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Recommendations for municipalities to become compliant with national legislation on biological invasions

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Background: *The South African National Environmental Management: Biodiversity Act* (No. 10 of 2004) (NEM:BA) requires all Organs of State at all spheres of government to develop invasive species monitoring, control and eradication plans. Municipalities across South Africa are required to comply with the Alien and Invasive Species Regulations under NEM:BA but are faced with myriad challenges, making compliance difficult.

Objective: This paper unpacks some of the challenges municipalities face and provides guidance on how to overcome these in order to achieve NEM:BA compliance. Through a strategic, municipal-wide approach involving different landowners, compliance can be achieved and many of the associated challenges can be overcome. For example, lack of awareness and capacity within municipal structures can be addressed through various platforms that have proven successful in some areas.

Conclusions: Using the City of Cape Town as a case study, we highlight some of the notable successes in overcoming some of these challenges. For example, the City's Invasive Species Strategy has resulted in municipal buy-in, departmental collaboration and a city-wide invasive plant tender, allowing for streamlined invasive plant control across the city. We present a framework as a first step towards measuring compliance and how the national status report can measure the level of compliance by Organs of State.

Introduction

Biological invasions are a large and growing threat to ecosystem integrity in many parts of the world and have been identified as a priority for management, both nationally (Simberloff, Parker & Windle 2005; van Wilgen et al. 2012) and internationally (McNeely et al. 2001). The International Convention on Biological Diversity (CBD) Strategic Plan for Biodiversity (2011–2020), with the Aichi Biodiversity Target Nr. 9, states that invasive species with their associated pathways need to be identified and subsequent measures be put in place to minimise their spread (McGeoch et al. 2010). Furthermore, it stipulates that priority invasive species are to be controlled or eradicated (Caffrey et al. 2014). Legislation, regulations and strategies have been put in place at a global level (Global Strategy, McNeely et al. 2001) as well as for larger regions (e.g. EU Regulation 1143/2014 on Invasive Alien Species). Numerous countries, signatories as well as non-signatories to the CBD, have taken it upon themselves to follow suit [e.g. Mexico (National Advisory Committee on Invasive Species 2010), Great Britain (Great Britain Non-native Species Secretariat 2015)]. Similar approaches have been adopted at subnational levels, such as regional (Virginia, USA [Virginia Invasive Species Working Group 2012]) or specific areas, such as cities (Brisbane, Australia [Brisbane City Council 2013]) or nature reserves (Maunakea, Hawaii [Vanderwoude et al. 2015]).

Globally, urbanisation is on the rise, with an estimated 50% of the world's population currently living in cities. This trend is expected to increase drastically in the next few decades (Faeth, Saari & Bang 2012; Grimm et al. 2008). Increased urbanisation results in increased introductions of potentially invasive species to these human-dominated landscapes.

Biological invasions in urban areas are of concern as they can have considerable impacts on urban biodiversity and ecosystem services (Kowarik 2011). Cities are often points of introduction of non-native species (Pyšek 1998; Vitousek et al. 1997), and the associated large variety and frequency of pathways and vectors aids in the movement of species within an urban environment and surrounding areas (Alston & Richardson 2006; Hawthorne et al. 2015; von der Lippe & Kowarik 2008). In cities, non-native species encounter climatic conditions, habitats, hydrology and soils

Note: This paper was initially delivered at the 43rd Annual Research Symposium on the Management of Biological Invasions in South Africa, Goudini Spa, Western Cape, South Africa on 18-20 May 2016.

that have been profoundly altered by human activity, amplifying the establishment and spread of these species (Klotz & Kühn 2010; Kowarik 2011; Pickett et al. 2001).

Urbanisation and the associated introductions of non-native species present a significant challenge to people and landscapes in South Africa (van Wilgen 2012). The trade in ornamental plants and pets, and other enterprises that rely on non-native taxa, continues to introduce new species into urban areas, many of which remain undetected or unregulated, or both (Cronin et al. 2017). Invasive species management in urban areas is challenging for a number of reasons. Numerous entry-points, vectors and pathways within urban areas lead to high propagule pressure of invasive species (Kowarik & von der Lippe 2007; Pyšek 1998). Stakeholders in municipalities are numerous and often have strongly divergent views about the impacts and benefits of particular invasive species, and as a result, significant conflicts arise over the management of such species (Dickie et al. 2014; Gaertner et al. 2016; Zengeya et al. 2017).

The National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA, hereafter referred to as the NEM:BA Act) covers all aspects of South Africa's biodiversity conservation and management at a country level and makes provision for the control and management of invasive species nationally (Alien and Invasive Species regulations under NEM:BA, hereafter referred to as NEM:BA regulations). Achieving NEM:BA compliance would require to meet the terms of the NEM:BA regulations, the specific actions it outlines and adhering to the timeframes stipulated, namely, submitting invasive species monitoring, control and eradication plans (from here onward referred to as 'area management plans') within 1 year from September 2016, after the guidelines for management plans were published (Section 5.2) (Figure 1).

A national strategy aimed at addressing biological invasions in South Africa (DEA 2014) has been drafted. Although the document has not been formally released, it is readily available. The strategy provides guidelines for Organs of State (Box 1) for managing invasive species, areas and pathways of introduction and movement against the background of the four stages of invasion (initial introduction, establishment, expansion and dominance).

Management of invasive species in South African municipalities is limited, with the City of Cape Town and eThekwini (metropolitan municipalities in the Western Cape and KwaZulu-Natal, respectively) being exceptions. For example, in Cape Town, a dedicated Invasive Species
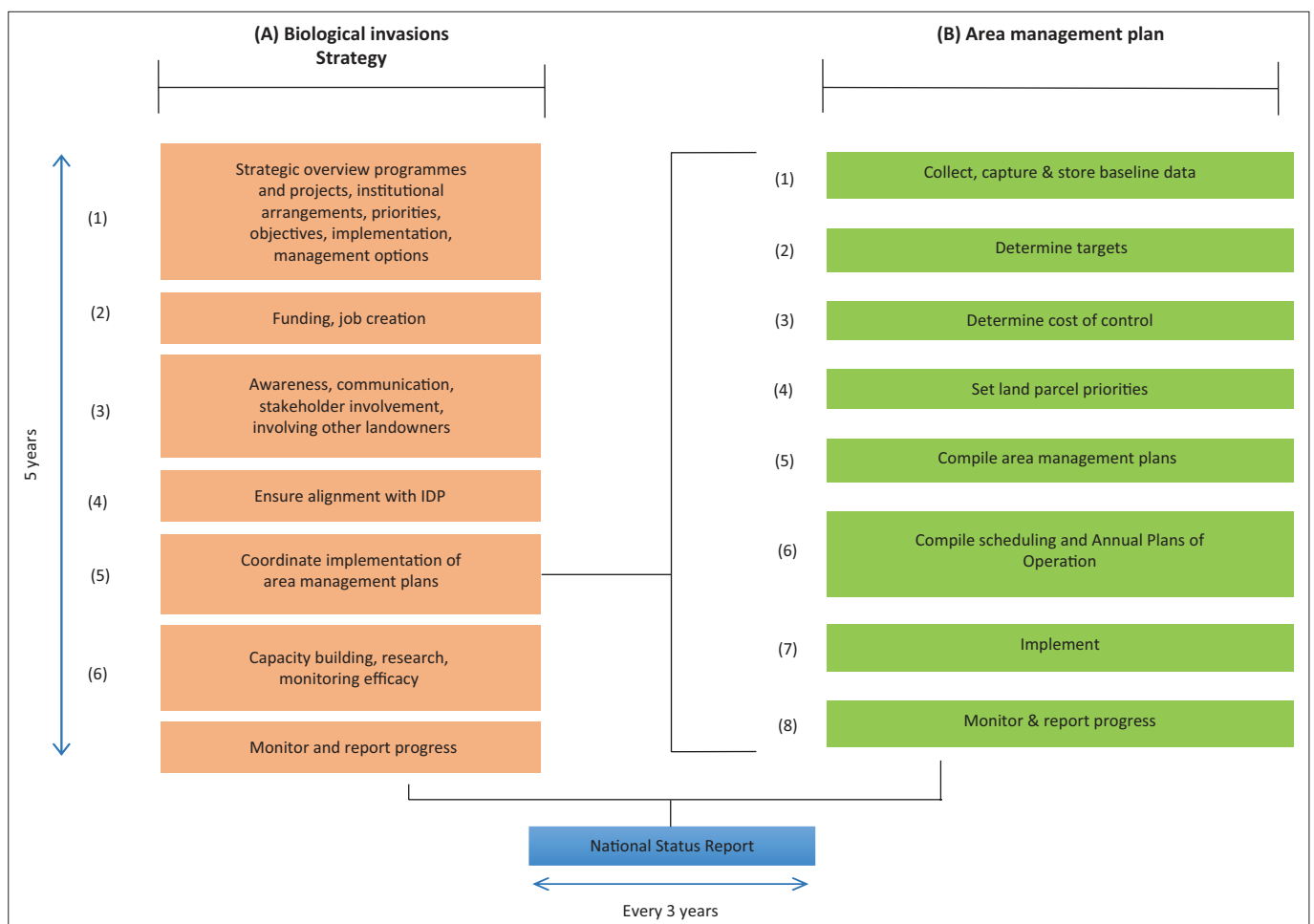

FIGURE 1: Overall framework of NEM:BA requirements (IDP: Integrated Development Plans).

BOX 1: Definitions and explanations.

Competent Authority: Any organ of state, delegated by DEA, that has the legally delegated or invested authority, capacity, or power to perform a designated function. Once an authority is delegated to perform a certain act, only the competent authority is entitled to take accounts therefrom and no one else. In terms of NEM:BA, a competent authority can be either (1) the Minister; (2) an organ of state in the national, provincial or local sphere of government or (3) any other organ of state.

District Municipality: Is a municipality which executes some of the functions of local government for a district. District municipalities are comprised of several local municipalities.

Integrated Development Plan (IDP): This is an overall strategy document for the municipality.

Invasive Species Monitoring, Control and Eradication Plan: A plan contemplated in section 76 of the NEM:BA Act and in Regulation 8.

Land under the control of Organs of State: There is uncertainty surrounding the interpretation of this clause – it may refer only to land parcels owned by a municipality (the stance taken by the City of Cape Town and adopted for the remainder of the paper) or it may refer to all parcels of land within a municipal boundary. The latter however, may prove impractical, as the municipality does not have authority over privately owned land and activities thereon. This matter needs to be clarified by DEA to ensure sound understanding and subsequent NEM:BA compliance by municipalities.

Land parcels: Land, or properties, owned and managed by municipalities can be protected areas, public open spaces, a river corridor, office buildings and road verges.

Legislative competence: Legal authority to carry out an activity.

Mandates: An official order or commission to do something.

NEM:BA compliance: Adhere to all actions stipulated within the legislation, within the timeframes given

Organs of State: Any department of state or administration in the national, provincial or local sphere of government.

Status Report: A national status report, tracking progress to compliance across the country needs to be compiled by SANBI as per Section 11 of the NEM:BA Regulations, not to be confused with the status report to be submitted by managing authorities of protected areas (as per Section 77 (1) and (2) of the NEM:BA Act). Thirdly, as part of the area management plans submitted by Organs of State a 'status report on the efficacy of previous control and eradication measures' needs to be submitted (as per Section 76(3d) of the NEM:BA Act).

Strategy: A plan of action or policy designed to achieve a major or overall aim.

TABLE 1: Measuring compliance and an indication on the level of awareness: Number of municipalities in each province (according to 2016 demarcations) (Part A) with a comparison of the number of municipalities that attended the awareness raising (NEM:BA roadshow) (Part B) and training events (South African Green Industries Council [SAGIC] training) (Part C). Number of plans submitted by September 2016 by municipalities within the different provinces (Part D) (data provided by DEA).

Province	Part A			Part B			Part C			Part D		
	Total number of municipalities			Municipalities attended NEM:BA roadshow			Municipalities attended SAGIC training			Number of submitted control plans		
	Metro	District	Local	Metro	District	Local	Metro	District	Local	Metro	District[a]	Local
Eastern Cape	2	6	31	2	1	6	1	2	5	-	-	-
Free State	1	4	18	1	1	3	1	1	3	-	-	-
Gauteng	3	2	6	3	-	5	3	-	3	-	-	-
KwaZulu-Natal	1	10	43	1	-	4	1	-	4	1	-	-
Limpopo	-	5	22	-	2	6	-	2	5	-	-	1
Mpumalanga	-	3	17	-	2	4	-	2	5	-	-	-
Northern Cape	-	5	26	-	2	2	-	2	3	-	-	-
North West	-	4	18	-	2	7	-	2	5	-	-	-
Western Cape	1	5	24	1	3	9	1	4	7	1	1 (1[b])	5 (3[c])
Total	**8**	**44**	**205**	**8**	**13**	**46**	**7**	**13**	**40**	**2**	**1**	**6**

Source: Authors' own work using data supplied by DEA and SAGIC

[a], Not all district municipalities manage or own land; thus, some district municipalities are not required to submit plans as per the current regulations. Hence the number of plans submitted will not equal the number of district municipalities once 100% compliance is achieved.

[b], Annexures missing, thus still viewed as incomplete.

[c], Letters were submitted to state (1) no budget is available to complete plans, (2) plans are complete but awaiting council approval and (3) the plans are being developed and will be submitted at a later stage.

Unit has been integrated into the municipal structure, aimed at streamlining and facilitating invasive species management across the metro (Gaertner et al. 2016). Some municipalities (e.g. Mbombela Local Municipality in Mpumalanga and Eden District Municipality in the Western Cape) have initiated actions to comply with the NEM:BA regulations since they were promulgated (SALGA 2016; and pers. comm. with municipalities by the authors, 2016). However, the majority of the remaining municipalities have not met the set timeframes, as seen from the number of submitted plans (Part D of Table 1). They are faced with multiple challenges such as a lack of capacity to develop area management plans and to implement, monitor and report on control programmes (K. Montgomery pers. comm., 2016). By using Cape Town as a case study, the challenges and complexities around invasive species management in urban areas are discussed with the intention of providing some guidance on how to overcome these challenges.

The aims of this paper are to (1) outline the requirements for municipalities to become NEM:BA compliant, (2) highlight the challenges faced by municipalities, (3) provide guidance on how to overcome such challenges, (4) outline the process for compiling area management plans and (5) discuss some indicators that can be used to measure progress towards compliance.

The City of Cape Town

The City of Cape Town (hereafter referred to as the City) is situated in the Cape Floristic Region, a biodiversity hotspot with high levels of endemism (Cowling et al. 1996), and is thus of high conservation priority (Holmes et al. 2012). The Cape Town municipality covers an area of 2460 km^2, of which over 61% has been transformed for urban development or agriculture (Holmes et al. 2012). Cape Town is the economic and social hub of the Western Cape, and the population has increased by almost 30% over a 10-year period from 2001 to

2011 (City of Cape Town 2012). Key pressures on the biodiversity surrounding the City include urban sprawl, agriculture, development for tourism (Holmes et al. 2012), exploitation through illegal harvesting (Petersen et al. 2012), changing of fire regimes through either suppressing or accelerating fire patterns (van Wilgen & Scott 2001) and invasive species (Rebelo et al. 2011).

Introduction of non-native species to Cape Town started with the first settlers in the 1600s, which brought in woody plant species for timber and dune stabilisation (Wilson et al. 2014). In Cape Town, invasive species not only negatively impact native biodiversity by outcompeting indigenous species (McKinney 2006), aquatic invasive species such as water hyacinth (*Eichhornia crassipes*) also cause flooding by clogging water ways (Richardson & van Wilgen 2004). Dense invasive plant stands pose serious risks to human settlements; for example, invasive pines and wattles increase the severity of wildfires near residential areas (van Wilgen & Scott 2001), provide shelter for criminal activities (Gaertner et al. 2016), pose human health risks (Taylor et al. 2008) and decrease river flows (Le Maitre et al. 2011).

NEM:BA requirements

NEM:BA places a 'Duty of Care' (Section 73(2) [as amended]) on all landowners, whether private or public, to control invasive species on their land. Section 76(2a) determines that all Organs of State at all spheres of government (from National through to Local Government) must compile area management plans for land under their control; Section 76(4 a–f) of the Act states the requirements of these plans (see Figure 1 for more detail on the Regulations). For Organs of State to become compliant with the NEM:BA regulations, they need to develop, submit for approval and implement area management plans, report back (Section 76[4][d]) and provide measurable indicators showing progress and timeframes for completion to national government (Department of Environmental Affairs [DEA]) (Figure 1). The guidelines for the development of these plans have been published (DEA 2015) and are available on DEA's website (https://www.environment.gov.za/sites/default/files/legislations/nemba_invasivespecies_controlguideline.pdf). The completed area management plans were required to be submitted by the end of September 2016 (1 year after the publication of the guidelines for management plans (NEM:BA Regulations [2] [b]) (Figures 1 and 2). Plans must be drawn up for all land under the control of Organs of State (Box 1; Figure 2; see Guidelines provided by DEA 2015).

Area management plans must include a description of the land parcels (Box 1) in question, detailed lists and descriptions of all the listed species found on each of the land parcels, the extent of invasion and the efficacy of previous control and eradication measures. These plans should be included into the municipal Integrated Development Plans (IDPs) (Section 76 [2][b]), to ensure subsequent implementation and budget allocation (Ruwanza & Shackleton 2016). Furthermore, the NEM:BA Act (Section 77[1]) states that all Organs of State managing
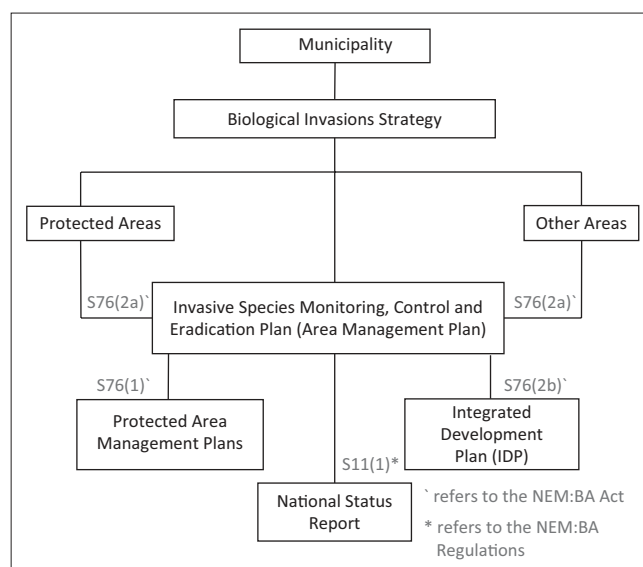

FIGURE 2: Framework for Biological Invasions Strategy and the steps required for developing area management plans for various parcels of land. Detailed guidelines on compiling area management plans are provided by DEA (2015).

protected areas are required to submit a status report (Box 1) 'at regular intervals', reporting on the progress made towards achieving the set targets. Smaller municipalities can develop a single plan for the entire municipal area. For larger municipalities, it is advisable to divide the municipality into more strategic areas (e.g. catchments or suburbs). Management plans should also make provision for invasive fauna. Collaboration with multiple landowners is required to assist with and ensure that plans are also developed for other land parcels within the municipality. Guidelines for private landowner area management plans are available on the City of Cape Town Invasive Species website (https//www.capetowninvasives.org.za).

Challenges faced by municipalities limiting NEM:BA compliance and recommendations to overcome these challenges

South African municipalities are facing a multitude of challenges, ranging from budget constraints to limited awareness and capacity. In this section, we firstly review these challenges, which have been identified through engagements with council officials, stakeholders, practitioners and scientists, and secondly present guidance on how to address the situation and to leverage invasive species management to benefit municipalities. Table 2 summarises the challenges and recommendations drawing on specific examples from the City of Cape Town.

Strategic planning and municipal buy-in

The Constitution of South Africa of 1993 regulates the responsibilities and legislative competence of each sphere of government. Municipal responsibilities include the delivery of a range of basic services such as access to water and sanitation (Section 73 of the *Municipal Systems Act*) to

TABLE 2: Challenges and proposed solutions in achieving NEM:BA compliance and managing invasive species management across municipalities.

Challenges	Solutions			Example	Sources
	Biological Invasion Strategy	Control plans	Communication/media	City of Cape Town: successes and challenges in invasive species management	
Land ownership	Determine land ownership and actions for addressing invasion across different landowners	Stakeholder involvement (e.g. Departments) for coproduction and coordination	Knowledge and information exchange; Interdepartmental and Institutional engagements; Landowner engagements; Creating of common vision and goal;	Cape Town's Invasive Species Strategy (2008) adopted by Council (Table 3), provided a platform for departmental alignment and resulted in city-wide invasive plant tender, resulting in streamlined clearing and better planning. This strategy is reviewed and updated every 5 years. Management plan development: The City was divided into four geographic regions. These regions were sub-divided into departmental land parcels, rivers, wetlands and protected areas. This sub-division strengthened the implementation of the strategy and management plans and helped to coordinate the invasive species responsibilities of the different departments.	Ruwanza & Shackleton 2016
Lack of awareness/ knowledge	Determine different audiences, means of communication and messages	Stakeholder involvement (private, business, governmental	Invasive Species Forums; Invasive species training (e.g. South African Green Industries Council [SAGIC]) Social media; Websites (e.g. www.invasives.org.za which municipalities can use to host their information and projects; currently used by three municipalities); Citizen science & citizen groups (e.g. garden clubs, friends' groups and ratepayer's associations) Knowledge and information exchange	Cape Town Invasive Species Forums (assisted with National roadshows and setting up of other forums); Partner with NGOs (e.g. Cape Town Environmental Education Trust); Partner with businesses (e.g. NCC Environmental Services; nurseries); Cape Town Invasive Species Facebook page; Spotter Network and Website providing information (www.capetowninvasives.org.za); Friends Groups (e.g. Friends of the Liesbeek; Friends of Constantia Valley Greenbelts); Volunteer Hack Groups; Garden Clubs, Ratepayers Associations; Media exposure (radio, TV, newspapers)	Crall et al. 2012 Cronin et al. 2017 Novoa et al. 2016 Sitas et al. 2016
Lack of capacity	Determine capacity needs; conduct needs analysis; actions to address	Dedicated environmental staff/ management; Provide necessary training; Outsource the development of control plans	Establish partnerships with different stakeholder groups; Collaboration with academic institutions; Identify 'champions' for invasive species management; Collaborate with different landowners within the municipal boundaries; Invasive species training (e.g SAGIC)	Establishment of Invasive Species Unit; Cape Town's Invasive Species Strategy (2008); Collaboration with the Research Institutes (CIB & Rhodes University); Partner with NGOs (e.g. Cape Town Environmental Education Trust); Mentorship of staff; Accommodating interns and volunteers to assist	Gaertner et al. 2016 Ruwanza & Shackleton 2016 Sitas et al. 2016
Limited and unpredictable budget	Determine long term strategic budget requirements; Prioritise; Establish partnerships; Job creation opportunities	Determine cost of control Annual Plans of Operation; Prioritise areas	Communicate with decision-makers, illustrate return on investment	EPWP allocation for invasive species management reduced by 50% in the 2016/17 financial year due to general budget cuts; Effective interdepartmental collaboration; Prioritisation workshop conducted following methodology of Forsyth et al. (2012)	Forsyth et al. 2012 Gaertner et al. 2016
Complexities/ conflicts of interest	Incorporate into IDP; Stakeholder involvement	Stakeholder involvement;	Research; Involve academic institutions Raise awareness (as stated above)	Conducted prioritisation workshop to identify priority areas for management; prioritisation process underway.	Gaertner et al. 2016

residents in a sustainable manner, promoting economic development and safe, healthy environments (Koma 2010). Environment is placed at the National and Provincial level of legislative competence, and thus local government prioritises service delivery over environmental aspects, such as invasive species control (Ruwanza & Shackleton 2016). However, municipalities play an important role in environmental planning and management but are not structured or mandated to perform their environmental responsibilities. Furthermore, many municipalities, particularly local municipalities, do not have dedicated environmental departments or staff, adding to a lack of environmental management at municipal levels. Currently, the NEM:BA delegations are not devolved to municipalities.

To encourage and assist local government to address environmental issues, we recommend that municipalities develop a biological invasions strategy in collaboration with their stakeholders (Figure 2). We further recommend that municipal strategies be aligned with the National Strategy (DEA 2014) for dealing with biological invasions by addressing the stages of invasion, priorities and management approaches for species, areas, pathways of introduction and movement of species. Such a strategy can help achieve political buy-in and aid in delegating responsibilities across departments. Furthermore, it allows for more streamlined processes, ultimately resulting in more efficient expenditure and accountability. It also addresses the issue of multiple landowners within municipal boundaries, as further discussed below. DEA should consider the possibilities and processes of appointing municipalities as competent authorities to assist with invasive species management across municipalities (including privately owned land).

We recommend that a template and guidelines for municipal strategies be developed and made readily available to all municipalities. The City of Cape Town developed such a strategy in 2008, which was adopted by Council (Tables 2 and 3). Table 3 outlines some of the aims and indicators for success as per the City of Cape Town Invasive Species Strategy.

District municipalities play a coordinating role for several local municipalities; hence, we recommend they should

TABLE 3: The City of Cape Town's Invasive Species Strategy (City of Cape Town 2008).

Aims	Indicators for success
Obtain high level buy-in and support for the implementation of the biological invasions strategy	Achieved. The strategic framework was approved by the council.
Establish a management and coordination scenario for effective and integrated management of IAS within the City's boundaries	Achieved. An Invasive Species Unit was established coordinating invasive species functions across different line departments. Regular meetings with departments to iron out issues, plan and report back are conducted.
Develop an Invasive Alien Species education, communication and awareness strategy for the City of Cape Town	Achieved. Resulted in outreaches in schools, communities, visits to the biological control facility on environmental days, for example, World Wetlands Day and Invasive Species Week. Facebook page, Invasive species website, Spotter network and establishment of invasive species forums to facilitate public participation.
Develop and implement a legal and policy framework for IAS management	Achieved. Framework produced and recommendations are in process of being implemented. Risk assessment conducted.
Develop funding mechanisms to support IAS management	Achieved. Different funding mechanisms ensured implementation of control plans. Funding sources include EPWP, departmental, Working for Water, Working for Wetlands, ward allocations.
Establish priorities based on given resources and appropriate weighting of desired outcomes	Achieved. Although implementation is challenging because of the different dynamics in urban areas and inconsistent budgetary allocations.
Develop integrated control plans based on identified priorities, with clear timelines and required resources	Partly achieved in the absence of guidelines for developing the control plans; the City relied on annual plans of operation and long term control schedules. Process to develop control plans according to guidelines commenced in October 2015.
Monitor effectiveness of the IAS management in the City of Cape Town	Partly achieved because of capacity constraints.

IAS, Invasive Alien Species.

facilitate the development of district-wide strategies (in collaboration with their respective local municipalities) as well as the various municipal invasive species area management plans. The role of the South African Local Government Association (SALGA) is to ensure that municipalities are aware of the new legislation relevant to them and provide assistance by unblocking compliance challenges (N. Mtsewu pers. comm., 2016). According to NEM:BA Section 76(3), the minister may appoint the South African National Biodiversity Institute (SANBI) to assist municipalities with compiling management plans and status reports that report back on the efficacy of control measures (Wilson et al. 2017). As such, SALGA acts as an important link between DEA, SANBI and municipalities to assist and guide municipalities.

Consolidating the management plans under district-wide or metro-wide strategies will ensure consistency and higher standards of plans and reduce the number of plans to be submitted to DEA substantially (44 district and 8 metro plans would have to be submitted from local government authorities, instead of a total of 257 [205 Local, 44 District and 8 Metropolitan municipalities] plans [Part A of Table 1]).

Issues around promulgation of the NEM:BA regulations

Several shortcomings have been identified regarding the process of how the NEM:BA regulations were promulgated: NEM:BA was first promulgated in 2004, but the NEM:BA regulations were only promulgated in 2014; therefore, the determinations of NEM:BA still need to be institutionalised by municipalities, who in the absence of expertise are still not fully aware of their obligations. The timeframes and requirements set by the NEM:BA regulations therefore pose a challenge to municipalities (SALGA 2016). Furthermore, the institutions delegated to assist other Organs of State (the DEA and SANBI) have been criticised by municipalities for their lack of guidance (K. Montgomery pers. comm., 2016).

An additional concern is that the contents of the guidelines as well as the regulations are not easily interpretable by those having to apply these on the ground. Hence, simplification of the management plan guidelines and interpretation of the NEM:BA regulations should be considered by DEA and communicated by SALGA. Tools and templates should also be developed to assist with writing management plans, and all material should be made readily available to support municipalities in becoming NEM:BA compliant.

Multiple landowners within municipal boundaries

Within municipal boundaries, a mosaic of different landownerships co-exists, namely, national and provincial governments, residential, agricultural, industrial and communal (Table 2). The portions of land managed or owned by these different landowners vary in size, land use and levels of invasive species infestation as well as potential introduction and spread of invasive species. A lack of synergy and collaboration between municipal authorities and the different landowners can be problematic and counter-productive when managing invasive species in urban areas. Holistic management approaches require private landownership buy-in and cooperation. However, achieving such cooperation is complex and requires significant resource capacity, with few success stories to date (e.g. Sitas et al. 2016).

In an analysis conducted by SALGA (2016), several municipalities were found to be unsure of the number of properties registered under their name. We recommend municipalities conduct an audit of land parcels known to be under the control of the municipality and start developing area management plans for those land parcels. Furthermore, we recommend a register (or database) and a map of known municipal land parcels be kept and updated as and when new information becomes available. The strategy should make provision for dealing with land ownership and liaison between the municipality and other land owners within the municipal boundaries to ensure synergy.

Lack of awareness/knowledge

Awareness of invasive species impacts is generally poor and knowledge of the requirements set out by the NEM:BA regulations (under Chapter 5) is lacking. This applies to the public (Shackleton & Shackleton 2016) and professionals (e.g. nursery owners; Cronin et al. 2017; Table 2). Knowledge regarding invasive species-related matters within municipalities varies extensively. Although some municipalities are aware of the obligations placed on them by the NEM:BA regulations (100% of metros, 29.5% of districts and 22% of local municipalities attended NEM:BA-specific roadshows, Part B of Table 1), they often do not have the capacity or knowledge to address these requirements given the timeframes and are consequently stalled in their attempts to move forward. Others are unaware of the regulations and thus compliance cannot occur (SALGA 2016).

To raise awareness within municipalities, several initiatives are recommended (aimed at the public as well as the municipal staff). Municipal Invasive Species Forums are a useful platform for raising awareness about the impacts of invasive species, addressing municipal and landowner responsibilities, and allowing stakeholder and public input as well as obtaining buy-in. Other effective means of advocacy in engaging the public include social media and citizen science projects (such as spotter networks; e.g. Crall et al. 2012; Hawthorne et al. 2015).

Showcasing the negative impacts of invasive species (e.g. fire threat due to increased fuel loads), as well as the success of invasive species clearing projects, in enhancing ecosystem service delivery can be useful for raising awareness among the general public (van Wilgen et al. 2011). Furthermore, knowledge and information exchange with other municipalities (through informal discussions or inter-municipal workshops) or other relevant stakeholders is critical in bridging the knowledge gap (Sitas et al. 2016; Table 2).

Involving and collaborating with established interest groups (e.g. garden clubs, Table 2) provides an opportunity for municipalities to harness the interests and expertise within these stakeholder groups to achieve the collective purpose of reducing impacts of invasive species in urban areas (Table 2). Although this is a time-consuming activity, it has proven successful in mitigating potential conflicts and creating a common goal and understanding of the situation at hand. Table 2 lists additional examples of initiatives that could assist in raising awareness drawing on examples implemented by the City of Cape Town.

Lack of capacity

Municipalities are comprised of urban centres (within the urban edge, usually consisting of mixed use: residential, industrial and commercial) and peri-urban areas (generally consisting of a matrix of residential, agricultural and natural areas). Some municipalities (e.g. the City of Cape Town) own and manage protected areas within their boundaries, requiring an additional status report in terms of the NEM:BA Act (Section 77[1] and [2]). Depending on the municipal structures, different line functions or departments are responsible for managing the different parcels of land (e.g. the parks department manages public open spaces and roads department manages the road verges). This split in functions complicates invasive species management, as multiple departments have different mandates, access to resources and varying expertise in managing biological invasions.

The lack of capacity in terms of institutional and human resources limits municipal performance (Koma 2010). Numerous municipalities do not have dedicated environmental staff or departments (Ruwanza & Shackleton 2016). Understaffing because of budget constraints regularly results in staff having to double up on their responsibilities. Furthermore, the skills capacity gaps in some municipalities are a major challenge, where staff are placed in positions for which they are not adequately trained or experienced (Koma 2010).

In addition to these constraints, managing invasive species is not traditionally part of cities' or towns' mandates (Box 1); therefore, they are not institutionally geared for this task (Ruwanza & Shackleton 2016). Municipalities generally do not have the correct equipment, expertise, capacity or budget to address the issue of invasive species in addition to meeting everyday service delivery requirements (Table 2).

Faced with limited management capacity, as discussed above, municipalities are unable to achieve NEM:BA compliance. Several approaches can be adopted to aid in developing capacity. A starting point is to (1) raise awareness and involve multiple landowners within the municipal boundaries, (2) obtain high level municipal management buy-in and support for ensuring NEM:BA compliance, (3) create an understanding of what the requirements for compliance are for different stakeholders and landowners, (4) identify the resource and capacity requirements to achieve compliance, (5) determine what capacity and resources are available nationally for building capacity and assisting municipalities in collaboration with SALGA, (6) implement a programme to develop capacity and increase synergy and collaboration across different municipalities to ensure effective use of limited resources, (7) increase access to information (invasive species information and associated control methods) and finally (8) development and access to a central database for tracking clearing operations and guide planning processes. Options to build capacity can be addressed through different strategies and collaboration with multiple landowners, communities and business (see Table 2). An alternative approach would be the outsourcing of the management plan development and subsequent implementation. However, to ensure this is executed properly, in-house expertise is required to oversee and guide the process. Accrediting service providers in the invasive species realm will further ensure that competent service providers are appointed.

## Limited and unpredictable budget

Municipal income varies according to the size of the municipality (Figure 3) and its ability to generate revenues (Ramakhula 2010; Ruwanza & Shackleton 2016). Property tax, one of the main sources of revenue for municipalities, is heavily reliant on privately owned land and as such is generally proportional to population size. This results in large differences across municipalities. Large, sparsely populated areas usually generate relatively poor revenues, while densely populated metropolitan municipalities generally generate much higher revenues (Figure 3). Municipal budgets are prepared every year (Nyalunga 2006) and applied to meet mandated service delivery requirements. Due to the pressures on service delivery, infrastructure and health, amongst others, municipalities are often not able to meet their mandates. Faced with backlogs in service delivery, municipalities can be further crippled through subsequent violent protests, which increase the pressure on resources and capacity, as municipalities have to restore damaged property and infrastructure.

The NEM:BA requirements do not make provision for additional financial resources to assist municipalities with data collection, compilation of the area management plans, implementation, monitoring and reporting (SALGA 2016). Municipalities further lack funding to appoint appropriately skilled service providers to compile management plans (SALGA 2016).

SALGA compiled an internal report on municipalities of the Western Cape and their level of compliance on the NEM:BA regulations (SALGA 2016). The report identified several challenges and found that one of the key challenges faced by municipalities is the fact that the NEM:BA regulations do not come with implementation budget. Furthermore, it found that most municipalities do not have the necessary capacity to perform the related environmental functions. As a result of the lack in capacity, components of the environmental management function are allocated to different departments within the municipality. 'This raises a serious concern, as it proves the lack of proper capacitation of local government to adequately perform the environmental management functions' (SALGA 2016).

The sum of all environmental budgets stipulated in municipal IDPs was found to consist of less than 1% of total municipal budgets (Ruwanza & Shackleton 2016). Ruwanza and Shackleton (2016) further found that budget allocation to environmental issues varies greatly between metropolitan, district and local municipalities. District municipalities generally allocate more budget to environmental issues than local and metropolitan municipalities. However, under environmental projects, invasive species management is allocated the lowest budget.
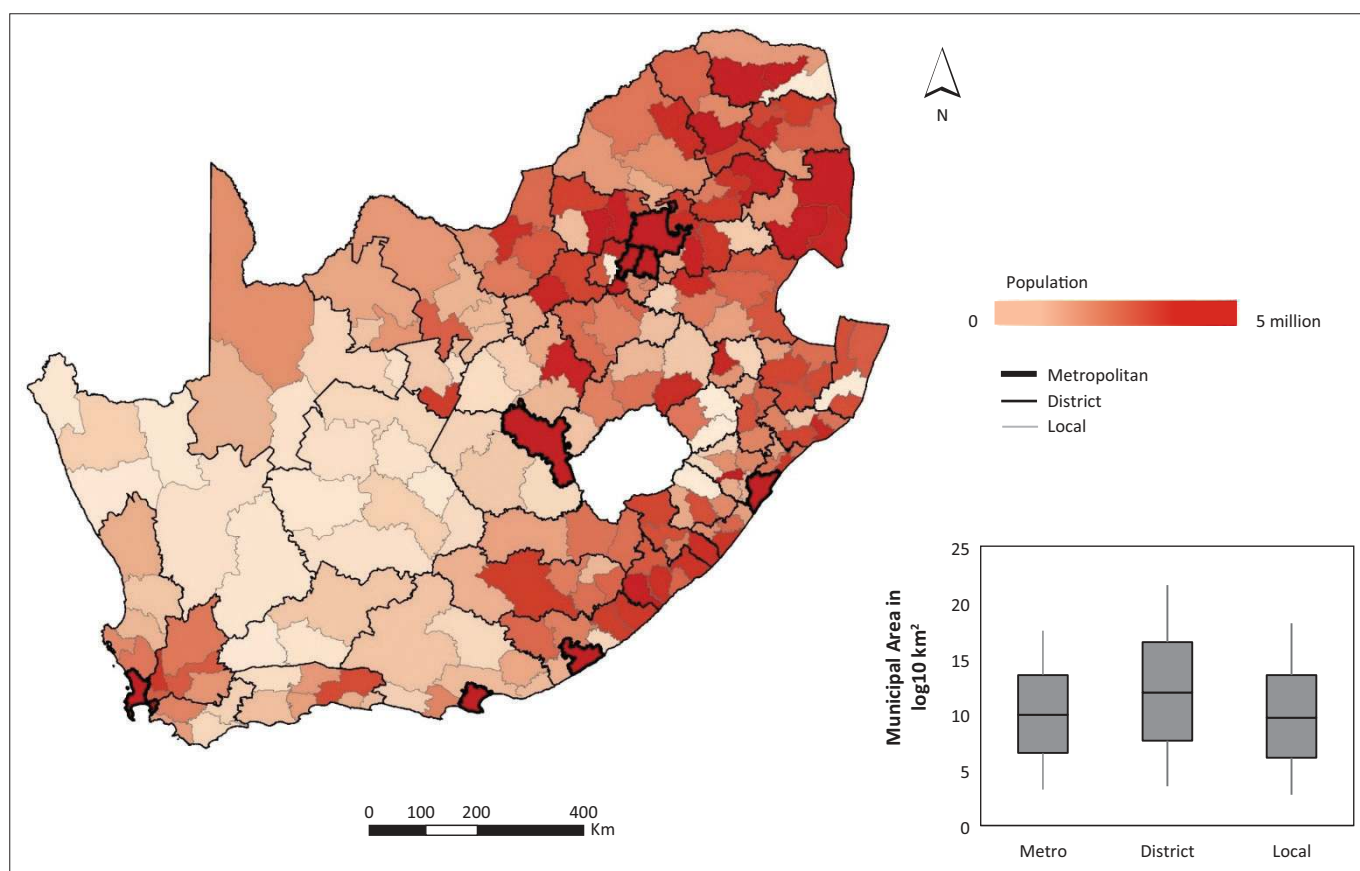
Source: StatsSA 2016 Community Survey (CS) data (http://cs2016.statssa.gov.za/ accessed 17 November 2016).

FIGURE 3: Large variation in municipal sizes and population count across the country. Differentiation is made between the different levels of municipalities, with metropolitan municipalities generally being small and highly populated. Variation in municipality sizes is also shown across the different municipal types (insert: area in km^2 on log$_{10}$ scale).

Invasive species management is not separately funded but is mostly dependant on available operational funding (short-term) from the different departments responsible for managing land parcels. Municipalities across the country have the option to access Expanded Public Works Programme (EPWP) funding; however, this funding is primarily used for short-term job creation opportunities rather than invasive species management (Table 2). However, operational funds as well as access to funding through EPWP fluctuate widely between financial years, making it difficult to plan adequately. Allocating operational funding for managing invasive species is challenging because of competing priorities, the absence of a long term strategy, priorities and area management plans. If invasive species management is not regarded as a core function by the municipality, control mainly focusses on aesthetics (public open spaces and road verges) or addressing public complaints about security issues related to 'overgrown' land.

We recommend municipalities strengthen collaboration between different owners and managers of land parcels within a municipality to help leverage resources for achieving common goals and objectives. A Biological Invasions Strategy (see Figure 2; Table 3) can enable municipalities to improve budgeting processes and specifically allocate funding for invasive species management. Furthermore, it supports applications for resources and capacity (e.g. from Working for Water and EPWP) to fund priority invasive species interventions.

Prioritising land parcels for invasive species control assists with funds being appropriately allocated and utilised, resulting in the highest return on investment being achieved. It also assists municipalities in addressing competing issues characteristic of dynamic urban environments.

Measuring progress towards NEM:BA compliance

Municipalities are faced with a multitude of challenges, limiting their ability to comply with the recently promulgated NEM:BA regulations. This paper is not aimed at providing the solutions to all the challenges municipalities are facing; rather it is aimed at providing commentary on how municipalities could go about addressing limitations to ensure compliance with the NEM:BA regulations.

To measure the level of compliance, DEA should determine the number of municipalities that have submitted their plans according to the timeframes stipulated (Figure 4[1]).
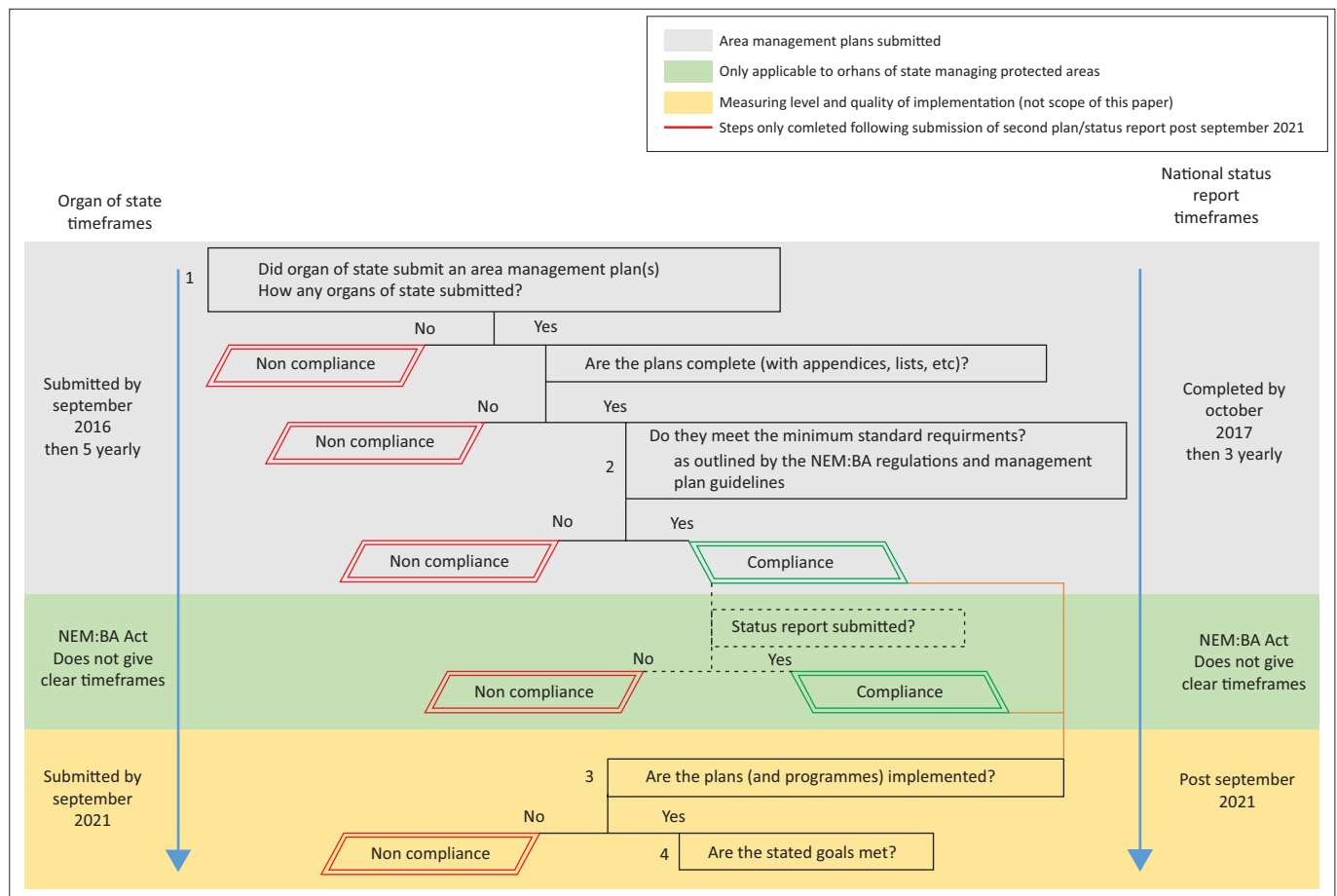
The first section (grey) refers to area management plans submitted (starting in September 2016 and to be repeated every 5 years).

The second section (green) only applies to nature reserves and the third section (orange) can only be completed once plans have submitted their second, revised plan, post September 2021. Numbers 1 to 4 refer to key indicators (narrative in text).

FIGURE 4: Measuring compliance: A simplified framework for measuring compliance of Organs of State, in line with the timeframes given to Organs of State and the National Status Report (Wilson et al. 2017).

The reasons for non-compliance should be determined to enable DEA to put measures in place in collaboration with SALGA to assist those municipalities who require additional support, resources and capacity. Appropriate actions should be taken by DEA to address these gaps to ensure those municipalities comply by the time the next national status report is compiled. Management plan standards will need to be assessed, using the guidelines as a baseline [Figure 4(2)]. The second national status report would then analyse the data to monitor the levels of change. An increase in the number of plans (and standard of plans) should indicate successful progress towards compliance (revisit Figure 4[1]).

Monitoring the implementation of area management plans (Figure 4[3]) requires municipalities to submit their updated plans and reports as required by the NEM:BA regulations. Alternatively, the uptake of control activities into municipal processes can be measured through the analysis of IDPs (Ruwanza & Shackleton 2016). The progress towards meeting set targets and goals (Figure 4[4]) can be determined through analysing updated management plans and reports submitted by Organs of State.

However, to increase the level of compliance for all Organs of State, steps need to be taken to overcome some of the challenges municipalities are faced with. Through coordinated national efforts by DEA, SANBI and SALGA working together with municipalities, nation-wide compliance can be achieved. Municipalities require guidance as to how best to bridge some of the challenges they are faced with when it comes to working towards NEM:BA compliance. Starting with increasing the level of awareness and capacity within municipalities should be one of the first steps undertaken by the said stakeholders. Ensuring easier access to information for municipalities could greatly assist in addressing some of the challenges municipalities face. A central database on species information and associated clearing methods, as well as a database for tracking and planning clearing operations, could greatly benefit municipalities as well as the development of the National Status Report. The hosting of a central invasive species database requires careful consideration as it will ultimately determine the usage, accessibility and ability of municipalities to plan, track progress and produce progress reports. Using the http://www.invasives.org.za website with a link to the DEA and SALGA websites should be considered.

Acknowledgements

Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

The paper was a joint product of all the authors. The writing of the paper was led by U.I., with input from all co-authors on an equal basis.

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