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Assessing And Strengthening Community Capacity Building In Urban Biodiversity Conservation Programs

Conserving native biodiversity in cities involves addressing social and ecological factors that contribute to the persistence of species. Multiple activities and programs are needed, with the participation of land managers across private and public realms; from householders to state and local governments. There are few planning and assessment tools that assist practitioners, at the scale of local governments and in the context of urban ecosystems, to consider and address inter-related human and ecological issues. We present a systems-based framework, drawn from diverse literature, for assessing conservation programs (before, during, or after implementation) on the basis of having social and ecological features that strengthen a community's capacity to achieve conservation and human wellbeing outcomes. The framework can assist consideration of a program's impact on the community's social and ecological resources, the linkages between them, and how these might be strengthened to better achieve desired social and ecological goals. To illustrate its use we apply the framework to data from an urban wildlife gardening program in Melbourne, Australia. Using the framework highlights where the program strengthened the community's social and ecological resources for undertaking conservation, and their deployment in conservation activities. It also helps to identify potential future actions, in this case fostering community-local government program codesign, setting ecological targets for coordinated private and public land management, and dovetailing with the municipality's community strengthening programs. Community capacity building frameworks can highlight aspects of urban conservation programs that are currently underappreciated, including modes of community involvement, and their social as well as ecological benefits.

Keywords

urban nature conservation, social-ecological framework, conservation planning, conservation management, urban greening

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INTRODUCTION

Increasingly, biodiversity conservation attention is directed to urban landscapes where populations of native species persist (Aronson et al. 2014; Ives et al. 2016) and can be supported by addressing the drivers of their survival (Kueffer and Kaiser-Bunbury 2014; Aronson et al. 2017). These drivers derive from the interaction of social and ecological processes, including landscape configuration and heterogeneity, built and physical environmental qualities, species needs, biotic interactions, and human activities (Cadenasso and Pickett 2008; Aronson et al. 2017). Human interactions with urban biodiversity occur at a number of levels, including individual, community and institutional and are informed by cultural norms and practices (Buizer et al. 2016; Raymond et al. 2018).

Importantly, the biophysical domain (e.g. air, water, nature), environmental spaces (geographical places and their associated biodiversity), humans and their norms and practices are each affected by each other, with varying outcomes for conservation and human wellbeing (Fish et al. 2016; Palomo et al. 2016). The physical, mental, emotional, spiritual, and cultural facets of wellbeing that can be supported or enhanced by urban green spaces are well described (e.g., Russell et al. 2013; Mensah et al. 2016). These benefits can be passively received (e.g. cooling from trees) or derived from recreational, social or cultural practices in green spaces, including engaging in environmental stewardship and biodiversity conservation activities (Keniger et al. 2013; Capadi et al. 2015; Maller et al. 2019).

By biodiversity conservation (conservation) we refer to actions that support the persistence of indigenous (locally native) plant and animal species amongst the suite of species living in or visiting an urban area, recognising that contemporary species assemblages will be different to the assemblages that existed there prior to human habitation (Kowarik 2011; Lepczyk et al. 2017). The ecological role and conservation value of different types and management of urban environmental spaces varies to some degree for different species, given that each species has its own biophysical and behavioural needs (Fischer and Lindenmayer 2007; Lepczyk et al. 2017). These needs include appropriate climate; soils; water and food; amount, size and structure of vegetation; species interactions (e.g. predators, competitors); and behavioural and reproductive requirements (Pickett et al. 2011). For human actors as well, the access to and value of urban environmental spaces varies (Buizer et al. 2016; Palomo et al. 2016). Thus, biodiversity conservationists and urban green space planners and managers may have different goals for the use and value of green spaces (Lepczyk et al. 2017), although human wellbeing may be a common goal.

Depending on the species targeted for conservation and the context in which it is occurring, urban conservation activities may include seed collection; plant propagation and planting; species reintroduction; conservation-focused land management; and habitat protection, restoration and enhancement such as introducing water features, removing weeds, and improving vegetation structure and composition (Cadenasso and Pickett 2008; Pritchard et al. 2011; Kueffer and Kaiser-Bunbury 2014). These activities can be at coarse (e.g. regional park) or fine (e.g. single mature tree, domestic garden) scales, and in ‘unconventional’ spaces such as cemeteries, brownfield sites, gardens, roadsides, railway verges, and building cavities (Garrard et al. 2018; Soanes et al. 2018; Threlfall and Kendal 2018). Sufficiently sized patches, connectivity, and ‘stepping stones’ of suitable habitat can be key survival factors for many species (Fischer and

Lindenmayer 2007; Lepczyk et al. 2017). Providing these resources requires diverse urban land managers, from residents to businesses and public authorities, acting complementarily to support conservation on public and private land across urban landscapes (Colding 2007; Goddard et al. 2010), and linking their efforts through networks (Ernstson et al. 2010). Suggestions have been made for engagement strategies that respond to the degree, type of human activity, and relationships people have with their biotic communities (Martin et al. 2014; Chan et al. 2016). Supportive institutional policies and practices are also found to support long term continuity of citizens in conserving qualities of urban green spaces (Mattijssen et al. 2017). However, these approaches are poorly recognised or enacted (Ernstson et al. 2010; Buijs et al. 2016). For example, local government conservation initiatives for residents are often directed towards nature education and experiences rather than supporting engagement in conservation activities (Hall et al. 2017).

Practical considerations for urban conservation programs include methods to plan, assess, and improve community-based conservation work (Shwartz et al. 2014). Setting priorities and choosing assessment measures is difficult because social and ecological systems are complex, dynamic and poorly understood, with many unknown feedback loops (Folke et al. 2007; Game et al. 2014). Many conservation approaches and tools are not well suited to this complexity (Game et al. 2014), and there are no definitive conservation program planning or evaluation methodologies (Stem et al. 2005; Bottrill and Pressey 2012).

In this paper we propose an assessment framework for use by urban conservation practitioners to determine how well they build community capacity to achieve biodiversity benefits and community wellbeing in the long term. Using data at hand, practitioners can consider social and ecological inputs, interactions, and interim outcomes of programs in order to plan, modify and manage them. Our framework, drawn from diverse literature including on community health, natural resource management, conservation, and environmental stewardship, considers the social-ecological context of a program, and both conservation and human wellbeing goals. We begin by describing the challenges of conservation program evaluation, particularly in an urban conservation setting. We then define community capacity building, provide a rationale for its use as an assessment lens, and introduce our community capacity building framework. We provide a worked example following this, and finally we discuss the challenges and opportunities of using the framework for urban conservation program assessment.

EVALUATION OF URBAN CONSERVATION PROGRAMS

Traditionally, conservation program assessment has focused on ecological measures only (Kapos et al. 2009; Bottrill and Pressey 2012), usually related to increasing the probability of persistence of ecosystems, habitats, species, and/or populations in situ (Kapos et al. 2008). Amongst the difficulties of defining and tracking these measures are the time periods required to observe change (Kapos et al. 2008; Bottrill et al. 2011); the lack of baseline data (Bottrill et al. 2011); and the lack of clarity about inputs, outputs, outcomes, long term impacts and the likelihood of a causative relationship between them (Bottrill and Pressey 2012). Bottrill and Pressey (2012 p 411) present this example: Analysis of spatial data → identification of conservation areas → reduction in threat from land conversion → avoided loss of biodiversity, noting that the inputs do not necessarily lead to the outcomes or long term impacts, and therefore have limited use as measures.

Increasingly, social considerations are being integrated into conservation planning, for example identifying how communities use an area and where conservation is more likely to attract community support or participation, in order to target conservation opportunities (Ban et al. 2013). There have been criticisms of some of these approaches for their static, prescriptive, and technical nature, which limits understanding of dynamics and trade-offs, and consideration of social factors that are not technical or easily ‘measurable’ (Ban et al. 2013). More recently, systems frameworks that identify social and ecological factors that benefit both biodiversity and the quality of life of human communities have been proposed to evaluate, plan and modify conservation programs at a regional or global scale where human livelihoods are involved (Ban et al. 2013; Kaplan-Hallam and Bennett 2018). Amongst the identified social factors are individual and collective action for nature, confidence, sense of place, interaction with and connections to nature, and leadership (Amel et al. 2017).

Tracking of both social and ecological performance has been reported for developing world scenarios seeking to protect habitats or species within or adjacent to areas used by local communities (Brooks et al. 2012; Brichieri-Colombi et al. 2018). In this literature, social measures focus on poverty alleviation (e.g. employment creation, rights to land and resources) and investment of project-derived socioeconomic gains in conservation (Sheppard et al. 2010; Brichieri-Colombi et al. 2018).

Social-ecological assessment frameworks are also needed for urban conservation scenarios in the developed world. In these scenarios, programs are overseen by local governments whose institutional mechanisms are often poor at appreciating and harnessing diverse municipal actors like residents and businesses on private land (Ernstson et al. 2010; Secretariat of the Convention on Biological Diversity 2012; Buijs et al. 2016). Biodiversity issues are often siloed in a single local government department rather than being integrated across multiple portfolios such as planning, urban design, and community development, leading to a bifurcation of conservation and human wellbeing goals (Puppim de Oliveira et al. 2011). Social and ecological considerations are poorly linked (Aronson et al. 2017). Land and governance is fragmented with different forms of tenure (Cadenasso and Pickett 2008); the scale of conservation work is fine yet needs to be linked across a landscape. Conservation program planning and evaluation also needs to account for culturally and socio-economically diverse communities (Pickett et al. 2011) with varying interests, needs and values (Andersson et al. 2017). This is the context for which we have chosen community capacity building as a program assessment lens.

RATIONALE FOR USING COMMUNITY CAPACITY BUILDING AS AN ASSESSMENT LENS

Community capacity refers to the concept of community assets, for example natural, financial, technical, social and human capital, which can be deployed to produce services or disservices for the community. It has been used in conservation program evaluation (e.g. Moore et al. 2006; Kapos et al. 2008; Botrill and Pressey 2012; Mountjoy et al. 2013a) and in ecosystem services, natural resource management and environmental stewardship literature (e.g. Garnett et al. 2007; Raymond and Cleary 2013; Palomo et al. 2016; Bennett et al. 2018). It is important to note that the scale and detailed elements of capital referred to varies with the scale and type of outputs being considered. This applies particularly to natural, financial, and technical capital. Features of

human and social capital are more consistent. Indeed Eakin et al. (2014) argue that generic human and social capacity associated with human development are critical to harness specific environmental management capacity (in this case climate change adaptation) and there can be positive synergies in developing both simultaneously.

For conservation purposes, Bottrill and Pressey (2012) propose using forms of social capital, such as frequency and type of conservation agency collaborations, or level of conservation knowledge, to measure efficacy of conservation planning investment. Although not measures of species persistence, these forms of social capital (termed capacity indicators) were posited as more relevant to conservation success than resources spent because they underpin actions required to address conservation challenges (Kapos et al. 2009; Mountjoy et al. 2013b). Examples of capacity indicators in Western conservation and natural resource management programs taken from empirical studies are shown in Table 1. In the cited studies (refer footnote to Table 1), the interactions between these forms of capital and how they might be strengthened or harnessed to better achieve conservation or natural resource management are not discussed. Social elements are treated as inputs rather than potential goals, and community wellbeing is not identified as a targeted outcome.

Table 1 Indicators of community capacity for conservation or natural resource management taken from empirical studies (Australia, N America)

Natural Capital	Social Capital	Human Capital	Institutional Capital	Economic Capital
<ul style="list-style-type: none"> • Desired biodiversity values in landscape¹ • Desired seed and propagative material in nurseries¹ • Natural resources that sustain biodiversity^{1,4} • Environmental assets⁵ 	<ul style="list-style-type: none"> • Trust, respect, tolerance^{1,2,4} • Shared values, mutual goals^{1,2,3,4} • Shared understanding of environmental issues⁴ • Communication^{4,5} • Motivation¹ • Sense of place¹ • Learning together^{3,4} • Outreach, education² • Networks/networking^{1,4} • Staff and volunteers^{2,5} • Relationships/partnerships^{1,4} • Cooperation⁵ • Community pride and involvement⁵ 	<ul style="list-style-type: none"> • Knowledge^{1,2,4,5} • Skills^{1,2,4,5} • Experience^{1,5} • Commitment¹ • Motivation^{2,5} • Leadership and leadership succession^{2,4,5} • Strategic skills⁴ • Time⁵ 	<ul style="list-style-type: none"> • Effective governance processes^{1,4} • Collaborative governance processes^{3,4} • Not bound by traditional concepts of agency roles³ • Shared responsibility, sense of ownership with community³ • Plans² • Effective communication² 	<ul style="list-style-type: none"> • Financial resources^{1,2,4,5} • Equipment, supplies^{2,5} • Facilities⁴

¹Moore et al. 2006; ²Mountjoy et al. 2013b; ³Wondolleck and Yaffee 2000; ⁴Raymond and Cleary 2013;

⁵Mendis-Millard and Reed, 2007

We chose community capacity building for program assessment because it is a systems-based concept, involving mobilising forms of capital that comprise capacity in iterative,

interactive processes, in order to better achieve user defined outcomes (Simmons et al. 2011). There are three features inherent in concepts of community capacity building that make it suitable as a framework for evaluating urban conservation programs. First is the inclusion of human actors and social forms and their interactions as elements of community capacity. Second is the notion that community capacity is an *outcome as well as an input and means* of capacity building, that is, community capacity can strengthen through community capacity building, subject to the capacity at hand. For example, individual wellbeing can be an element of human capacity that enables conservation action as well as the product of that action. Third is the recognition that capacity building is comprised of dynamic, interactive processes of effectively deploying forms of capital (Mendis-Millard and Reed 2007; Wendel et al. 2009; Simmons et al. 2011). The purpose of capital deployment may be conservation, environmental stewardship (Bennett et al. 2018), ecosystem services (Palomo et al. 2016) meeting biosphere reserve mandates (Mendis-Millard and Reed 2007), or any number of human wellbeing outcomes (Simmons et al. 2011). Assessing capacity is particularly useful when the end outcome (in this case persistence of wildlife and community wellbeing over generations) extends beyond the expected life of a program and is subject to an array of unknowable circumstances.

One of the seminal definitions of community capacity comes from Robert Chaskin (2001: 295), who used it to evaluate urban social change initiatives:

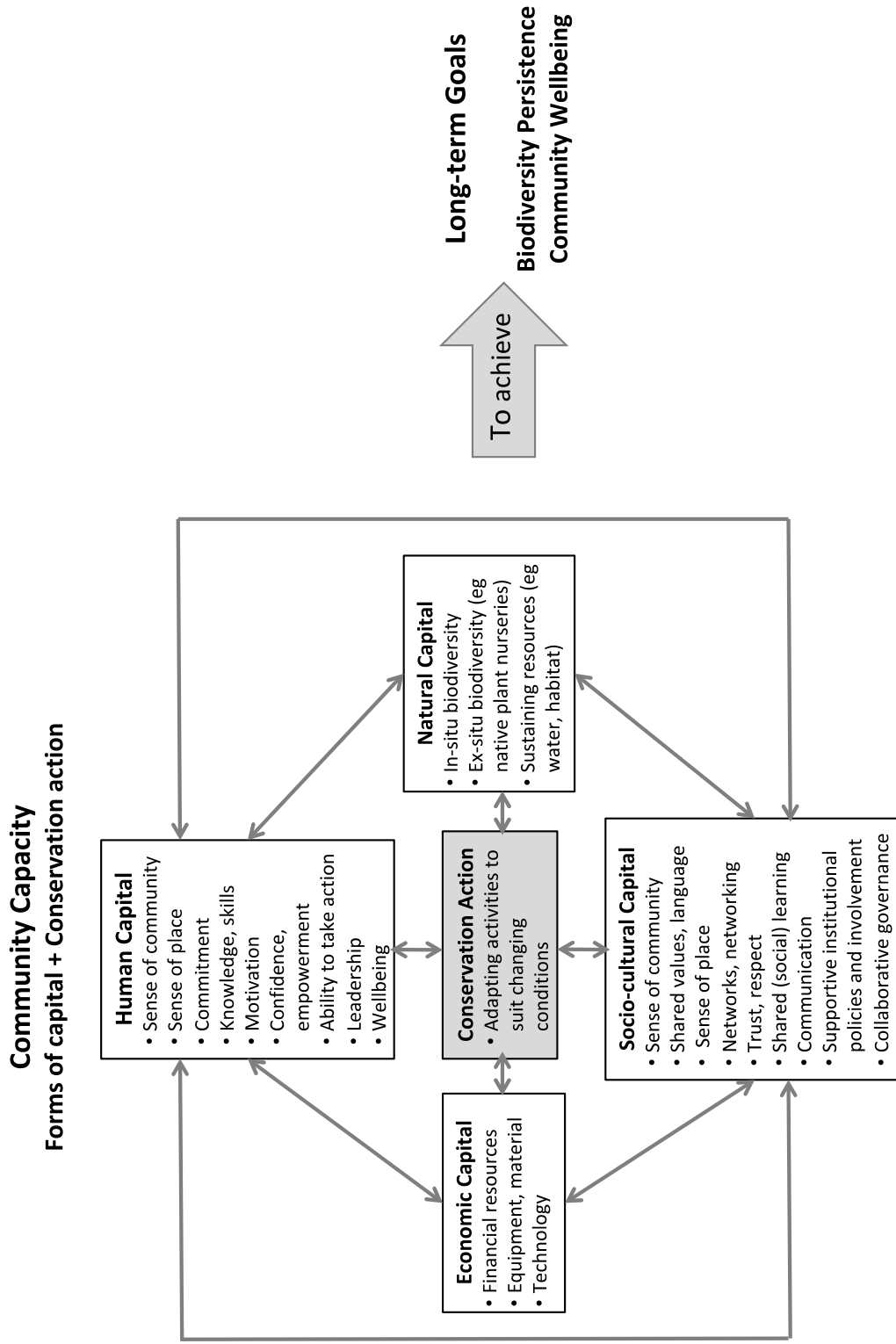
Community capacity is the interaction of human capital, organizational resources, and social capital existing within a given community that can be leveraged to solve collective problems and improve or maintain the wellbeing of a given community.

What particularly appeals in Chaskin's (2001) definition is his articulation of community wellbeing as a desired outcome. A capacity building framework can focus attention on how a community conservation program is improving a community's ability to address its biodiversity conservation and wellbeing issues in an integrated way. This ability can be adjusted and deployed to suit the dynamic challenges and circumstances characteristic of urban biodiversity conservation. There are few capacity building frameworks illustrated in the literature.

COMMUNITY CAPACITY BUILDING FRAMEWORK

Our community capacity building assessment framework is illustrated in Figure 1. It draws on a range of literature from the community health, natural resource management, conservation, and environmental stewardship areas. We define two long-term goals for conservation programs: biodiversity persistence and community wellbeing (shown on the far right of the figure). We use a 5-block diamond to represent community capacity, defined as the ability of the community to achieve these long-term goals. This includes four categories of capital (human, socio-cultural, economic, natural) and, in the shaded centre, the deployment of these forms of capital in conservation action, linked to each other through feedback loops, represented by the double-headed arrows.

Figure 1 Community capacity building assessment framework showing capacity elements indicative of success derived from the conservation, natural resource management and community health literature¹



¹ Wondolleck and Yaffee 2000; Bouwen and Tailieu 2004; Norton 2005; Moore et al. 2006; Mendis-Millard and Reed 2007; Ansell and Gash 2008; Berkes 2009; Kapos et al. 2009; Wendel et al. 2009; Simmons et al. 2011; Sandoval et al. 2012; Mountjoy et al. 2013b; Raymond and Cleary 2013; Metcalf et al. 2015; Mattijssen et al. 2017

By human capital we refer to an individual person's attributes (e.g. skills, experience, motivation, feelings) that enable conservation action. In some literature human capital may also encompass group attributes, for example population demographics (Mendis-Millard and Reed 2007; Palomo et al. 2016; Bennett et al. 2018). By socio-cultural capital we refer to human group dynamics, attributes, institutions and practices. Some elements in human and socio-cultural capital will be common as they refer to attributes of both individuals and groups (e.g. sense of place, sense of community). Some authors refer separately to social, cultural, and institutional capital (Moore et al. 2006; Mountjoy et al. 2013a; Bennett et al. 2018) which we have bundled under socio-cultural capital. By economic capital we refer to financial, material and technical resources. By natural capital we refer to biophysical resources that sustain the persistence of the species or communities of species being targeted for conservation. This can include a variety of elements, as noted in the previous discussion, dependent on species' needs. By conservation action we refer to activities that support the persistence of species targeted for conservation.

The categories of capital in the framework are populated with elements indicative of program success (capacity indicators) drawn from the community health, natural resource management and conservation literature. These are shown in Figure 1. The lists are not exhaustive but serve as a guide for the user to consider in the context of their own programs. For simplicity, the framework does not illustrate finer-grained feedback loops that happen between capacity elements within and across categories and processes over time.

Our framework includes some features developed by Mendis-Millard and Reed (2007) for community-based biosphere reserve management but differs in several ways, including adding conservation action as a category of community capacity and nominating community wellbeing as a desired goal. Our framework also has similar components to a conceptual framework of environmental stewardship presented by Bennett et al. (2018). In the Bennett et al (2018) model, broad environmental stewardship is the end goal. Actors, motivation and capacity are the inputs, feeding into actions and then to outcomes (which might be social, ecological or both), in a linear sequence. Our framework differs in targeting human wellbeing and biodiversity persistence as end goals, identifying the capitals and conservation action as inputs, and linking each of the capitals with each other and conservation actions through interactive feedback loops. We expand on the importance of these interactions in the ensuing discussion. Our framework allows for assessing conservation programs at spatially fine to landscape scale, in an urban context where numerous humans interacting with each other and fragmented habitats have a direct bearing on what conservation and wellbeing outcomes can be achieved. Its ability to be used for a variety of scenarios is critical given the many potential subjects of conservation, each requiring different actions by diverse actors and at different scales.

Adaptive capacity, the ability to respond to change, is intrinsic to our framework because the underpinning mechanisms such as learning from doing, collectively sharing and remembering new knowledge, collaborating (Armitage 2005) and having institutional policies and support (Mattijssen et al. 2017), are elements of the framework's human and socio-cultural capital and conservation action units. However, confirming the realisation of adaptive capacity will require periodic assessment over time. Transformative capacity, used in the context of socio-ecological systems, refers to social qualities and mechanisms required for transformative (radical) systemic change to achieve local and global sustainability (Moore et al. 2014; Wolfram 2016). While some of the identified social qualities are found in our framework (e.g. leadership, involvement

of civil and agency actors, trust, social learning), the scale of the intended sustainability transformation is beyond the scope of our framework's conservation program evaluation purpose.

The assessment process consists of populating the blocks of the framework with attributes relevant to specific assessment goals, program and context. If the objective is program design, capacity elements can be set as goals for program strategies. If program assessment is the aim, the presence of desired capacity features or changes in them over a particular time period can be used to appraise program value and consider improvements. Ideally this would be part of a recursive improvement approach that considers the municipal context (Benvie 2005; Kaplan-Hallam and Bennett 2018), other local conservation or wellbeing programs, medium-term aims for biodiversity conservation and community wellbeing, and monitoring methods. Indeed community capacity can be built through a capacity assessment process, as Mendis-Millard and Reed (2007: 555) found, by "providing a forum to reflect upon the state and future of their communities and the meaning and potential of the biosphere reserve designation" in which their participatory research was situated.

APPLYING THE FRAMEWORK TO AN URBAN CONSERVATION PROGRAM

Worked Example: Knox Gardens for Wildlife (G4W)

The Knox Gardens for Wildlife program (G4W) (Knox City Council 2016a) is collaboratively run by a local government, Knox City Council (Council), and community group, Knox Environment Society (KES). The program recruits and supports local residents and businesses to foster indigenous species on their land to complement Council's conservation work on public land. These activities, called wildlife gardening, include removing environmental weeds, planting indigenous species, improving or maintaining habitat, for example keeping nest hollows and large trees, adding water features, and layering vegetation, including planting prickly thicket to shelter small birds. A key feature of the program is the provision of a personal garden assessment to members, conducted by volunteer garden assessors. Further detail on the program background is provided in Table 2.

Data and findings from research on the G4W program that align with the capacity indicators of program success shown in Figure 1 were mapped into each of the framework's categories of human capital, socio-cultural capital, natural capital, economic capital, and conservation action. Material used in the assessment includes published findings from the research. For specific methods and methodology refer Appendix 1 and Mumaw (2017a). The research was conducted in 2014-2016 to understand: 1) how the program engages and supports residents to wildlife garden in the context of public-private collaboration for conservation; 2) how a land stewardship practice develops; and 3) the effects involvement has on participants' subjective wellbeing and connections with nature, place, and community.

Data sources included group or individual interviews with various individuals associated with the program including 16 members, 13 garden assessors, 3 program founders, 3 program coordinators and KES (2) and Council officers (3); demographic data from the 16 interviewed program members and observations of their gardens; a 2009 Council survey of 94 members

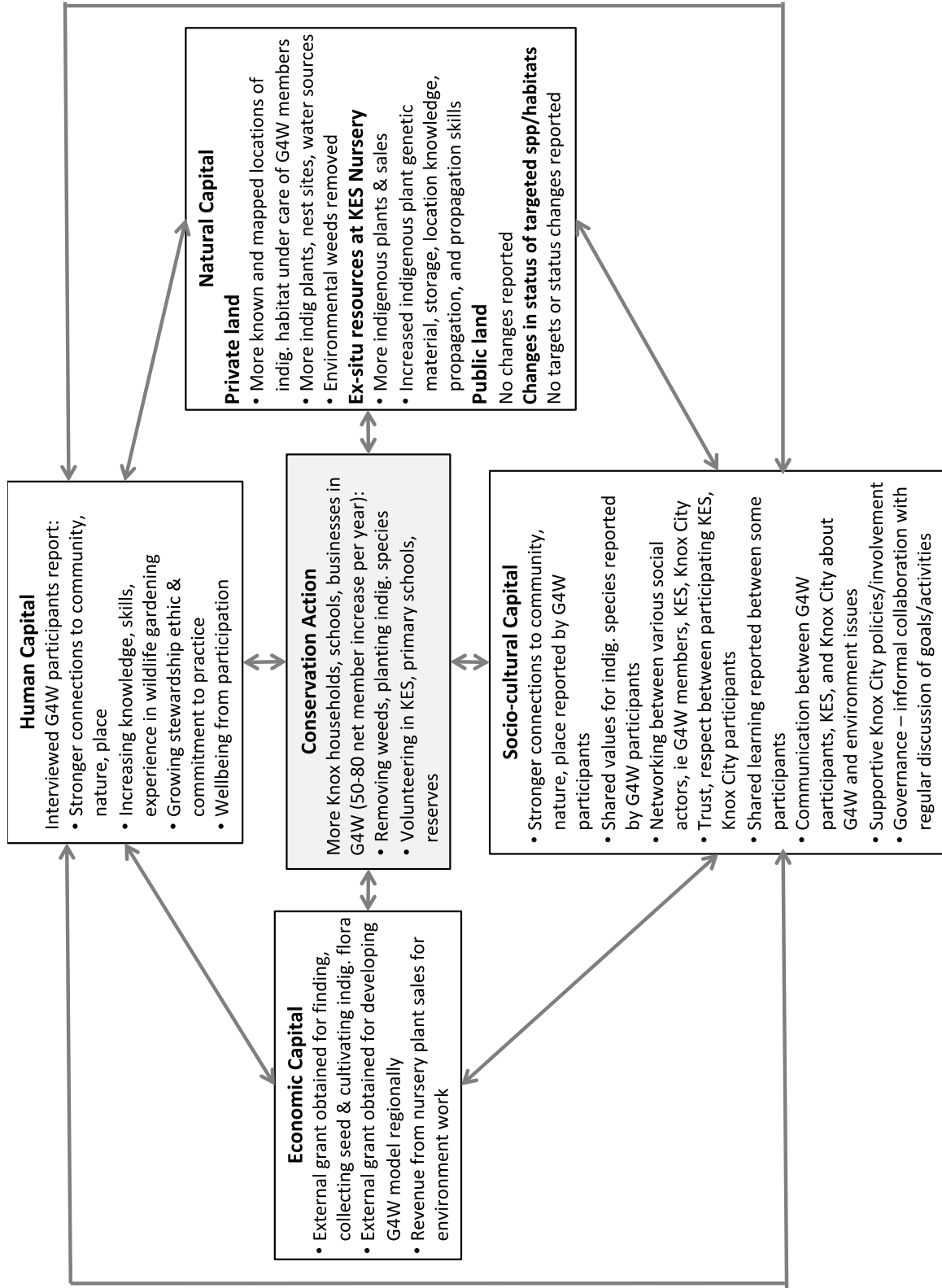
representing a 42% response rate; an open-ended questionnaire of 5 garden assessors; and researcher observations.

Table 2 Background information on Knox municipality and Knox Gardens for Wildlife (G4W)

<p>Knox City governance, location and size</p> <p>Knox City is one of 31 local government areas in greater metropolitan Melbourne, Australia. It is located in the outer eastern metropolitan area, approximately 25 kms from the Melbourne General Post Office. Knox City covers 114 square kilometres, and has just over 154,000 residents and 58,000 homes in eleven postcode localities (Knox City Council 2017). The municipality borders national parks on its eastern and southern boundaries.</p>
<p>Socio-demographics</p> <p>Over the last 30 years Knox has undergone rapid housing and business development; consolidation is occurring but growth continues (Knox City Council 2016b). Knox City's socio-demographic profile is similar to the general Australian population but has more couples with children and residents living in separate houses.</p>
<p>Ecology</p> <p>Twenty-five % of Knox is covered by tree canopy (Jacobs et al. 2014). Dominant native vegetation is open eucalypt forest and scrub bushland (Knox City Council 2015). Many native fauna species are listed as threatened or near-threatened in Victoria; 84% of indigenous plant species are locally threatened, 41% critically so (Lorimer 2010). One hundred and eighteen sites of biological significance have been mapped; threatened habitats and species occur on conservation reserves, and on school, business, roadside and residential land (Lorimer 2010).</p>
<p>Knox Biodiversity strategies</p> <p>Managing bushland reserves; planting indigenous species; increasing habitat corridors and waterways; setting regulatory overlays to support biologically significant sites; engaging community in habitat improvement on public and private land (Knox City Council 2008).</p>
<p>Knox Gardens for Wildlife program (G4W)</p> <p>G4W supports residents and businesses to foster indigenous species on their land to complement conservation work on public land. Knox City and the Knox Environment Society (KES), a community group that supports Knox's environment and runs an indigenous plant nursery (Knox Environment Society 2015), run G4W. Knox City provides administrative coordination; KES provides indigenous plants and volunteering opportunities. Both provide garden assessments and wildlife gardening advice. Any resident can join G4W by signing up. Garden assessors visit new members' gardens, explain the program's purpose, and identify environmental weeds, indigenous biota, and opportunities to help conserve Knox indigenous biodiversity. Members receive a written assessment report, vouchers for free KES nursery plants, newsletters, and event invitations (Mumaw and Bekessy 2017).</p>

Figure 2 provides a snapshot of the framework assessment, which is summarised briefly below.

Figure 2 Impact of Knox Gardens for Wildlife (G4W) from a community capacity building perspective



Human Capital

Interviewees spoke of improvements in human capital, primarily G4W members' increasing knowledge, skills and experience in wildlife gardening, and stronger connections to nature, community, and place (Mumaw 2017b). Some reported a stronger ethic, commitment to, and values for conserving wildlife and the environment as a result of program participation (Mumaw 2017b). Members and garden assessors reported subjective wellbeing benefits from participating in the program by experiencing nature, sharing experiences and knowledge, learning, and making a worthwhile contribution to wildlife and the environment (Mumaw et al. 2017). These outcomes were linked to interacting with people associated with the program, the visible involvement of Council and KES, their endorsement of the conservation value of members' gardening, and learning by doing (Mumaw 2017b; Mumaw and Bekessy 2017; Mumaw et al. 2017). The outcomes also contributed to strengthening elements of socio-cultural capital, for example stronger community connections, communications between participants, and shared values between group members. This demonstrates the importance of recognising the interactions between forms of capital in understanding their collective contribution to achieving the end goals of biodiversity persistence and community wellbeing.

Socio-Cultural Capital

Strengthening of socio-cultural capital occurred through the development of new linkages between involved actors (Mumaw et al. 2017), growing trust and respect, and appreciation of different parties' contributions to conservation. For example, one Council program coordinator said:

The messages coming from KES are probably stronger than the messages that come from us, because they're coming from a community group as opposed to an authoritative government figure.

At the same time, the coordinator reported that program members rang Council staff to talk enthusiastically about wildlife in their gardens, felt Council wanted to hear from them, and that Council was "pro-environment" in their support of the program. Council support for the program was highly valued and motivating for participants (Mumaw 2017b; Mumaw and Bekessy 2017). A KES office holder noted the opportunity to build relationships with Council staff and community members about and for the environment through program planning and events. Both program members and KES office holders explained the importance of to them of seeing other community members volunteer to help the environment:

People come here [KES nursery] and they cannot believe it's run by volunteers... that people are still doing things because they value them... for the sheer good of it. (KES office holder)

The strengthened social capital, including connections between community members and Council and the shared learning between them, came from participating together in a program to conserve municipal indigenous biodiversity (Mumaw 2017b; Mumaw and Bekessy 2017; Mumaw et al. 2017).

Natural Capital

Program-related improvements in natural capital were reported for private land through the conservation actions of members, including their removal of environmental weeds, adding water features and planting of indigenous species (Mumaw and Bekessy 2017). Council interviewees reported identifying and mapping previously unknown occurrences of indigenous species or remnant vegetation on members' properties, and donation of conservation-significant land to Council by some G4W members. KES office holders reported improving their collection and holding of genetic material and propagation skills for indigenous plant species. This included securing a grant to locate, collect, store and propagate threatened indigenous genetic material, which they obtained with the support of Council:

It's our job to try and find the ones on the list...and we either collect cuttings or seed or the plants themselves...and then we try and grow them, and then through Knox Council, put them back into various reserves. (KES office holder)

No species- or habitat-specific conservation or monitoring strategies for integrating Knox Gardens for Wildlife member- and Council managed land were raised by interviewees.

Economic Capital

Three contributions of economic capital generated by the program were mentioned: two external grants obtained for related activities and revenue procured from growth in indigenous plant sales. A KES office holder noted "we've got ourselves a 50% increase [in plant sales] over the last 2 years here at this nursery, a factor of 4 or 5 over the 5 year period". This was attributed in part to program members although there was not a system in place to track whether sales were made to members.

Conservation Action

This category of the framework represents deployment of human, social, natural, and economic capital in conservation action, which itself builds further capital for fostering biodiversity and wellbeing. Council records show increasing numbers of households becoming program members year on year. All interviewed members had planted indigenous species and all but one had removed environmental weeds and this level of action was endorsed by findings from a 2009 member survey (Mumaw and Bekessy 2017). Ninety-six per cent of survey respondents reported planting indigenous species and 88% removing environmental weeds. Some garden assessors and program members reported bringing wildlife gardening into their children's or extended family members' schools and pre-schools, volunteering in Council reserves, or joining KES and participating in seed collection and plant propagation:

It's been good for us as a family because I've been able to introduce [son] to the nursery...he came out seed collecting so then he learns how it works, how a plant actually reproduces and how you collect seed, and that's been important for us as well.

DISCUSSION

The community capacity building framework mapping illustrates that the G4W program stimulated gains in human capital (conservation knowledge, skills and motivation, and wellbeing), social capital (social links, communication, shared values and learning), natural capital (knowledge of biologically significant sites, improved habitat quality on private land, ex-situ biodiversity resources) economic capital (grants and revenue from plant sales) and increased conservation action. These gains were generally linked to each other. For example, the support of KES and Council in developing and resourcing the program (socio-cultural capital) motivated and skilled residents to wildlife garden (human capital), leading to their undertaking conservation action, leading to increases in their subjective wellbeing (human capital), and improvements in natural capital.

The assessment does not quantify on its own what difference the program has or will make on the long-term survival of locally native species or community wellbeing. What it does offer is insights into previously poorly considered social and ecological community resources for conservation that the program has accessed and strengthened, and linkages between them. It provides a basis for considering how these resources might be harnessed to improve the community's connections with nature and each other, and be put to use in future conservation activities.

Although impact assessments are more frequently being used to review the social aspects of conservation programs, results are rarely applied to adaptively manage programs (Kaplan-Hallam and Bennett 2018). Tools like the community capacity building framework are useful in the context of making sense of practical engagement with conservation in 'an ongoing stream of commonplace, task-oriented, local practices', looking forward, acting on the situation at hand, and dealing with uncertainties through learning by doing (Wagenaar and Wilkinson 2015:1267). This is particularly appropriate given the uncertainties, complexity, and different values and access urban residents have to nature, wildlife and green spaces in cities. One can under-estimate the contribution of a program to the long term goals of conservation and fostering wellbeing if one's focus is on the individual parts rather than the whole, or on desired outcomes which are affected by many uncontrollable or unknowable forces. The participants in the G4W research did not have such a framework. The learnings that surfaced for them as they developed or engaged in the program, heard the emerging research results, and considered future actions, highlight how such a framework could speed up or inform such a process, and indeed were the impetus for our development of the framework. We describe these learnings as a way of demonstrating the opportunities of using the framework.

The intent of program founders was for the program to encourage residents to value and help conserve indigenous biodiversity:

It was a way that we could potentially influence residents that lived around reserves, [to improve habitat] ... we could increase corridors... introducing the community to biodiversity and the concept of the value of biodiversity. It was a way of getting people to connect to the natural environment through their own space.

However, there were few monitoring or assessment measures of program success at the outset. Founders reported that initial performance measures consisted of tracking membership growth and attendance at program events. Over time, program leaders began to notice and appreciate the social benefits being generated by the program:

The social connections ... [were] never an intended outcome, so that was just something that I'm still amazed by... people really have enjoyed finding others that have similar values... it's made [the indigenous plant nursery] a community hub. Like, people go there now, not just because of plants, they go there for those social connections.

Discussing our research results with program leaders stimulated their interest in understanding and monitoring the social impacts of the program, and how these build further potential to achieve biodiversity conservation outcomes. A Council manager noted that social measures were now being considered as performance indicators for the program including community participation, connectedness and wellbeing outcomes:

Do people feel better connected to their community, do they feel engaged with what's going on, connected with people, do they feel engaged with the political aspects of the society they live in. Those sorts of things moving forward are the things I think we should be measuring in addition to the biodiversity outcomes that the program is trying to achieve... the connection between biodiversity and community health and wellbeing.

Program coordinators subsequently designed a member survey, with the help of one of the researchers, to quantitatively test the wellbeing and social connection results from the qualitative research interviews. Council interviewees also noted that the involvement of families, young children, and new immigrants was a positive indicator of building capacity for future conservation action and represented a broader demographic than is typical for their conservation programs. Indeed, the potential to connect new immigrants into the community is now viewed as a key benefit of the program and there is some consideration of how the G4W program can complement the municipality's other community strengthening programs.

Another significant learning for the program founders, which comparisons with the framework's capacity indicators can draw out, is the importance of collaboration between Council and community members in the design and management of the program. A KES co-founder explained the importance of community involvement:

If things are pushed from the ground up they often work a lot better than when they come from the top down because the top down [Council] would have seen it very much as a feel good program, whereas the people coming pushing it have turned it into something real, pushing it from the ground up. (KES co-founder)

With limited financial resources the founders worked together to implement the program organically, celebrating 'small wins'. A collaborative partnership developed:

The relationship between Council and KES has become much more of a partnership focus. It's developed a trust... we work together on programs and objectives that we want to achieve as a partnership, that's been a fantastic thing. (Council co-founder)

The founders developed trust, shared understanding, a commitment to continue, and regular program planning. These are qualities deemed critical for successful collaboration between agencies and stakeholders (Wondolleck and Yaffee 2000; Bouwen and Taillieu 2004; Ansell and Gash 2008), and for effective environmental stewardship in cities (Bodin et al. 2006; Andersson et al. 2014).

From an ecological perspective, a Council manager's assessment intent was a long term measure: "I'd like to think that every 10 years, we would review how are we tracking in terms of our remnant vegetation on private land and on public land". There was no articulation of the value of knowing where indigenous species could be found or having opportunities to engage community members in propagation and planting of indigenous species, either in the community nursery or on their land, to complement Council's conservation work. Yet growth in wildlife gardening knowledge, competence, and confidence builds capacity for community conservation action. These conservation resources are noted in our framework and can stimulate consideration of how to develop specific targets and strategies for complementary public/private conservation land management. Research is pointing to new options in cities, for example using pollinators as conservation targets (Hall et al. 2017). During the research Council staff completed mapping the gardens of G4W members and began discussing how future planting of roadsides could encourage wildlife corridors between sites of local biological significance and members' gardens, strengthening habitat connectivity as well as motivation and reward for participating members.

The community capacity building framework helps to focus attention at the outset on varied social and ecological capacities, from natural to social capital, indicative of facilitating conservation and wellbeing in urban settings. As illustrated in the case study, the framework assists users to recognise how gains and benefits from different conservation resources and activities interact with each other. It illustrates how conservation action builds capacity in capital resources for future action, and how capacity elements, like wellbeing, enable conservation action - through interacting feedback loops. Rather than assessing a program on discrete outcomes, users can identify where to gain co-benefits and how to strengthen the community's ability to address future socio-ecological challenges. The capacity indicators serving as assessment guides in the framework are taken from published literature in urban and peri-urban developed world scenarios. Further studies are required to review and modify the list, recognising that the specifics will vary by context. Applying the framework to a variety of conservation programs in different contexts will better illuminate its utility. The interactions and feedback loops between the framework components are also an important area for future research. Importantly, the framework is not an assessment 'endpoint'. Its value as a tool for practitioners is to make sense of and discuss learnings to improve a program, consider alternative approaches, and to link the program with an array of others. These may range from biodiversity to planning and community development, so that conservation and wellbeing outcomes can be improved in longer-term and integrated ways across municipal departmental portfolios.

CONCLUSION

Community capacity building is a concept generally used in community health or social development to focus on how a community can harness its resources to address collective challenges and foster wellbeing. It is relevant to urban biodiversity conservation, where

flexibility, creativity, and community involvement are required in an operating environment of complexity and uncertainty. The capacity building framework introduced here provides a means to facilitate shared learning about a program, its conservation and social context, and opportunities for progressing action. As illustrated through the case study, the very process of carrying out a program can develop its own capacity as a vehicle of change; in this case engaging more actors, developing shared values and knowledge, and nurturing a conservation-focused collaboration with mutual trust and respect amongst diverse social actors. Using the framework highlights that an ecological program embedded in a social context has social outcomes that may be undervalued or unknown by municipal ecological practitioners, for example strengthening participants' connections to place and community, and developing a sense of wellbeing. It focuses attention on the critical role of community capacity to achieve the long-term goals of biodiversity persistence and community wellbeing, and provides a way to value, monitor, and improve it. We endorse further consideration of this approach in cities and beyond, where engaging residents and other potential actors in biodiversity stewardship is often poorly considered, as are associated opportunities for strengthening social cohesion and wellbeing.

APPENDIX 1:

Data sought, informants, and data collection and analytical methods used to generate findings

Data Sought	Informants ¹	Collection method	Analytical method
A. Knox Gardens for Wildlife (G4W) features & background			
Case study features, procedures, social and ecological context	G4W coordinators (3); founders (2)	Open-ended interviews, one to two hours Knox website and documents	Synthesise information -
B. Impact of participation on Knox Gardens for Wildlife members			
Attributes of interviewees & their properties	G4W members (16) – diverse sample selected with help of garden assessors ²	Demographic questionnaire Observations of gardens, lot size from web	Categorise information
Impact of G4W on members' gardening purpose and practice, wellbeing and connections with place, nature and community		Semi-structured interviews in members' gardens ² , 45 minutes – two hours	Inductive, iterative analysis of interview transcripts using codes derived from participants' responses with assistance of NVivo ^{2,3}
Wildlife gardening activities of members		Knox City unpublished survey of G4W members ²	Quantitative analysis of responses to close-ended questions ²
Usefulness of G4W features; suggestions for improvement			Review responses to open-ended questions, categorise using NVivo ²
C. Impact of Knox Gardens for Wildlife program (garden assessor perspective)			
Diversity of G4W members; experiences with G4W	G4W garden assessors (13) - current and past assessors invited ⁴	Group interview, one hour	Review group interview transcript
Personal impact of participation in G4W on wellbeing and connections	G4W garden assessors (5) - group interview attendees invited ⁴	Open-ended questionnaire	Categorise responses aligned with wellbeing concepts and about connections with place, nature and community ⁴
D. Perceived Knox Gardens for Wildlife goals and achievements			
incl history, purpose, strategies, social and ecological contributions	G4W founders (2); coordinators (3); KES officers (2); Knox managers (3)	Semi-structured interviews, one to two hours	Review interview transcripts, categorise using NVivo software

¹Informant numbers total more than 32 because four informants participated in more than one role²Mumaw and Bekessy 2017³Mumaw 2017b⁴Mumaw et al. 2017

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