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Connecting the strategic to the tactical in SEA design: an approach to wetland conservation policy development and implementation in an urban context

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ABSTRACT
The paper presents an analytical approach to strategic environmental assessment (SEA), focused on bridging the strategic level assessment of policy objectives with tactical planning and implementation. This is done within the context of an applied SEA application for urban wetland policy development and implementation in the fast growing city of Saskatoon, Saskatchewan, Canada. An expert-based strategic assessment framework was developed and applied to assess the potential implications of alternative wetland conservation policy targets on urban planning goals, and to identify a preferred conservation policy target. Site-specific algorithms, based on wetland area and wetland sustainability, were then developed and applied to prioritize individual wetlands for conservation so as to meet policy targets within urban planning units. Results indicate a preferred wetland conservation policy target, beyond which higher conservation targets provide no additional benefit to sustainable urban development goals. The use of different implementation strategies, based on wetland area vs. wetland sustainability, provides operational guidance and choice for planners to meet the policy objectives within neighbourhood planning units, but those choices have implications for local land use and wetland sustainability.

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Strategic environmental assessment; wetlands; scenario analysis; multi criteria analysis; strategic planning

Introduction

Wetlands provide important ecological services, including carbon sequestration, wildlife habitat provision and flood control. Despite that, wetlands are amongst the most threatened habitat in the world; close to 50% of original wetlands worldwide have been completely lost, including an estimated 71% of wetlands in the Prairie Region, Canada (Mitsch & Gosselink 2007). The majority of wetland loss has historically been attributed to agricultural land conversion, but urban development is now a significant driver of wetland loss and degradation (Rubec & Hanson 2009; Bartzen et al. 2010; Sizo et al. 2015). The primary instrument in Canada for assessing and managing land use and development impacts to wetlands is project-based environmental assessment (EA); however, urban development, urban land use planning and wetland conversion in urban environments typically do not trigger EA (Noble et al. 2011). When EAs are triggered, for such activities as highway infrastructure development, for example, the assessment of impacts to wetlands is focused on mitigation or compensation, as opposed to ensuring actions that serve to create or enhance the sustainability of wetland systems.

Westbrook and Noble (2013) argue the need for a more strategic approach to assessing and managing impacts to wetlands – an approach that better connects science with land use planning and that provides direction for implementing policy and land use plans on-the-ground. In principle, strategic environmental assessment (SEA) has the potential to provide a framework to support urban wetland sustainability-based policy and planning; (Ramsar Convention Secretariat 2010; Nielsen et al. 2012; Sizo et al. 2015), creating a development context for sustainability and determining the necessary transformations to ensure successful policies, plans and programs (PPPs) (Cherp et al. 2007; Partidário 2012). Recent reviews of SEA, however, indicate that challenges remain in translating broad strategic principles and objectives in SEA into more specific, operational plans and practices (Noble 2009; White & Noble 2013). Strategy is central to the nature of SEA, but strategic level principles in SEA are not always translated into operational practices through decision-making process (Fischer 2003; White & Noble 2013). Strategies must steer implementation (Emmelin & Nilsson 2006), and strategic directions emerging from SEA need to be accompanied by practical direction for

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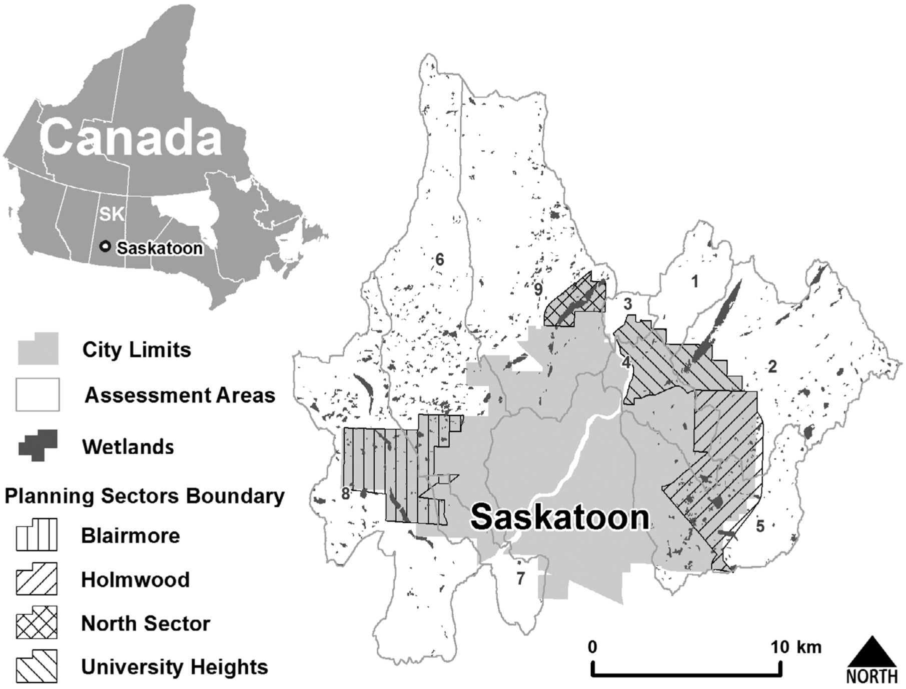

Figure 1. Saskatoon urban and wetland environment assessment areas and planning sectors.

on-the-ground PPP implementation (Acharibasam & Noble 2014).

Strengthening the relationship between the strategic and the tactical aspects in SEA is important to the continued adoption of SEA, and more importantly to its influence on PPP outcomes. Strategic and tactical planning are interrelated and complementary processes, which must link to each other and inform and support one another for the effective development and implementation of PPPs. Compared to discussions of broad strategic principles, practical frameworks and methods supporting SEA, particularly quantitative approaches that support both strategic and tactical SEA design, have been much less prominent in the academic literature, even through practical methods and guidance remain amongst the main challenges encountered during SEA implementation (Liou et al. 2006; Noble et al. 2012; Geneletti 2015). There is a need for further methods development in SEA, particularly quantitative-based methods that are sensitive to the often fuzzy nature of strategic issues, but at the same time capable of providing tactical guidance for those implementing PPPs.

This paper presents a SEA analytical approach demonstrating how to tier the strategic and tactical levels of a PPP in an applied urban land use planning and decision-making context. Specifically, this paper demonstrates an approach to SEA to support PPP development and implementation for urban wetland conservation. The SEA design focuses first on the evaluation of alternative wetland conservation policy options based on strategic urban planning goals and second on translating broad strategic policy direction to site-specific wetland conservation planning priorities. In the sections that follow the study area for this research is introduced, followed by the SEA design and methods used for the strategic and tactical assessment. Results of the SEA application to the city of Saskatoon, Saskatchewan – one of the fastest growing cities in Canada, situated in the middle of the prairie pothole (wetland) region, are then presented. The paper concludes with a discussion of the results, including the SEA approach and directions for SEA research in the context of urban wetland environments.

Study area

The study area was the city of Saskatoon urban development region, Saskatchewan, Canada. The city of Saskatoon is located on the banks of the South Saskatchewan River, in the Prairie Ecozone and Moist Mixed Grassland Ecoregion. Despite the ecological and societal importance of wetlands to the prairie region (Rubec & Hanson 2009), approximately 40% of wetlands in the province of Saskatchewan have been lost, with half of the remaining wetlands considered threatened (Huel 2000).

The city of Saskatoon is the largest city in the province with an estimated population of 248,297 (as of 2013). The city is experiencing significant growth, with an average annual population growth rate of 2.6% (City of Saskatoon 2010; Statistics Canada, Census of Canada 2011) and a projected population of 387,742 by 2032 (City of Saskatoon 2013a). The majority of land development to meet population growth has been in the form of outward expansion and suburban neighbourhood development. Over 80% of the local native prairie landscape in Saskatoon and its surrounding area have been transformed by urban development and resource industries (City of Saskatoon 2014a). The future development

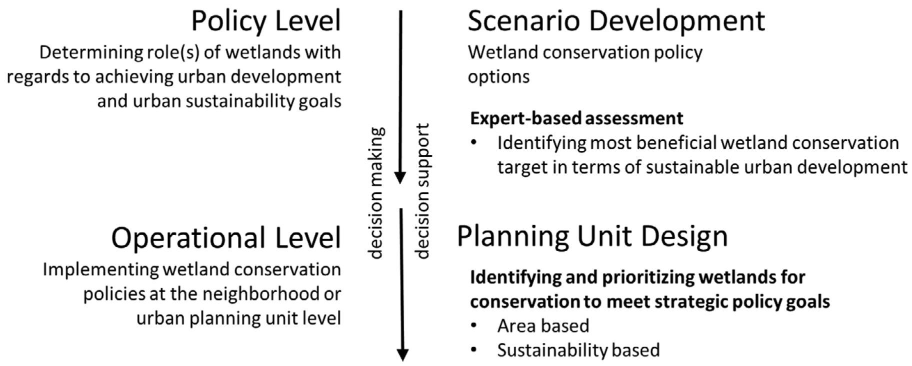

Figure 2. SEA design approach.

of the city will result in both direct and indirect impacts to nearby lands, including wetlands. However, the possible impacts of urban development activity on wetlands in Canada is not a subject to SEA under current federal or provincial laws or regulations (Noble et al. 2011), and the City itself does not have a formal SEA process.

The assessment focused on the city's four urban planning units: Blairmore, Holmwood, North Sector and University Heights (Figure 1), defined based on the City's development sector planning process (City of Saskatoon 2014b). These four planning units were selected because they represents the city's future growth areas and the spatial extent of development over the next 30 years (Sizo et al. 2015). The spatial extent of each of the four urban planning units was then adjusted to the next closest water catchment (referred hereinafter as *assessment areas*, see Figure 1), arguably the smallest geographically and ecologically meaningful scale for a regional level assessment (Dubé et al. 2013). Water catchments represent the minimum hydrological unit in terms of the ability of a wetland's system to maintain its functions and stability over the long term (Ehrenfeld 2000; Committee on Mitigating Wetland Losses, Board on Environmental Studies and Toxicology, Water Science and Technology Board, National Research Council 2001). The assessment areas contain approximately 1,870 ha of wetlands, with approximately 506 ha of wetlands located within the urban planning sectors.

Methods

The assessment design consisted of two phases (Figure 2): a *strategic* phase, focused at the policy level and on the identification of a strategic direction (wetland conservation target), considering also competing sustainable urban development goals; and a *tactical* phase, focused at the operational level of implementing the policy on-the-ground, considering the application of a wetland conservation target within the urban planning process. Presenting SEA as two broad phases, strategic and tactical, is a simplification of SEA process. We acknowledge that SEA design typically consists of such systematic steps as screening, scoping and options assessment through to follow-up design; however, our focus in this paper is on developing an analytical approach to SEA, and specifically how the strategic aspects of SEA can be better connected to how policies or plans are implemented on the ground. In the strategic phase, a scenario analysis exercise was developed to assess alternative, city-wide, wetland conservation policy targets on the basis of existing urban development planning goals for the City, using an expert-based multi-criteria evaluation process. In the tactical phase, results of the expert-based assessment, and the preferred wetland conservation policy targets, were applied to the City's planning units' design, identifying individual wetland conservation priorities within each of the planning units. Each of these phases is described below.

Strategic assessment: urban wetland policy options

Four policy options for wetland conservation in the city of Saskatoon were developed for the analysis. The options were developed by the authors based on various City planning documents (e.g. future growth strategy, strategic growth plans, environmental policy reports) and in consultation with the City's planning division. The options capture two possible extremes of wetland conservation: 0 and 100% conservation of existing wetland areas across the urban region, with intermediate trade-offs established at 33 and 66% conservation targets. This stepped approach allowed investigation of the City's current wetland conservation strategy, which assumes integration of preserved or constructed wetlands into new neighbourhood design with a conservation target of approximately one-third of existing wetland area in any development sector (personal communication, City of Saskatoon, Planning Division, 25 November 2014).

Each policy option was assessed in terms of its potential implications for meeting the urban planning and development goals of the City of Saskatoon. City planning and development goals were identified based on: (i) goals and objectives specified in city planning documents, (ii) discussions with city planners; and (iii) drawing also on urban sustainability policy and planning

Table 1. Evaluation criteria for wetland policy conservation targets.

Evaluation criteria	Environmental sustainability (En)	Economic well-being (Ec)	Quality of life (QL)
	En_1: Advance the city's 'compact city' strategy (e.g. minimize urban sprawl)	Ec_1: Increase the affordability of housing	QL_1: Advance the 'complete communities' strategy (in the context of access to open space, recreational areas, aesthetic landscapes)
	En_2: Advance the city's responsible environmental management and conservation strategy	Ec_2: Increase the marketability of future neighbourhoods	QL_2: Advance sustainable transportation and connectivity (in the context of pedestrian and bicycle friendly design of neighbourhoods)
	En_3: Decrease greenhouse gas emissions	Ec_3: Minimize cost of urban flood control infrastructure	QL_3: Increase water security in the region

literature. These goals were developed as criteria (Table 1) and used as the basis for an expert-based assessment of alternative wetland policy conservation targets.

The *environmental sustainability* (En) criteria attempt to capture issues that relate to the footprint of urban growth and development. Criterion En_1, for example, concerns the potential impact of a proposed policy or initiative, in this case a wetland conservation policy, on the urban development footprint or compact city design – a concept espoused by the City as a way to reduce waste, decrease transportation network expansions and increase neighbourhood accessibility. Emphasis is placed on managing expansion at the City's boundaries and increasing in-fill development (City of Saskatoon 2000, 2009, 2013b). Criteria En_2 and En_3 are based on meeting the sustainable city growth concepts and environmental management policies of the City (City of Saskatoon 2000, 2009, 2011a, 2011b, 2013b) and are directly related to the services provided by wetlands, including habitat provision and carbon sequestration (Mitsch & Gosselink 2000; McInnes 2010). Criterion En_2, for example, focuses on maintaining or increasing natural areas throughout the city, and protecting biodiversity.

The e*conomic well-being* (Ec) criteria are based on how the implementation of a policy or plan may impact the overall economic well-being of Saskatoon. In the case of wetland policy, criterion Ec_1 addresses the relationship between the conservation of wetland area and the availability of land for residential development, including housing affordability (City of Saskatoon 2009, 2011c, 2013b). Criterion Ec_2, marketability, captures the relationship between the services provided by urban wetlands (e.g. recreational, aesthetic, cultural) and the living attractiveness of a neighbourhood (Bolund & Hunhammar 1999; Bolitzer & Netusil 2000). Criterion Ec_3 addresses the implications of a policy or plan for flood control, and thus captures the possible economic cost of the replacement of natural flood control services provided by urban wetlands (Mitsch & Gosselink 2000).

The final group of criteria, *quality of life* (QL), takes into consideration the social and health benefits or costs of a policy or plan. Criterion QL_1 is based on the complete community concept (City of Saskatoon 2011b, 2013b), focused on accessibility to natural open spaces, recreational activity support and aesthetics. Criterion QL_2 considers accessibility implications, and particularly the availability of green transportation (e.g. pedestrian trails, bike trails) (City of Saskatoon 2009, 2013b). Criterion QL_3 addresses issues related to water security, namely quality and quantity, but also considering how a policy or plan may alter urban hydrology.

Expert-based assessment

An expert-based assessment of wetland policy options was structured using the analytic hierarchy process (AHP) (Saaty 2008), a form of multi-criteria analysis that allows for the ranking of options based on a set of competing evaluation criteria. The AHP has proved successful in a variety of evaluation and assessment contexts (Noble 2002; Mendoza & Martins 2006; Noble & Christmas 2008; Herva & Roca 2013). The AHP relies on the subjective judgments and values of decision-makers; however, amongst the advantages of the AHP is its applicability to the assessment and weighting of fuzzy criteria, alongside solid ones, through the use of ratio scales and scoring. The AHP breaks down a complex problem into a hierarchical structure of strategic goals and objectives, followed by more specific operational criteria and options assessment, thus allowing a decision-maker to focus on smaller sets of decisions and to compare between elements efficiently. An advantage of the AHP, within the context of SEA, is that '… by decomposing a problem or process in its components and combining them in a rational mode from the large [i.e. strategic], descending in regular steps, to the smaller [i.e. tactical], it is plausible to join via paired comparison judgments the lesser [i.e. tactical] to the greater [i.e. strategic]' (Papadopoulos & Konidari 2011, 16). The AHP was structured based on an overarching goal, defined by the three groups of criteria, which was used to assess the four wetland conservation policy targets (Figure 3).

An expert panel was compiled based on invitations sent to City of Saskatoon organizations involved, or who have an expressed interest, in land use, city planning and development, or wetland conservation. A total of 16 individuals from 12 organizations agreed to participate, including municipal planners (e.g. urban planners, environmental planners, wetland and urban policy analysts), the private sector (e.g. land developers, environmental consultants) and researchers (e.g. wetland ecologists,

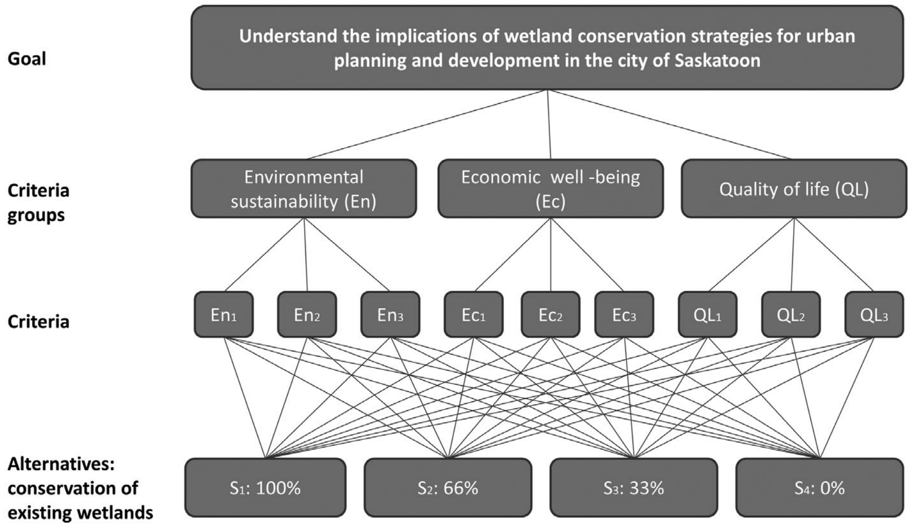

Figure 3. AHP evaluation structure for wetland conservation policy scenarios.

Table 2. Paired comparison assessment scale.

Intensity	Definition	Explanation
1	Equal	Two criteria/option are equally preferred/important
3	Moderate	One criterion/option is slightly preferred to/more important than the other
5	Strong	One criterion/option is strongly preferred to/more important than the other
7	Very strong	One criterion/option is very strongly preferred to/more important than the other
9	Extreme	One criterion/option is extremely preferred to/important than the other

Note: Intensity values 2, 4, 6, and 8 can be used as transition rates. Source: Saaty (2008).

planners). Participants reported a median of 17 years experience in their respective field of expertise.

The assessment process consisted of two parts. In the first part, participants were asked to evaluate the relative importance of each evaluation criterion within the broader context of future planning and urban sustainability goals for the city of Saskatoon, using a pairwise comparison approach. The pairwise approach was based on comparing groups of criteria, and then criteria within each group, using Saaty's (2008) assessment scale (Table 2). In the second part of survey, participants used the same pairwise approach to assess each wetland conservation policy option ($S_{1–4}$) against each other policy option in terms of its perceived impact on, or contribution to, the City's planning and development goals (see Table 2).

Expert Choice Comparion™ web-based survey software (Expert Choice 2014) was used to administer the survey and to derive criteria priorities and scenario preference scores. Each participant was sent an email invitation containing a unique link to the survey software. They were presented with a brief description of the assessment problem as well as the overall planning and sustainability goals for the City, and then guided through the assessment process, hierarchically, from assessing the relative importance of each strategic goal and objective to evaluating competing policy options. The resulting scenario preference scores were plotted against the wetland conservation scenario targets to identify any association between wetland conservation targets and expert's preferences: higher preference scores would depict a preference for wetland conservation scenario targets that are more beneficial to the achievement of the City's development goals. Then, one-at-a-time local sensitivity analysis (Hamby 1994) was performed to evaluate the sensitivity of the conservation scenario scoring. To do this, the groups of criteria priorities (i.e. En, Ec, and QL) were repeatedly adjusted, one priority at a time, with their minimum (0) and maximum (1) values and results reassessed to understand the possible range of scenario priority scoring. This allowed an assessment of the stability of the expert's scoring of conservation policies against the evaluation criteria.

Tactical assessment: wetland conservation policy application on the ground

Results from the expert-based strategic assessment provided an understanding of the overall conservation policy preference; however, it did not provide guidance on policy application at the urban planning unit level. To assist planners in determining how best to apply a city-wide policy or conservation target on the ground, and in different urban planning units, two conservation priority approaches were examined: an area-based approach and a sustainability-based approach. The first approach reflects the City's current approach to wetland conservation; the second integrates broader land use characteristics.

Policy application using an area-based approach to prioritize individual wetlands for conservation

An area-based approach to wetland conservation is based on wetland surface area only, and larger wetlands are given a higher conservation priority. Area-based conservation is based on the notion that wetland size has an influence on the capability of the wetland to maintain its functions (Dahl & Watmough 2007). For example, larger wetlands have been shown to provide better support for wildlife habitat and more effectively influence water quality (Moreno-Mateos et al. 2010), whereas a decrease in wetland size can reduce the spectrum of hydrological functions that a wetland can maintain (Cohen & Brown 2007). The area-based approach is consistent with the City's current approach to wetland conservation, whereby wetlands are conserved or constructed as part of neighbourhood design. Larger wetlands, and large complexes of wetlands, are more likely to be preserved than small and/or isolated wetlands (personal communication, City of Saskatoon, Planning Division, 25 November 2014).

An area-based index (ABI) was thus used to identify wetlands to meet conservation policy targets:

$$\text{ABI} = \frac{W_k}{W} \tag{1}$$

where ABI is the area-based conservation preference or priority of the wetland, W is the total wetland area and W_k is the individual wetland area. The ABI is calculated for an individual wetland per urban planning unit. The assumption is that a higher ABI indicates a higher preference for conservation when applying a city-wide wetland conservation target based on wetland area. Area-based conservation does not consider other important factors in determining the conservation value of a wetland, such as surrounding land uses or the density and distribution of wetlands in a given water catchment.

Policy application using a sustainability-based approach for prioritizing individual wetlands

A sustainability-based approach was used to complement the area-based approach, using landscape indicators as a proxy for the sustainability of wetland functions. Wetland size and wetland complexes are important, but not the only parameters that can be used for prioritizing how to implement an urban wetland conservation policy. Numerous indicators related to wetland functions can be used to assess wetland sustainability, or threats to sustainability, and thus prioritize wetlands within a water catchment (Brooks et al. 2006; Canter & Atkinson 2011). These include landscape indicators that have been shown to provide insight into the sustainability of wetlands within a water catchment, namely total built-up area, built-up area to total water catchment area ratio, total wetland area, number of wetland areas, wetland density, wetland area to total water catchment area ratio, average wetland area size and wetland to built-up area ratio (Mitsch & Gosselink 2000; Schweiger et al. 2002; Wang et al. 2008).

To aggregate landscape indicators into a single index for more simplified analysis, yet still capture the multidimensional characteristics of the region (Canter & Atkinson 2011), a normalized Landscape Composite Index was developed. The normalized Landscape Composite Index (nLCI) is a multi-dimensional description of wetland sustainability in an assessment area in a single measure, based on multiple landscape indicators (Equation 2):

$$\text{nLCI} = \frac{\sum \text{nLI}_i + \sum(1 - \text{nLI}_j)}{N_{\text{nLI}_i} + N_{\text{nLI}_j}} \tag{2}$$

where nLI is the normalized landscape index, with i indicating a positive and j a negative threat to wetland sustainability, and N is the number of indicators considered. The nLCI varies from 0 to 1, assuming index values closer to '0' represent lower levels of wetland sustainability (i.e. higher risks to wetlands) in an assessment area. The following indicators were used for nLCI calculation for each assessment area: total built-up area, ratio between built-up area and water catchment area, wetland area, wetland number, wetland density, ratio between wetland area and total water catchment area, average wetland size, ratio between wetland and built-up area. Individual wetland conservation priorities were calculated by the following nLCI adjustment (nLCI_{adj}):

$$\text{nLCI}_{\text{adj}} = (1 - \text{nLCI}) \times \text{ABI} \tag{3}$$

where nLCI is the normalized Landscape Composite Index for an assessment area, and ABI is the area-based individual wetland priority. The nLCI_{adj} was calculated for each wetland and describes the individual importance of a wetland in terms of its likely contributions to broader wetland sustainability within an assessment area.

Results

The sections that follow present the results of the assessment. First, results of the strategic assessment of wetland conservation policies are presented. This is followed by an example of tactical level wetland conservation policy implementation within the urban planning units, comparing the area- and sustainability-based conservation prioritization approaches.

Expert-based strategic assessment of wetland conservation policy options

Results of the experts' assessment of environmental, economic and quality of life development goals, and respective criteria (Table 2), are summarized in Figure 4. Overall, the quality of life and the environmental sustainability criteria were almost equally prioritized (0.39 and 0.36, respectively) by respondents as more important

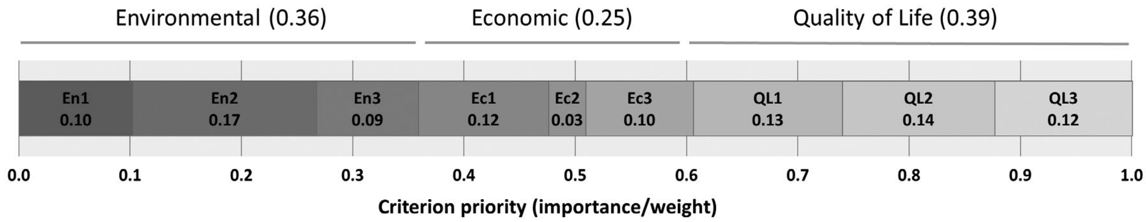

Figure 4. Relative priority assessments of environmental (En), economic (Ec) and quality of life (QL) development goals and respective criteria. Importance/weights scaled from 0 to 1.

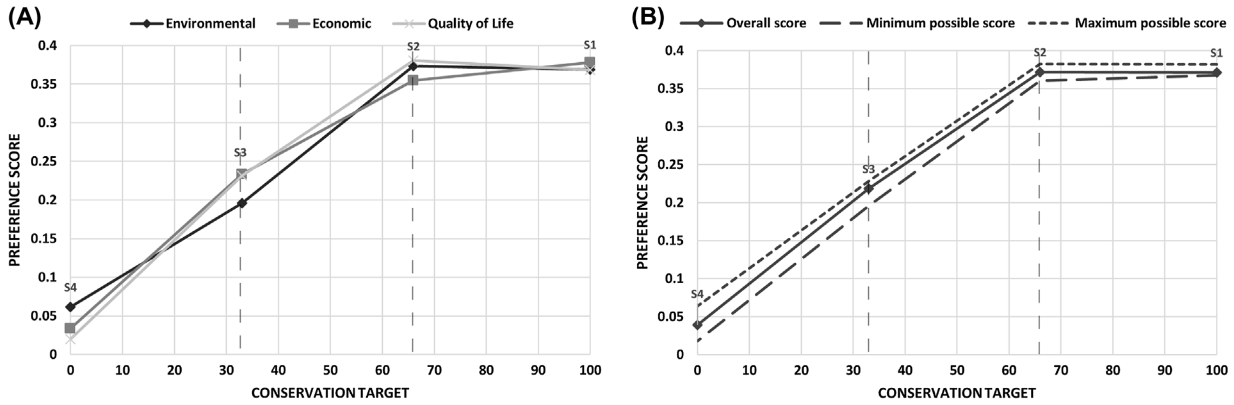

Figure 5. Wetland conservation scenario preference scores based on environmental, economic, and quality of life development goals (A), and overall score with sensitivity analysis (B).

for informing planning and development decisions than the economic well-being group of criteria (0.25). Increasing the marketability of future neighbourhoods, criterion (Ec_2), received the lowest priority of all criteria, and advancing the City's responsible environmental management and conservation strategy, criterion (En_2), received the highest score.

In the second part of the survey, the implications of alternative wetland conservation policy targets were examined with regard to the City's overall planning and development goals. Conservation policy preference scores for environmental, economic and quality of life criteria behaved similarly across the set of competing wetland conservation targets (Figure 5(A)). There is a considerable increase in preference scoring from the 0 (S_4) to 33% (S_3) and 66% (S_2) wetland conservation targets, but little change in assessment results between the 66 and 100% (S_1) policy option. For S_1, a 100% wetland conservation target, preference increases only marginally based on economic criteria, and slightly decreases based on meeting environmental and quality of life criteria. Across the full set of urban planning goals, participants identified a 66% conservation target as the preferred basis for an urban wetland policy (S_2) (Figure 5(B)), after which an increase in the wetland conservation target to 100% was not seen as providing additional benefit based on the suite of urban planning and development goals. The sensitivity analysis indicated relative stability in the experts' scenario assessment results, based on the overall ranking of wetland conservation scenarios and the magnitude of difference between scenarios (Figure 5(B)).

Area and sustainability based approaches for wetland conservation policy application within urban planning units

Two wetland policy scenarios, S_2 and S_3, with conservation targets of 66 and 33%, respectively, were chosen to assess wetland conservation policy application at the scale of individual urban planning units. Both area- and sustainability-based preference algorithms were used for calculation of individual wetland conservation priorities (ranks). Scenario S_3 approximates the City's current wetland conservation strategy (30% of existing natural or constructed wetlands); S_2, a 66% conservation target, was identified in the expert assessment as the preferred policy option, after which an increase to the next conservation target was assessed as generating no further benefit to the City's development goals.

Figure 6 depicts wetlands that were identified for conservation using the area- and sustainability-based algorithms for scenario S_3 (Figure 6(A.1–3)) and scenario S_2 (Figure 6(B.1–3)), as options to meet the strategic policy targets. In most cases, both the area-based and sustainability-based algorithms identified the same wetlands to meet the specified policy targets. However, under both scenarios, there were wetlands identified by only one of the area-based or sustainability-based method. The arrows in Figure 6 denote these. For example, in Figure 6(A.3) a wetland in the north central region was selected using the sustainability algorithm to meet the conservation targets, in combination with a wetland in the central region of the planning unit. The wetland in the

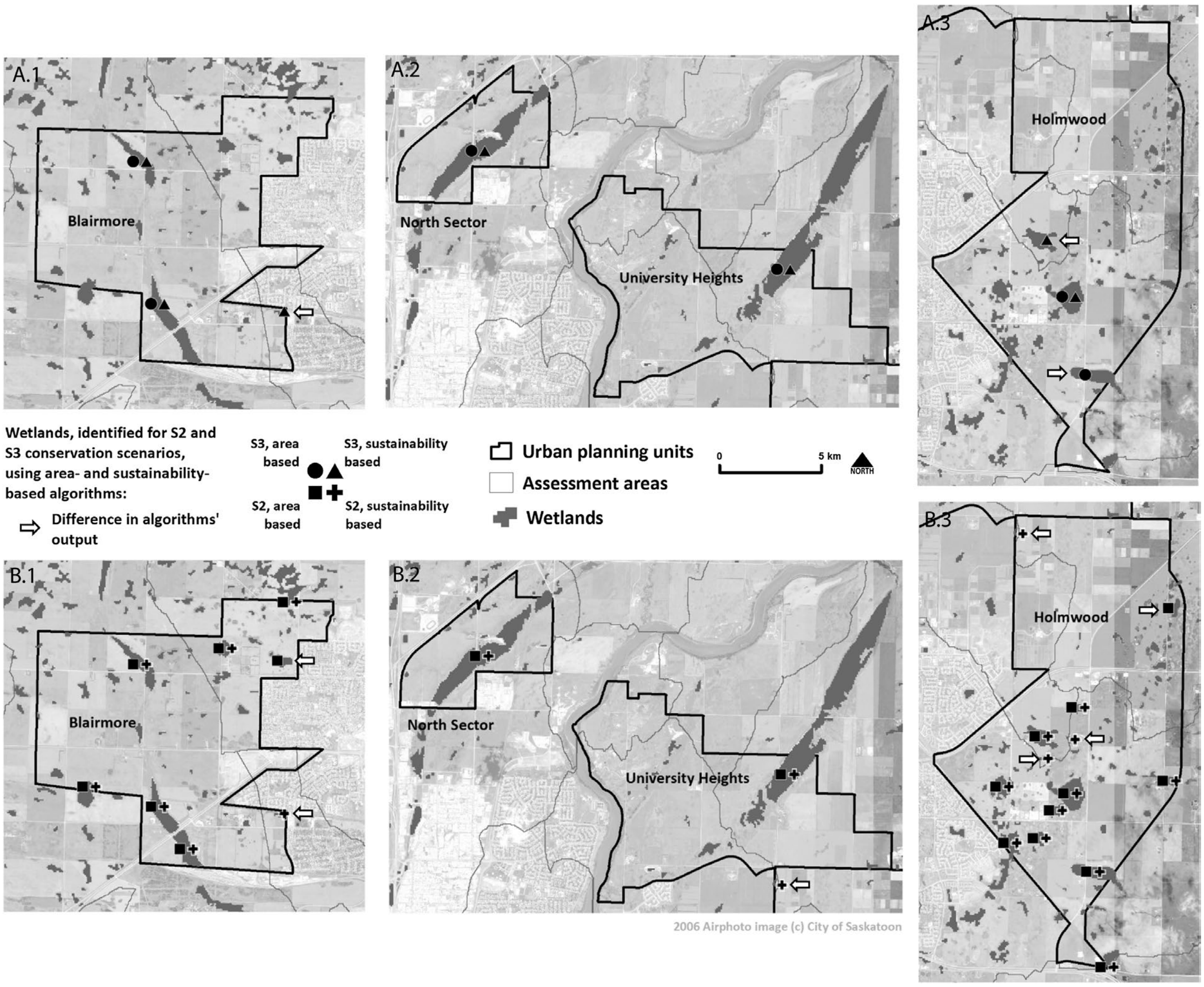

Figure 6. Urban planning units with wetlands, identified for S_3 (A.1–3) and S_2 (B.1–3) conservation scenarios using area- and sustainability-based algorithms.

north central region was not identified using the area-based approach. The sustainability algorithm considered numerous landscape factors, including total built-up area, ratio of built-up area to water catchment area, wetland density, and the ratio of wetland and built-up areas. However, using only the area-based approach, which is the City's current approach, a wetland in the southern part of the planning unit was selected to meet prescribed conservation targets, in combination with a wetland in the central part of the planning unit. The results indicate a combination of wetland options for planners or land developers to meet the City-wide conservation targets, but also indicate that how the policy is implemented, using area or broader sustainability parameters, will affect the distribution of wetlands selected to meet policy targets.

Discussion

This research demonstrated an analytical approach to connecting the strategic and tactical elements of SEA, based on an evaluation of the potential implications of wetland conservation strategies on sustainable urban development goals. Four scenarios, defined by alternative wetland conservation targets, were assessed against city-wide urban development goals. Results indicate that the City's current wetland conservation policy, of approximately one-third conservation, is not sufficient based on sustainable urban development goals. A city-wide wetland conservation target of 66% was identified as the preferred policy direction, after which the next highest conservation target was assessed as not providing any additional benefit.

To link strategic-level policy with on-the-ground implementation, and determine how best to meet the city-wide conservation target in planning practice, wetlands within individual neighbourhood planning units were prioritized using two approaches: first, an area-based approach, reflecting the City's current wetland conservation practice, whereby larger wetlands or wetland complexes are given priority based on neighbourhood design; second, a sustainability-based approach, which considers a combination of landscape indicators at the water catchment scale to identify wetlands for conservation within individual urban planning units. Under both the City's current policy and the preferred 66% target, different wetlands were identified for conservation based on the area- vs. sustainability-based approach, providing design choices for planners when implementing a strategic, city-wide wetland conservation policy within individual neighbourhood planning units. Results also indicate that the current approach to policy implementation, an area-based approach, may meet city-wide policy targets but will result in less-preferred wetland selection for conservation than when based on landscape metrics that consider water catchment land uses and wetland threats.

Beyond the regional context, and the specific application demonstrated in this paper, this research responds to two primary concerns in the literature regarding applied SEA. First, the need for structured and quantitative approaches in SEA to address the often-fuzzy nature of strategic-level PPPs (Noble et al. 2012), including the need for SEA research to better address analytical methods (Geneletti 2015). Second, the difficulty often experienced in advancing SEA principles to practice, as there have been few concrete examples and little guidance as to how to operationalize strategic principles in an applied SEA context (Noble 2009; White & Noble 2013) – that is, how to better connect strategic thinking in SEA design with applied PPP practice. The SEA design presented here is applicable for the use in scenario analysis and can provide planners with answers to ad hoc requests regarding options for PPP implementation, in this case wetland conservation, at the operational level. The structured approach means that the SEA practitioner can explore different tactical 'what if' scenarios and generate reliable results without having to collect new assessment data (White & Noble 2012). This provides flexibility for the practitioner in examining the robustness of the recommended PPP, to see what happen, should broader policy or development objectives, or specific on-the-ground planning conditions or constraints change – i.e. how strategic changes might affect operational decisions. Similarly, the practitioner can examine alternative operational designs for meeting strategic policy objectives, and test for consistency with strategic-level values.

There are limitations to the approach demonstrated here that could be addressed in future applications. First, the assessment was limited to a small group of experts and could be expanded to include much broader public participation. This might include, for example, local community members, aboriginal groups and/or other interested parties. Using an online assessment tool, as demonstrated in this exercise, provides an opportunity to easily expand 'strategic' discussions beyond the expert panel to include members of the public from across the urban region. Second, the evaluation criteria were based on the Saskatoon city's development goals, so as to ensure application that was meaningful in the current urban planning environment. Future assessments might extend beyond prescribed goals and explore even broader evaluation criteria, identified by assessment participants. Finally, the individual wetland preference ranking exercise used the $nLCI_{adj}$ landscape based index as a proxy for a wetland's ecological value. Other, physically based measures of wetland functions could be integrated in the assessment, depending on a data and/or resource availability, for example, using wetland data on biodiversity (wildlife habitat and/or vegetation), hydrology, nearby land use or water quality.

Conclusion

Strategic initiatives emerging from SEA, including policies for wetland conservation or management (Amezaga & Santamaría 2000), often prove difficult to implement at the operational level (White & Noble 2013) and there remains a disconnect between strategic direction provided through SEA and the tactical direction required by those responsible for implementation. Often broad strategic level initiatives, based on stakeholder views or values, are not translated sufficiently into operational practices through planning and decision-making processes (Fischer 2003; Noble et al. 2012; White & Noble 2013). As such, scholars have argued for the development of appropriate methods and guidance for SEA to assist the translation of sustainable, strategic choices into operational practice (Noble et al. 2012; White & Noble 2013), including more analytical-based SEA design (Geneletti 2015). This paper presented an approach to support decision-making in SEA, based on an application to urban wetland conservation policy implementation, that links the *strategic context*, where conservation policy scenarios are evaluated against urban planning goals, with the *operational context*, were tactical decisions are made regarding the conservation of individual wetlands to meet broader policy objectives. The approach is valuable for examining 'what if' strategic options, in a structured and quantitative analytical framework at the operational level, and for providing the 'on-the-ground' guidance on how to meet of high level strategic policy targets. More research is still needed on effectively linking strategic-level initiatives, including those PPPs developed based on SEA processes, with the tactical planning and implementation measures that meet the broader strategic-level goals. Specifically, there is a need for examples for practice, reporting on the lessons learned, and guidance for assessing and then operationalizing strategic initiatives in different PPP land use contexts.

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