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Land-use planning as a tool for balancing the scientific and the social in biodiversity and ecosystem services mainstreaming? The case of Durban, South Africa

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4 Land use planning as a tool for balancing the scientific and the social in biodiversity and
5 ecosystem services mainstreaming? The case of Durban, South Africa.

6
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14
15
16 **Abstract**

17
18 This paper evaluates the role of land use planning, especially open space systems, in
19 mainstreaming biodiversity and ecosystem services (BES) at the urban level. Whilst there is
20 increasing interest in BES mainstreaming to balance environmental protection with socio-
21 economic development, there is also concern that BES thinking deflects attention from
22 underlying social justice questions. Through the case study of Durban, South Africa - often held
23 as an exemplar in BES mainstreaming - we argue open space systems can offer a pathway to
24 BES mainstreaming that is both scientifically effective and socially just. Yet what makes this
25 possible in Durban, we argue, is (a) a robust scientific evidence base deployed reflexively and
26 sensitively; (b) a move towards explicit emphasis on providing benefits of BES to the most
27 vulnerable people; and (c) supportive policy frameworks plus the presence of biodiversity
28 managers able to navigate the political as well as scientific landscape.

29
30 **Keywords:** Durban; environmental mainstreaming; ecosystem services; open space system;
31 urban planning.

32
33
34 **Acknowledgements**

35
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41 dissemination.

43 FULL MANUSCRIPT FOR BLIND REVIEW

44

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58 managers able to navigate the political as well as scientific landscape.

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61 urban planning.

62

63

64 **1. Introduction**

65

66 This paper evaluates the role that land use, in particular open space systems, may play in
67 balancing environmental and societal concerns when mainstreaming biodiversity and ecosystem
68 services (BES) at a local government level. Using the case study of Durban, South Africa, we
69 argue the spatial nature of land use planning offers a platform for reconciling environmental
70 protection and social justice concerns in BES mainstreaming. However, we also argue the
71 Durban experience shows that effective BES mainstreaming via land use requires reflexive use
72 of the underpinning scientific knowledge and significant capacity at local government level.

73

74 *1.1. Biodiversity and ecosystem services and developing country cities*

75

76 The Millennium Ecosystem Assessment holds that human development relies greatly on services
77 provided by nature (Millennium Ecosystem Assessment, 2005). Reliance on such ecosystem
78 services for basic livelihood could be relatively high in less industrialised yet rapidly urbanising
79 nations (Roberts et al., 2012). However, cities in low and middle-income country (LMIC)
80 contexts also often face complex political, social, and economic challenges (Pierce et al., 2002;
81 Swiderska, 2002), and tend to have less governmental and societal capacity to address
82 environmental problems (Puppim de Oliveira, 2002). The immediate need to tackle socio-
83 economic issues such as poverty, sanitation, drinking water, and infrastructure supply can place
84 pressure on environmental protection or biodiversity conservation (Seto et al, 2012).
85 Furthermore, the negative effects of climate change are likely to be felt first and most strongly in
86 LMICs (Stern, 2007), with impacts such as extreme temperature, unseasonal drought, heavy

87 rainfall and flood not only damaging infrastructure, but also putting ecosystem services at risk.
88 As such, the cities and countries which rely most on ecosystem services tend to (a) have less
89 institutional capacity to balance development imperatives with environmental protection; (b)
90 have higher exposure to effects of climate change; and (c) be less likely to have access to funds
91 or technology to repair or replace damage.

92

93 It is for this reason that practitioners and researchers increasingly advocate the need to coordinate
94 development alongside conservation of biodiversity and ecosystem services (BES) (e.g. Puppim
95 de Oliveria et al., 2011; Seto et al., 2013). Damaged ecosystem functions, such as water
96 circulation, climate regulation, and disease control, can negatively impact human well-being and
97 in turn act as a barrier to socio-economic development (e.g. Millennium Ecosystem Assessment,
98 2005; Su et al, 2010). The value of healthy ecosystems in reducing the impacts of climate change
99 in an urban setting is also recognised through the emergence of ecosystem-based adaptation
100 (EbA) for climate change adaptation within an urban context. EbA - the use of BES as part of an
101 overall adaptation strategy (IUCN, 2009) - is argued to produce multiple benefits to people such
102 as climate adaptation, carbon sequestration, food security, livelihood and cultural value (Munang
103 et al, 2013) and frame the climate challenge at a municipal or local scale where fine-scale
104 recommendations can be made (Roberts et al, 2012). There is thus an emerging sense that BES
105 conservation is vital to both continued development and reducing the effects of climate change.

106

107 The municipal government scale is particularly significant within this. Although cities only
108 occupy 2-3% of the Earth's surface, they are estimated to consume 75% of world resources and
109 generate 50% of world wastes today (UNEP, n.d.). Yet cities also offer opportunity to mitigate

110 negative impacts and enact sustainable use of natural resources (Wilkinson et al., 2013; Revi et
111 al, 2014). As above, it is local governments who have the precision to put national- or
112 international-level environmental goals into action (Kern and Alber, 2008). Through processes
113 such as provision of investment, determination of physical forms, and enactment of
114 environmental management (Puppim de Oliveira et al, 2011), local government is vital in
115 consolidating economic development and environmental conservation (Seto et al., 2013) and is
116 thus a crucial site for realising the potential BES conservation benefits outlined above in
117 practice.

118

119 *1.2. Connecting BES and the urban scale: mainstreaming*

120

121 Given the role ecosystems can play in development and in attaining climate adaptation in LMIC
122 contexts, the health of BES can be considered an important foundation for urban sustainable
123 development. Attaining this, however, necessitates integrating BES conservation into wider
124 urban planning measures. As Wilkinson et al (2013) argue, it is impossible to uncouple a
125 discussion of urban development from the urban environment and its ecological base. This
126 integration is known in environmental governance as 'mainstreaming' (e.g. Sowman and Brown,
127 2006). Mainstreaming involves integration of conservation and sustainable use of biodiversity
128 into cross-sectoral planning (SCBD, 2012), connecting this with economic (Cowling et al., 2008)
129 and societal (Swiderska, 2002) development. The precise nature of mainstreaming will vary
130 depending on context (Bass et al, 2010), but one avenue - as we explore in this paper - is land
131 use. Land use planning provides legally entrenched norms and rules for making decisions about
132 how land and associated natural resources are to be used (Cowling et al., 2008). As such, if new

133 norms and standards as to the value of BES conservation can be embedded into planning
134 systems, it may ensure ecosystem integrity during development processes and help to balance
135 social and economic development with environmental protection and associated climate
136 adaptation benefits (Haines-Young, 2009).

137

138 *1.3. Challenges to ecosystem services and biodiversity conservation*

139

140 The effectiveness of ecosystem services as a conservation governance tool has, however, been
141 challenged. Norgaard (2010) suggests the term may act as a ‘complexity blinder,’ over-
142 simplifying the complex social, economic and political factors which contribute to environmental
143 degradation in the first instance. Considering environmental problems and their solutions in
144 terms of ecosystem services has been argued to reinforce or even increase existing social
145 inequality by perpetuating thinking in terms of a market economy, where those already in more
146 powerful positions continue to win out (Kosoy and Corbera, 2010; Matulis, 2014). More broadly,
147 a focus on quantification and systematisation in urban environmental governance arguably
148 engenders top-down technocratic solutions (Broto, 2015), excludes or marginalises those whose
149 knowledges cannot be expressed in numerical terms (Spash, 2009), and/or deflects attention
150 away from issues of social equality that mean some groups of people have less access to
151 environmental amenity in the first place (Haase et al, 2017). The drive towards cross-sector
152 consensus on the need for environmental protection that terms like ecosystem services work
153 towards has been seen as depoliticising and tending towards maintaining the status quo (Aylett,
154 2010). In short, it is important to retain a healthy scepticism as to whether BES mainstreaming
155 undertaken in the name of balancing environmental protection with social and economic

156 development really does deliver benefit to the most vulnerable members of society.

157

158 This paper considers this challenge of ensuring BES conservation delivers both environmental
159 protection and equitable socio-economic benefit. To do so, we assess BES mainstreaming in
160 Durban, South Africa, with particular focus on the role an open space system has played in the
161 process. In urban biodiversity circles, Durban and the eThekweni Municipality governing it¹ is
162 frequently cited as an exemplar of good practice from both an environmental and social
163 standpoint. The Local Action for Biodiversity initiative, for instance, states:

164

165 *Durban has made a name internationally for its early and comprehensive Local Agenda 21*
166 *activities and its long-term strategic planning. It was not surprising that this ICLEI member city*
167 *co-initiated the Local Action for Biodiversity Project and published the first biodiversity report*
168 *in terms of the project.*

169 (eThekweni Municipality & ICLEI Africa Secretariat, 2007: 2).

170

171 The Secretariat of the Convention on Biological Diversity (2013: 42) adds “Durban, South
172 Africa, is located in a global biodiversity hotspot and has been committed to sustainable
173 development for decades.” What is striking is that whilst critical social scholars may have good
174 grounds to be suspicious of such claims given the concerns over ecosystem services framings
175 outlined above, Durban’s BES-related efforts appear to be viewed favourably - or at least not

1 eThekweni Municipality is the name of the metropolitan municipality governing Durban and the towns surrounding it. eThekweni Municipality itself uses the term 'Durban' to describe the location in which its BES activities largely take place (e.g. eThekweni Municipality, 2015), hence in this paper we use 'eThekweni Municipality' when referring to specific actions undertaken by the municipal government and 'Durban' to refer to the location of those actions.

176 remarked upon negatively - in critical environmental scholarship around the city (e.g. Bond and
177 Dada, 2007; Aylett, 2011; Chu et al, 2017). The purpose of this paper is hence to evaluate how
178 eThekwini Municipality has been able to attain this, and to assess what it may tell us about how
179 land use can aid BES mainstreaming in a way that both ensures environmental protection and
180 delivers tangible benefits to the most vulnerable.

181

182 **2. Case Study**

183

184 Durban is located in a biogeographic transition zone, between the Cape Temperate habitat to the
185 south and the tropical Mozambique habitat to the north. These neighbouring habitats bring
186 various species to the region, including endemic species that have adapted to the environments of
187 the transition zone (eThekwini Municipality, 2015). Radical urbanisation in the past century has,
188 however, caused a sharp decline in local biodiversity along with the disappearance and the
189 degradation of natural habitats around Durban. Nonetheless, eThekwini Municipality has come
190 to be widely regarded as an LMIC city government which has made progress with
191 mainstreaming BES into local development. Key to attaining such mainstreaming has been the
192 city's open space system, the Durban Metropolitan Open Space System (D'MOSS), which is
193 viewed as an available, cost-effective and sustainable strategy to enhance local resilience
194 (Longhurst, 2011; Roberts et al., 2012). D'MOSS is an interconnected greenspace system which
195 includes both public- and privately-owned lands in eThekwini Municipality. Having originated
196 in the late 1970s for preserving rare and endangered species, D'MOSS has evolved into a more
197 comprehensive means of assessing ecosystem functioning (eThekwini Municipality, 2015; Shih,
198 2017). The plan was officially adopted in Durban in 1989 after more detailed ecological

199 evaluation, and in 2003 the D'MOSS conservation network was approved by councils to guide
200 future planning and development of the open space system. The latest version of D'MOSS is a
201 sector plan and a spatial layer, which identifies areas sustaining biodiversity and supplying
202 ecosystem services. It is incorporated thoroughly into the city's planning systems - including
203 Integrated Development Plan, Strategic Development Framework, Spatial Development Plans
204 and municipal Town Planning Schemes - as a controlled development layer (eThekwini
205 Municipality, 2015). It is the role of D'MOSS - and by extension land use - in enacting BES
206 mainstreaming that is the focus of our paper.

207

208 One of the grounds on which eThekwini Municipality can claim progress on BES conservation
209 comes through the annual State of Biodiversity Reports. These are produced by the
210 Municipality's Environmental Planning and Climate Protection Department (EPCPD) and made
211 publicly available along with supporting documentation and technical reports (eThekwini
212 Municipality, 2011a). The 2014/15 report, for instance, noted 10% and 8.6% of D'MOSS are
213 formally protected and managed respectively for BES; observed downward trends in invasive
214 species across the majority of parks and nurseries; and indicated over half of vegetation types
215 were meeting targets (eThekwini Municipality, 2015).

216

217 **3. Methods**

218

219 Two methods are utilised: (a) documentary analysis of textual and other statistical material
220 pertaining to planning policies, plans and programmes, as well as biodiversity strategy and action
221 plans; and (b) interviews with municipal government staff and academics with specialist in-depth

222 knowledge of issues in the case study.

223

224 *3.1. Documentary analysis*

225

226 To assess the processes through which BES mainstreaming was attained and the arguments and
227 rationales used to support BES mainstreaming via land use planning, qualitative content analysis
228 was undertaken on policy documentation produced by eThekweni Municipality. The core
229 documentation analysed was the five-year Integrated Development Plan (IDP) for eThekweni
230 Municipality, as well as the annual interim IDP review reports. As this is the umbrella document
231 for all other plans, it provides a comprehensive overview of the policy landscape within which
232 BES mainstreaming occurs (see also Sowman and Brown, 2006). Reports were sampled from
233 2003, when the first municipal IDP was produced after jurisdiction change, through to 2016.
234 This IDP analysis was supplemented with review of other relevant Durban-specific
235 documentation, with sampling following a 'snowball' approach of following up relevant
236 references in policy documentation and peer-reviewed literature. Materials consulted were
237 selected Spatial Development Framework documents; the Service Delivery and Budget
238 Implementation Plan (2006-2016); State of Biodiversity Reports; and content related to
239 development planning, environment and management on the eThekweni Municipality website
240 (www.durban.gov.za). To reduce bias from sampling only Municipal reports and encompass
241 independent/potentially critical perspectives, an additional narrative review of grey literature and
242 peer-reviewed academic literature discussing BES in Durban was undertaken (see Mabon and
243 Shih, forthcoming for further information on this process). This focused on the drivers and
244 contexts for BES mainstreaming, such as budget allocation and the social dimensions of

245 environmental issues more generally in Durban.

246

247 Relevant statements in the documentation were identified showing: (a) the extent to which BES
248 is considered in the Municipality's development framework; (b) the role of D'MOSS in BES
249 mainstreaming; (c) the level of priority of BES conservation within wider civil affairs; and (d)
250 the policy landscape within which BES is considered. Prior (2003) holds that the social context
251 in which documents are utilised is just as important a part of analysis as the content of the
252 document itself. Therefore, this more qualitative mode of sampling and analysis that allowed the
253 researchers to take into account the wider contexts of the policies reported was considered
254 appropriate, given the aim of understanding how BES mainstreaming in Durban balances
255 environmental and social concerns.

256

257 *3.2. Interviews*

258

259 The documentary analysis was supplemented with five in-depth interviews with informants
260 holding significant knowledge about biodiversity conservation, urban planning and/or socio-
261 economic issues in Durban and South Africa. Whilst this may appear a small sample, the aim of
262 the interviews was to help explain in more depth the experiences and challenges around
263 mainstreaming observed in the documentary analysis. Chase (2005: 667) explains "any narrative
264 is significant because it embodies – and gives us insight into – what is possible and intelligible
265 within a specific social context," and the interviews in our study were similarly used to help
266 understand the context of BES mainstreaming in Durban. Given the significant complexity of the
267 topic, interviewees were sampled who would be able to talk at length about the subject. A small

268 focused sample was considered more appropriate to support the objectives of the study than a
269 more extensive sample offering less in-depth knowledge.

270

271 Staff across all management levels from the Environmental Planning and Climate Protection
272 Department (EPCPD) of eThekweni Municipality with professional expertise in biodiversity
273 were interviewed for 60-90 minutes each (Respondents 1-3), plus an academic working at a
274 South African university with knowledge of planning at the national level (Respondent 4). An
275 academic with experience in social justice in post-apartheid South Africa (Respondent 5) was
276 subsequently interviewed to provide a more cautious perspective on the success or otherwise of
277 Durban's environmental planning measures. Whilst the academics' contributions are relatively
278 easy to anonymise, the highly specialised and specific nature of information provided by
279 Respondents 1-3 is likely to make it obvious they are employees of EPCPD, no matter how this
280 is reported. To preserve participant anonymity, specific job titles beyond 'EPCPD' are therefore
281 not given when reporting material from interviews, and caution has been exercised not to include
282 content which may make respondents' true identities obvious. In any case, the EPCPD has over
283 twenty staff (eThekweni Municipality, 2011b), so listing respondents as employees of EPCPD is
284 in itself unlikely to make their personal identities apparent.

285

286 Interviews followed a semi-structured approach. An interview guide was developed to cover the
287 topics of biodiversity conservation, the status and prospects of BES mainstreaming, and the
288 socio-political status in Durban and South Africa. Within this, however, the interviewers were
289 able to ask follow-up questions as required. The interviews were transcribed and analysed
290 according to an adapted version of the voice-centred relational method (Doucet and Mauthner,

291 2008). This involves reading each transcript four times - once for the plot and evaluator
292 responses; once for the speaker's own voice; once for the speaker's discussion of relationships;
293 and once for links to wider themes. The value of this approach is that it provides a more rigorous
294 reading of qualitative interview data, helping to draw themes and ideas out of the transcripts in a
295 systematic way whilst still acknowledging the subjective and interpretative nature of qualitative
296 research.

297

298 **4. Findings and analysis**

299

300 We break the findings down into three broad categories - scientific evidence; societal context;
301 and political factors. Following principles for rigorous qualitative research (Mays and Pope,
302 1995) we refer to relevant documents or interview extracts where appropriate to support our
303 points.

304

305 *4.1. Scientific evidence base with spatial component*

306

307 The first area we assess is the strong role for scientific knowledge in supporting BES
308 conservation in Durban. Challenges around putting 'evidence-based planning' into practice are of
309 course well-known (e.g. Davoudi, 2006; Li, 2013), and the importance of socio-political factors
310 in attaining BES mainstreaming via land use are addressed in Sections 4.2 and 4.3. However, in
311 Durban it is true that BES thinking is at base informed by environmental science knowledge, in
312 particular D'MOSS. As outlined in Section 3.2., D'MOSS is an interconnected green space
313 system comprising ecologically valuable areas in both private- and public-owned lands. It was

314 first developed in 1979 to protect important natural areas from urban development, but has
315 evolved from these conservation-oriented roots to serve multiple functions and provide a
316 comprehensive assessment of ecosystem functioning (Roberts et al, 2012; eThekwini
317 Municipality, 2015; Shih, 2017).

318

319 The key role D'MOSS serves in relation to BES conservation actions is provision of evidence to
320 allow a targeted approach to conservation. As one EPCPD respondent explained:

321

322 *One of the things we do is to make sure that the open space system that we're asking to protect*
323 *has good reasons to be protected [...] we use systematic conservation planning which uses*
324 *computer algorithm to input biodiversity features along with opportunity and threat layers, for*
325 *example floods, into a computer program [...] If we keep on saying no to development all of the*
326 *time then we will tend to undermine our case, so we need to be clear on what it is that we want to*
327 *protect.*

328 (respondent 1, EPCPD, eThekwini Municipality)

329

330 In the respondent's words, emphasis is placed on creating a robust scientific evidence base for
331 environmental protection, and taking a focused approach to protect the areas of greatest
332 importance on the basis of this evidence. The process described refers to the mapping of
333 D'MOSS, which is included as a conservation layer in GIS systems in eThekwini Municipality
334 for communication with other sectors. This means land with high biodiversity significance is
335 formally included within land use plans as space where development is subject to strict controls.
336 From the outset, then, eThekwini Municipality and its D'MOSS system indicate that inclusion of

337 BES-related scientific knowledge within spatial planning frameworks can help to ensure
338 locations of highest value are protected.

339

340 However, this underlying 'scientific' evidence base and the very idea of conservation are not
341 apolitical. As an academic working in development studies explained when asked for her
342 thoughts on the social implications of conservation:

343

344 *Conservation, I mean that is something that has been very attached to, even colonial sort of and*
345 *settler, almost going back to settler cultures [...] it's absolutely clear that that's where*
346 *conservation has been, even the early idea of the National Parks, I mean that all comes back to*
347 *the colonial era [...] You know, so conservation would be seen as something that is like*
348 *reactionary basically.*

349 (respondent 5, academic working in development studies)

350

351 Caution must therefore be exercised to ensure BES mainstreaming based on 'science' does not
352 inadvertently repeat or reinforce historical injustices. This is something to which eThekwini
353 Municipality appears to be sensitive, an interviewee (Respondent 1) stating that in the name of
354 conservation "we can expropriate, there is a law in South Africa, but we don't use it often
355 because there is old political connotation to it". eThekwini Municipality's own description of
356 D'MOSS likewise justifies science-based conservation firmly in terms of social justice, referring
357 to the South African constitution:

358

359 *The property as a whole may still be developed, albeit that certain very restrictive conditions*

360 *may be imposed on such development. It should be noted that Section 24. of the South African*
361 *Constitution, specifically relating to Environment, has relevance whereby everyone has the right*
362 *to an environment that is not harmful to their health or well-being; and to have the environment*
363 *protected [...] while promoting justifiable economic and social development.*

364 (eThekweni Municipality, 2011c: np)

365

366 Given this historical context, the scientific evidence base of D'MOSS thus appears to be used as
367 a *guide* for sustainable land use planning in Durban (Rouget, 2015) rather than a barrier to all
368 forms of development. For instance, D'MOSS is now used not only for biodiversity
369 conservation, but also to inform future decisions so as not to increase emissions via land use
370 change (Aylett, 2011). This pragmatic move to allow some lands to be released from protection
371 may help to move past the idea of BES thinking as being about preventing *all* development,
372 which in turn may help to justify or build support in situations where preservation of greenspace
373 *is* crucial to conservation or ecosystem-based adaptation.

374

375 In short, D'MOSS provides a vehicle for mainstreaming BES into wider development processes
376 in Durban by formally including areas of high biodiversity as control zones in spatial planning
377 frameworks. This means that wider urban planning is underpinned by scientific knowledge of
378 biodiversity. Crucially, however, this scientific knowledge appears to be used reflexively and
379 sensitively given the South African historical context, with D'MOSS guiding development rather
380 than preventing it outright. We now assess the evidence-based yet pragmatic approach taken with
381 D'MOSS in greater depth by discussing its relation to socio-economic development needs.

382

383 4.2. *Connection with societal context*

384

385 As above, it is well understood that planning is a social process (Crawford, 2016; Davoudi,
386 2006), whereby scientifically appropriate conservation must be balanced with what is considered
387 socially acceptable (Mabon and Shih, forthcoming). BES conservation in South Africa takes
388 place within a context of socio-political pressure. The very nature of South African cities -
389 sprawling with fragmented and segregated neighbourhoods - is itself a legacy of apartheid
390 policies (Du Plessis and Landman, 2002; Crane, 2006). Post-apartheid, migration into cities
391 (particularly from formerly excluded groups), has led to new problems of inadequate housing,
392 high unemployment rates and urban environmental deterioration (Cadman et al, 2010).
393 Expansive informal settlements are being created on the urban fringe, placing pressures on
394 fragile ecosystems (Goebel, 2007). Figure 2 illustrates the kind of landscape in Durban within
395 which many of the issues discussed in this paper are sited.

396

397 Further, approximately 40% of the population lived below the lower-bound poverty line in 2015,
398 with 13% of households in informal dwellings in 2016 (Statistics South Africa, 2017). Social
399 inequality continues to be politically important post-apartheid, so it is understandable that the
400 post-apartheid government has placed more emphasis on socio-economic issues than
401 conservation. Statistics South Africa (2017) observes that the Gini coefficient (per capita
402 income), a common measure of inequality, has decreased slightly for South Africa (from 0.72 in
403 2006 to 0.68 in 2015) but remains high in comparison to other nations. These levels of inequality
404 vary *within* South Africa, the black African population recording the highest Gini coefficients at
405 0.55 in 2011, and the white population the lowest at 0.42 in 2011 (Statistics South Africa, 2014).

406 From analysis of South Africa's Income and Expenditure Survey data, Seekings and Natrass
407 (2005) hold that inequality actually rose post-apartheid, increasing from 0.65 to 0.69 between
408 1995 and 2000, and that those marginalised during apartheid have continued to be so since.

409

410 This overarching and ongoing need to redress social inequality is reflected in the evolving
411 rationale for D'MOSS. In 1979, the first open space plan in Durban was drawn by the Wildlife
412 Society, and aimed at wildlife protection. In 1999, partly in response to the movement of Local
413 Agenda 21 and the national government's increasing emphasis on social equality, D'MOSS was
414 reconceptualised to encompass ecosystem services (Roberts and Diederichs, 2002). This shifted
415 the focus from biodiversity conservation in the name of pure scientific value (Freund, 2001),
416 towards understanding the multiple environmental, economic, and societal functions from which
417 urban residents might benefit. This wider 'ecosystem services' framing was bolstered by an
418 economic assessment of D'MOSS, which estimated its replacement value at R2.24 billion per
419 annum (Roberts and Diederichs, 2002), later recalculated to R3.1 billion per annum (eThekweni
420 Municipality, 2003; World Bank, 2016). This signified a financial and business case for BES
421 conservation, extending beyond intrinsic or scientific value (Freund, 2001) and connected to
422 socio-economic development imperatives. More recently, BES has been explicitly linked,
423 through its role in ecosystem-based adaptation, to addressing issues of poverty and climate risk
424 in Durban. What is significant about this is that increasing emphasis has been placed in
425 discussions around BES in Durban (e.g. Roberts et al, 2012; Roberts and O'Donoghue, 2013) on
426 issues of social justice, via job creation and poverty alleviation for the people most directly
427 dependent on the services provided by ecosystems.

428

429 In short, whilst the underpinning basis of D'MOSS remains BES conservation, the way in which
430 the EPCPD has framed and rationalised the open space system has shifted over time from
431 'conservation' towards ecosystem services and economic valuation. Most recently, this has
432 moved further towards explicit consideration of how the gains from BES conservation can
433 accrue to the most vulnerable members of society, thus linking to the political imperative to
434 redress inequality outlined above. An example of this in practice is the Tree-Preneur programme,
435 associated with the Buffelsdraai Landfill Site Community Reforestation Project, which works
436 with the Wildlands Conservation Trust NGO to engage unemployed community members as
437 'Tree-preneurs' to grow trees for use in a reforestation project (Douwes et al., 2015). The
438 seedlings can then be exchanged for credit notes for food, basic goods and school fees
439 (eThekweni Municipality, 2011d). The project is rationalised by the EPCPD thus:

440

441 *Can we protect the environment at the same time while growing the economy? And can we*
442 *conserve nature and biodiversity at the same time while increasing the number of jobs?*

443 (respondent 2, EPCPD, eThekweni Municipality)

444

445 And a colleague explained, when pressed on awareness of conservation and climate issues
446 around the project:

447

448 *[We have] difficulty in communicating climate change messages. The means of communication*
449 *differs according to the community; i.e. city level and rural areas. For example, Tree-preneurs*
450 *was slow to start up, but once a few people get it, then other people picked it up. Most locals just*
451 *do it for the job than for the idea of climate change. The concept of climate change itself is quite*

452 *hard for locals to grasp, but it's starting to get through in the recent years.*

453 (respondent 3, EPCPD, eThekwini Municipality)

454

455 Key to note are the range of rationales – economic development, general environmental
456 protection, biodiversity conservation, jobs – which are deployed by EPCPD staff when
457 discussing an initiative whose underlying motivation is BES conservation. This has the effect of
458 creating multiple pathways towards support for actions undertaken in the name of BES
459 conservation, not all of which require actors to buy into ‘hard science’ rationales around
460 biodiversity or even climate change. Roberts (2010) believes framing BES in terms of not losing
461 development gains post-Apartheid can help to gain political traction – which we assess in more
462 depth in Section 4.3.

463

464 All of this indicates it is not only the presence of a scientifically robust open space system that
465 aids BES mainstreaming, but also how this system is justified in relation to overarching socio-
466 political imperatives. Fashioning multiple rationales for conservation actions in the way
467 eThekwini Municipality has may increase the chances of support across sectors. Especially
468 important within this is emphasis not only on climate change and biodiversity, but also
469 messaging around the role BES health can play in daily living. Such benefits include
470 environmental hazard reduction (Roberts et al, 2012); employment (Douwes et al, 2015); and
471 food production, heat mitigation and runoff retention via, for instance, the Green Roof Initiative
472 (eThekwini Municipality, 2011e). These rationales may be easier to engage with than potentially
473 distant and opaque discussions on biodiversity or climate change, as they make clear the role that
474 BES can play in preventing harm to humans or increasing quality of life.

475

476 *4.3. Political landscape*

477

478 We finally assess the role formal and informal political processes have played in moving towards
479 BES mainstreaming via open space in Durban. From a formal policy perspective, what is distinct
480 about eThekweni Municipality – and of significant advantage in working towards BES
481 mainstreaming - is that space is given explicit consideration and detail across all levels of the
482 planning process. A key reason for this is the presence of Integrated Development Plans (IDPs),
483 which were designed to redress inequalities post-Apartheid and which South African
484 municipalities are required to prepare by law to guide planning, budgeting, management and
485 decision-making. Whilst the effectiveness and propriety of IDPs has been debated in other
486 contexts (e.g. Binns and Nel, 2002; Harrison, 2001), they create a favourable environment for
487 BES mainstreaming due to their connection to Spatial Development Frameworks (SDFs) and
488 Spatial Development Plans (SDPs). The SDF and SDP translate IDP decisions into land use
489 policies (IDP 2005/2006) and detail development and management guidelines divided by river
490 catchments based on the concept of carrying capacity of land (IDP 2005/2006; eThekweni
491 Municipality, 2013) respectively. This means social, economic *and* environmental goals can be
492 considered at the same time, using land use planning to balance these by explicitly identifying
493 locations in which planning actions required to realise these goals will take place.

494

495 The annual review processes for IDPs and subsequent SDFs allow plans to be updated to rapidly
496 respond to emerging issues. The value of these short review cycles to BES mainstreaming is
497 evidenced by rapid proliferation and increasing frequency of environmental terminology (such as

498 sustainability and natural/ecosystem services in the earlier versions; and climate change and
499 ecosystem-based adaptation in the later versions) in the IDPs. This is paralleled by a shift over
500 time in the IDPs from emphasis on economic development with BES protection as a separate
501 issue, towards identifying the links between BES and development.

502

503 The key point is that as a result of specific historical and contextual factors, eThekweni
504 Municipality has from the outset a development framework favourable for translating high-level
505 decisions on environmental issues into practical planning actions. The explicit focus on spatial
506 matters creates good compatibility for preserving an open space system as a basis for BES
507 conservation and ecosystem-based adaptation. However, whether these formal processes alone
508 are enough to facilitate BES mainstreaming across sectors is open to question. Review of the
509 Municipality's IDPs indicates varying recognition of the importance of BES integration with
510 development across the Eight-Point Plan, which sets the priority areas for the Municipality's
511 development. In Plan One: Sustaining Our Natural and Built Environment, horizontal
512 mainstreaming (i.e. across sectors) can be more frequently observed since the 2005/2006 IDP
513 through refinement of the Spatial Development Framework and open space systems, which
514 provide an arena for inter-sectoral cooperation. For sectoral mandates, however, strategies to
515 address BES are limited to specific programmes such as building, land use and environmental
516 control compliance systems; and coastal, riverine and estuarine management plans. This goes
517 part way to horizontal mainstreaming, but BES still seems linked mainly to discrete programmes
518 rather than being a core concept running through all activities. Moreover, BES is rarely
519 mentioned in the other seven plans, suggesting BES integration is still largely driven by the
520 environmental planning sector.

521

522 When it comes to building momentum for BES mainstreaming across sectors, more informal
523 political processes come into play. As an interviewee involved in implementing biodiversity-
524 related projects explained, when asked how the EPCPD took steps towards mainstreaming in
525 practice:

526

527 *It's about going out and meeting these departments and providing them with guidance as to the*
528 *sort of best practices they should be engaging in [...] We keep meeting the people again and*
529 *again, try to circulate the information. A lot of progress is made once people start understanding*
530 *the problem.*

531 (respondent 2, EPCPD, eThekweni Municipality)

532

533 And in terms of making practical gains on BES conservation, an interviewed colleague noted the
534 value of the tactical and strategic knowledge of a key figure in addition to institutionalised
535 processes:

536

537 *[NAMES PERSON] is a different kind of leader. She's very good at identifying strategic*
538 *opportunities. [NAMES PERSON] realized that choice and lobbied for the first few months she*
539 *moved through the momentum. She doesn't follow the LAB step. I think with some people that's a*
540 *big failure, but [NAMES PERSON] finds opportunity and just goes. Luckily when she changes*
541 *direction she gets it right almost all of the time.*

542 (respondent 1, EPCPD, eThekweni Municipality)

543

544 This role of informal interaction between departments and sectors in building support, and of the
545 less formalised ways through which policy directives are translated into action, has likewise been
546 noted in academic outputs produced by EPCPD staff as ‘learning by doing’ (Roberts et al, 2012)
547 and ‘after hours’ work (Leck and Roberts, 2015). This political nous is further reflected through
548 the ways in which budgetary challenges around funding BES are surmounted. BES integration
549 mostly falls under one of eThekwini Municipality’s eight priority areas, titled “Develop and
550 sustain our spatial, natural and built environment”. However, this area has received only a very
551 small share, mostly less than 2%, of the annual budget in the last decade. Alternative means to
552 secure budget for BES-related activities have hence had to be imagined, as seen when
553 interviewees discussed alien invasive species control and land acquisition respectively:

554

555 *We receive funding from our own local government treasury, and additional funding from other*
556 *national government departments. [...] Also public private partnerships [...] there is a mix of*
557 *spending from funding, comes from government, businesses, international donors, some*
558 *international works.*

559 (respondent 2, EPCPD, eThekwini Municipality)

560

561 *If, during January and February, the other departments have failed to spend all of their money,*
562 *then we go to treasury, and try to use up all of the savings, or unspent money. Because in the*
563 *case [it is] important for local government to spend all of the money.*

564 (respondent 1, EPCPD, eThekwini Municipality)

565

566 This challenging financial backdrop means there is a need to secure alternative funding sources,

567 and to imagine affordable solutions to balance development with biodiversity conservation. For
568 instance, eThekweni Municipality has developed environmental servitudes, whereby private land
569 ownership is allowed for passive recreation, with the municipality only having to provide rate
570 relief as compensation for the landowner managing the area responsibly (Boon, 2006). Another
571 is ecological compensation, whereby off-site habitat creation or financial compensation (in both
572 cases paid by the developer) is undertaken if land development becomes unavoidable (eThekweni
573 Municipality, 2011c). These financial restrictions also reinforce the importance of robust
574 arguments in favour of BES to attain broad engagement and support for measures.

575

576 BES mainstreaming thus happens in a political landscape, which encompasses not only formal
577 policies but also ‘informal’ politics. The underpinning policy framework in eThekweni
578 Municipality, which to an extent exists due to the social and historical context, creates a
579 favourable environment for BES mainstreaming via land use. Yet it is also true that ‘champions’
580 with not only techno-scientific knowledge but also understanding of political processes and how
581 to work within them are very important in moving mainstreaming forwards in a challenging and
582 constantly shifting environment. This has been noted elsewhere in research into sustainable
583 urban planning, not only for the EPCPD in eThekweni Municipality (Freund, 2001), but also for
584 Curitiba in Brazil (Rabinovitch, 1992) and Barcelona in Spain (Depietri et al, 2016).

585

586 **5. Discussion**

587

588 *5.1. Scholarly implications*

589

590 We draw out two scholarly implications of our findings with regard to BES mainstreaming. One
591 is the way in which ‘science’ is undertaken and utilised to inform BES conservation. Effective
592 BES conservation within complex ecosystems and political contexts requires officials with
593 significant technical and scientific knowledge. Biodiversity management within eThekweni
594 Municipality is overseen by a highly skilled team, who regularly publish peer-reviewed scientific
595 papers on their work and have involvement in the Intergovernmental Panel on Climate Change.
596 In the context of wider awareness within South Africa over the colonised nature of education
597 (Nathane and Harms Smith, 2017), this has potential to raise questions over whether already
598 marginalised members of society have access to knowledge and decision-making spheres. What
599 is noticeable in Durban, though, is that this scientific evidence base is applied cautiously and
600 reflexively. Contrary to concerns elsewhere over conservation being led by international
601 ‘experts’ (Broto, 2015), in Durban the expertise is locally situated, coming from within the
602 EPCPD and University of KwaZulu-Natal and moving to encompass community actors (e.g.
603 Taylor et al, 2016). In other contexts, such ‘local experts’ who are themselves citizens as well as
604 scientists (e.g. McKechnie, 1996; Mabon and Kawabe, 2016) have been argued to be crucial in
605 informing empirically sound yet locally appropriate decisions due to their understanding of local
606 socio-political contexts. Further, work to provide scholarships as part of BES activities by
607 eThekweni Municipality (e.g. Cockburn et al, 2016; Taylor et al, 2016) may help to redress
608 differences in access to knowledge across social groups, and EPCPD staff are willing to open
609 themselves up to frank and critical reflection on their practice in academic literature (e.g. Leck
610 and Roberts, 2015).

611

612 Thus, whilst eThekweni Municipality does work on the basis of BES conservation based on

613 scientific evidence, this is undertaken by locally-situated actors who appear aware of – and are
614 working to address – social inequalities that uncritical application of conservation and ecosystem
615 services thinking is argued in the wider literature to have the potential to intensify. This may help
616 to sidestep some of the concerns about ecosystem services-based thinking as perpetuating
617 existing structural causes of inequality raised in Section 1. For BES mainstreaming, the Durban
618 case indicates that whilst there is of course a key role for scientific evidence in developing open
619 space systems, it is crucial this 'evidence' is tempered with recognition of the social context of
620 knowledge production and is used to guide – rather than control – BES conservation.

621

622 Our second reflection is on the potential for land use, especially open space systems, as a means
623 of attaining environmentally sound yet socially appropriate BES mainstreaming. EThekweni
624 Municipality's open space system offers an example of how BES mainstreaming via spatial
625 planning may balance up environmental and societal pressures. By mapping out greenspaces and
626 their ecosystem services via D'MOSS, the city has a scientific evidence base to justify
627 identification of un-developable areas. This process allows developers to be offered alternative
628 locations for projects, thereby protecting key sites but not becoming a barrier to politically
629 important economic development. D'MOSS and associated projects also facilitate identification
630 of ways in which greenspace (and its conservation of ecosystem services) can be a source of
631 value - not only the financial 'value' of ecosystem services, but also potential for creating
632 employment within communities to manage and maintain ecosystems. Including an explicit
633 spatial dimension in BES mainstreaming may hence initiate discussion on where the benefits of
634 BES interventions accrue in relation to potentially vulnerable communities. This use of spatial
635 tools such as GIS has been advocated in other contexts (e.g. Apparicio et al, 2016; Haase et al,

636 2017; Pearsall, 2017) as a starting point for understanding the spatial justice dimensions of urban
637 environmental governance. It may thus be the case in Durban too that including areas of high
638 biodiversity value within planning frameworks – and indeed using land use planning as the key
639 means to enact municipal social, economic and environmental policies – helps to guide BES
640 conservation in a way that does not further marginalise already vulnerable groups.

641

642 However, the Durban case also indicates that attaining BES mainstreaming via land use requires
643 reconceptualisation of open space in terms of ecosystem function and also its contribution to
644 social justice (e.g. Curran and Hamilton, 2012; Wolch et al, 2014) rather than purely ‘parks and
645 recreation’. This returns to the above point about cognitive demands and institutional capacity. In
646 this regard, developing decision-support tools which help to extend ‘green infrastructure’
647 thinking beyond environmental planners (e.g. Foster et al, 2011; Norton et al, 2015) may provide
648 an avenue to connect BES conservation with urban green planning more widely. Moreover, as
649 per Buscher and de Beer (2011), sustained engagement by planners and municipal officials with
650 critical 'outside' research (as done in Durban via e.g. Chu et al, 2017) may help ensure social
651 justice concerns are not sidelined in environmental planning. In short, an open space system can
652 – if managed correctly and with appropriate critical reflection – become a guide for sustainable
653 development which is of benefit across society yet does not compromise crucial BES functions.

654

655 *5.2. Policy and planning implications*

656

657 We finally raise implications from the Durban case study for planners and practitioners working
658 on BES mainstreaming in other contexts.

659

660 First is the importance of retaining an explicit social justice angle as part of BES policy, both to
661 sustain political traction and also retain support of communities and civil society organisations.
662 This entails reflection on how BES conservation may help to reduce inequalities (not only
663 though involvement in conservation, but also through initiatives such as scholarships which
664 reduce education gaps) and/or connecting BES conservation with social policies as part of the
665 mainstreaming process.

666

667 Second is the importance of developing and supporting ‘champions’ within municipal
668 government who are aware not only of the scientific basis for BES conservation, but also the
669 wider municipal, national and even international policy landscape. Durban illustrates that this
670 knowledge of how to connect BES to overarching political imperatives and to understand
671 decision-making processes is key to attaining mainstreaming in a complex and dynamic
672 governance landscape.

673

674 Third and final is the importance for academics, international organisations, and planners
675 working in other contexts treating ‘best practice’ case studies such as Durban with caution, and
676 avoiding using them as ‘truth spots’ (Peck et al, 2011) where lessons learned are uncritically
677 exported to other contexts. Whilst eThekweni Municipality has made admirable progress on BES
678 mainstreaming, this has happened within a specific historical, social and environmental context
679 which has engendered certain planning frameworks (e.g. IDPs) and international attention (e.g.
680 from the 100 Resilient Cities programme and ICLEI’s Local Action for Biodiversity). This is not
681 in any way to diminish the work of the Municipality, simply to note the importance of

682 acknowledging local contextual factors when applying ‘lessons learned’ elsewhere.

683

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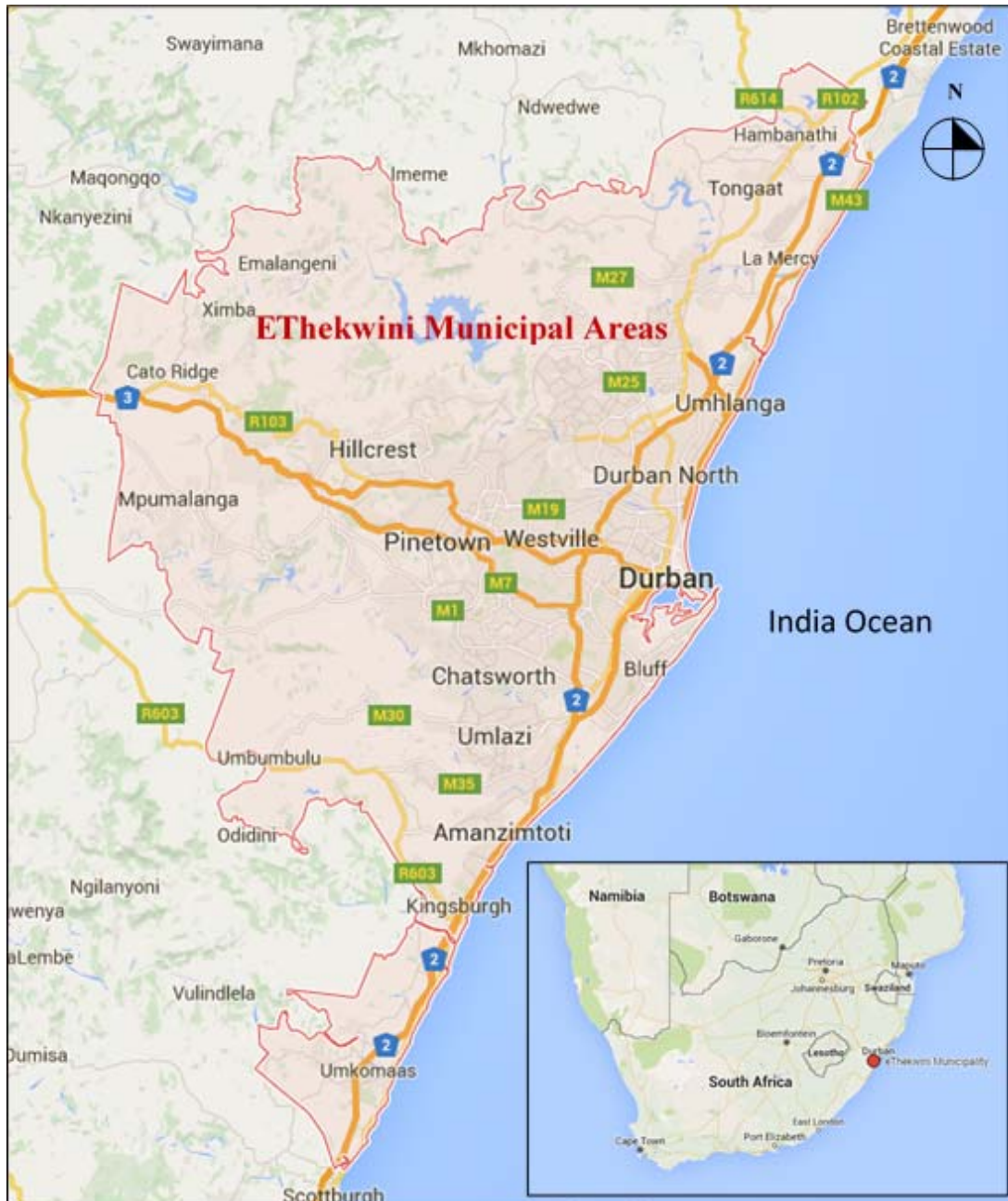
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959 Figure Legend

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961 Figure 1: Location of the Durban and eThekweni Municipal Area (source: adapted from Google
962 Maps, 2016)

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967 Figure 2: Indicative image of landscape in Durban (source: taken by author)

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