Smartphone-based volunteered geographic information for land registration: the case of the Scottish crofting community

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Summary

Many countries lack proper land registers, which is not surprising given the high cost and long timeframe to produce highly accurate cadastres. Employing volunteered geographic information as a cheaper and quicker alternative for this purpose is gaining recognition, with the latest tool being the smartphone. This paper investigates the socio-technical issues surrounding this approach, with the Scottish crofting community as a case study. Crofters tested CroftCappture, which records boundary points and saves geotagged photographs and descriptions. Results show there is added value in recording multimedia to help clarify boundary complexities and record stories about crofts which would otherwise be lost.

KEYWORDS: land registration, crofting, smartphones, volunteered geographic information, location-based services

1. Introduction

Land registration is crucial in ensuring land tenure security and facilitating good governance, and is linked with increased land value and the stimulation of investment (Feder and Nishio, 1999; UNECE, 2005; De Vries, Bennett and Zevenbergen, 2016), forming an essential part of land administration systems (LASs). Dysfunctional LASs lead to problems such as boundary conflicts and land degradation (McLaren, 2011b). Highly accurate, traditional surveying methods are incompatible with the needs of those regions lacking proper LASs. The sheer cost and time involved to hire land professionals to generate accurate and standardised land information is a major barrier to many governments in putting such systems in place (Dale and McLaughlin, 1988; Indufor, 2014; McLaren, 2014). Cheaper, widely available tools to collect and identify spatial information, employed in a VGI context, are therefore recognised by some as a useful, 'fit-for-purpose' alternative (Adlington, 2011; McLaren, 2011b, Moreri, Fairbairn and James, 2015; 2016; Petrelli, 2015).

One of the latest VGI techniques being explored for land registration is the use of smartphones, given their capabilities as ubiquitous, low-cost devices (McLaren, 2011a). Markedly interesting amongst these capabilities is the ability to add descriptions and photographs. These capture additional information that is otherwise lost in a purely geometrical shapefile and can provide invaluable context. Such 'informal' forms of tenure recordation often underpin a more complex system of land rights (UN-Habitat, 2012). While the technology for smartphone-based VGI for land registration is in place (e.g. FAO's Open Tenure and USAID's Mobile Application to Secure Tenure), little has been researched about the socio-technical implications of this approach in recording (complex) cadastral information among communities (McLaren, 2013). This research seeks to contribute to this gap through a case study on the Scottish crofting community.

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Crofts are agricultural units of under 50 hectares falling under specific legislation, dotted around designated crofting areas (Figure 1). Digital, map-based croft registration is far from complete. The Crofting Commission recognises the importance of an up-to-date Crofting Register in providing reassurance and tenure security to crofters (The Scottish Government, 2009). The Scottish Crofting Federation (2009), however, urges registration to happen in a more participatory manner, so incorporating VGI in the process would seem a favourable solution. It further stresses the inability of the current registration process to capture the complexities inherent to croft boundaries. In that sense, the ability of smartphones to record alternative forms of boundary evidence could address this issue.

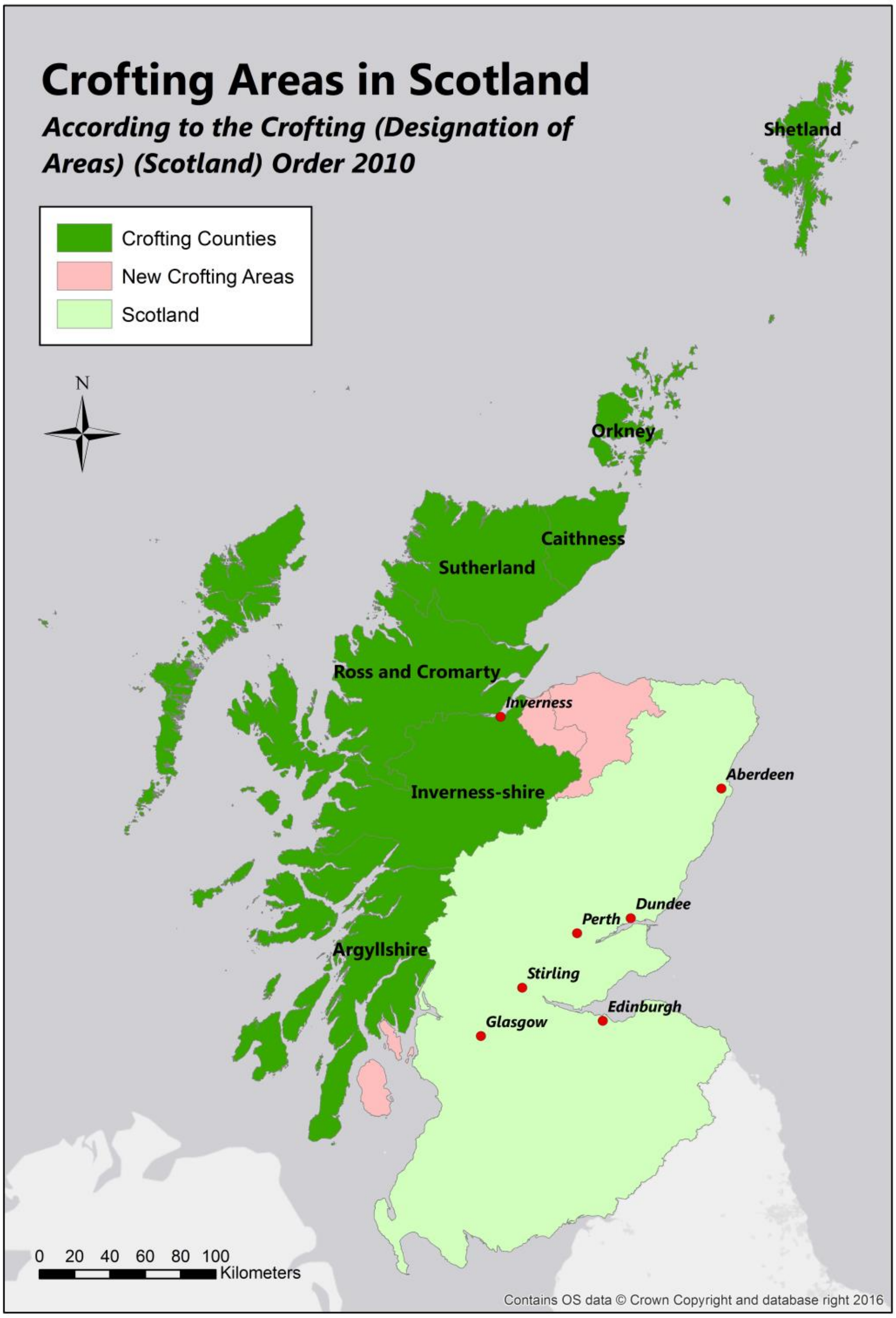

Figure 1 Designated crofting areas in Scotland.

2. Background

The benefits of using VGI in land administration include the reduction of costs and time for cadastral mapping, transparency and simplification in official land registration procedures, and the participation of citizens in the accuracy improvement of cadastral data (Basiouka, 2016). Some may not envision a VGI approach fully replacing professional cadastral mapping, but see it as having the potential to improve land information systems through the provision of supplementary information that has greater currency over existing systems (Navratil and Frank, 2013; Roberts et al., 2013; Basiouka and Potsiou, 2014; Clouston, 2015).

Despite VGI being deemed as promising in land administration, researchers have expressed their concern over the rigour, precision and validation of such an approach, as well as the technical expertise and access to the technology required, and the socio-technical impediments and digital divide that can exist at multiple levels within and outside a community trying to record their land. It is clear that where boundary data and land rights information are crowdsourced, there must exist frameworks for recording the quality of that data (Laarakker and de Vries, 2011; Keenja et al., 2012; Rajabifard, Kalantari and Williamson, 2013; Sanchez-Rodilla Espeso, Mackaness and McLaren, 2013; De Vries, Bennett and Zevenbergen, 2015; Lin, 2016; Navratil and Frank, 2016). Also needed are ways of validating the data and ensuring it is of a form that can be used alongside pre-existing, more formal data sources (Bégin, 2012; Fonte et al., 2015). Furthermore, while VGI is increasingly being accepted by governments at various levels, regulations and legislation hamper the progression of its use, for instance in land registration (Haklay et al., 2014).

3. Methodology

CroftCappture[‡], an Android application relying on location-based services to capture evidence (coordinates, descriptions and photographs) of croft tenure was developed to support this research (Figure 2). Crofters were presented with the application and asked to collect evidence of their croft (Figure 3). Their feedback served to reveal whether they see additional benefit in being able to capture alternative forms of evidence, and what concerns they have in terms of trust and validation.

Figure 2 The evidence collection interface of CroftCappture.

[‡] The Android Studio project and APK file can be found at https://drive.google.com/file/d/0Bzjt5oBNvNY9dWZtTUFfajMzeWM/view?usp=sharing. Note that CroftCappture is only fully functional within the United Kingdom due to the extent of Ordnance Survey mapping.

Figure 3 Evaluation of CroftCapture with crofters.

4. Results and discussion

The geographical spread of crofts, the difficulty of contacting crofters and a hesitancy to be involved meant that only two crofters participated in field experiments. The poor level of participation may in part be due to a suspicion of new technology. For example, crofter B asked if the application was capturing other information unbeknownst to him (such as land quality). Crofter A suggested that crofters 'not following the crofting tradition' would not want to participate in any activity that they thought might reveal this.

Crofter A pointed out a nearby sliver of 'no man's land' as well as a neighbour's fence being offset a few metres from the original boundary wall in order to avoid having to maintain the wall (Figure 4). There were issues over shared responsibility for access roads. Broader discussion revealed considerable complexity to a croft boundary than the simple measurement of the position of markers. The Scottish Crofting Federation (2009) suggests that clarification over such vagaries may indeed lead to new disputes, yet the current croft registration process does not include any efficient or low-cost mechanism for dispute resolution; the only option is an expensive court settlement. Establishing boundaries in a manner that captures all the complexities surrounding them would require a more participative mapping procedure, preferably as a community. Crofter A highlighted the potential of CroftCappture in gathering historical and contextualising information such as transmogrified boundary markers (photographs 14 and 15 in Figure 4), dykes that were a remnant of the Highland Clearances, stonework from nearby clava cairns, and strainer posts that mark former croft boundaries – information that is otherwise lost in digital systems.

Crofter A revealed the difficulty in getting crofts registered and the cost associated with professionals having to resolve boundaries. The Scottish Crofting Federation (2009) has pointed out that the registration process put into place by the Crofting Commission hardly reflects the difficulties and expenses involved in registering a croft. Both crofters A and B see that CroftCappture could be beneficial in terms of reducing costs and effort in getting their crofts mapped (e.g. crofters B took 1.5 hours to map his croft, as opposed to perhaps weeks of correspondence with the Crofting Commission to get the mapping right). Reflecting on its functionality, the crofters suggested its use for recording land use, or as basis for land improvement grants. Offering such additional services on the back of their submissions could entice participation in land registration.

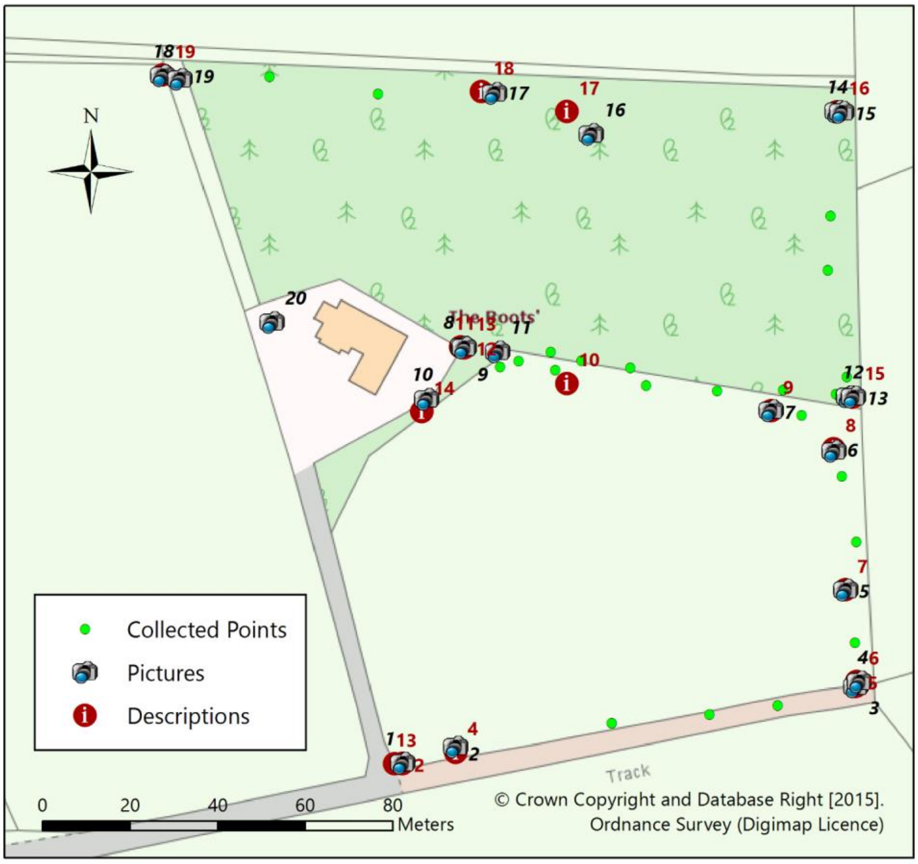

Figure 4 Map of the evidence collected by crofter A.

Figure 11 (continued) Selection of photographs (in parentheses) and corresponding descriptions – 1. Old boundary marker (1). 4. Dyke left over from the Highland Clearances (2). 5. Changed boundary (3). 7. Shared boundary with maintenance (5). 8. Corner marker (6). 9. The forest is part of the croft land (7). 12. Original croft boundary (8). 13. Original croft boundary (11). 16. Transmogrified boundary (14, 15). 19. No man's land (18, 19).

5. Conclusion

Some of the shortcomings in the accuracy of a smartphone-based VGI approach to land registration could also be overcome using other VGI approaches such as community mapping (supported by high-quality base maps), which would, for instance, give the opportunity for dialogues between crofters to settle any disputes that may arise. In that sense, a fusion of VGI approaches would be the ideal solution. In countries where no land register is in place, this level of positional accuracy may be acceptable as the technology still manages to provide some form of land boundary information (i.e. it is 'fit-for-purpose'). In either event, it highlights the importance of gathering photographs and descriptions that could help clarify boundary descriptions, such as markers that are inaccurately placed or boundaries in dispute.

The multimedia functionality of a system like CroftCappture could be exploited by land owners and tenants interested in telling a story about their land, especially in cases where land ownership is fundamentally intertwined with storytelling (e.g. the Aboriginals; Verran, 1998), or where boundaries are complex by nature. It could also include use as a reporting tool for malpractice in land matters. Crofters could be further incentivised to use CroftCappture if it simultaneously gathered other information relevant to improved husbandry or land improvement grants.

Whilst many report on technical aspects of mobile services, this research has highlighted socio-technical issues that need to be addressed if widespread adoption is envisaged. There are issues of trust and the circumspect nature of crofting communities, with their strong sense of independence and place. There is the potentially subjugating role of technology when it is seen as merely reinforcing traditional hierarchical practice in the gathering of cadastral information. So, in certain countries where the STDM is gaining recognition this approach is already being implemented; where LASs have only just departed from standards of high accuracy and pure geometry, and authorities are just starting to learn that a boundary is more than simply a line, it will take more time.

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7. Biography

Rica Duchateau obtained an MSc in Geographical Information Science from the University of Edinburgh in 2016, of which her dissertation forms the basis of this paper (see Duchateau, 2016). She currently a Graduate Technical Associate at Informed Solutions, a leading independent geospatial IT and digital transformation consultancy with its head office in Altrincham, Greater Manchester. Her interests include using GIScience for the benefit of communities, particularly in less-developed countries and disaster modelling.

William A. Mackaness is a senior lecturer in GIS at the University of Edinburgh. His interests are in visualisation methodologies in the context of smartphone technology.

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