# Geospatial Ethics Case Studies

## Case study 1: Mapping Muslim Neighbourhoods

A GIS professional employed as director of a research laboratory called the Center for Risk and Economic Analysis of Terrorism Events at the University of Southshire receives an inquiry from a senior officer of the Southshire Police (SPD). The officer seeks the laboratory’s assistance in a “community mapping” project whose purpose is to “lay out the geographic locations of the many different Muslim population groups around the metropolitan area,” and to “take a deeper look at their history, demographics, language, culture, ethnic breakdown, socio-economic status, and social interactions.”

The community mapping project is to be one component of a counter-terrorism initiative that aims to “identify communities, within the larger Muslim community, which may be susceptible to violent ideologically-based extremism...”

Off the back of local newspaper stories and within days, representatives of three local Muslim groups send a letter to the officer expressing “grave concerns about efforts by the SPD to map Muslim communities as part of its counterterrorism program.” The signatories argued that the community mapping project ...seems to be premised on the faulty notion that Muslims are more likely to commit violent acts than people of other faiths. Singling out individuals for investigation, surveillance, and data-gathering based on their religion constitutes religious profiling that is just as unlawful, ill-advised, and deeply offensive as racial profiling. Meanwhile, the SPD’s research proposal arrives at the University lab.

The well-funded project will involve considerable (badly needed) GIS work, involving support for both student interns and professional staff. The potential project’s stated purposes align with the Center’s mission, which is to “to improve the Nation's security through the development of advanced models and tools for the evaluation of the risks, costs and consequences of terrorism.” However, the associate director worries about the unfavourable publicity and possible legal action that might attend the project. How should they respond to the project proposal?

## Case study 2: Stag and deer migration Routes

An environmental consulting firm in the North of Scotland is hired by a natural gas utility to produce a map of a proposed pipeline through a portion of Sutherland in preparation for a public hearing (a hearing attended also by potential funders for the project). The company already has a pipeline route in mind but wants to assess this further within the context of the physical landscape, private land ownership, and public lands data. In the end they want to choose the shortest, most direct route to minimize capital expenditures for construction and pipeline efficiency.

Geophysical, environmental, political, social, economic and regulatory factors often come into play when refining the best route. A GIS analyst within the consulting firm is assigned to this project and proceeds to gather all pertinent data including existing topographic maps (DEMs), potential landslides, land use, land cover, geologic fault, soils, roads, railways, streams, station points, resident locations, administrative boundaries (including land ownership), vegetation, regulatory data, and subsurface seismic data.

The analyst plans to use these variables within a multi-step raster and network analysis involving the calculation of cost surfaces, distance surfaces, and direction surfaces in combination with source points, station points and destination points in defining an optimum pipeline route. The analyst also has access to Stag migration routes throughout the region from Defra and local sources. Although the proposed path of the pipeline itself will not fall within wildlife refuges, the migration corridors for this important species move beyond reserve areas. In fact the analyst found these migration routes to intersect the proposed pipeline at several points so marks them on her map and brings this finding to the attention of their supervisor. For reasons unknown to the analyst, the supervisor instructs them to remove the stag and deer migration routes from any maps prepared for the public hearing. What should the analyst do?

## Case study 3: Proprietary Software in an Emergency

GISCorps is a non-profit organization, founded in 2003 by the Urban and Regional Information Systems Association (URISA). It coordinates short-term, volunteer-based GIS services to underprivileged communities worldwide.

GISCorps supports humanitarian relief, emergency response, health and education, local capacity building, and community development. In its brief history, GISCorps has worked on a wide range of relief projects, including assisting response efforts to Hurricane Katrina in Mississippi (summer 2005), the aftermath of severe storms and flooding in Missouri (spring 2008), and the aftermath of Cyclone Nargis in various areas of Myanmur (Burma, spring 2008). Volunteers are carefully screened for professional competence and a match of skills, and availability with the mission at hand.

An experienced GIS analyst has volunteered through GISCorps to assist in the response to a tsunami that has devastated the coastal areas of a developing country. Help is needed to support damage assessment and critical search and rescue operations by local authorities. Volunteers are needed with skills in map production, spatial analysis, and data management, as well as proficiency with GPS receivers and general experience in disaster management. Participating volunteers include those from GISCorps, but also other organizations.

A major GIS software company (ASRI) has donated licenses of its product for use in the emergency. The donation has been made strictly to the local authorities only. However, the number of volunteers and local residents available to map the tsunami damage and critical rescue corridors is much greater than the number of available software licenses. Time is of the essence, as many people will die from lack of fresh water if rescue crews are not able to find the best routes to them around destroyed buildings and debris carried inshore by the tsunami waves. You are aware that several of the other volunteers are using illegal “bootleg” copies of the software against the terms of the agreement with ASRI … What should the analyst do about it?

## Case study 4: Tracking Mobile Phones in Mobility Research

In an article published in the scientific journal *Nature* a team of researchers affiliated to a northern university observed that the daily movements of human beings follow “simple reproducible patterns” that can be simulated with a “single spatial probability distribution”. Their findings are potentially significant to scientists concerned with spread of infectious diseases including COVID, traffic forecasting, emergency response, and other diffusion processes related to human mobility. The authors base their conclusions on the movements of mobile phone users whom the authors tracked using records provided by an unidentified private telecommunications company.

One set of records included the locations of the nearest cell phone tower to every call made by a sample of 100,000 mobile phone users over a six-month period. A second data set included the locations of 206 GPS-enabled mobile phones recorded every two hours for one week. Although the phone users were not informed that their locations were being tracked, the telecommunications company did disguise their records so that individuals could not be identified. Both data sets were acquired in an unidentified European country **prior** to the European Union’s adoption of the General Data Protection Regulation.

Controversy ensued when ‘*Nature’* readers and news organizations learned that mobile phone users were tracked without their knowledge or consent. In response to the controversy the researchers’ university has assembled a panel to advise its own Board about the ethical implications of location-based research. You have been asked to participate in the panel as a subject matter expert on geospatial technologies. Should the researchers in this study have been required to acquire informed consent? Under what conditions do you recommend that the Board insist that human subjects’ locational privacy be protected in future?

## Case study 5: Collateral Damage Mapping

A professional analyst employed as a geospatial intelligence expert by a national security agency is tasked to predict civilian casualties likely to be caused a missile attack on the suspected urban headquarters of an alleged insurgent leader in a foreign country. Your analysis indicates that dozens if not hundreds of non-combatants are likely to be injured or killed as a result of the pre-emptive attack. As a certified professional, what ethical obligations should the analyst consider and what should they do to honour those obligations?

## Case study 6: Low-level Radioactive Waste Siting Map

The Northumbershire Department of Environmental Protection (DEP) hires a contractor to identify potential sites for a 500-acre storage facility for low-level radioactive waste (LLRW). In collaboration with the DEP the contractor assembles a region wide GIS database that includes the geographic distributions of pertinent geological, hydrological and land use criteria. The contractor proposes to use overlay analysis to disqualify unsuitable areas. For example, areas characterized by any combination of permeable bedrock, excessive slope, or proximity to key water resources or protected lands (among other factors) will be deemed unsuitable.

The project involves two stages of screening for unsuitable areas: regional, and local. Each stage involves data fusion and analysis at larger map scales and greater detail. Public hearings are held at each stage to afford residents opportunities to ask questions about which areas have been disqualified, which are still in consideration, and why. The contractor produces reports for the hearings that explain the screening process and illustrate the geographic distributions of pertinent criteria and disqualified areas. By the second stage, three quarters of the region’s land area are disqualified. The agency hopes that communities in areas not yet disqualified will volunteer to host the facility in return for significant financial incentives. Most residents who attend the hearings, however, are determined to keep the proposed facilities as far as possible from their backyards.

A GIS analyst employed by the contractor is assigned by their supervisor to produce a regional map showing areas disqualified after stage 2. A requirement is that the map be reproducible by black-and-white photocopy, and that it fit on a 11” x 17” page so that it can be folded into a page-size (8.5” x 11”) report. The GIS analyst calculates that 1:1,500,000 is the maximum map scale at which the entire area can be shown on an 11” x 17” page. At this scale, some “islands” of potentially suitable areas surrounded by disqualified areas but large enough to contain a 500-acre facility will be too small to see.

When the analyst explains this to her supervisor, they suggest that they include on the map a disclaimer stating that “it is possible that small areas of sufficient size for the LLRW disposal facility site may exist within regions that appear disqualified on the map. The detailed information for these small areas is retained within the GIS even though they are not visually illustrated." How should the analyst respond to this suggestion?

## Case study 7: Environmental Justice Web Map

Tom owns and operates a small software development firm that specializes in web mapping. He is a certified GIS analyst. A non-profit lobbying group called “environmentaljustice.org” has approached Tom’s firm with a request for bid for a custom web mapping application to be hosted at its web site.

The web map is to show the spatial association of (a) industrial sites known to have discharged toxic substances into the environment with (b) the locations of what the organization calls “communities at risk”. Environmentaljustice.org defines the latter as areas characterized by high rates of low-income families, people with low educational attainment, people of colour, working class people, renters, and children in poverty. The web map will be freely available to anyone who has access to the Internet through a properly configured web browser.

Most data are from the recent census and all of the data layers the map will combine are public records – although they have not been combined before at a national scale and in such an interactive format.

The organization’s goal is to promote public awareness and concern about what it considers to be the unjust exposure of underprivileged people to the risks associated with industrial pollution. Because of a benefactor’s very large donation, the organization is able to offer Tom a very lucrative contract.

Included in the data to be mapped is open data compiled by the Environmental Protection Agency which pinpoints industrial sites known to have discharged toxic substances.

Meanwhile, a large firm that produces glass fibre has learned about the planned web mapping project, and is already considering legal action to block it. The firm is concerned that the web map is likely to be misinterpreted by novice viewers, and that the firm will be among those accused of exploiting communities at risk. Lawyers are prepared to argue that thematic maps of this kind reveal spatial relationships, but cannot prove causation or intention. The firm and others like it feel that it is libelous to promote the notion that they locate factories near neighbourhoods that have the least political influence. Furthermore, they are concerned with the accuracy and completeness of the data that will be mapped. For example, some toxic release information is confidential, while some companies do not accurately report the number, types and volumes of pollutants released. Honest companies (such as this glass fibre firm) will be penalized unfairly, they believe.

Environmentaljustice.org has presented the project concept at public meetings around the country. The project has attracted endorsements from some communities, including one that blames a disproportionate incidence of lung and stomach cancers on the toxic releases of a nearby chemical plant. Residents of this and other neighbourhoods welcome the visual evidence that they hope will compel court action against local industrial polluters. However, other community groups are sceptical of the planned web map because they fear the implications of lost jobs and tax revenue if employers are forced to shut down.

Tom is ambivalent about submitting a bid for the lucrative project. He knows that his small firm is qualified to create the web mapping application, that the necessary data exists, and that the contract would benefit the company, its employees and their families substantially. On the other hand, he knows that his small firm would be vulnerable to legal action by a large corporation, that the glass fibre firm’s concerns about data quality and potential misinterpretation are valid, and that his reputation could suffer if the project is discredited. If you were Tom, how would you decide the right thing to do?

Case studies heavily adapted and simplified from <https://sites.psu.edu/gisethics/>.