Practitioner perspectives on nature conservation at the urban edge

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Abstract: As the boundaries of our cities expand, many new suburbs are being developed near nationally listed threatened ecological communities and threatened species habitat. For example, all new greenfield development in the ACT is occurring in lowland settings that support threatened grassy woodland communities.

This study uses semi-structured in-depth interviews (n=35) and focus groups (n=2) to ask urban practitioners about their experiences with greenfield development in Gungahlin and the Molonglo Valley in the ACT. The practitioners include development managers, planners, ecologists and engineers and, the reserve managers and ecologists with research and management responsibilities for threatened grassy woodlands.

Practitioners were asked about challenges of developing near nature reserves, the processes, knowledge and practices employed to mitigate impacts, and the value of collaboration with community stakeholders during the process.

Challenges in marrying policy objectives of both delivering housing and protecting ecosystems is commonly cited by informants. The complexity involved in translating strategic environmental commitments into acceptable measures at site scale, and the collaboration and types of knowledge needed for these deliberations, is not well understood by decision-makers.

Willingness to experiment and respond in creative and innovative ways to manage biodiversity impacts is being hampered by the realities of post-construction handover to the municipal agency. Limited capacity to maintain and monitor the effectiveness of on-site measures is perceived to be a barrier to take up of new approaches.

Failure to invest in post-occupancy review of development processes and measures in sensitive ecological settings represents a missed opportunity for professional reflection and knowledge transfer, for maintenance of conservation and management activities, and the development of an important 'community of practice' with application beyond the ACT.

Introduction

Global social changes mean more people now live in cities and by 2050, nearly 70% of the world's population will be urban (United Nations, 2014). Australia is highly urbanised with almost 80% of Australians living in the 20 largest cities of 80,000 people or more (Commonwealth of Australia, 2015). Australia's population will grow under the medium scenario to 30.5 million by 2031 and 41.5 million by 2061. 75 per cent of this growth to 2031 will be in the capital cities, rising to 80 per cent in 2061. Canberra is part of this phenomenon, with a predicted increase of 145,336 people (39%) by 2031 to 520,412, and doubling of the current population to 740,903 by 2061 (ABS, 2013).

Most new development in Australian cities is greenfield estates at the urban edge and apartments in city centres (Commonwealth of Australia, 2015). Urbanisation is a major cause of biodiversity loss (Forman, 2014, McDonald *et al.,* 2008; McKinney, 2006) and greenfield development poses significant threats to remnant biodiversity. Australian cities are disproportionately important for biodiversity conservation containing the last remnants of nationally important grassland and woodland ecosystems (McDonnell, 2007; Williams *et al.,* 2005) and supporting more threatened species per unit-area than non-urban regions (Ives *et al.,* 2015 in press).

Canberra is a case in point where development fronts in Gungahlin and the Molonglo Valley coincide with valuable remnant grassy woodlands and threatened fauna. Both areas have been subject to strategic assessment under the *Environment Protection Biodiversity Conservation (EPBC) Act* 1999, with development approved subject to offset requirements including new reserves and research and monitoring of protected matters (ACTPLA, 2011; ACTG, 2013).

These developments are progressing even though the effects of urbanisation on biodiversity are not well understood (Bohnet & Pert, 2010; Alberti, 2005; White *et al.,* 2005). There are gaps in our understanding about species requirements and development effects (Gordon *et al.* 2009, Buxton *et al.* 2006) and research is needed across multiple ecological levels and for multi species (McDonnell 2007, Garden *et al.* 2006). There are few long-term studies in urban areas and limited monitoring of urban biodiversity interventions (Taylor & Ives 2009).

The edge of our cities is a flash point for competing social and ecological objectives, the need to provide housing to meet population growth and the survival of nature within suburbs and nature reserves. This research explores how practitioners working in this space are meeting this challenge, their experience with assessment and development processes, and the role for interdisciplinary and community collaboration in urban settings.

Background: Urban planning and management practice and biodiversity

Our planning and environmental assessment systems provide the framework for decisions about new settlement in our cities and the protection of biodiversity (Thompson & Maginn, 2012). Traditional planning tools and concepts such as zoning to separate incompatible land uses and use of environmental zones over constrained land are not adequate to protect biodiversity and maintain habitat connectivity across the urban landscape (Drinnan, 2005; Fitzgibbon *et al.* 2007; Beatley, 2000). More integrated methods and greater interdisciplinary collaboration is needed (Williams & Smart, 2012) moving beyond traditional knowledge sets and tools (Meng, 2009).

While planners are key actors at the interface of land use and biodiversity conservation (Garrard & Bekessy, 2014) they are not leading practice. Few policy/practice-focused papers about biodiversity planning have been published in *Australian Planner* over the last decade, with only a few substantive contributions (see Lemke, 2009; Rhodes *et al.,* 2008; Fallding, 2004). A 'Biodiversity' edition in 2010 had two short focus pieces and did not attract any peer reviewed articles (Fowke *et al.,* 2010). Competencies in biodiversity planning are also not required for certification as a 'practising planner' (www.planning.org.au/certification).

Planners are not alone in neglecting this space. Ecologists have been absent from public discourse about how we retain biodiversity in urban landscapes (Corbyn, 2010; Marzluff, 2002; Miller & Hobbs, 2002) and reluctant to work in human dominated landscapes (McDonnell, 2007). Ecological research also needs to respond to questions being asked by practitioners to help them improve urban biodiversity outcomes (McDonnell & Hahs, 2013).

A single Australian study has explored the experience of planners seeking to protect and integrate biodiversity in residential projects in a hotspot region in Western Australia (Grose, 2010b). Planners felt hampered by limited ecological knowledge and a lack of access to ecological specialists and applied research. Similar sentiments were expressed in Sweden (Sandström *et al.,* 2006) and Finland, where planners felt ecologists should be more active in the process of providing insights for plans and researching function of ecological corridors (Yli-Pelonen & Niemela, 2006). Studies in the US reveal that Councils with higher environmental performance have biodiversity specialists in planning teams (Stokes & Hanson, 2010; Miller *et al.,* 2009). Access to ecological expertise is also needed for post-occupancy management of habitat in urban developments, with the Australian study finding limited ecological knowledge among municipal managers (Grose, 2010b). Similar findings have been made in the US about the implementation phases in conservation subdivisions (Hostetler & Drake, 2009).

These knowledge gaps seem surprising given complex regimes in most Australian jurisdictions to align planning and biodiversity conservation decisions, including bio-certification schemes (NSW Government, 2011) and offset policies (DSWEPC, 2012; ACTG, 2015). Urbanising areas have been identified as a priority for guidance about implementation of offsetting regimes (Connolly & Fallding, 2009; Farrier *et al.,* 2007).

Ecologists are now responding with the development of metrics to measure the effectiveness of biodiversity offset regimes over time (Miller *et al.,* 2015) and research on their conservation benefits (Maron *et al.,* 2013). Strategic mapping tools are being developed to integrate ecological data in settlement planning allowing practitioners to visualise opportunities for enhancing habitat connectivity (Bekessy *et al.,* 2012; Parker *et al.,* 2008). Recent ecological research in urban areas is also providing much needed evidence about edge impacts and priorities for urban habitat conservation (Le Roux *et al.,* 2015; Rayner *et al.,* 2015; Ikin *et al.,* 2014).

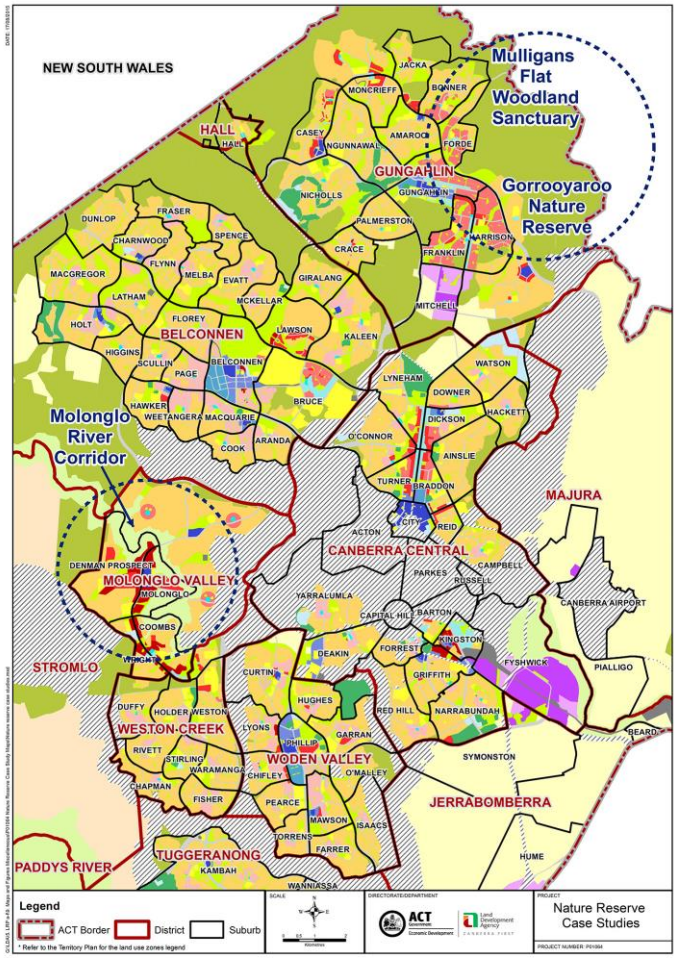
The urban development industry meanwhile has been devising its own rating tools to assess sustainability performance of residential projects, including biodiversity aspects. A 2010 report found six existing tools and thirteen under development in Australia, but little integration across schemes. Many of these tools are designed to measure parameters that give the greatest market advantage, limiting their ability to influence wider practice change across industry (Blundell, 2010). A new national rating framework, Green Star communities, is also in the pilot phase (GBCA, 2011, McNabb, 2013), and biodiversity planning guidelines for grassland conservation in urbanising areas are being developed to align with industry schemes (Garrard, 2015).

Despite new tools and research to assist biodiversity decision-making, these is little evidence of integration and collaboration across the different sectors and disciplinary domains with most knowledge sitting outside the institutions that employ urban planning and management practitioners (Handel, 2014; Grose, 2014, 2010a). Taylor & Hurley (2015, p. 4) also note that much urban research is 'poorly tailored for professional implementation' creating barriers to 'research-to-practice' information exchange.

Research setting and context

Two urban estates adjoining nature reserves in the ACT were selected for this study (Figure 1). Forde in Gungahlin on the northern edge of Canberra, adjacent to Mulligans Flat nature reserve and, Wright and Coombs in the Molonglo Valley, adjacent to the Molonglo River reserve.

Figure 1. Location of study sites



Mulligans Flat protects nationally endangered Box-Gum woodlands providing habitat for threatened woodland birds and other wildlife. A long-term ecological research project is underway to explore the response of these woodlands to various management treatments. A predator proof fence erected around part of the reserve in 2009 has enabled the reintroduction of threatened species to the reserve (Shorthouse *et al.,* 2012).

The Molonglo River corridor supports endangered natural Temperate Grasslands and Box-Gum Woodland, the largest ACT population of the nationally vulnerable Pink-tailed worm lizard on the rocky grassy slopes next to the River as well as many threatened woodland birds (ACTPLA, 2011).

Forde commenced in 2006 and is Canberra's first master-planned estate. Forde Developments designed a suburb that responded to the natural setting, using the open space network to retain mature box gum trees and augmenting habitat with native landscaping, and sensitive treatment of the creek line (Lend Lease, 2006). Forde was the first suburb developed after the 2003 fires, integrating new requirements for an edge road along the reserve boundary and an asset protection buffer (ACTG, 2014). It set a new benchmark for residential development attracting premium prices and selling out two years ahead of expectation (CIC, 2012; McNabb, 2013). Development is complete with over 1250 lots accommodating around 3000 people.

The ACT Land Development Agency (LDA) commenced Wright in 2011 and Coombs in 2012, with over 4500 dwellings being constructed to accommodate about 9000 people (www.lda.act.gov.au). These were the first *EnviroDevelopment* certified suburbs in Canberra, for categories of energy, ecosystems, waste and community, and also the largest development in Australia to have received accreditation (UDIA, 2011). An agreement between the ACT Greens and ACT Government had stipulated how these suburbs would be developed including solar passive requirements for each dwelling (LDA, 2010). There were protracted negotiations about setbacks for the urban boundary adjacent to the River to meet requirements for fire management and protection of threatened species, identify edge treatments (Eco Logical, 2011) and provide for public access and management (Hassell, 2012).

Development of both estates is of interest to ACT catchment and conservation groups who have long associations with the adjacent nature reserves both as advocates and citizen scientists (Bounds, 2014). These groups initiated a novel governance structure, Bush on the Boundary (BoB), as a forum to address biodiversity and urban development impacts during the design and development of Forde, and Wright and Coombs at Molonglo (CCACTR, 2013).

Research approach and methods

This research uses case studies, suited to in-depth investigations of social phenomena in context (Yin, 2009). Mixed methods were used: semi-structured interviews; focus groups; participant observation in group settings; and document analysis including of technical reports, research papers and media articles. Each method provides different insights but as Layder (2013, p.71) notes:

> *"Observations act as both a check on interview data and/or documentary materials. Conversely, documentary materials and interviews will serve as a check on the reliability, accuracy and veracity of your observations."*

Semi-structured interviews allow for the 'discovery' of information about a person's views and experience (Layder, 2013) and are the principal data in this study. Thirty-five practitioners in planning, development, biodiversity conservation and management participated in interviews lasting 60 minutes. Interviews were audio recorded and transcribed. The sample covered designers, advisers, developers decision-makers and land managers in the private, public and community sector (Table 1).

Table 1. Practitioners interviewed in study

Practitioner group	**Number Interviewed**	**Role at study site/s**
Developers - private/public (D)	5	Concept planning, estate design and delivery
Public policy/decision-maker (DM)	5	Environment and planning decisions
Planners - government/consultant – landuse and infrastructure (P)	5	Strategic planning and assessment advice
Ecologists - government/consultant/research (E)	4	Ecological advice
Community – ecology/sustainability/education (C)	4	Place knowledge, education, citizen science
Environmental planners - assessment, fire, weeds (EP)	6	Impact mitigation and risk management advice
Public land managers (LM)	5	Land management advice
Other – real estate valuer (V)	1	Valuation advice
Total	**35**	

Two focus groups were conducted with proceedings audio-recorded and transcribed. Focus groups were used as a sounding board for the perspectives emerging from interviews (Finch & Lewis, 2009). The first focus group held in July 2012 and explored the experience of 10 practitioners from the LDA developing estates next to nature reserves. The second focus group explored views about the BoB with 20 participants in November 2012.

Informant data from interviews and focus groups was coded into thematic files that relating to the main lines of inquiry. This data was analysed to draw out commonly cited issues and some specific perspectives about the case studies (Spencer *et al.,* 2012).

The researcher also attended bi-monthly BoB meetings; reference group meetings for the Molonglo River Reserve, Mulligans management meetings and public meetings. Active participation in these settings, allowed for both observation and interaction with practitioners (Layder, 2013).

Results

Results have been presented under six main themes of inquiry. A summary of the key issues that emerged from the interview data and focus groups is provided where these perspectives were expressed by 3 or more informants. Excerpts from interviews are also included to reveal different perspectives among the practitioner groups (see Table 1).

Theme 1. Challenges of developing near reserves

All practitioners acknowledged significant challenges working near reserves with many expressing reservations about the desirability of this urban form (see Table 2). Practitioners in advisor roles and the decision-makers were most concerned about the long-term ecological consequences and large up-front investments required for investigations and edge treatments. The development practitioners were mindful about the financial risks and close public scrutiny they attract as the developer, while openly acknowledging the amenity and marketing opportunities presented by the reserve setting.

Table 2. Perspectives about the challenges of developing near reserves

Summary of key issues
-Sensitive setting carries public and private risks (financial and environmental) -Greater scrutiny of developer and agency performance -Uncertainty about long-term biodiversity impacts of development next to reserves. -Large investment needed in investigations and treatments -Marketing opportunities from proximity to reserve -Perceptions that reserves become proxy for open space in adjacent suburbs
Interview excerpts about the challenges of developing near reserves
“Where it is difficult to develop because of environmental constraints, financiers see that as a risk and we have to reflect the time delay in bringing it to the market and holding costs.” (V)
“You have to be conscious of its existence on your boundary. People are watching you. Whilst it has constraints, it has benefits, a reserve can’t be built on so it’s a great selling tool.” (D2)
“I have no hesitation about the appropriateness but I want it done well, that environment protection is the best we can achieve while balancing our need for housing.” (DM1)
“New edge subdivisions are relying on reserves as “sacrificial” open space. We’ve seen it in Molonglo with the river corridor.“ (C2)
“Developers see the reserve in marketing terms, they incorporated the environment to a point with Coombs and Wright to get it off the ground.” (P2)
“We have to use our resources in smarter ways, achieve a pattern of settlement that doesn’t continue to hit what are increasingly stressed ecosystems already.” (DM3)
“I think if you had a choice you wouldn’t do it, but then it’s beneficial that, we’re learning about it not just as planners and scientists but the community as well.” (P5)
“I worry about the economic imperative of developing edge suburb, ecological common sense suggests you don’t put suburbs right up against reserves.” (E4)

Theme 2. Effectiveness of planning processes near reserves

Practitioners viewed Forde as a good demonstration project and a model for how to develop next to nature reserves. Practitioners noted that once the concept for the suburb was adopted as policy and construction progressed, it set a new standard for residential development (see Table 3). Practitioners within and outside of government perceived the planning process at Molonglo was compromised by the political imperative to release land. Strategic plans provided little guidance about weighting competing policy objectives and no principles for defining the urban boundary. Aligning requirements to manage fire risk and threatened species at the site scale required tailored solutions and different knowledge sets. Practitioners managing these investigations and trying to settle the urban boundary at Coombs felt these

complexities were not well understood by the decision-makers. Some practitioners cited instances where there was an unwillingness to prosecute agency policy.

Table 3. Perspectives about planning processes near reserves

Summary of key issues
-Bio-sensitive design at Forde shifted policy and practice and set new benchmarks -Tensions reconciling social/economic and ecological objectives at Molonglo -Land release targets seen as driving and compromising planning processes -Physical and ecological complexity at site scale not well understood by decision-makers. -No go areas and principles for setting boundaries should be addressed in strategic planning
Interview excerpts about planning processes near reserves
"Part of the journey at Forde was to get the officials to understand a new way of doing things. We took them interstate to show how it was done, to allay fears, because, there's a standard they wanted, and we had to change that. It was ground breaking." (D1)
"I don't think it was appreciated how difficult Molonglo would be and how hard the physical planning would be, and nor did they appreciate the infrastructure costs." (P3)
"Bushfire boundaries and no go areas for environment should have been settled. The danger is if you get pressure to fast-track and don't give things as much as attention." (P2)
"Many agency people don't trust the planning process they are asked to engage with." (EP5)
"It's not a bad planning process but this insane desire to develop at the quickest rate means we're not running processes sequentially so, jumping the gun on many decisions." (C3)
"In reality it's political. We can provide all the advice in the world but it comes down to dollars as a result of lost housing blocks." We're not fully involved and that's deliberate because we're seen as a barrier." (EP3)
"At Molonglo, the key challenge was defining the boundaries. I would have thought that if not setting the boundary, then principles should be developed by the strategic planning." (D5)

Theme 3: Availability and sharing of knowledge

Practitioners felt they had adequate information for decision-making in their different domains but many referred to the poor systems for capture, sharing and data management across government (Table 4). The separation of the research and land planning and management functions was seen as a negative. Practitioners noted the absence of pathways to feed site-based and community knowledge into decision-making and a tendency in the planning cycle to draw heavily on consultancy reports and discount other forms of knowledge. Peer review of consultancies was identified as a means of ensuring all relevant knowledge is on the table. The utility of local knowledge was acknowledged by practitioners during estate design and construction with the BoB the primary means for sharing this knowledge (Table 6).

Table 4. Perspectives about knowledge sharing

Summary of key issues
-Better integration of data/knowledge/systems needed in and across agencies -More professional collaboration and integration of ecological research and planning functions -Peer review of external (consultant) ecological studies required to ensure adequacy -Recognition of the value of site-based and community ecological knowledge but few sharing pathways
Interview excerpts about knowledge sharing
"A duplication of effort going on. I'd like to see more consistent approaches and ways of sharing and utilizing data that others go to great effort to collect." (EP5)
"Departments think they are the sole repository of the expertise, a culture of the 'professionals know best'." (C3)
"The sort of fragmented organisation we have with research sitting over there and us here is OK while we know each other but as time goes on that goodwill will disappear." (EP2)
"We don't have enough environmental scientists and they should be on the same floor as the planners – prevents an "us and them" mentality. There is a lot of silos." (EP6)
"With the way we work, a lot of knowledge in people's heads and we have a big turnover of staff. So, that's a real problem." (LM2)
"If you're a land manager the most basic information you need is what land you manage. We don't even know that in the ACT. The system can't tell you what we manage." (EP3)
"I don't think it's well integrated. Without the planners and the researchers working together ... I don't think ecological advice is listened to. We're dominated by the development authorities." (E2)

Theme 4: Post occupancy management next to reserves

Practitioners were very satisfied with the quality of landscaping and open spaces that had been created in the new suburbs but conscious of the realities of post-occupancy maintenance (see Table 5). Since handover of spaces in Forde, weeds have invaded the habitat plantings next to the reserve and along the waterway. Development practitioners see this 'neglect' as the most frustrating and demotivating aspect of their work to create more nature sensitive communities. The acute funding and technical capacity shortfalls in post occupancy management of urban spaces was noted by all practitioners, including the decision-makers. Several practitioners acknowledged that the suburban maintenance budget had not increased for a decade despite the addition of a dozen new suburbs in the ACT. At Molonglo, practitioners viewed the early involvement of the land managers in the roll-out of the remedial and restoration works as a positive step. The injection of new funds for post-occupancy management via EPBC offsets was seen by many as creating a 2-tiered system where reserves within offset programs are actively monitored and managed and others miss out.

Table 5. Perspectives about post occupancy management

Summary of key issues
-Disconnect between policy to protect biodiversity and the resources and professional knowledge needed to maintain conserved areas and new habitat after handover -Fragmented management of biodiversity across urban landscape and little targeted research -Funding for offset areas creating a 2 tier system of management. -No maintenance and monitoring of suburban biodiversity measures (Forde) -Improved process where land managers involved from design concept and in remedial works (Molonglo)
Interview excerpts about post occupancy management
"TAMS's resourcing has not grown in proportion to the asset base. People expect government to be efficient, but you can't do it off the smell of an oily rag and get quality maintenance." (DM2)
"We need long term monitoring that enables us to assess the effects of remedial actions." (C3)
"It's disappointing that when we leave the estate, its down to dollars, the things that we've put in place for the environment are not maintained." (D4)
"We have lots of operational problems treating invasives but there's no weed research in the ACT." (EP2)
"We don't adequately price the cost of maintaining our reserves. When you consider their value for human health and wellbeing, as natural places, amenity value, we just don't capture that." (DM3)
"We are weak on consequences and costs, if you want to maintain and improve reserves it costs. Newly planted trees need maintenance." (EP6)
"I'm conscious of the numbers, it's a massive commitment and we struggle to manage the place — we have 17 times more green space than Sydney." (DM1)
"We don't go back to check whether the work we've done near reserves is the best way to do it?" (D5)

Theme 5. Collaboration with community stakeholders – the BoB

BoB was viewed as a valuable forum by all participating practitioners (see Table 6). Strengths cited by informants revolved around its utility for problem-solving because information was freely shared, concerns aired and confidences maintained. Having participants with the right skills and practical knowledge was seen as a particular strength and also led to collaborative projects between community groups and developers. The success of BoB during the development of Forde created the momentum for establishment of a BoB forum at Molonglo with the same modus operandi.

Table 6. Perspectives about stakeholder collaboration – the BoB

Summary of key issues
-BoB seen as beneficial forum to air and resolve issues during development process. -Key strengths were information-sharing; confidentiality; informality; time-limited; issue/place focused. -Creative projects and partnerships evolved to deliver community education projects -Sharing and application of local knowledge not enabled elsewhere -Model is readily transferable to other urban edge conservation settings
Interview excerpts about stakeholder collaboration – the BOB
"We had the right people and could have open discussion and thrash things out. It was collaborative relationship and an opportunity to get feedback before something got out of hand." (D2)
"The big strength is talking through issues of common interest in an environment that's not formulaic, it's not about making decisions or reaching consensus, it's a space to share views and discuss options." (E2)
"They're all vocal and got their views, and special interests that they're looking after, but it seemed to me to work well as a forum. If there was a problem, it could be discussed." (D1)
"Mulligans Flat Road was a good outcome - they were going to build a highway through the reserve and they ended up just sealing the existing alignment." (C3)

"It was a huge surprise because, often NGOs are highly negative and highly critical. But BoB is the complete opposite, its about wanting to help, not trying to tear it down." (P4)

Theme 6 – Practice learning and innovation next to reserves

Development practitioners cited the rigid application of standards for some infrastructure as a disincentive for adopting new practice as well as minimal evidence about how remedial measures are performing in the landscape (see Table 7). Developers were inclined towards experimenting with new approaches but often resort to the path of 'least resistance' for cost and time reasons. The pace of activity means practitioners quickly shift to the next project with little time for reflection, although many acknowledged that learning is built into business planning for subsequent projects.

Table 7. Perspectives about learning and innovation

Summary of key issues
-Limited evidential base and rigid application of standards acts as a barrier to willing innovators -Most learning built into new projects via business planning -Some transfer of learnings happening through BoB (Forde to Molonglo) -Offsets research to provide evidential base inform urban edge habitat management (Molonglo)
Interview excerpts about learning and innovation
"Cost indicators drive low maintenance solutions. They need technical capability, people with understanding because if you don't understand something it's easier to reject it." (D3)
"It's interesting for me coming from a background which treats developers with suspicion, they are totally frustrated by their inability to deliver environmental outcomes". (EP1)
"We are challenging notions around infrastructure, that's a huge challenge for asset managers". (PI)
"The process is about who can stay in the trenches the longest? We get timed out and then take the path of least resistance to build the estate". (D4)
"The reflection happens, in business planning for the next stage. What would you do again? What would you do differently?" (D3)

Discussion

There is ongoing public debate about the adverse impact of greenfield development on biodiversity in Canberra (Cook, 2011; Doherty, 2011; Thistleton, 2013, 2014). Practitioners interviewed in this study are concerned about these impacts and open to working in different ways and using new knowledge to create more ecologically sensitive communities near reserves.

The ACT's planning and land management regimes however are not necessarily responsive, with perceived failures of knowledge flows, inflexible standards and inadequate investment in care, monitoring and review of biodiversity interventions. Practitioners talk of the 'disconnect' between policies to protect biodiversity applied during design and planning and the management reality after construction. While new funds for suburb maintenance were made available in 2015/16 ACT budget (Kelly, 2015) there were significant cuts to weed control (Thistleton, 2015).

Failure to care for conserved and newly landscaped areas not only undermines the biodiversity benefits but is demotivating for developers who have invested in more responsive designs and frustrating for new residents (Sawa, 2015). This policy implementation gap is not unique to the ACT (Grose, 2010a) and also mirrors the post-occupancy experience in conservation subdivisions in the US (Hostetler, 2012; Hostetler & Drake, 2009).

On a positive note, new research funded by EPBC offsets in the Molonglo Valley is generating knowledge about how to manage threatened reptile species and habitat that is transferable to other urban edge habitats (Reinfrank, 2015). New ecological studies are also reframing how we might use the urban matrix to retain and maintain biodiversity values (Ikin *et al.,* 2015). For example Stagoll *et al.,* (2012) found that large eucalypts, such as those retained in urban parks at Forde, increase the number of native birds, and also breeding.

An exciting finding of this study is the valuable role played by community stakeholders in facilitating BoB forums which were able to counter many of the barriers to the exchange of information between urban researchers and practitioners (Taylor & Hurley, 2015). BoB operates as a 'community of practice', a safe space to jointly explore and reflect on what might work, while anchored in the realities of development practice (Wenger, 2010). Practitioners were willing participants because they shared an interest in improving development practice near reserves. Illsey *et al.* (2010) talk of these soft spaces allowing for collaboration across boundaries and creating opportunities for leadership and promotion of cross-sectoral initiatives.

Conclusion

Outer urban expansion in our capital cities is coinciding with nationally listed threatened ecological communities and species. This study explores the perspectives of practitioners involved in two new residential estates in Canberra adjacent to nature reserves that protect listed communities.

At Forde, development practitioners drove the cultural shift from the conventional to a sympathetic design concept that respects the adjoining nature reserve and retains and augments habitat within the suburb. At Coombs, planning and development practitioners struggled to translate strategic fire management and biodiversity requirements into acceptable measures at the site-scale, with no local precedents to draw on and uncertainty about ecological effects.

Practitioners participating in this study were more than willing to innovate but cited barriers created by inflexible regulations and absence of evidence about how interventions function over time. In particular, the absence of a cohesive municipal regime for post-occupancy management and monitoring of biodiversity interventions is identified as a missed opportunity for experiential learning and wider take-up. This space needs more investment and collaboration between ecologists, open space and conservation managers to maintain conserved and created urban landscapes, monitor how they function over time and channel this knowledge back into decision-making. Research underway on threatened reptiles in the Molonglo Valley provides a model of how this might work but such projects are currently limited to only a few EPBC listed threatened species and communities.

This study reveals the value of BoB forums at Gungahlin and Molonglo, and now being replicated at the Riverview development in the ACT and Googong in NSW. Mutual interests in improving development practice at the case study sites created a fertile space for 'community of practice' type learning (Wenger, 1998). These self-governing forums facilitated exchange of research and local knowledge and novel collaborations between developers and the community (LDA 2013), providing a 'research to practice' model with potential application in other Australian cities with similarly engaged practitioners (Taylor and Hurley, 2015).

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