recurrent statistics contained in the Irish Census from 1821 to 1971; assisted in the development of the Great Britain Historical GIS (see separate report on Great Britain); provided historical census data for that project; digitized the 1676 Compton Census; and worked on a range of historical-statistical data for Wales. Hence, the Centre is well placed to develop an Irish Historical GIS.

A number of factors explain why an Irish GIS would be of significant value. Ireland is simply little mapped. Even within historical geography and subjects that have been exhaustively analyzed using both quantitative and qualitative sources, Irish historians have rarely visualized or analyzed spatial relations. The Irish Potato Famine is a case in point. Scholars have produced detailed, lengthy books on a quantitative analysis of the Famine without a single map. The absence of maps is all the more striking because historical arguments about the Famine are essentially spatial, such as that the Famine was worst in the west of Ireland and not as bad in Ulster. The recent atlas by CDDA and associates, *Mapping the Great Irish Famine* (1999) (using computer cartography rather than GIS) demonstrates that across a whole host of different measures, from demography to housing quality, religion, and language, there was a clear spatial dynamic. In other words, important research debates could be addressed by a national GIS.

This is even more the case for topics for which CDDA already holds a large amount of spatially referenced data for Ireland in electronic format. The Database of Irish Historical Statistics contains more than 32 million data values of census and related sources, all referenced by place-name and geographical location. These census data are far more comprehensive than for many other countries. Early Irish censuses go beyond head counts. They include information on the Irish language, literacy levels, religion, housing, emigration, and agriculture. Other datasets include crime statistics, health data, and civil registration information. Thus for Ireland, a rich set of data are already available for a GIS.

Further, Ireland's administrative geography lends itself to the development of a historical GIS. As in other countries, administrative units changed over time and generally do not nest one within another. Poor Law Union boundaries, for example, cross-county boundaries, and the number of Unions changed from, for example, 130 in 1840 to 163 by 1851. However, the smallest administrative unit, the townland, *does* nest within all higher-level units, both civil and ecclesiastical and from 1861, the census records the administrative provenance of each townland. Moreover, townland boundaries rarely changed, and when they did they normally divided with no change to the outer boundary. Townlands are small, averaging about 200 acres; they total over 62,000 units. Digitization of these polygons would be a major task but justified, as from this all other units could be created.

The digitization of townland boundaries is not required, however, thanks to a network of collaborators CDDA has built who are assisting in this area

and others. Ordnance Survey Northern Ireland, the national mapping agency, has agreed to allow CDDA to use their modern townland boundary coverage free of charge for educational purposes. CDDA has the straight-forward task of time-enabling these 1970s boundaries. Other key alliances have been formed with local museums, the School of Geography at Queen's University, and the Northern Ireland Statistical Research Agency, each providing unique expertise or sets of data for the Irish GIS.

Finally, the Irish project is learning from the experiences of the pioneers of national historical GIS development. Unlike the Great Britain Historical GIS, the Centre is not digitizing multiple administrative boundaries—it is starting with the most recent, accurate, detailed boundaries and working back in time. This avoids the problem of inaccurately overlaying coterminous boundaries that appear not to match as they have been digitized from different, imperfect sources. Because of the nature of Ireland's administrative geography, different coverages for different administrative units will not be created, as all units will be built from the townlands. CDDA is not re-digitizing existing electronic data, namely the boundary data coming from the Ordnance Survey and recent socioeconomic data from the Northern Ireland Statistical Research Agency, considerably reducing costs as a result. Furthermore, in collaboration with the Electronic Cultural Atlas Initiative (see separate report) and the School of Archaeology at the University of Sydney, we are adapting TimeMap, a free, easy-to-use geospatial browser that enables researchers to use the data without having to learn GIS software.

To date, the Centre has the bulk of the attribute data in digital format and the modern boundary data available. Scholarly research so far has identified the need to begin mapping Ireland's past and the potential of spatial analytical techniques (see Ell and Gregory, this volume). The geospatial browser is well developed. Over the next few months, work to time-enable the townland coverage will begin together with the computerization of the locational attribute data. Each stage in this process is linked to a range of substantive research outputs. CDDA is creating a major research resource and will also be at the forefront of scholarship using the resource.

CDDA Resources Online

- CDDA online: <http://www.qub.ac.uk/cdda>

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The Belgium Historical GIS

Since 1990, a historical database of Belgian municipalities has been under construction at the Department of Modern History at Ghent Uni-