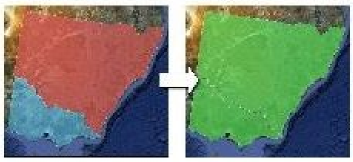
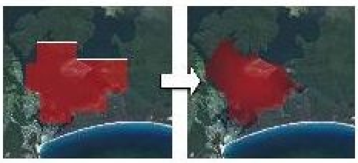
LET THE DIALOGUE BEGIN

Beyond Cadastre 2014

Multipurpose cadastres, Cadastre 2014, and sustainable land administration have radically altered understanding of cadastres and their potential over the last thirty years. Many of these concepts continue to be relevant. However, the world is not in stasis, so cadastral science must anticipate and facilitate emerging change. The authors present six design elements relating to the role and nature of future cadastres as a starting point for further dialogue.





Globalised society will affect the design of future cadastres. Firstly, will be a need for survey-accurate cadastral data; secondly, a shift in focus from land parcels to property objects. Third will be a need for height and time information, and fourth for real-time updating and accessing cadastral databases. Then there are complex commodities in the land market traded worldwide that induce the need for regional and global cadastral networks, and a requirement to model the organic natural environment. These factors will be elaborated here, including progress status and what needs to be done.

Survey Accuracy
Digitising cadastral paper maps, carried out in the1980s and 1990s, significantly diminished accuracy. Whilst earlier paper-based cadastral plans exhibited survey accuracy (sub-centimetre), this is not so for many modern digital cadastre databases; crude digitisation of paper maps introduced large errors (Figure 1). Many applications will require survey accuracy, including building management, utility administration, infrastructure organisation, precision farming, navigation and sea-level rise response. Not only will survey accuracy be needed for ownership parcels, but also the hundreds of new and emerging property objects, so as to accurately understand the complex layering of property interests. Countries and states equipped with survey-accurate cadastres are far better placed to manage these challenges. A good amount of literature describes the concept of survey-accurate cadastres. However, the majority has been based on experience from New Zealand, Malaysia, Israel and Australia. An audit of other jurisdictions appears necessary. The desire for survey accuracy has recently been informally described as a preoccupation of uncertainty-averse surveyors: fitness for purpose would be a better goal. Whilst this might be true, a survey-accurate cadastre will presumably fit all purposes and therefore remain an ongoing aspiration, particularly as costs fall and expertise required for implementation becomes less.

Property Objects
The proliferation of new property rights, restrictions and responsibilities will force a shift in focus from land parcels to property objects. Parcels will continue to be an important people-land organisation tool. However, many new interests exhibit vastly different spatial footprints (Figure 2). Much theoretical work has been undertaken, such as the Land Administration Domain Model using the UML object-oriented language. Practical implementation will require smart investment and re-engineering of cadastral systems and processes.

Height and Time
Management of vertical villages, proliferation in property interests, and sustainability analysis require modelling and visualisation of the third (height) and fourth (time) dimensions (Figure 3). Availability of the third and fourth dimensions will greatly reduce administrative friction caused by misinformation and poor understanding of property interests, and thus planning and development times. Preliminary work undertaken to understand legal and other barriers, coupled with ongoing technical advancements, will enable the extension of traditional 2D cadastres to 3D and 4D.

Real-time
Emergency management, property-market management, fiscal policy, and navigation tools require cadastral information to be updated and accessed in real time. Updating may currently take weeks or months in most jurisdictions. To date, mobile computers and GPS units enable utility companies to achieve real-time updates across their networks. This technology will also enable cadastral surveyors to

measure and instantaneously update while in the field. Robust checking processes will continue to ensure integrity. Although there exists minimal literature on real-time cadastres, research on marine-management systems may provide initial clues, since these aim at modelling extremely dynamic environments.

Regional and Global

Globalisation clearly affected mortgage-backed certificates and other complex commodities in the land market. For example, a lack of accurate and timely information led to international investors purchasing toxic US property commodities as information on the mortgage practices in the US became available too late. Interoperable cadastral systems would appear to offer a method for integrating and better understanding the relationship between land markets (Figure 4). In these, as with international share trading, high-integrity information will be essential for organising investments. Regional links between states, countries and other jurisdictions are already emerging. An example is PSMA Australia's ‘Cadlite', which provides an aggregated model of Australia's inherently state-based cadastral systems. Moreover, technical standardisation such as the Land Administration Domain Model, legal property object model, and Australia's ePlan initiatives will enable easier interoperability between systems. Problems and concerns about the environment are often spread over multiple jurisdictions, so environmental management also requires integration of cadastral systems at regional and global levels. The Murray-Darling Basin in Australia provides an example. The European Union is working on standardising the cadastral domain to enable integration in the medium term. The Asia-Pacific region, through the Permanent Committee on GIS Infrastructure for the Asia-Pacific (PCGIAP), has also conducted preliminary work on linking regional and global cadastral networks.

Fuzzy and Organic

Many new property interests are designed around natural phenomena rather than the strict bearings and distances or Cartesian coordinates found in traditional land parcels (Figure 5). For example, many interests in the marine environments exhibit fuzzy and changeable boundaries. Legal controls protecting flora and fauna or the land interests of indigenous communities, such as those found in developing countries, are often vague and require new tools for representation and management. The continuous movement of such boundaries can be measured and visualised within the cadastral framework using Ambient Spatial Intelligence achieved through Wireless Sensor Networks.

Much Still to Do

While much theoretical work has got underway on some elements, work is still needed on all. Collaborative research, most likely through the FIG Commission 7 framework, would enable further development of design concepts and assist in defining the nature and role of future cadastral systems.

Acknowledgements

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Further Reading

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