



Article

Fit for Purpose Community Mapping in South Africa

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Abstract

Communal areas in South Africa invariably lack cadastre and other information needed for sustainable planning. Usually land ownership is unclear and only limited state capacity exists in providing basic services infrastructure. This paper describes community mapping as a participatory means to encourage development. The impact of community-based mapping is assessed and if participatory methodology can fulfil its well-known objectives. Reflections on two community-based mapping projects facilitated with residents show that in these circumstances, community-based mapping is effective in bringing about change. Flamingo Crescent is an urban informal settlement located in Lansdowne, Cape Town. Informal settlements such as these are high density and organic, making service delivery difficult due to the lack of space. Re-blocking is an in-situ method of upgrading an informal settlement so that basic service and access can be provided. The Goedverwacht Moravian Mission Station in the Western Cape has no internal cadastral boundaries and therefore the spatial framework is fuzzy and confusing. The objective of the study is to use a mapping technique that is economically viable, fast and at an accuracy determined by purpose rather than technical and legal requirements for formal land registration. Findings spotlight some of the advantages of community-based mapping during these projects by assessing their impact using critical outcomes of participation, empowerment and ownership.

Keywords: community; mapping; participatory; informal settlement; re-blocking

Introduction

Land reform and housing availability in South Africa are contentious issues that have arisen from a past in which race was used as a basis to regulate people and marginalise the majority.¹ In South Africa, land reform and housing are constitutional imperatives. Section 25 of the Constitution addresses land reform, while section 26 addresses the right to housing.² One aspect of land reform is to address land tenure security for those deprived of it as a result of racially discriminatory laws.³

Between 1994 and 2000, various pieces of legislation were enacted in response to the state's obligation to provide secure land tenure and affordable housing to its citizens. In 2004, the ANC government launched a programme called Breaking New Ground (BNG). The objective of BNG was to alleviate poverty, improve the quality of life of the poor, promote economic growth and develop sustainable human settlements.⁴ BNG policy is significant in that it refocuses housing delivery from subsidised housing units to the development of sustainable human settlements.⁵ The plan was to gradually eradicate (upgrade) informal settlements by 2014. Informal settlements are described as unplanned developments located in geographically disjointed areas. These settlements usually have limited access to basic services and no form of land tenure security.⁶ Although these settlements are undesirable, they do provide people with a low-cost option to shelter. Following BNG, a programme to upgrade informal settlements was introduced.

In 2012, a National Development Plan was implemented with the aim of examining how poorer people access land, and to develop legal instruments to regularise informal settlements and recognise residents' rights. The realisation that a national informal settlement development programme was necessary led to the National Upgrading Support Programme, which supports in-situ informal settlement upgrading.⁷ Since 2013, the Department of Rural Development and Land Reform has launched a number of new policies and proposed amendments to laws.

This article argues that meaningful citizen participation is necessary to ensure effective transformation in line with government policy and the United Nations Global Development Agenda and Sustainable Development Goals. A one-dimensional citizen participation structure is not suggested, but instead a process through which citizens can participate in voicing their concerns and implement their needs in conjunction with local government strategies. This study advocates a simple, participatory, fit-for-purpose, mapping approach where residents gain local knowledge and are able to communicate their aspirations using maps. Community mapping is intended to articulate and communicate spatial knowledge from inside communities to outsiders.

Formal land administration systems in South Africa cannot cope with non-formal land rights arrangements found in communal areas and informal settlements,⁸ The result of this is a lack of reliable land information and lack of development planning. It is up to these communities to collect information and regulate themselves. Linking people to land and collecting multilayered data locally is easily done using techniques such as Global Positioning System (GPS) enabled smartphones and tablets, and paper maps combined with satellite imagery and mobile Geographic Information System (GIS)/GPS.⁹ Smartphone applications and out-of-the-box GIS domain-specific software can easily be configured for non-technical people to use. Community mapping allows information to be supplied by non-specialists who are better able to express their needs, priorities and goals. The purpose of this is to pre-empt development and prepare the community for change. A community-driven Participatory Geographical Information System (PGIS) is used to manage local spatial data and provide residents with an opportunity to participate in development. An interim general plan drawn by the community becomes the basis for facilitating planning that is flexible, dynamic and locally desirable.

Two community-based mapping projects are used to examine the impact that community-based mapping has on the outcomes of these projects. The following section examines the concept of fit-for-purpose community mapping. Thereafter, the two community-based mapping projects are discussed. The conclusion summarises the preceding discussion, drawing together citizen participation and fit-for-purpose community mapping as an interim measure to boost morale, assist local government and promote transformation.

Fit-For-Purpose Community Mapping

Communicative planning is a contemporary, pro-poor planning theory that tackles poverty. This planning theory is very effective in fostering community participation.¹⁰ One of the problems with the model is in the public participation process itself. Planners in South Africa who follow devised theatrical guidelines on public participation seldom actually make the participants part of the process.¹¹ One way of improving both participation and communication in this regard is by implementing a physical mapping exercise. The mapping process is used as a vehicle for planners to communicate with residents and understand their interests. The mapping process is a combination of participatory, community and cognitive mapping methods at an accuracy fit-for-purpose. This combined mapping method is linked to the communicative planning model. Community mapping is based on the theory of community rationality, grounded in Habermas's (1984) assumption that reason is inherent in communication, and is concerned with clarifying the normative procedures by which agreement can be reached. The understanding is that human and natural systems interact holistically as a complex adaptive system.¹²

Community mapping is synonymous with community-based planning, whereby strong and functional synergy is encouraged between local government and communities. Community mapping also lends itself to the concept of subsidiarity, whereby citizens are directly responsible for managing collective needs and activities of general interest within the community.¹³ Community mapping offers grass-roots activism where citizens are mobilised to lobby local government for better services.¹⁴ An important aspect of community mapping is risk analysis. Understanding risk generally requires up-to-date detailed spatial data. Resilience has received much attention in recent years.¹⁵

The following subsections link complex adaptive systems; subsidiarity and participation; community activism and empowerment; and resilience and ownership to the community-based mapping process.

Complex Adaptive Systems

A 'simple and predictable' community can essentially be managed by means of a systems-planning approach where centralised decision making and authority is applied. However, communal settlements are unpredictable complex systems that are non-reducible and require diffusion of power. A system comprises many things or entities, referred to as agents. A complex system comprises agents that interact in a non-linear dynamic manner governed by rules. A complex adaptive system is a system in which the agents adapt, rather than the system as a whole. Such complexity requires a holistic integrated planning approach, where the emphasis is on the components within the system and their mutual influences.¹⁶ The assumption is made that community mapping is an effective means of documenting spatial behaviour and measuring self-organisation and adaptation.

Subsidiarity and Participation

Horizontal subsidiarity is a system where individuals or associations are directly responsible for managing the communal needs that are of general interest within the community.¹⁷ Subsidiarity creates opportunities for dialogue and exchange among different viewpoints and approaches to reach shared decisions independently of political affiliation or party representation. In the situation where municipalities are weak, indifferent or thinly stretched, it is important that creative technical capabilities are developed within the community so that physical projects can be prepared and managed.¹⁸ Dedicated and creative community teams are needed to conceive, plan, finance, organise and implement development schemes on the ground. Communities that have the capacity to use multiple innovative mindsets are able to solve problems better and focus on priority issues. Community mapping, and the networking of ideas and perspectives, is a key feature in the success of projects.

Community Activism and Empowerment

Community mapping is grounded in grass-roots activism where each individual has a chance to give their view on developmental issues. In many cases, local residents in communal areas of South Africa do not know the legal and institutional arrangements that govern land tenure reform in their communities, and they have no platform to enquire or voice their concerns. Often, locals are adversely affected when development decisions are taken on their behalf, causing uncertainties and tensions among them.¹⁹ Grass-roots community mapping ensures that inhabitants are more informed about policies and policymaking.

Spatial Resilience and Ownership

Spatial resilience implies that a system can: (1) have the same identity while undergoing change; or (2) be flexible and deal with the unforeseen; or (3) simply recover to its previous steady state. If the change exceeds a critical amount, then the system starts functioning in some other way.²⁰ This can result in the system developing a different identity. The types of social environments of the system will influence how much they can change before they reach a threshold. This can be seen as a measure of their resilience.²¹ Resilience is difficult to measure. A deeper understanding of system dynamics can provide a better understanding of resilience.²²

The Case of the Flamingo Crescent Informal Settlement

The Department of Town and Regional Planning at the Cape Peninsula University of Technology (CPUT) was invited to assist with the in-situ re-blocking services upgrade of Flamingo Crescent in March 2013 as a supporting organisation.

Background

The community of Flamingo Crescent is located in an industrial area on property zoned public open space that is owned by the City of Cape Town. The settlement is comprised of 104 households, 405 residents, of which 95 per cent are unemployed and the majority are elderly.²³ The settlement was founded in 2007 when the City of Cape Town relocated vagrants in the area to the site. Informal settlements such as these are high density and organic, making service delivery difficult due to the lack of space. Re-blocking is an in-situ method used for upgrading informal settlements so that basic services can be provided without relocating residents. Existing structures are broken down and rebuilt in a more organised way so that space is made available. The re-blocking process is community-led, where demolition and rebuilding is done mostly by the residents themselves (see Figure 1). The mobilisation phase of the upgrading project starts with a community-based daily savings scheme. The money saved is used to contribute financially to the cost of new top structures. The Flamingo Crescent community contributes 10 to 20 per cent to the cost of their top structures through the community-based daily savings scheme.²⁴ The remainder of the cost of the top structure is funded by the community-based non-government organisation Community Organisation Resource Centre (CORC). The municipality provided sewerage, water, electricity and grey water drainage to each household, as well as roads and storm water system. Before demolition takes place, a map is drawn showing existing structures and their floor area. The map, in this case, is the first comprehensive land register that records land occupation and tenure claims made by the residents.



Figure 1 Trust permits residents to confidently dismantle their structures and rebuild them according to the new approved spatial layout.

Aim of the Project

The aim of the project is to provide the community technical support for the mapping process using CPUT students who are undergoing training in GIS. A holistic and collaborative approach is taken, where community participation is encouraged and keeps central to the process that residents of informal settlements be the determinants of their own development agenda.

Objectives of the Project

Objective 1: Mapping and enumeration

Objective 2: Reconfiguring the spatial layout to accommodate services – this includes the redesign of top structures, public space and roads.

Objective 3: Reciprocal learning – the transfer of knowledge between community residents and CPUT students.

Objective 1: Mapping and Enumeration

The first phase of the mapping exercise is to draw a sketch of the spatial layout of the community. This includes top structures (shacks), access points, roads, tracks, paths, water points and toilets. The sketch is drawn independently by the community without assistance (see Figure 2). The sketch is intended to provide a record of how the community perceive their assets. A second map is drawn by the community, assisted by CPUT students, using measuring equipment. Measurements are taken around the perimeter footprint of the structures using a tape measure. Corners points are geo-referenced using Global Positioning System (GPS). The accuracy of the measurements is important so that floor areas can be correctly calculated. Each household is entitled to the same space they occupied before, based on these measurements.



Figure 2 Top left – Community map drawn with the help of CPUT students; Bottom left – Community sketch; Right – Cardboard cut-outs of top structures reorganised by residents to facilitate service delivery.

Objective 2: Reconfiguring the Existing Spatial Layout

Once the mapping is complete, a new spatial layout is negotiated. Technical teams within the partnership are appointed to assist with a new spatial layout design. A qualitative approach is taken whereby residents actively participate in the design by physically positioning scaled cardboard cut-outs of their shacks, making up the new spatial configuration. The participation of residents results in a layout that is centred on lived space rather than technical metrics (see Figure 1).

Objective 3: Reciprocal Learning

During the mapping process, student and residents were confronted with different perceptions of what development is and what it means for them. The development of informal settlements tends to bypass public participation, leaving residents with no knowledge of their rights. It is important for residents to understand the role of space in relation to the state, society and capital. Movement is another critical issue that is misunderstood in an informal settlement. The need for access, and mobility for pedestrians, goods and services, as well as the general public, need to be considered. Residents were able to learn more about the importance of space in relation to their environment.

Concluding Remarks

Re-blocking provides an interim and incremental approach to improving the lives of informal settlement residents. Community mapping helped residents build a sense of place and a sense of belonging, which translates into a sense of well-being. Although the outcome is ultimately to provide improved services, the mapping process includes residents who are marginalised in the community. The new spatial layout provides access to public services, well defined courtyards and spaces, which are primary drivers for community building.

The Case of the Goedverwacht Moravian Mission Station Project

Goedverwacht is a communal village situated in the Western Cape's Bergrivier Municipality. The mission station falls under the trusteeship of the Minister of Land Affairs in accordance with the Rural Areas Act 1987.²⁵ The implication of this is that the community does not fall in the jurisdiction of the local municipality, and is therefore responsible for its own development and services provision. The settlement consists of approximately 500 households that have developed informally along the Platkloof River.

Background

The newly enacted Western Cape Land Use Planning Act 2014 (LUPA) repeals the Rural Areas Act 1987, and requires that all land within a municipal boundary not regulated by a zoning scheme or town-planning scheme be included in an existing zoning scheme as contemplated in Section 33(1) of the Act. This must be done within five years of the Act being implemented, which in this case is 2020. The consequence of this is that Goedverwacht can no longer continue as a communal village, which will have a profound impact on the way the settlement is managed.

Although residents of Goedverwacht do not have secure legal tenure to their properties, they do have the long-term guarantee of rights to their properties, administered by the church. To date, South Africa does not have a legal system for registering an individual's right to land that is predominantly based on shared use in a community. The Communal Land Tenure Bill 2017, published on 18 August 2017, aims to address insecurity of land tenure in communal areas, and to deliver a legal registration framework for communal land. The Bill makes provision for a land rights enquiry to investigate suitable land tenure options for the community. To implement this, the Department of Rural Development and Land Reform needs to appoint a land rights enquirer to consult with members of the community and interested parties.²⁶ The responsibility of the land rights enquirer is immense and unrealistic, considering the intensive consultation that is needed with residents to understand community dynamics.²⁷ Records of land rights in a communal area are usually controlled at the community level and are not necessarily recorded in a formal manner, thus close consultation is needed to establish who has rights to what. It might not be that one person has sole rights to a piece of land, but shares it with many people who claim different rights at different times. Only once these multiple land rights are made visible can a fair assessment be made as to the way forward.

The Goedverwacht project attempts a community-led land rights enquiry that is done before the formal enquiry. The purpose of the enquiry is to establish the community's view concerning the current land tenure system, and whether it is perceived as providing adequate land tenure security or not. This information will allow the community to lobby government when need be.

Aim of the Project

The aim of the project is to produce a land-use map that depicts general property boundaries and community assets. The purpose of the map is to prepare for of a government-implemented land right enquiry. This will aid the transition from customary land administration to a formal one.

Objectives of the Project

Objective 1: Determine property boundaries using a general boundary approach (see Figure 3). Multilayered data is collected locally using technology such as GPS, quad-copter drone, enabled smartphones and tablets, paper maps combined with satellite imagery and mobile GIS/GPS.



Figure 3 Property boundaries were determined from topographical features such as wire fences, walls and hedges. When boundaries were not well defined, residents assisted by drawing sketches.

Objective 2: Build a GIS that emulates a land information system that is affordable, accessible and upgradeable.

Objective 3: Identify community assets and strengthen social relationships.

Objective 1: Property Boundaries and Land-Use Map

Aerial photography is used initially to collaborate with residents. Residents identify their boundaries and other information relating to their properties. Residents are encouraged to draw sketches of their neighbourhood. During consultation, residents describe what resources they have and how they contribute to their livelihood (see Figure 4). This information is captured in a GIS along with other information, such as residents’ social values and aspirations. GPS technology is used to coordinate and measure features such as building footprints, roads, tracks and paths. Large-scale aerial photographs were obtained using a quad-copter drone at approximately 100 m above ground. The accuracy of the map is fit-for-purpose and not as stringent as the accuracies required by the Land Survey Act 8 of 1997. The Act requires property boundaries be physically beaconed and surveyed by a land surveyor, then approved by the Survey General. The formal method is expensive and time-consuming and not appropriate at this stage of the enquiry.



Figure 4 CPUT students engage with residents during the mapping process. The general plan is a visual document that is also effective for negotiating and lobbying local government.

Objective 2: Land Information System

Spatial data is captured in a GIS comprising spatial data and alphanumeric attribute data. The GIS is required to be simple and easy to use. Out-of-the-box GIS domain-specific software is configured for non-technical people to use. The GIS data is managed by CPUT students.

Objective 3: Community Assets and Social Relationships

The mapping process has been extended over three years, allowing community members to acquaint themselves with the project and participate at a pace with which they feel comfortable. The general plan is a visual document that is effective for negotiating and lobbying government. The emphasis is not only on the map, but also on the mapping process.

Concluding Remarks

An interim cadastral plan is drawn representing land use, general property boundaries and community assets. The map can be used by the community to lobby local government in a bid for a community-driven solution. The accuracy of the demarcated boundaries is defined by the purpose, thus reducing unnecessary time and cost. Because the map is derived at a grass-roots level, all residents are included in the process despite their position in society. The mapping process is simplified so that the technical aspects of mapping do not restrict participation. During the mapping exercise, students were able to learn from residents and, in turn, residents gained knowledge about land rights and land security.

Assessment of the Success and Impact of Community Mapping in the Two Projects

Assessment Method

The three critical outcomes used to evaluate the success of mapping during the two projects are participation, empowerment and ownership (see Tables 1 and 2).²⁸ Participation is assessed by the willingness of residents to partake. It is argued that horizontal subsidiarity and participation go hand in hand. Empowerment is measured by an increase in advocacy, activism, and the ability to lobby. Lobbying in this case is grass-roots activism where each individual is given a chance to have their say. Ownership entails building resilience by taking responsibility for one's own progress. An evaluation of these outcomes does, to some extent, indicate the effectiveness of the projects. However, how good the outcomes are cannot be assessed as yet and will need more time.

Table 1 Successes and impact indicators for the Flamingo Crescent Informal Settlement project.

Flamingo Crescent Informal Settlement		
Critical Outcomes	Action by Residents	Success/Impact Indicators
Participation (willingness, desire, interest, subsidiarity)	Residents showed a vested interest in the map Measuring of top structures was cooperatively managed Enthusiastic collaboration with stakeholders	Negotiated layout approved by local government (collaborative design) Eviction fears curtailed (demolition/rebuilding done mostly by residents themselves) Community commitment to the process (no service delivery rioting)
Empowerment (advocacy, activism, ability to lobby)	Build partnerships with the Informal Settlement Network (ISN) Support academic institutions and students in the village Attend local government meetings	Local government support for a people's process Positive media coverage (television interviews and social media) International university interest in in-situ re-blocking upgrade methods
Ownership (control of data acquisition, use and distribution, resilience)	GIS database – assisted by community-based NGO (CORC) The naming of streets (new layout)	Individual postal address registered at the post office (allotment area, number and street name)

Table 2 Successes and impact indicators for the Goedverwacht Moravian Mission Station project.

Goedverwacht Moravian Mission Station		
Critical Outcomes	Action by Residents	Success/Impact Indicators
Participation (willingness, desire, interest, subsidiarity)	An agreement to support and facilitate Mobilise and stimulate residents to take action towards people-led initiatives Organise and facilitate a genuine people’s dialogue	Sustainable and continuous engagement with CPUT in compiling a land-use map (from 2015 to 2018) Willingness to host CPUT students and facilitate reciprocal learning
Empowerment (advocacy, activism, ability to lobby)	Support a less technical mapping method to include all residents in the development process	An interim general plan of property boundaries and land-use information
Ownership (control of data acquisition, use and distribution, resilience)	Build a GIS database – assisted by CPUT Land Information System	Flexibility of spatial plans, policies and land-use management systems

Flamingo Crescent Informal Settlement

Participation: Community residents were motivated and enthusiastic to take part in the project. Participation was significant, with residents contributing to the design of space. Subsidiarity principles were followed, allowing organisational matters to be handled by competent community residents. All residents were able to alter the map and update the attribute information as they saw fit.

Empowerment: The map provided residents with visual confirmation of their presence in the community. For the first time, residents were acknowledged as belonging. Advocacy, and the means to lobby local government for better services, was empowering for the residents. Trust was established, and residents confidently dismantled their structures and rebuilt them according to the new approved spatial layout without fear of eviction (see Figure 2).

Ownership: Residents took ownership of the upgrading process through the community saving scheme and the mapping and enumeration process. Despite delays and temporary disappointments, the community showed significant resilience and were able to mitigate and overcome numerous difficulties. The information obtained and presented by the community during the upgrade contributed significantly to their resilience. People who live in these settlements display extreme resilience and agency despite the unhealthy and undignified conditions. It is this resilience and agency that allows these communities to uplift themselves with the help of partnerships.

Goedverwacht Moravian Mission Station

The impact of community mapping in this project is difficult to assess because it is ongoing. The project is in its third year, and is in the process of building social capital and capacity within the community. A land information system is being built consisting of features such as property boundaries, top structures and other topographical features. Attribute data is continuously being added through engagement and crowdsourcing.

Participation: The intention is to promote horizontal subsidiarity where local government assumes a subsidiary role in planning, coordinating and possibly managing community-based projects.²⁹ The idea is to promote citizen participation and create opportunities for dialogue and exchange among different viewpoints. Community-based mapping, in this case, is intended to prepare the community for future projects. The true impact of the community-based map will become evident in time.

Empowerment: In order to establish legal cadastral boundaries in a communal area, the land must first be proclaimed as a township, then formally surveyed and subdivided into individual land parcels before being registered in the Deeds Office. This process is costly and time consuming, considering the technical accuracy and the legal processes needed. This study suggests an interim approach to demarcating land parcels at Goedverwacht, using the fit-for-purpose mapping and land administration system based on the guiding principles developed by the Global Land Tool Network, UN-Habitat and Kadaster. In so doing, residents of Goedverwacht are empowered to determine how to deal with land reform and its consequences. When the Department of Rural Development and Land Reform sends a land rights enquirer

to assist the community, residents will be in a position to lobby government and promote their ideas and desires.

Ownership: According to SPLUMA,³⁰ the principle of spatial resilience is the flexibility of spatial plans, policies and land-use management systems. The Goedverwacht community has taken steps to wrestle ownership through strategic planning and incremental gathering of information.

Concluding Remarks

Transformation in South Africa cannot afford delays. Local governments in South Africa are widely viewed as being in a state of crisis. Many municipalities are under severe budgetary constraints and are struggling to cope with discriminatory spatial geographies created in the past. The issues of land tenure reform and housing availability are critical and need attention. These real problems seek solutions that require cooperation from both the government and citizens. One of the main stumbling blocks in dealing with issues such as land tenure reform and housing delivery is the delay of effective legislation and housing backlogs. This article suggests that the solution resides in the power of the people to lobby government.

Communicative planning methodology has been effective in addressing poor and marginalised communities. However, the public participation process is in most cases ineffective. Community mapping is used as a vehicle for planners to communicate and interact with residents. Reciprocal learning empowers residents and provides them with the tools to lobby government. Community mapping is implemented at a technical level that allows non-technical people to participate. Thus, the emphasis is on what makes a place significant, rather than on the technical aspect of mapping. The accuracy of the map is fit-for-purpose and can be improved incrementally as the need arises.

CPUT students participated in two community-based mapping projects: one, an urban informal settlement and the other, a rural communal village. Both projects used community mapping to assist the community in achieving their developmental goal. In both instances, the community initiated the partnership with CPUT and defined the purpose, terms and conditions of the project. In the case of the Flamingo Crescent Informal Settlement, an in-situ re-blocking exercise was done to accommodate the delivery of basic services, which includes sewerage, water, electricity, grey water drainage, roads and storm water. The Goedverwacht Moravian Mission Station required a land-use map to facilitate the LUPA requirement of integrating the village into the local municipality's land management scheme.

Three critical outcomes are used to assess the impact of community mapping: participation, empowerment and ownership. The Flamingo Crescent Informal Settlement project provided evidence that participation, empowerment and ownership were achieved. The Goedverwacht Moravian Mission Station project is ongoing and difficult to assess; however, the results show substantial value in both the map and the mapping process. Community mapping provides valuable information regarding community assets, and encourages communication between citizens and all stakeholders.

Declarations and Conflict of Interests

The author declares no conflict of interests with this work.

Notes

¹ Van Wyk, *Planning Law*, 460; Hornby et al., 'Introduction: Tenure Practices'; Pieterse, 'Introduction', 12; Tonkin, *Sustainable Medium-Density Housing*.

² 'Constitution of the Republic of South Africa'; Van Wyk, *Planning Law*, 470; Tonkin, *Sustainable Medium-Density Housing*, 34.

³ Kingwill et al., 'The Policy Context', 53.

⁴ Van Wyk, *Planning Law*, 484; Goven, 'Kosovo Informal Settlement Upgrade', 149.

⁵ Tonkin, *Sustainable Medium-Density Housing*, 43.

⁶ Van Wyk, *Planning Law*, 460.

⁷ Van Wyk, *Planning Law*, 480.

⁸ Hornby et al., 'Introduction: Tenure Practices', 96.

⁹ Kakembo and van Niekerk, 'The Integration of GIS', 454.

- ¹⁰ Innes and Booher, *Planning with Complexity*; Healey, 'Relational Complexity'.
- ¹¹ Steyn, *Reforming Normative Planning*, 54.
- ¹² Innes and Booher, *Planning with Complexity*, 33–4.
- ¹³ Carra et al., 'From Community Participation to Co-Design', 243.
- ¹⁴ Kalandides, 'Citizen Participation', 160.
- ¹⁵ Barnes, and Nel, 'Putting Spatial Resilience into Practice'.
- ¹⁶ Nel, 'Complex Adaptive Systems'; Lansing, 'Complex Adaptive Systems'.
- ¹⁷ Carra et al., 'From Community Participation to Co-Design', 243.
- ¹⁸ Todes and Turok, 'Spatial Inequalities and Policies in South Africa', 25.
- ¹⁹ Hornby, et al., 'Introduction: Tenure Practices'; Cousins and Pollard, 'Land Tenure and the Governance of Wetlands'.
- ²⁰ Barnes and Nel, 'Putting Spatial Resilience into Practice'.
- ²¹ Cumming et al., 'Understanding Protected Area Resilience'.
- ²² Quinlan et al., 'Measuring and Assessing Resilience', 277.
- ²³ Kiefer and Ranganathan, 'The Politics of Participation', 2.
- ²⁴ Kiefer and Ranganathan, 'The Politics of Participation', 6.
- ²⁵ 'Rural Areas Act'.
- ²⁶ 'Communal Land Tenure Bill 2017'.
- ²⁷ Whittal, 'A New Conceptual Model', 10.
- ²⁸ Cochrane and Corbett, 'Participatory Mapping', 9.
- ²⁹ Carra et al., 'From Community Participation to Co-Design', 243.
- ³⁰ 'Spatial Planning and Land Use Management Act'.

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